THE KUILS RIVER MULTIPLE:

VERSIONS OF AN URBAN RIVER ON THEEDGE OF CAPE TOWN, SOUTH AFRICA

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This thesis is dedicated to my little brother, Mxolisi Solomon. Thank you for sometimes being my research assist and for being my comedic relief in the rough times. Gone too soon but never forgotten.

Declaration

I know that plagiarism is wrong. Plagiarism is to use another's work and pretend that it is one's own.

I have used the APA convention for citation and referencing. Each contribution to, and quotation in, this thesis from the work(s) of other people has been attributed, and has been cited and referenced.

This thesis is my own work.

I have not allowed, and will not allow, anyone to copy my work with the intention of passing it off as his or her own work.

Signed by candidate

Nikiwe Solomon

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Abstract

This thesis explores how diverse ways of knowing and being with the Kuils River, located in Cape Town, South Africa, are shaped and in turn shape the river. The management of water (in pipes and rivers) and the development of water infrastructure are deeply rooted in societal development agendas that, over time, have been embedded in discourses of empire, economic growth, state formation, sustainability and technological efficiency. When river management is informed by different agendas, the practice of management then differs across different levels of governance, research and communities, and multiple meanings of different forms of human-water relationships emerge. This study examines how the resulting tangle of meanings impacts river management practices in Cape Town, and in turn shape the well-being of people and more-than-human communities living in and with the river. Environmental management and protection is often understood as a singular, unified, objective practice but is enacted differently according to context; it varies by discipline and plays out differently across municipal interventions and service delivery. Based on roughly three years of ethnographic fieldwork in the Kuils River catchment area and its associated landscapes and bodies of water, this thesis explores how lives, politics, technology and environment are impacted by river management practices in Cape Town and how these produce different versions of the river, which in turn shape the everyday of the Kuils and how it is managed.

Specific research questions include: What are the diverse ways of knowing and relating to the Kuils River? How are these diverse ways of knowing and relating enacted? How does this shape river and capital flows, governance and the well-being of multispecies communities? I respond to these questions by engaging with current debates in environmental humanities, science and technology studies (STS) and cultural and environmental anthropology. Using Annemarie Mol's *The Body Multiple* (2002) as a matrix through which to explore 'the river multiple', the study engages with historical and techno-political conceptions of managing urban rivers to consider environmental well-being and justice in the context of climate change. In focusing on the interactions of residents living along the river, on the government officials in charge of managing the Kuils River and its associated water bodies and on the flow

of the river itself, this thesis foregrounds differing meanings of 'environment' and their management and how these versions limit the achievement of urban and peri-urban wellbeing. This thesis explores divergent experiences of the managed Kuils River (including those of people and of the water body) to demonstrate that particular logics have geological effects that will be experienced far into the future.

The study approaches the river's flows, banks and infrastructures as an archive of deep histories and imagined futures, a paradox of technological interventions and an evidentiary of neoliberal logics. Exploring the ways in which the biological, social, geological, technological, political and economic intersect, I describe how the Kuils River has become incorporated into the City of Cape Town's imagination of water futures.

The evidence basis for the study includes experiences related by Kuils riverbank residents and archival and archaeological data, contributing to environmental humanities scholarship at the intersection of STS and environmental anthropology.

Acknowledgements

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This thesis would not have been possible without my participation in the courses provided by the Environmental Humanities South programme at the University of Cape Town, as a student and later as a lecturer. I have been fortunate enough to continuously engage with scholarship emerging from the Environmental Humanities over the last six years, and many of the arguments framed in this thesis are a result of deep engagement with students and instructors through programme seminars, presentations and workshops.

People have made efforts to help me throughout my research journey to ensure I had funding, that I was safe and to reassure me about the relevance of my work. Dr Mao Amis, thank you for opening the doors that placed me on this trajectory of watery worlds. The funding and work experience have moulded me and will continue to shape the scholar that I become. Mpumi and the women of Igalelo Labafazi, thank you for opening your homes and hearts. Ilva and the KuilaLove project, Adrian and Oom Jethro, Sydney and the people of Arocha, Mariam, Noora, Nazeem and the people of Sandvlei, Nazeer Sonday, Susanna and the people of the Philippi Food and Farming Campaign, thank you for sharing your knowledge and experiences and for opening up your homes and sharing your food. I owe so much to the people of Cape Town. To the City of Cape Town respondents, thank you for making time and directing me to the resources that assisted in shaping this thesis.

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Finally, my eternal gratitude to the Kuils River and its beings and becomings – past, present and future. This entire thesis would not have been possible if this world of relating in the Kuils did not exist. I would also like to acknowledge the land on which the river flows and on which the city rests, on the bones of the first peoples of this coastal city.

Preface

I began my PhD journey with an interest in how switching to renewable energy would save the Earth. Needless to say, I was a bit 'green' to the field of Environmental Humanities and had spent some time in a space which I now see as being aligned with a 'green neoliberal agenda'. At the beginning of the journey, my ideas around the environment were centred around improving economic efficiency, which would lead to better environmental management, with the impacts also being felt at the community level. However, the longer I researched the thesis, and having participated in courses in the Environmental Humanities South programme (such as "Earth, Ecology,Humanities" and "Science, Nature, Democracy" and the methods course "Researching the Anthropocene"), I became interested in various *kinds* of questions, particularly around obsessions with neoliberalism, the authority of science and technology and how to address environmental justice in the Anthropocene. And as a response to climate change, I became more aware of how limited is the dominant focus on economic productivity, technical efficiency and scientific objectivity.

This evolution in my ideas also resulted in a shift in my career trajectory, a 'change of heart' that taught me that the personal is political and the political personal, an idea that I explore throughout this thesis. Ethnographic research does not claim to be objective (in the sense that that capacity is claimed (and contested) in, for example, laboratory sciences), as the process of immersive research affects the researcher deeply throughout. Personal and political transformation therefore informed the concerns that shaped the questions I asked, as the project developed, because research is deeply intertwined with social interests, and the way we do research requires us to co-create and to slow down (Stengers, 2018). Stengers (2018) argues for an alternative science in which researchers stop seeing themselves as the 'thinking, rational brain of humanity', the carriers of the only acceptable knowledge, 'causing the shutdown of the concerns of the public or to spread the belief that scientific progress is inevitable and will resolve all of society's problems'. From writing about how economic productivity and technical innovations will equip us to respond to climate change, I began to write with more nuance, engaging with issues of environmental justice and responding to societal problems with feeling. I became aware that to engage with different kinds of

questions one must engage with different ways of knowing, which sometimes requires unconventional methods – within anthropology in particular and in the social sciences more broadly.

I was concerned about challenges of representation not only for the people who live in toxic spaces, but also for the Kuils River itself. To avoid being a helicopter researcher who only sees the world from above and 'outside the Earth', the focus of my professional disposition was to ground the work I did by walking along, in and with the river and by grounding my work in people's everyday experiences to ensure that my research was relevant to them and that long-term relationships could be maintained. Thus my work, while ethnographically informed, was also action research, which refers to 'the systemic collection of information that is designed to bring about social change' (Bodgan & Biklen, 1992: 223).

INTRODUCTION

The Kuils River Multiple

INTRODUCTION TO AN URBAN RIVER

The Kuils River rises in Durbanville's Kanonkop area in Cape Town, South Africa, merging with the Eerste River in the Macassar area, about 30 km away from its source. The Eerste River, which begins in the Jonkershoek Mountains adjoining Stellenbosch, flows south to enter the Kuils-Eerste River estuary, one of eleven estuaries in the Cape, before entering the sea at False Bay, where the Indian Ocean joins the Atlantic. The Kuils River and Eerste River are important rivers that run through the eastern part of the Cape Metropolitan Area (CMA), together forming a bigger catchment and draining an area of approximately 660 km^2 (Chingombe et al. 2010). A portion of this catchment falls within the CMA (through which the Kuils River flows), and the rest falls within the Stellenbosch municipality (where a significant part of the Eerste River is located).

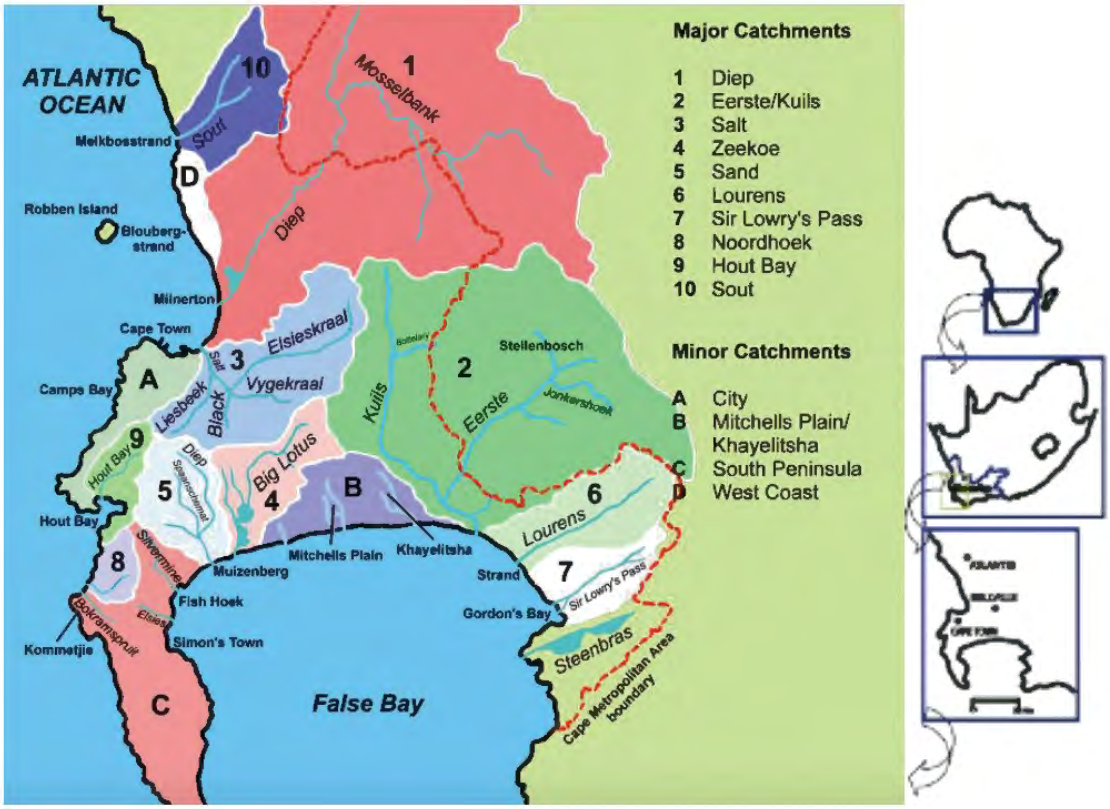


Image A: Major and minor catchments in the Cape Town Metropolitan area. The Kuils River is located in the Eerste/Kuils catchment. (Source: CMA website in Chingombe et al. 2010)

The Kuils River was once a seasonal river, drying up in the summer months to form small pools, also known as “kuils'' (in the Afrikaans language), but flowing in torrents during the winter rains. Along its course, the flow and quality of water and life in the Kuils River is shaped by multiple factors, such as wetlands, agricultural lands, canals, flows from small tributaries, effluent from several wastewater treatment works (WWTW) and storm water flowing into the river from formal and informal residential areas. Day and Brown (1998) observed that the river (and by extension, the Eerste River after its confluence with the Kuils River) now flows throughout the year due to the high volume of effluent processed by four Waste Water Treatment Works (WWTWs[1]) and increasing stormwater drained from residential and industrial areas along its path[2]. The river also featured multiple wetlands, but over 80% of these have been depleted due to rapid urban growth and the development of industrial parks and residential areas over the last 40 years (Magoba and Brown, 2008). The location of the Kuils, once characterised by vast tracts of land for farming that more recently have been earmarked as a space for rapid urban development such as the construction of Reconstruction and Development Programme (RDP) housing and industrial areas, has resulted in a hardening of surfaces that has increased stormwater flow into the river. The river thus bears both urban and agricultural pollutants of unknown origin, known as nonpoint source (NPS) pollutants. This study limits its focus to the Kuils River and surrounds, including the area where it joins the Eerste River up to False Bay.

[1] The four WWTWs along the Kuils and Eerste are:

a. Scottsdene, which pumps wastewater into the Bottelary River, a tributary that joins the Kuils at the middle section of its course;
b. Bellville, which pumps wastewater into the middle section of the river in the Sarepta/Kuils River neighbourhoods, adjacent to where the Bottelary River meets the Kuils River;
c. Zandvliet, which pumps into the lower section of the river a few metres upstream of the Sandvlei community;
d. Macassar, which pumps wastewater into the Eerste River after its confluence with the Kuils and before it enters the sea at False Bay. The Macassar WWTW area is a popular bird-watching site, as there is a lagoon there before entering the sea that is teeming with life.

[2] See Appendix A for WWTWs located in Cape Town and volumes treated.

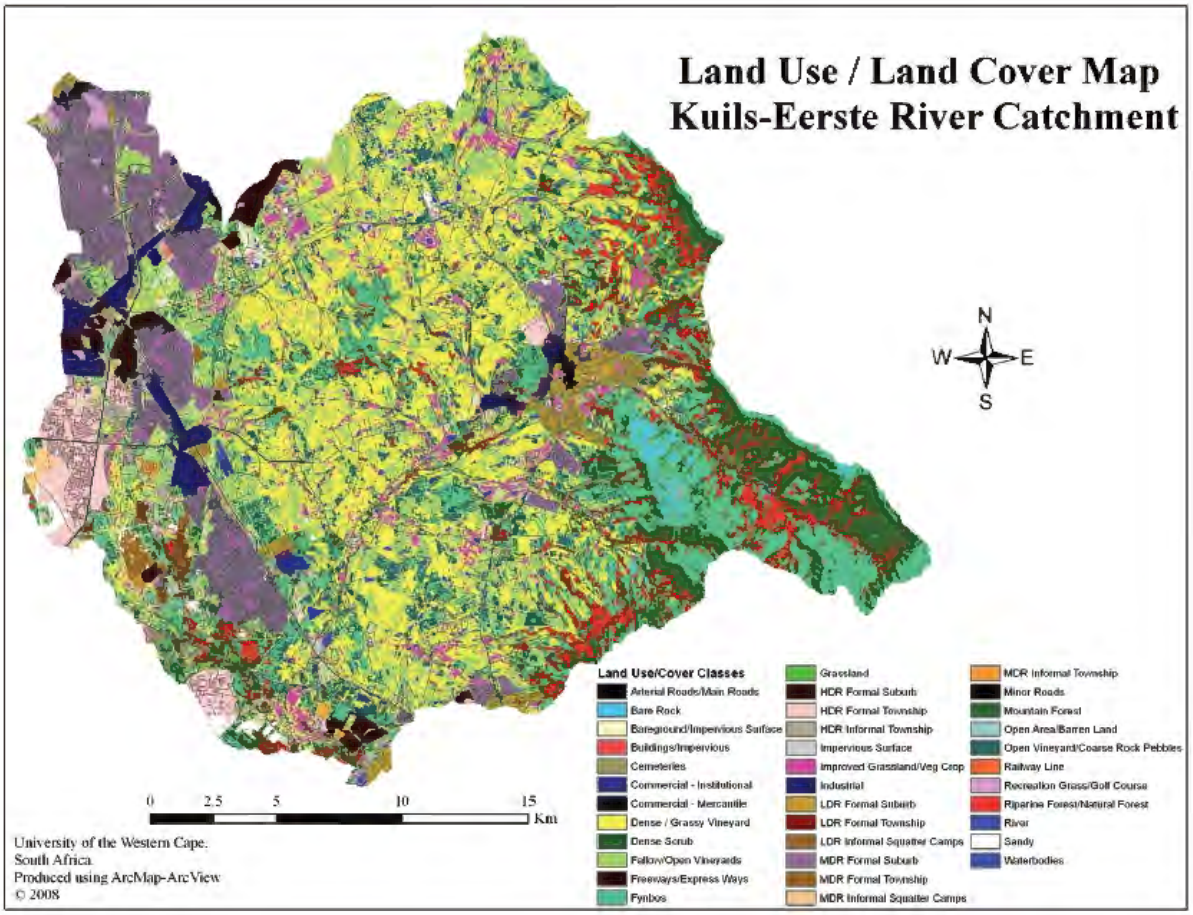


Image B: Land use and land cover of the Kuils-Eerste River catchment. (Source: Chingombe et al. 2010)

The increased development in the area, resulting in the hardening of surfaces using cement and tar, created impervious surfaces as demonstrated in yellow in the land cover image by Chingombe et al. (2010) above. Covering soils that were previously allocated for agriculture with cement and tar as well as removing natural ground cover such as grass, shrubs and trees, hampers natures processes of regulating flow in this urban environment. The decrease in plant cover also results in less evapo-transpiration necessary for rainfall and heat regulation, particularly in spaces with dense concentrations of materials that absorb and retain heat. This concentration causes what is called an 'urban heat island' that affects natural cycles and the well-being of people and multi-species communities. It also impacts the economy, as more energy is required to regulate the heat (e.g. increased use of air conditioners) and combat the effects of accumulating greenhouse gases (e.g. impacts on health and increased frequency of climate extremes of heat and flooding) (Hulley, 2012).

While researchers have studied the impacts of habitat loss and the marginalisation of people whose needs are made invisible under the guise of 'development' (Brundtland et al., 2012), this study explores how ideas that frame development and river management affect the "ecologies of well-being" (Cohen, 2013) of the river and adjoining communities in the context of climate change. In this study, the arguments formulated are often presented as a prompt to consider the alternatives available in river management for the achievement of ecological well-being. Ecological well-being, as highlighted by Grouzet and Lee (2014), refers to the balanced relationship between people and ecological systems, which leads to successful management, fair and sustainable distribution of natural resources for current and future generations. The quality of human life is directly linked to the state of the environment, and therefore, ecological well-being is not the sole focus on the environment, but rather includes human (the individual and society) relationships to the environment.

As such, the concept of urban metabolism (Thomson & Newman, 2018; Sanches & Bento, 2020) becomes key to understanding human relationships to the environment. Urban metabolism refers to the material and energy flows in cities that are shaped by social, economic and environmental forces to create a complex system. In this study, I argue that these forces within the complex system have geological effects, and by drawing on an analysis of infrastructure and governance, of geographies of space and materials and of histories of settlement and displacement, I demonstrate that development, particularly in Cape Town, is not neutral. I argue that while the discourse around development on the African continent often suggests the prioritisation of meeting the basic needs of people and are generally geared towards an improvement in well-being, when economic development is valued above all else, particular approaches to infrastructure development occur and form a particular local expression of what some scholars call the Anthropocene (Crutzen, 2006; Chakrabarty, 2018) and others the Capitalocene (Moore, 2016a), discussed throughout this thesis. The Anthropocene is a proposed geological period that dates the beginning and continued impact that humans have had on the Earth's geology and ecosystems, including but not limited to climate change brought on by human activity. Moore (2019:50) however argues that not all humans bear the same responsibility of altering the Earth so significantly, and failure to acknowledge this is "a special brand of blaming the victims of exploitation, violence and poverty". Moore (2019) argues that an accurate description to describe this geological epoch

would be the Capitalocene as this approach rejects the anthropocentric flattening and economic reductionism (p53). The Capitalocene proposition highlights that in order to understand the planetary crisis today, power, production and accumulation must be taken into account alongside white supremacy, patriarchy and modern class rule in how nature has been positioned as cheap and up for exploitation. Nature is therefore not an idea or something that just exists out there, but is intimately linked to efforts of how it must be harnessed and controlled, through the use of subjugated bodies such as women, colonised people and more-than-human worlds for profit-maximisation. When capital accumulation becomes narrowly focused on economic achievement and politics and certain technologies are used as instruments of domination to control the subjugated.

This study therefore explores how lives, politics, technology and environments are impacted by river management practices in Cape Town and how these shape efforts to achieve wellbeing among those that live closest to the Kuils River. The river has been used as a dumping site for solid waste and waste from industrial areas as well as WWTWs. The river has also been used as a site for technological interventions to control, move and protect water and critical biodiverse natural areas along its path. The study contrasts the ideas that drive economy-based approaches to infrastructure with the many engagements between the river and the people who come to it for recreational and ceremonial reasons, such as cleansing, initiation and reconnection with the ancestors. It is also used to water gardens and livestock by many that live along its path. These different interactions with the Kuils River elicit quite different ways of relating to it, where one way is steeped in everyday local practices of being, while the other is commensurate with global ideas and practices oriented toward financialised economics.

To explore how people and river shape and produce one another, my research explores the multiple meanings, practices and ways of knowing associated with both water governance and lived lives along and in the Kuils River. When environmental water management is understood to be a singular issue, it becomes clear that when enacted in practice, very different ideas are in play of what the purpose and role of a river is understood to be within an urban setting. Using ethnographic material, archaeological and archival data, I demonstrate the multiple meanings of environmental governance, developing an argument that has broader significance for the governance of waterways.

Engaging with people who live along or near the watercourse that is the Kuils, this study provides insight into experiences of living with the polluted river, its impacts on people's health and the difficulties they have in proving that harm. The Kuils River's health and human health have been shown by researchers to be inextricably linked (see Fourie, 2005; Nel, 2013; Mwangi, 2014), but the complexities of providing evidence of environmental harm to a specific standard of both evidence and direct causality mean that such an association is easily disregarded. Strategies for river management often overlook knowledge claims by the communities that live in toxic spaces or the research findings of scientists that focus on the impact of pollution on people and multi-species communities (these scientists are also at risk of reputational harm from the city's responses, as discussed in Chapter 2). This makes certain populations and geographies of the Kuils vulnerable to environmental sacrifice (Davies, 2019).

Sacrifice zones are often located in edge-dwelling communities made up primarily of people of colour with low incomes, or are 'hot spots' of chemical pollution, where residents live in close proximity to industrial areas or heavily polluted streams (such as the Kuils) (Davies, 2018). In South Africa, these areas also lack adequate housing, water and sanitation infrastructure. As Davies (2018) suggests, these patterns of unequal services and protections often constitute environmental racism, demonstrating that environmental justice is not just a 'poverty thing' but is a result of systemic and institutional patterns of inequality that are swept under the rug of democracy (Mbembe, 2019). I argue that how this is enacted is a form of violence on human and multi-species communities, some explicit and visible and others as forms of slow violence, which is cumulative and has potentially cascading effects. Rob Nixon (2011: p 2) refers to slow violence as a violence that:

> Occurs gradually and out of sight, an attritional violence that is typically not viewed as violence at all. Violence is customarily conceived as an event or action that is immediate in time, explosive and spectacular in space, and as erupting into instant sensational visibility. We need, I believe, to engage a different kind of violence, a violence that is neither spectacular nor instantaneous, but rather incremental and accretive, its calamitous repercussions playing out across a range of temporal scales.

In this study, I also argue that with South Africa's history of unequal development, infrastructural violence has morphed into instances of slow violence. One way the state

organises society is through infrastructure, where state practices converge with the global economy and development (Scott, 1998). As such, infrastructure becomes an interesting and important site for the study of how relations of power and hierarchy translate into overt forms of physical and emotional harm (Rodgers & O'Neill, 2012). So while the discourses of municipal infrastructure are inevitably claimed to be 'for the betterment of society', I argue that the particular assumptions built into the design of infrastructure often take for granted the social consequences of infrastructure's day-to-day (mal)functioning (Rodgers & O'Neill, 2012). With this observation centrally in mind, this study demonstrates how violence is enacted through infrastructure in relation to the Kuils River.

One such instance was made visible through an encounter with the Department of Informal Settlement, Water and Waste, a division of Cape Town's Water and Sanitation Department. On this particular occasion, I sat in the dim light of a government office in Cape Town's Central Business District (CBD), with no windows to see the famous views of Table Mountain and the ocean, features that have exponentially pushed up the price of property in the Mother City. Professors Lesley Green and Leslie Petrik, Dr Bernelle Vester (a bio-engineer), residents of Sandvlei and myself had walked into the office for an emergency meeting to discuss the findings of water samples taken from the Kuils River in the Sandvlei/Macassar area on the edges of Cape Town on the 27th of November 2018 (see appendix B for results). The samples showed exceptionally elevated levels of *E. coli* and *Enterococcus*, bacteria found in the gut of humans that wreaks havoc outside of that environment.

I remember feeling quite uneasy about the meeting, given the tension and frustrations that had emerged from previous meetings about the impact of the Zandvliet WWTW on the river and the residents who live along it. The large contingent of Sandvlei United Community Organisation (SUCO) members also threw me off, as city officials normally outnumbered us in meetings of this kind. I perched awkwardly on my seat and greeted the people closest to me, both engineers by training, and nodded to the CoCT representatives, who had professional backgrounds in the sciences (such as water chemistry, health and marine biology). On our side were anthropologists, a process engineer, a chemist and, as mentioned, members of SUCO.

As we sat down I saw frowns and anxious looks pass between everyone in the room. The chair of the meeting, the Executive Director of Informal Settlements, Water and Waste for the City,

started the conversation by addressing the discomfort felt by the city officials at the presence of so many SUCO members. The chair said that they had understood that the meeting would include just academics and city staff, with the goal of understanding the water test results and planning the way forward. An attempt at negotiation was made, which included appeals from Professor Green, director of the Environmental Humanities South at the University of Cape Town, to consider four pertinent issues with regards to research and policy formation. These issues were:

1. The ethics of what it means to do research without consulting those directly affected by river pollution. While we as academics were equipped with tools and methods to conduct research and sample the water, it was ethically imperative to not limit our findings to our own understanding of the numbers the test revealed, but to also consider how this was translated and experienced by residents of Sandvlei. The intention was to include the inputs of the residents in other ways, and acknowledge these inputs as other ways of knowing often not recognised within the domains of academic knowledge and technical expertise.
2. Including these translations and experiences requires a grounding of knowledge/science in the everyday to inform policy that is connected to the people it governs.
3. Grounding knowledge in the everyday requires a democratisation of knowledge in policy and governance, challenging the supremacy and role of quantifiability in the representation of lived experience and as the ultimate truth.
4. The democratisation of knowledge should also question the difference between the roles of elected city officials (who play the role of dealing with politics) and those who are appointed (who misdirectedly only deal with the 'facts' of science and management).

However, the City officials opted to remove themselves from the meeting before the results could be disseminated. Green, Petrik and I had engaged with the CCT before, setting up a meeting immediately after we received the test results of a water sample I had collected a month earlier. The test results showed alarming levels of *E.coli*, enterococci and chemical nitrates in the water. In this meeting, after disseminating the results, suggestions were made

to further canalise the river, which we opposed as this would only have shifted the problem elsewhere. The representatives of the CoCT also objected that we were causing unnecessary alarm about the quality of water entering the river and then flowing into the sea, which they noted to be an egregious offence at the start of the tourist season. Our methods of collecting the water samples were questioned, as regulations required that we collect water samples from the middle of a flowing river – we argued that residents and their animals interact with the water on the banks of the river. We left that meeting feeling rather frustrated, as it seemed that more efforts had been made to discredit our research than to actually address the problem of the polluted river. This was not just a 'clash of knowledge' about the river but was also about knowing the river through numbers versus seeing it flow past homes and interacting with it; through water samples versus breathing in the fumes and pathogens released by it, shaping and being shaped by it.

After the representatives of the CoCT excused themselves from the meeting, I remained in the boardroom with my colleagues and the SUCO members. A conversation about how to engage with the city unfolded as Green set up the laptop to begin the presentation to those still in the room. The consensus was that people were tired of toeing the line, as this had not resulted in their issues being heard. I suggested that we needed evidence that would stand in a court of law, and the SUCO members argued that they had been providing evidence for years but it was never accepted. An argument between myself and Mr Sallie, a SUCO member, ensued about the kind of evidence that would be accepted in this arena: what constituted evidence and how the evidence should be collected. To me, it meant being able to present a watertight case should the need arise, but I saw from the expression of my interlocutor that I was missing the point. Mr Sallie said, 'Why should we have to end up in court? I just want my kids to be safe. Is that a crime that I would have to end up in the courts to solve the issue?" In short, however, the only form of evidence that the city would accept had to be based on scientific evidence that met particular scientific descriptions of cause and effect and were devoid of the experiential aspect that was so central to the ethical claims about well-being presented by the SUCO members.

The sense I got from the meeting was an attempt by the CoCT representatives to be neutral and objective to the issue about the river. Because to include feeling and experience was to

make it personal, and the personal becomes political, which would not count as objective science, and the section of the Department of Water and Sanitation in charge of the technical aspects of water and waste management apparently does not deal with the politics.

Mrs Salie, the wife of Mr Salie, then reflected on a site visit that the director of the Water, Waste and Informal Settlements the same official had done in their neighbourhood, saying,

> 'I can't believe we are going through this again. The last time when they came to see the waste treatment plant, they refused to hear us. One of them even refused to shake my hand. Am I contaminated? And now they will not sit with us to talk. I am angry and I am hurt.'

I reflected on the deep irony of this encounter, where the CoCT had failed to acknowledge that the contamination of the river was affecting the people, but then treated the people as if they were in fact contaminated.

Over the weeks that followed, I reflected on how communication had failed between the different parties who wanted to develop a solution to the problem. Everyone seemed concerned about the state of the river, but the point of contention had become what evidence was supplied, how it was presented and who was entitled to present it. This seemed to be a semantic dispute about what actually constituted the river and how it should be cared for. The city officials, academics and Sandvlei community agreed that the Kuils River was polluted, but disagreement arose particularly when seeking to understand the 'complex urban Anthropocene ecology in which infrastructure is failing, and the environment is overwhelmed by new forms of toxicity' (Green, Solomon, Petrik & Barnes, 2019), made evident by the increase in human health issues and the disappearance of animal and plant species over the years. However, only one team's data was being accepted by the City, and that was the data for which the City had paid and that was acceptable to the Council's reigning orthodoxy.

The Kuils River is not a space that **always** produces obvious and blatant signs of toxicity, but it can do so in subtle and incremental ways that communities observe and endure for years (Davies, 2019). This does, however, allow communities to accumulate knowledge about the

flux of the river over time, how pollutants enter and exit, and the effects of these pollutants on those living along its waterways – an approach quite different to that of the city officials who take water samples a few times a month, or even to us as researchers who collect samples after a major event has changed the composition of the river. This one river is subject to many differing experiences, and therefore different concerns, expressed with differing evidentiaries. For City officials to assert one form of knowing the river as true but the other as false was surely an act of epistemic violence (Spivak, 1988). Gayatri Spivak uses the term "epistemic violence" in her key text *Can the Subaltern Speak?,* as an approach of highlighting the silencing of marginalised groups. For Spivak, the "layperson", "general, non-specialist", "the illiterate peasantry: and 'the lowest strata of the urban subproletariat'" (ibid: 42) are often silenced and subjected to epistemic violence by those who supposedly know better. This silencing is a result of the devastating effects of colonialism and erasing of local knowledge to privilege knowledge and epistemic practices, often from certain parts of the global North. Although Spivak's argument has been disputed strongly, her insight into the difficulties for marginal groups in addressing this type of violence that attempts to undermine local knowledge possessed by marginalised communities is useful for this study. As she astutely notes, one way of enacting epistemic violence is to disparage a given groups' knowledge claims, damaging their ability to speak or be heard. Spivak's argument can be extended to the relationship between rivers and people, as the ways of knowing the river by the community are considered inadmissible in disciplines that require facts through science and measurement. Accounts that are based on experience and framed as personal are unobjective and therefore dismissed in the hallways of science and governance because there is only one truth, one way of knowing the river. Yet, as this study demonstrates, the river is multiple, and therefore there are multiple ways of experiencing and knowing the river.

One could argue that the dismissal of local or informal accounts of the river's contamination perpetuates humanity's slow response to environmental degradation, in this instance allowing marginal and vulnerable people and geographical spaces to be 'sacrifice zones' for the benefit of the greater Cape Town population (Davies, 2019). Ignoring local claims of environmental injustice helps to perpetuate the brutality of governance by science and experts **only,** which I discuss in more detail in the study. The toxic spaces remain disputed and dialogues reach a stalemate, while communities continue living in polluted and degraded

environments. The situation described above demonstrates how different forms of knowledge practices around water and, in particular, the river, can enact violence despite having similar intentions.

I also interrogate the idea of slow violence as one that is "out of sight". Asking for whom this violence is 'out of sight', I document the experiences of the communities living along the polluted Kuils River and examine the kinds of physical and political infrastructure that perpetuate environmental degradation across different geographies in the Cape Town metropolitan area. The notion of slow violence is extended to 'deep time' in this study, exploring geological histories, presents and futures in relation to spatial and social justice, where environmental threats are not only dispersed to marginalised groups but are also deferred to the future (Davies, 2019; Farrier, 2019). This notion of slow violence coupled with time is key to understanding the equivocations of river management in Cape Town.

I was inspired by the work of Annemarie Mol (2002), who in *The Body Multiple* sets out an 'ontological politics' of bodies that suffer from atherosclerosis, a disease in which plaque builds up inside arteries. For Mol, this is an ordinary disease generally understood by physicians, pathologists, nurses, radiologists and patients, as the thickening arteries due to cholesterol, calcium and other substances in the blood. However, the difference is in how this knowing of the disease is enacted in practice. Each of the different knowers pay particular attention to what concerns them. For instance, a physician would pay attention to the pathology of the disease, the nurse would be concerned about patient care, whilst the patient is concerned about navigating everyday life with this disease. Mol's notion of the multiplicity of the disease is therefore important in highlighting that object (the disease and in this study, the river) is a not singular entity but an amalgamation of partially coherent and partially coordinated enactments. The ontology[1] of an object is thus decentred to a multitude of practices. Mol (2002:viii) therefore proposes an engagement in an "ontological politics", which is a politics that explores the way issues, objects and/or things are positioned or framed and how "bodies are shaped and lives are pushed into one shape or another" through a multitude of practices.

[1] In this study, I use the term ontology to mean the ways of being, existing and becoming of entities at the most fundamental level.

Mol's work makes possible an equivalent question about rivers and the knowledge of them, so in this study I look at *the river multiple* through stories of an urban river, exploring how lives, politics, technologies and environments are shaped by interactions and enactments of the river. They are stories about relationships, interconnectedness and thinking about futures, about flows of water, capital and cement. I demonstrate how the many different ways of relating to the river have been shaped through science, politics, technologies, management practices, changing climate and chemical flows in the Anthropocene. I tell these stories to address the unequal knowledge terrains that comprise environmental justice.

The study also shows how the river's flow shapes geo-technical and socio-political landscapes by exploring its deep and recent history, the present and future. While the study explores the limits of thinking about a river only in terms of natural resource management, engineering or conservation, I also attempt to understand enactments of the Kuils River, how relating to the river means that 'what we think of as a single object may appear to be more than one' (Mol, 2002: vii). In the case of a seemingly single river flowing at the urban edge of Cape Town, how it is interacted with and how it is known elicits different responses and meanings. This in turn informs the different modes of governance required for those living along and in it. What do these multiple versions of knowing and enacting mean for the river? What does it mean for people and the multiple species that live with the river? Does this mean production of multiple natures and therefore an enactment of different futures for the river?

CONTEXT OF RESEARCH

The research was started as South Africa faced one of its worst droughts in decades. According to the South African Weather Service, the drought of 2015, a result of the extreme weather system El Nino, was the worst to hit the country since 1982 (BBC News, 2015). Five provinces out of nine, where the bulk of the country's maize supply (a staple food in South Africa) comes from – namely, the Free State, KwaZulu-Natal, Mpumalanga, North-West and Limpopo – were declared drought-stricken areas in 2015 (Ngoepe, 2015). Cape Town and the Western Cape were not affected at the beginning of this national drought, and many citizens believed they had narrowly avoided a disaster of epic proportions. However, in February 2017, the Western Cape was declared a disaster area due to the intensifying drought conditions (De Lille, 2017b;

Zille 2017a; Ramaphosa, 2018). Cape Town receives the bulk of its rain during the three to four winter months, from late May into August. Increase in climate unpredictability and a growing urban population placed pressure on the city's ability to supply potable water. Using figures such as dam percentage levels and the number of days' worth of potable water left, the municipal and provincial water departments worked closely with their media departments to launch a full campaign to educate and encourage better water use by its 'customers'. In framing citizens as 'customers' under this model, access to water was not presented as a right that secures life but as a commodity to be purchased.

Large sums of money were spent on communication campaigns (about R1 million – see Palm, 2018), the installation of the much-dreaded water monitoring devices to control how much a household could consume every month,[2] repairs to failing infrastructure and an exploration of alternative potable water sources. Desalination and underground water were identified as the most viable options to meet the growing demands of the city, and treated effluent was to be reused by industry and for the maintenance of green public spaces to decrease nonconsumption freshwater use (see CWRA, 2019).

The Table Mountain Group Aquifer (TMGA) and Cape Flats Aquifer (CFA) were identified as highly attractive and viable supplementary sources for the water needs of the city, but the drilling of the TMGA was placed on hold while the city reviewed the environmental impact. Environmental assessment reports highlighted that drawing from the aquifer would be disastrous for the area, posing a threat to the unique biodiversity of the Cape Floral Region, a UNESCO World Heritage site. Nevertheless, Barry Wood (manager of Bulk Water for the City of Cape Town) and Chris Hartnady (Hydrogeological leader on the Table Mountain Group Aquifer at Umvoto, a private consulting firm) announced on Cape Talk Radio that the drilling of this aquifer had been planned over the last ten years and that the project would be completed in 2024 (Friedman, 2017). The drilling of the aquifer officially started in August

[2] Water monitoring devices are a point of contention in South Africa, as they place limits on how much a person can use every month. The CCT provides a free basic minimum of 6000 litres of water per month for what they call "indigent" households, which translates to 200 litres per day. Once this limit is reached, citizens are billed for what they use for the rest of the month, their water pressure is reduced, or their supply is cut off. However, in some households, particularly in townships and informal settlements where taps may be shared with neighbours, the water quickly runs out and the owner of the property with the tap is left with a large bill. The poor infrastructure in these areas is also an issue, with burst and leaking pipes attended to slowly. People in wealthier suburbs are not held to the same level of accountability for their water use.

2020 and, once complete, was expected to provide 20 million litres of water per day to Cape Town's water systems for the first phase. Upon completion of the project, the City is expected to access 33 million litres of water a day, with an additional 15 million litres per day expected from the Nuweberg well field, which is currently in the exploratory drilling phase (Pace, 2020).

The CFA, also considered an augmentation supply for Cape Town's water security, is currently being drilled. The CFA lies east of the city bowl, below one of Cape Town's last remaining areas of urban agricultural land, the Philippi Horticultural Area (PHA). The CCT and building developers were – and are (at the time of writing, between 2016 and 2020) – embroiled in a court battle with local farmers and PHA activists who oppose the purchase of land to build private schools, houses and a private prison in an area with one of the last recharging points for the aquifer. It became apparent in court that the city had not yet put plans in place to manage the recharge of the aquifer; overdrawing from the aquifer will lower its water table and increase the chances of saltwater inundation, making the water less suitable for consumption and the agricultural activities of the PHA. It was suggested that wastewater be used to recharge the aquifer, but scholars and activists have cautioned against this considering CCT's increasingly polluted urban rivers and polluted wastewater (discussed in more detail in Chapter Four). Some PHA farmers and activists have argued that the shortterm planning and vision for the development of the city, focused as it is on economic growth rather than a climate-resilient future, places every citizen at risk and exacerbates inequality.

The drought made Cape Town citizens more conscious of our complex relationship with water, particularly in a water-scarce country such as South Africa. Questions such as "Where did we go wrong?", "How do we consume water?", "How do we share water?" and "How do we treat our water resources?" emerged, and concerns about the role of infrastructure, institutions and communities of practice in governing our relationships with water became the central focus of media, education and research institutions and conversations around dinner tables in and outside the home, both locally and globally. Cape Town was anticipated to be the first major city in the world to run out of water. The mantra of the Democratic Alliance (DA)-led government was that a well-run city would never run out of water, which was also a taunt at the "failing" African National Congress (ANC)-led metropoles. Frustration from some Cape Town citizens mounted as they became aware of how much freshwater runs in Table

Mountain streams (e.g., 2,77 million litres flows from the Oranjezicht spring[3] every 24 hours (IOL, 2017)) and the urban rivers of the metropole that were used to water recreational spaces, despite pronouncements that every drop counted during water rationing. These springs, streams and rivers are also being polluted, and some were diverted directly into the sea. Communities demonstrated against the CCT, who wanted to drill and concrete over the Cape Flats Aquifer's last remaining recharge zones to build houses, bringing to the fore the complex relationships between the land (and soil), the anthropo-not-seen (underground water, microbes and insects) and the form of development envisioned by the city. In this study, I explore how these conflicts emerged and are of significance, especially in this time of rapid climate change and as we grapple with the legacies of colonialism and our shifting relations to the land. Cape Town is a particularly interesting case, as it is considered one of the 'most divided cities' in South Africa.[7] The drought exacerbated these inequalities, with the media exposing excessive water use by the wealthy as poorer communities were blamed for wasting water. The water shortage was also a great leveller, however, as evidenced by the queues for water at sources such as the Newlands Spring. Should the Western Cape Province have run out of water, everyone would have been affected.

The rainfall in 2019 and 2020 was more bountiful, with dams at full capacity at the time of writing (between 2019/20). CCT increased water tariffs during the drought, apparently to increase resilience the city of Cape Town to prepare for climate shock events and perhaps also to also deter the waste and overuse of water. After the drought, civic groups and activists requested that the tariffs be reduced, as the dams were now full and families were struggling to pay such high tariffs, particularly as the economic fallout of the COVID-19 pandemic were felt. In response, Mayoral Committee ("Mayco"[4]) member Xanthea Limberg argued that the City had not made a profit from the drought and had not budgeted for a profit from the sale of water. Budgets that were made public, however, showed a significant 'surplus' because of

[3] In 2014, the Scientific Services Branch of CCT found that the water from a number of the Table Mountain Springs was of a very high quality. At the beginning of the drought, Oranjezicht Spring water was used to irrigate the Green Point Urban Park, Cape Town Stadium and Green Point Athletics track (all located in some of the wealthiest neighbourhoods in Cape Town). However, Oranjezicht Spring water was diverted to the Molteno Reservoir during the 2017 drought (letter from former mayor Patricia de Lille, IOL News, 2017). [7] A report published by the South African Human Rights Commission (SAHRC, 2018) considered South Africa to be the most unequal society in the world – a legacy of colonialism, apartheid and 'trickle-down' economics.

[4] The Executive Mayor is supported by an Executive Deputy Mayor and a Mayoral Committee (the 'Mayco'). Each member of the Mayoral Committee has a portfolio with specific functions.

water sales during the drought period. Limberg argued that a reduction in tariffs would only be possible if water consumption increased, as CCT was selling about 30% less water than they had during the drought. Any decision to move to a lower tariff level is apparently based on 'how much water can be sold so that water services can be paid for rather than how much water is in the dams' (Cape Argus, 2020). This demonstrates the intensified financialisaton of water and wastewater treatment to increase water conservation and sustainability. The water and wastewater domains consequently are then incorporated into forms of economic expansion associated with financialisation more generally. The logic of financialisaton enables water and associated infrastructure to become a part of the market driven by profit-based incentives. When capital accumulation becomes a priority, it is not limited to the domain of the markets but rather filters into new areas of social, environmental and economic (re)production, even as other areas of production are reduced (Bellamy Foster & McChesney, 2009; Fine, 2010). This is discussed in more detail in later chapters.

AIMS AND SCOPE OF RESEARCH

This is a study of ways of relating to and knowing an urban river. It explores the ways in which the Kuils River adapts to, relates with and shapes landforms and societies in many and diverse ways and explores how infrastructure, society, politics and governance shape materiality, flows and interactions with the river. It is about how the river enacts the objects it interacts with. Rather than just treating the river as an object of social and cultural production – something produced through social relationships and imbued with meaning through cultural schemes – my research also considers how knowing the river is done and what the implications of the different ways of knowing are (Krause & Strang, 2016: 633). This study looks at the river as an assembly of water, rocks, microbes, plants, people, soils and infrastructure, beyond the general description of a river as a large body of flowing water. To understand the river as more than just a course of water opens up diverse ways of knowing it, which in turn inform the diverse ways it can be managed and governed democratically. The stories I relate in my research are drawn from interactions with people, plants, animals, texts and water in and along the Kuils River in Cape Town. My research was conducted when South Africa was experiencing one of its worst droughts since the 1930s (DWS, 2017), bringing to

the fore concerns about water governance that were often hidden or downplayed, and sparking activism and responses from different sectors of society.

The purpose of this research is not to discount the role of science and engineering, but rather to challenge taken-for-granted notions of river management and to think with these disciplines about what regenerative practices might look like in a time of growing climate uncertainty. This requires an understanding of the history of river management in South Africa in general and in Cape Town in particular; the role and impact of techno-scientific management in shaping relationships to the river; the various relationships outside of the management paradigm that have been rendered to the periphery; and the kinds of politics that become embroiled in the river's management. The endgame is to think of the kinds of regenerative practices that become possible for multi-species worlds when care and wellbeing are a crucial point of departure in river management. While diverse ways of caring through science, engineering, activism, conservation and so forth exist, the challenge is that when one version of care supersedes others, the concerns of the less powerful are unattended by the sciences. In such a context, what kinds of injustices are allowed to be enacted? I propose that hearing different stories and different concerns and drawing these into dialogue with the sciences will make possible the exercise of a more democratic science in a society that values justice and equity.

The central research question is, therefore: What are the different ways of relating to, being with and knowing the Kuils River in Cape Town? I also ask: How does this shape the river and, in turn, how does the river shape ways of relating to it?

To address the above questions, I also ask:

- How do different actors – in communities along the river, in government offices or in labs – come to know the river?
- How are these ways of knowing the river enacted? How are they related?
- How do these shape how the river is responded to and how does the river respond to these enactments?

While questioning the appropriateness of ways of knowing the river and their enactment is at times crucial, I focus to a greater extent on what Mol (2002) refers to as *multiple*: for example, is the river framed as a source of life or as a sink for urban waste? How does this pull, push and shape lives? Focusing on the underlying understandings of the uses of the river in the city draws attention to the multiple realities of living with the Kuils, 'the river multiple'. If the uses of the Kuils are multiple, its governance is political (Mol, 2002). This thesis therefore addresses the question of how living with the river multiple can be done well.

RATIONALE: RETHINKING THE PLACE OF RIVERS IN URBAN LIFE

In *An Inquiry into Modes of Existence*, Latour (2013) discusses how different 'things' or 'phenomena' come into existence within society through different knowledge-making practices, each expressing their considerations of what is important. In an effort to foster 'good governance', there has been an increased reliance on the market to regulate and manage natural resources, including water. Water resources have thus become commodified, with infrastructure being developed in partnership with private entities and international organisations. In the process, water has taken on a different significance and is now a commodity rather than a commons, which in turn shapes how it is understood and interacted with. While a significant amount of social science research in South Africa and Africa in general focuses on access to potable water in relation to gender, race, class and governance, this research pays attention to an urban river, a subject often on the periphery of the discipline of anthropology, considered simply as part of the landscape or as a resource for humans or thought of in relation to indigenous knowledge systems. My intention is that this study leads to greater awareness of relationships with the Kuils River that go beyond the colonial and settler encounter, but to also recognise relationships that are not defined by control, command, or predictive neoliberal governance but instead have rivers (and all their constituents) recognised as central co-creators of our world. The well-worn dualisms of Western thought, separating humans from their environment, particularly during the enlightenment period, have played a crucial role in the violent transformation of people and ecosystems; continuously obstructing our ability to achieve both social justice and environmental justice. Studying contact zones where lines separating nature from culture have broken down, where encounters between humans and other beings generate mutual

ecologies and co-produced niches, centers on how a multitude of organisms' livelihoods shape and are shaped by political, economic and cultural forces.

My goal is to challenge the dominant white colonial metaphor of living outside/on the Earth and to begin seeing ourselves in and with the Earth. As modernist human beings, we rarely think of ourselves as living in the Earth, but off it, which justifies our relationships of exploitation. As such, my goal was to formulate research questions, mobilise emerging research methods and approaches and develop research materials and processes that can engage publics in the process of addressing the Earth. This study thus aims to add to the environmental humanities discourse on reclaiming what it is to be a humans in sync with Earth's natural cycles versus those that live outside of the Earth's natural processes.

STRUCTURE OF THESIS: THE DIFFERENT VERSIONS OF THE KUILS

Throughout the thesis, I consider the intricate 'modes of existence' (Latour, 2012) between residents living along the river, the river itself and management practices to explore the various local practices and experiences with the river – how, if at all, they are shaped by or in turn shape the river, and what it means for the everyday well-being of river communities (humans and more-than-humans). In engaging with these modes of existence, I draw on environmental anthropology and science and technology studies (STS), while keeping Mol's (2002) 'body multiple' and Blaser and de la Cadena's (2018) 'pluriverse' in mind. Such theories deconstruct the idea of one version of the world, drawing attention to how divergent knowledges and practices make worlds in which residents and government officials conceive of how to care for the river. I draw on the work of a number of global south scholars (Adichie, 2009; Blaser, 2013; Mkwanazi, 2016; Blaser & de la Cadena, 2018) as the crux of the thesis, scholars who highlight the pitfalls of relating a single narrative, especially one that glorifies colonial logics and vilifies and stereotypes Africa and poverty. As a result, this study provides multiple stories that highlight many relationships on the riverscape of polyrhythms that have entangled histories and futures. While I do not claim to tell the whole story of the multiple ways to relate to the river that exists on this landscape, I trace entanglements with the river and how these come to shape efforts to live with it.

In Chapter 1, I begin by setting out the context in which the study was done. Cape Town had experienced one of the worst droughts in 100 years. At the same time, there was a noted increase in service delivery protests in informal settlements (with a largely black population) due to the lack of adequate water and sanitation infrastructure. The drought and protests highlighted the problems of water and waste management in the city that urgently needed addressing in a time of climate uncertainty and pressures for more democratic and just governance.

After setting the context in which the study occurred, I draw on relevant conceptual and theoretical frameworks to support my argument for the river multiple. This section of the chapter sets out the intellectual foundations of my thesis in the environmental humanities, science and technology studies (STS) and environmental and infrastructural anthropology. The purpose of the chapter is to draw on particular theoretical and conceptual frameworks to argue for the acknowledgement of a 'river multiple' that establishes suitable approaches to river management that will achieve well-being for the residents and multi-species communities that live in and along the river.

Chapter Two highlights my experimental methods of engaging with transdisciplinary research and emphasises the importance of grounding, walking and listening, while also describing my process to find a research site and participants and to negotiate access and ethical engagement with the multi-species worlds of residents, students, city officials, the river and its landscape. The geological age of the Anthropocene compels a rethinking of how research within disciplinary confines is performed; epistemological approaches are often divided between human sciences and the natural sciences, which results in a bifurcated way of thinking about environment and society. In a time of increasing climate crises and growing inequality, however, innovative approaches to research are required to speak not only to the entanglements of human life, Earth systems and multi-species communities, but also to engage in scholarly critique that opens up new forms of collective problem solving that grows out of dialogue across different disciplines and sections of society.

In Chapter Three, I develop my research out of curiosity, thinking of the river as an 'infrastructure paradox'. Infrastructure development is characterised as a means of achieving

well-being for South African citizens and is meant to address the unequal development that occurred under colonialism and apartheid. I argue that while infrastructures are technical responses to the needs of citizens, they are also more than that, entangled in social, political and economic worlds and embedded in beliefs, capital, laws, science and engineering – all of which have geological effects. The challenge, however, is that when infrastructure is thought of as a single-faceted issue, as 'just technical', other facets become invisible. The politics of control, command and prediction are enacted through environmental and developmental policies are under the guise of improving infrastructure. As such, justice is a recurrent theme throughout the thesis. This study therefore sees infrastructure as a part of what makes up the Kuils River and explores how upgrades, degeneration, and permanence present as paradoxes in this waterscape (Howe, et al, 2016). The first paradox of infrastructure, which is its upgrades, suggests even as infrastructure promises improvement, connectivity and efficiency, it does this for some people at the detriment of others. The second paradox found in degeneration explores both the conceptual (in terms of relational breakdown) and the material (in terms of physical decay) are attributes of infrastructure. The third paradox of permanence explores the implied solidity and durability that attempts to defy time, bridging the past, present and future.

In Chapter Four, I explore the Kuils River as an 'archive' in relation to the city, with a reminder of how histories of settling/unsettling, environmental law, management practices, urban growth and politics are inscribed onto the landscape and create different versions of the Kuils across different time regimes. This helps foster an understanding of how these historic patterns have shaped the well-being of communities and the river and emphasises that while a justification for colonial settlement was the use of 'empty' space, the land and its people have an independent, pre-colonial history. The chapter explores water as socio-material terrain for the reproduction of racism by highlighting the necropolitics of Cape Town, and I explore the history of how practices of water management emerged, with debt servicing on infrastructure openly superseding democratic governance. I address how we can reimagine these for more democratic river futures.

Chapter Five provides insight into multiple conceptions of time, namely geologic, capitalist/financial, bureaucratic, technological, chemical, societal and political time. I

consider the river as 'deep' time, focusing on deep pasts, deep presents and deep futures by interrogating our obsession with rare earth metals that geoforms the Earth, and how rocks and chemicals that have gestated/are gestating in the present seep into deep futures. By examining the multiple versions of time of the Kuils River and of the river as deep time, I explore the interruption of our conceptual understanding of scale, time and geology to show how these are entangled with capital, technology, chemo-socialities and governance. Deep time is not just about understanding the geologic formations of millions of years ago, but is also about paying attention to ecological processes and making a connection to society's time.

Chapter Six explores the possibilities of thinking of a river beyond quantities of water (megalitres); stormwater problems; an urban drain; or an ecosystem service. The chapter attempts to move the narrative beyond the narrow ideas of development by using stories of multispecies relations between human, soil and water communities – stories of the people who live with the river, their current everyday lives, memories, wishes and their imagined futures for it, demonstrating different versions of care practices. The chapter challenges policy and law to call for a paradigm shift that prioritises lived relationships with the river over dominant technical, scientific and economic logics. Methodologically, I aim to show that stories are a powerful tool for learning about ways of being and relating to water in complex urban settings.

In the conclusion, I make a case for rethinking the conceptual and practical role of urban rivers to bring the river back into the convocation that is the city.

At the beginning of my research, I consciously used a broad-based approached to learn how to situate my current research questions as a form of "Anthropocenography" (Viveiros de Castro, 2013) and learn how to work and think in wider scales of space and time than we are accustomed to in the social sciences. My key task was to learn how to pose new kinds of research questions that not only did the work of scholarly critique but also opened new forms of dialogue-based, collective problem-solving by avoiding the imposition of meanings and topics of significance without first establishing local relevance. Although I began my field research with overarching questions, I understood that these might change as I became more

familiar with the context. As such, my research developed to focus on emergent topics that related to how communities use a river in the peri-urban space, which led on to other topics.

CHAPTER ONE

Reading the Kuils Multiple

CONCEPTUAL AND THEORETICAL FRAMEWORK OF THE STUDY

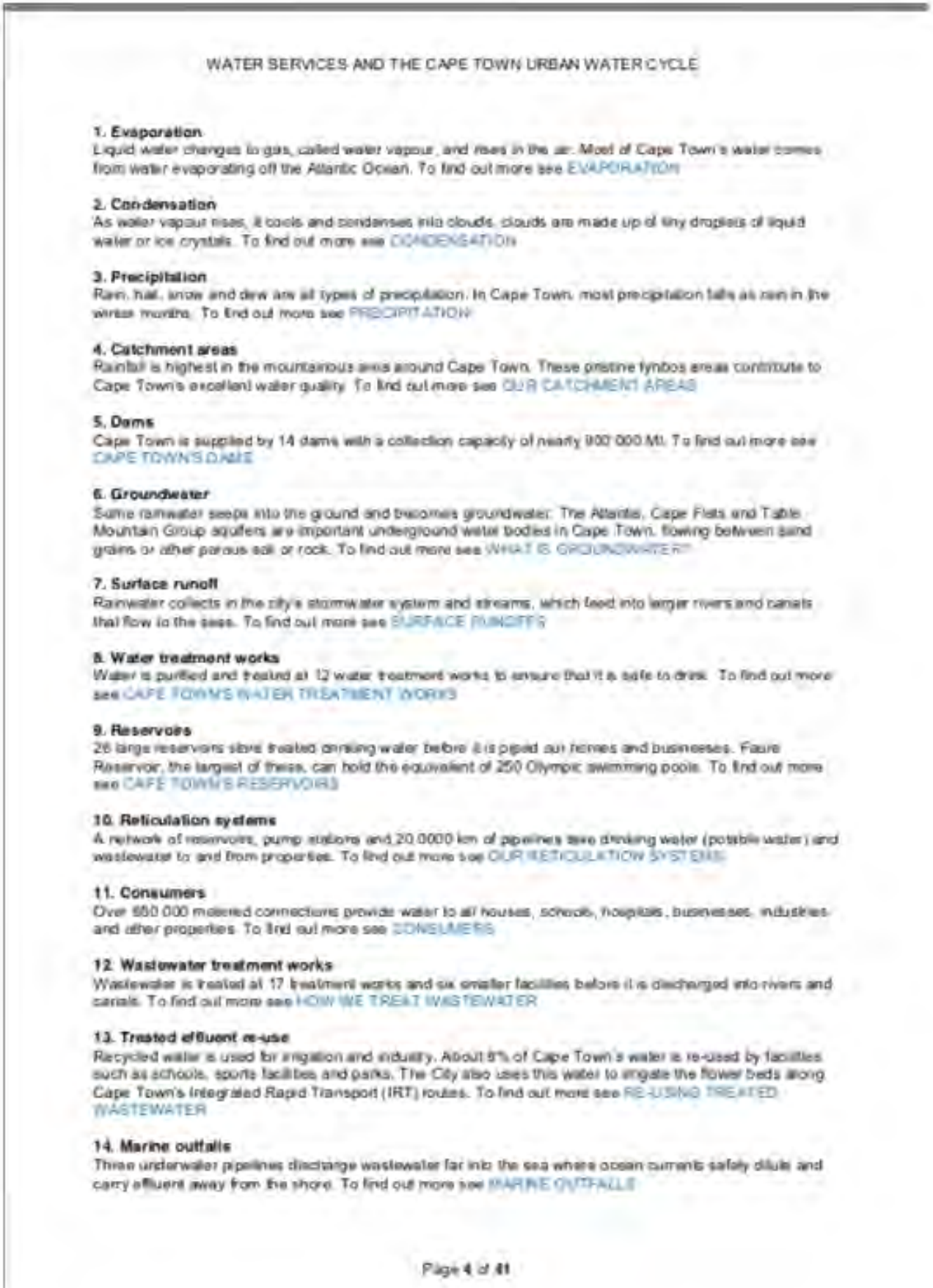
The Cape Town drought of 2016/17 highlighted the often-fragmented ways in which water is managed in the city, with a clear distinction and separate priorities for freshwater and wastewater. This meant that the bodies of water in Cape Town elicited different responses, where dams were protected whilst urban rivers such as the Kuils were neglected and used as sinks for urban waste. To understand these differentiated approaches to water management in the city, the chapter draws on theoretical and conceptual frameworks to build my argument of the Kuils River multiple. The different approaches within water management in general and river management in particular prompt varied ways of attending to the river. For instance, approaches in science that focus on the materiality of water place emphasis on water quality, asking questions such as "what makes up the composition of water?", whilst engineering priorities are on how things work, conservationists would focus on strategies to protect and preserve, whilst a social scientist may pay attention to the perspectives of human-river relationships and health scientists would focus on the what kinds of microbes reside in the river that could affect human health. These varied ways of seeing and knowing often produce multiple versions of the river.

These varied ways of knowing also produce a division between nature and society, placing humans (some) as masters over the Earth, due to the way disciplinary knowledge and expertise is enacted. The division between nature and society relegates the environment as resource to be exploited by humans. The prioritisation of certain knowledge practices (such as science and engineering) also renders other ways on knowing and being with the Kuils River as illegitimate resulting in biopolitics and different forms of violence. In this chapter, I draw on multiple theoretical and conceptual frameworks to highlight that understanding how knowing the river and how this is enacted is informed by different agendas which creates different practices of management across different levels of governance, research and communities.

Understanding the context in which the research was done is necessary to reveal how the obsession with capital renders invisible the complex nature of the urban water cycle, where nature is represented as a bank from which society can continuously withdraw. Such language and discourse are frequently used by the CCT and was used to justify tariff increases at the height of the drought. Simplistic images of the water cycle were used to portray water flows that we humans could plug into to derive ecosystem service benefits. It is envisaged as a simple relation between humans and water, with no other entities being affected. This also makes it easy to overlook the role of urban rivers such as the Kuils, which do not fit into the accounting models for freshwater supply provided by mega-infrastructure such as dams.

WATER SERVICES AND THE CAPE TOWN URBAN WATER CYCLE

Learn more about water and sanitation services, and components of the Cape Town water cycle with our water cycle graphic. Simply match up the numbers on our graphic to the different stages of the water cycle. You can find a summary of these on the next page of this handbook.



WATER SERVICES AND THE CAPE TOWN URBAN WATER CYCLE

1. Evaporation
Liquid water changes to gas, called water vapour, and rises in the air. Most of Cape Town's water comes from water evaporating off the Atlantic Ocean. To find out more see EVAPORATION

2. Condensation
As water vapour rises, it cools and condenses into clouds. clouds are made up of tiny droplets of liquid water or ice crystals. To find out more see CONDENSATION

3. Precipitation
Rain, hail, snow and dew are all types of precipitation. In Cape Town, most precipitation falls as rain in the winter months. To find out more see PRECIPITATION

4. Catchment areas
Rainfall is highest in the mountainous area around Cape Town. These pristine fynbos areas contribute to Cape Town's excellent water quality. To find out more see OUR CATCHMENT AREAS

5. Dams
Cape Town is supplied by 14 dams with a collection capacity of nearly 900 000 Ml. To find out more see CAPE TOWN'S DAMS

6. Groundwater
Some rainwater seeps into the ground and becomes groundwater. The Atlantis, Cape Flats and Table Mountain Group aquifers are important underground water bodies in Cape Town, flowing between sand grains or other porous soil or rock. To find out more see WHAT IS GROUNDWATER?

7. Surface runoff
Rainwater collects in the city's stormwater system and streams, which feed into larger rivers and canals that flow to the seas. To find out more see SURFACE RUNOFF'S

8. Water treatment works
Water is purified and treated at 12 water treatment works to ensure that it is safe to drink. To find out more see CAPE TOWN'S WATER TREATMENT WORKS

9. Reservoirs
26 large reservoirs store treated drinking water before it is piped out homes and businesses. Faure Reservoir, the largest of these, can hold the equivalent of 250 Olympic swimming pools. To find out more see CAPE TOWN'S RESERVOIRS

10. Reticulation systems
A network of reservoirs, pump stations and 20 0000 km of pipelines take drinking water (potable water) and wastewater to and from properties. To find out more see OUR RETICULATION SYSTEMS

11. Consumers
Over 650 000 metered connections provide water to all houses, schools, hospitals, businesses, industries and other properties. To find out more see CONSUMERS

12. Wastewater treatment works
Wastewater is treated at 17 treatment works and six smaller facilities before it is discharged into rivers and canals. To find out more see HOW WE TREAT WASTEWATER

13. Treated effluent re-use
Recycled water is used for irrigation and industry. About 9% of Cape Town's water is re-used by facilities such as schools, sports facilities and parks. The City also uses this water to irrigate the flower beds along Cape Town's Integrated Rapid Transport (IRT) routes. To find out more see RE-USING TREATED WASTEWATER

14. Marine outfalls
Three underwater pipelines discharge wastewater far into the sea where ocean currents safely dilute and carry effluent away from the shore. To find out more see MARINE OUTFALLS

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Images 1.1 and 1.2: Cape Town water services and urban water cycle presented in the draft Water Strategy 2019 (Source: CCT Water Strategy, 2019).

However, such a rudimentary model of the urban water cycle, even though the intent may have been to provide information for a wider audience, does not show the impact of flows of phosphates, ammonia, *E. coli* and *Enterococcus* from farms and kitchen sinks into rivers like the Kuils. Understanding the impact of the entities are important for citizens to be aware of their contribution to pollution in urban rivers which then equips them to better respond to water quality issues in the city.

What the representation of the water cycle above demonstrates are the dominant logics of accounting and engineering, presenting the stages as separate nodes/columns in a system as if they are not intimately linked, shaping and being shaped by each other. However, as was made quite visible by the severe Cape Town drought, these nodes and flows affect seawater in False Bay, increasing the occurrence of algal blooms and the feminisation of fish[5]; the increase in algal blooms clogs the desalination plant at Monwabisi Beach in False Bay. The effects are not only felt at landscape level but also impact marine ecosystems (see Petrik et al, 2017), which also loops back into everyday life in the city.

How does representing the water cycle as separate entities affect humans and other ecologies along the river and in the ocean? Disentangling the water cycle highlights how modes of knowing depend on an understanding of nature that is comprised of entities that are separable and subject to human mastery (see Plumwood, 1993). And yet as Astrida Neimanis (2017: p1) astutely observes:

> We are not on the one hand *embodied* (with all of the cultural and metaphysical investments of this concept) while on the other hand primarily comprising water (with all of the attendant biological, chemical, and ecological implications). We are both of

[5] The feminisation of male fish is believed to be a consequence of endocrine disruption caused by female hormones, estrogens or chemicals mimicking estrogens which are believed to be introduced into aquatic environments mostly through sewage effluent (Petrik et al, 2017). "The signs of feminisation in male fish are the production of a female yolk protein which is known only to be produced as a response to an estrogen exposure, and the occurrence of intersex – an abnormal form of hermaphroditism. Males with the intersex condition have early stages of egg cells in the testis and in some cases they have also developed the female duct which leads eggs to the oviduct. Feminisation has been found in varying degrees among individual fish from mild to very severe disturbances of the male reproductive system" (Christiansen et al., 2002: 9).

> these things, inextricably and at once – made mostly of wet matter, but also aswim in the discursive flocculations of embodiment as an idea. We live at the site of exponential material meaning where embodiment meets water. Given the various interconnected and anthropologically exacerbated water crises that our planet currently faces – from drought and freshwater shortage to wild weather, floods, and chronic contamination – this meaningful mattering of our bodies is also an urgent question of worldly survival.

The water that circulates in the atmosphere makes up a significant part of who we are as humans, and how the Earth creates a balanced environment for multi-species and landscapes. When the next drought occurs, imagine if citizens could collect clean water from the closest river rather than from water collection points guarded by military enforcers. What could this do and mean for the relationships that people have with urban rivers? Understanding these connections – the urban flows of water, nutrients and energy entangled with our own embodiment with water – is therefore important if we are to respond carefully and justly in the time of the Anthropocene. In the next section of this introduction, I explore the Anthropocene and human exceptionalism in relation to the Kuils, interrogating how it is used in the context of the 'global South'.

COSMOLOGY OF WATER IN CAPE TOWN

'A well-run city will never run out of water.'

• Patricia de Lille (Former Mayor of Cape Town)

The statement above was said often in response to fears of a looming 'Day Zero' at the height of Cape Town's drought. The former Mayor of Cape Town reassured citizens that measures were in place to augment the city's potable water supply, with projects planned and some already implemented, such as the quick detection and repairing of leaking pipes, and finding and using alternative water sources such as underground water and desalination. The language used by the former mayor echoed the language typically used in engineering and accounting budgets, often drawing on metaphors that referred to technical efficiency and

understanding relationships through machines and through infrastructure (Green, 2020). It could also be understood in the context of financial efficiency, referring to investment in infrastructure and proper fiscal management. Both engineering and fiscal management are bound up in the paradigms of science in support of state-making – namely rationality, objectivity and fact, but they also tie closely to metaphors of militarisation to command, control and prediction (Green, 2020).

Isabelle Stengers (2010) refers to 'metaphors of life' as cosmologies (in this study, the metaphors drawn from engineering, science and fiscal management), as belief systems that inform how people act and think in the world. For Stengers (2010) and Green (2020), ways of scientific knowing that claim to present only facts, without a critical reflection of how the facts are formulated and operationalised in the world, become a form of scientific fundamentalism that become naturalised/normalised. Understanding these cosmologies matters, as it allows us to see the shortcomings that place limits on 'big picture thinking', how objects, ideas, and concepts within networks of relating are connected and shaped and shift one another. What is made invisible when these 'metaphors of life' determine how relationships form in society? They may become relations of domination, with the role of power being ignored because to engage in these logics is imagined as being neutral, natural and apolitical. Relationships are then limited to a system as bounded and obscure the multiple entanglements that exist in human and/with more-than-human worlds.

The dominant cosmologies of urban rivers in Cape Town in particular, and globally in general, has been to treat them as sinks for our waste. This emerges as a result of early twentieth century city planning and engineering which oversaw the transformation of nature and space to suit the needs of growing urban settlements. The planning and engineering of that time drew on ideas of and methods of the technocratic conservation movement, which placed importance on the expert management of natural resources to ensure the maximum beneficial utilisation (Keeling, 2005: 1). Keeling (2005: 1) argues that controlling pollution and environmental conservation were associated with the notion of "assimilative capacity", a concept used by engineers to describe the ability of a body of water take in, dilute and disperse household, agricultural and industrial waste. By using quantitative modelling of the environment, engineers in charge of sanitary networks proposed the inclusion of natural

biophysical processes into the technological sewer networks (Keeling, 2005). As such, water's qualities as fluid, opaque and solvent enhanced its appeal as a means of disposal, useful for transporting urban wastes to spaces out of sight and out of mind. However, as this study demonstrates, the pollution generated in Cape Town is not transported to an 'empty' space, nor is it ever possible to do so. Neither the dilution of waste nor attempts to hide waste in water prevent the development of human and ecological health problems. Historically, water pollution has been seen as a local or regional problem, but studies have shown that water pollutants found in one part of the world can travel over long distances, through water currents and bodies of multiple species (for example, see Petrik et al., 2017). Freshwater and marine ecologists, social scientists, engineers and practitioners vested in the care of rivers have cautioned against the cascading effects of polluted rivers and the endangerment of ecologies and have been prompted to conceive of better ways of caring for rivers.

Once thought of simply as a natural resource for economic development, the transportation of goods, extraction for farm irrigation and a repository for household, agricultural and industrial waste, public protest and cultural claims have increasingly positioned rivers as more. Movements such as those that enabled the protection of the Whanganui River in New Zealand, the Ganges and Yamuna Rivers in India, the Vilcabamba River in Ecuador, Atrato River in Colombia and all the rivers in Bangladesh, to name a few, have called for the recognition of rivers as living entities, entitled to fundamental rights and legal guardianship (Iorns Magallanes, 2018). This proposed recognition is attributed to the growing critics of the predominant western mode of relating to the environment as property, with various indigenous groups calling for alternative forms that recognise the cultural 'inalienable connection' of local ways of living to the endangered life worlds of the Earth (Iorns Magallanes, 2018).

However, awarding 'legal personhood' to natural entities would make a river a person in law, in much the same way that companies, ships and other such entities have the rights and liabilities of a legal person. This reliance on humanity as custodians with the duty to observe the rights of the river in both law and practice has been critiqued (O'Donnell & Talbot-Jones, 2018), because capacity must be developed in terms of money, time and expertise to uphold the rights of the river in court. In addition, river representatives and funding sources should

be independent of the state and corporate entities but have real-world power to act, which can be extremely difficult in cases where corruption is likely to occur (O'Donnell & TalbotJones, 2018).

For instance, in Brazil where some of the most advanced and inclusive protections of rivers and forests are included in the Constitution, they are still susceptible to exploitation through under-handed deals between government and corporate entities. In recent years reports emerged of struggles in Brazil over land acquisition and forests by corporate entities (see Branford, 2016 and Telles de Souza, 2019). The deals saw the building of large infrastructure (such as dams) and the decimation of forests for timber, displacing people and placing significant threats on biodiversity of the Amazon Forest. The Brazilian government is responsible for enforcing rules and regulations, overseeing the extraction, transportation, and commercialization of timber from parts of Amazonia as well as the construction of dams, roads and other infrastructure. For Telles de Souza (2019), in theory, the regulatory system that enforces forest management plans, the issuance of permits for timber harvesting and land clearing for dam constructions and farms, the tracking of timber to ensure that it was not illegally removed from public lands or from the protected areas of private lands is the responsibility of the government. However, in practice, private companies collude with corrupt public servants—forest wardens, police officers, and others—to evade these rules (Telles de Souza, 2019). As a result, substantial quantities of timber are illegally extracted from public lands and protected private areas, and agricultural and livestock interests illegally burn and clear irreplaceable forests. While this case focuses on the impacts of forestry in the Amazon, the cascading effects of deforestation are visible in the rivers, as land cover is removed causing erosion, and siltation in rivers, impacting the composition of the rivers and how they flow. The rights of the river are superseded by development and profit-making priorities.

In other cases, it has been argued that defending natural landforms via the creation of legal personhood is heavily reliant on demonstrating that there will be an experience of 'harm' equivalent to that which might be experienced by humans. Thus, when anthropomorphised, the possibility for nature to achieve legal personhood in its own right is compromised

(Vanhala, 2012; Stone, 2012), as the focus is on the effects on humanity again, rather than on the rights of the river itself.

While some arguments highlight valid concerns, they also demonstrate the urgent need for a rethinking in our conception of nature as a resource and humanity's framing of itself as an 'extractivist master' that exists outside of Earth-life processes, which is a modernist and, I would argue, capitalist framing of the human. Therefore, as a counter to extractivist and developmentalist framings of the human, asserting legal personhood provides significant opportunities and potential shifts in how humans relate to nature (alternate ways of being human that have not been recognised or are being ignored are discussed in Chapter Five). In this time of the Anthropocene, it is critical to reorient humans to different ontologies and cosmologies, ones that are not based on strict frameworks of interpreting the law but are instead focused on shifting towards an ethics of response-abilities and care. This approach attempts to address the damage inflicted on the world's waterways over centuries, and it addresses the racist and extractivist relations that have been inflicted on indigenous, black, people of colour communities (BIPOC) over centuries of colonisation and displacement, particularly in Cape Town.

THE ANTHROPOCENE AND HUMAN EXCEPTIONALISM

In my work, I felt a certain discomfort with and encountered resistance to the concept of the Anthropocene and the notion of decentring the human. Kristina Lyons (2016:1) asks, 'For whom, when and how is human exceptionalism a problem that needs to be overcome in the first place?' I attempted to think critically about the Anthropocene in the global south and, in particular, its relevance to people living with the Kuils River. In 2016, in the preliminary stages of my PhD, I presented a paper that asked us to consider different relationships to urban rivers than those we currently have, relationships in which the human is not the centre of the universe but is in a co-dependent relationship with the beings and matter that make up the river. A colleague questioned romanticised ideas of nature and asked how one could even consider caring for rivers, trees and animals as a priority when black, disabled, queer and nonheteronormative bodies are systematically and continuously neglected. To call for these different relationships with the Earth even as people still lacked basic sanitation and access to water can be seen as a form of structural violence cloaked in environmentalism. I also

started to wonder how these different relationships can exist or even be imagined in a context where people have been displaced by over 400 years of colonialism and apartheid (and their remnants), where stories of connecting to the land and rivers are haunted by encounters of brutal unsettling.

In a later conversation, I was asked, 'But what is wrong with romanticising? Is it because of the way this word has been used to discredit? Wouldn't romance create a space for affect, a space to feel, to love?' Again, I had to reconsider taken-for-granted ideas and words and how they can be used to silence other ways of being and enable dominant knowledge processes. For instance, conservation and environmentalism are often whitewashed as what Prof. Green calls 'the unbearable whiteness of environmentalism' (personal correspondence) for the patronising role of the protector, the saviour of pure nature that must be protected from 'those who do not know better'. On the one hand, nature is seen as pure and must be protected from those who would exploit it – and destroy it, because they lack the knowledge of how to practice sustainable extraction. This is often the position taken by nature enthusiasts in South Africa, with black people being cast as the bad actors who destroy nature. But how can we think of protecting nature or care more about trees and rivers when millions of people lack access to adequate shelter, food, water and sanitation? The two viewpoints are often positioned as mutually exclusive and as such are mobilised for political purposes.

The Anthropocene is understood as the current era, in which humans are altering the planet to such an extent that a permanent and irreversible mark is being left on the planet's hydrosphere, atmosphere, cryosphere, biosphere and geological spheres (Williams et al., 2016 and Steffen et al., 2018). Concurrently, inequality and human rights violations are taking place across the world, including the displacement of populations for instance in the dam construction in the Lesotho Highlands (Mwangi, 2007; Letsebe, 2012; Mabula, 2018), the effects of a mine tailings dam bursting in Brazil (Phillips, 2020), oil spills in the Niger Delta (UNEP, 2011; EcoWatch, 2020) and the Gulf of Mexico, raging fires in the Arctic, Australia and the Amazon… the list goes on. And yet, global leaders appear reluctant to characterise this as a climate crisis, as it would require a change in currently unsustainable policies and the mobilisation of funds.

However, the term Anthropocene suggests that all humans are at fault for the transformation of the Earth's systems, yet not all humans pollute equally. Unsustainable patterns of consumption and production in the upper echelons of society are of grave concern and have adverse impacts on poor and marginal communities with limited access to resources. Decision-making around and governance of fast-depleting resources often occurs in the absence of those most directly affected by environmental policies about those resources. Anthropocene debates such as plantationocene (Davis et al, 2019) and capitalocene (Moore, 2015) draw attention to the devastating transformation of human-Earth relationships into extractivist modes of relating. The relationships between humans, soil and other life forms are subsumed by the agenda of economic growth. The Anthropocene debates also call attention to other creatures relegated to the margins as part of the landscape of human consumption, to be foregrounded anew as part of the political worlds of humans. They highlight that humans exist as part of and are dependent on these multi-species worlds, and to ignore this relationship by situating humanity at the centre of the universe is a sign of arrogance.

The work of Kathryn Yusoff (2018) interrogates how the Anthropocene 'proclaims the language of species life – Anthropos – through a universalistic geologic commons, it neatly erases histories of racism that were incubated through the regulatory structure of geologic relations' (p2). The notion of the universalistic geologic commons was made evident in the rhetoric of 'Day Zero', where all Cape Town's citizens faced a future without water. Should the drought have persisted, the focus on a shared future ignored how the city was designed to provide better access to water (through better infrastructure services such as water pipes and roads) in wealthier neighbourhoods than in poorer ones (see Ziervogel, 2019). Kirsty Carden, a senior researcher at the Future Water Institute at the University of Cape Town was quoted by The Associated Press (2018) as saying:

> It has been in the areas where people have gardens, they have swimming pools and the are much more profligate in the way that they use water, because the're used to the water just being, coming out of the taps. About a quarter of Cape Town's population lives in informal settlements, where they get water from communal taps instead of individual taps at home.

> And the are always picture of running taps and broken fixtures and 'Look at the leakage' and all the rest. But the reality is that those 1 million people out of a population of 4 (million) only use 4.5 percent of the water.

And yet, the focus of penalising water wastage were in the lower income and informal settlements where water management devices (WMD) were imposed, communal tap flow rates reduced and fines dispersed for those who transgressed (The Associated Press, 2018). People in higher income areas were targeted less, with WMDs being optional, and should they overuse water, their water was not shut off if they could pay the fine.

However, using the concept of the Anthropocene to think about the Kuils River and the residents along it helped me grapple with the impact that we as citizens have had on the river. Solid waste is dumped into the river, stormwater is drained from the housing being developed rapidly to address 20 years of housing backlogs, and poorly treated sewage effluent is pumped into the river. Instead of all the waste pumped into the river magically disappearing, it goes into the ocean and is transported great distances by currents and in the bodies on organisms, it evaporates into the air, becoming part of the water cycle. 'Anthropocene' implies a uniform and common history and culpability, the same experiences of being human in interactions with the river and a similar geologic record (see Lyons, 2016:1), but after months of walking the river, it was clear to me that politics, law and governance have shaped it across different time periods and have had geological effects on it.

The unequal impacts of environmental pollution further highlighted the 'incompleteness of address in the Anthropocene', where the focus on the 'species turn', whereby multiple species become central to the construction of discourse within the various disciplines, continues to underplay 'property relations and properties as a relation of subjugation' (Yusoff, 2018: 3). The early attempts to describe the Anthropocene focused on how humans (as a unified force), as mentioned earlier in the thesis, have altered the different spheres of the earth, causing significant environmental damage. The centre of these arguments focused on harm enacted on plants, animals and landscapes. And yet this approach to understanding the Anthropocene silences the often violent and dehumanising processes of creating geologic relations. For

instance, the REDD+[6] program, seen as a global effort to tackle climate change, has different effects on those living in the global south versus those in the global north. The conservation of forests in the global south creates protected areas, limiting and even criminalising those who enter these forest spaces without permission. The cultural, social and economic relations that exist between the locals and the forests are ignored, while countries in the global north can purchase carbon credits to offset their pollution and fund 'conservation efforts' in the global south. These ideas of conservation, rooted in colonialism and the mastery of nature, created new landscapes, new ecologies and new relations between humans and non-human nature; in the process, they created new ideologies of those relationships, thereby erasing other ways of being with nature (Shiva, 1989).

For Adams and Mulligan (2003: 1), 'Ideas about nature, whether as an economic resource that needed conserving and exploiting or as a precious reservoir of unchanged wildness, were a crucial element in colonial ideology, at home and abroad.' Modernist ideas about nature also characterised black bodies as closer to nature and to 'the wild' because black people's ways of living on the Earth were different and seen as primitive as their relationships to nature existed outside of the colonial ideologies of nature. The black and indigenous relationships recognized natural entities as kin and as sacred, requiring reverence and protection for the benefit of their communities. However, as mentioned, this way of living was seen as primitive, and required civilising of the black and indigenous people through colonial forms of education and forced assimilation of European values. This is discussed further in Chapter Four.

It is therefore important and necessary to trouble the assumptions of humans dominating the Earth, asking, by asking which humans and how this has been done in order to create more just responses to the problems in the Anthropocene era.

[6] The REDD+ programme's goal is "reducing emissions from deforestation and forest degradation in developing countries, and the role of conservation, sustainable management of forests, and enhancement of forest carbon stocks in developing countries" (United Nations REDD+ Programme, 2016:1)

NATURE/CULTURE DIVIDE: ON METABOLIC RIFTS, BIOPOLTICS AND GOVERNANCE

> *"How have we as a community allowed the polluter to jeopardize our land for so long? Why have we sat back and just complained about the violent reek, complained about our children who are losing the war against cheap drugs and moaned about how the municipality only cares about us when it is elections. Can we not see that all of these are connected? Isn't it obvious that our land treats us so badly because it's giving as 'good' as it gets?"*
>
> • *Ilva Mackay, blog post, 2012*

Ilva Mackay, a young woman living in the Kuils River neighbourhood for her whole life wrote a blog post for the *Climate and Women* (2012). Ilva's experience of living with a polluted river demonstrates how concomitant the environment is with social and economic outcomes of daily life along the Kuils River. In recalling growing up with the river, Ilva remembered growing up catching frogs and chasing dragonflies in the network of wetlands that once existed and how they would build canoes and play in the water. However, when development came to that section of the river, the intimate knowledge and interactions with the Kuils were transformed under the guise of modernity and progress. Due to the rapid growth on the urban edge, and the change from sparsely populated farmland to dense residential homes, layers of concrete were poured over the landscape and into the river to control how water flows, how plants grow and how people move in the area. For Ilva, this separation between the land and the river, the soil and people, the people and the river were more than just modernist approach to water management. It spoke volumes about how the river and the people living in close proximity were viewed through governance models that prioritised economic productivity and technical efficiency without knowing how people live in the spaces they are meant to care for. For Ilva's sister, who walked along the river with us, the way the river was treated as an extension of the Bellville wastewater sewer works reflected how the well-being of people of colour in the middle and lower reaches of the river was not a priority when she said,

> "Do you think the white people in Constantia and Bishopscourt would ever live with what we have to deal with here every day? I don't think so. They have rivers too, but

> they get to enjoy those spaces because they are protected. Somehow, they qualify as citizens who deserve more protection than us. I guess you have to have money for your life and environment to count".

The fundamental issues that became known from Ilva and her sister's experience are the separation of the social life of residents to the flows of the river, and the way histories of separate development and race continue to play out in how the Kuils River and its associated environments are managed and imagined. Clarke and Foster's (2010) adaptation of Karl Marx's notion of the metabolic rift is useful to think about this imposed separation between people and the environment under modernity. For Clarke and Foster (2010) the metabolic rift is a result on the alienation of people from the Earth and Earth cycles and this can be used to explain the rise in global ecological crises. Marx argues that the concept of 'metabolism' is inherent in social relations to nature, as it highlights the relations, exchanges and flows between people and nature, providing the conditions for labour. Marx explains that there is a 'necessary "metabolic interaction" between humans and the Earth' (in Clarke & Foster, 2010). The particular social metabolism is currently run by 'the capitalist mode of production, which influences the material exchange between society and nature' (p145). The very endurance of capitalism and neoliberal approaches to the economy and development depends on its extractive nature to perpetuate the modes of exchange that remove the work from the labourer.

Marx's idea of the metabolic rift emerged as he observed how the closure of the commons (where peasants were once able to collect firewood and food from forests and grow food on common lands) led to forced migration into European cities. As the size of the cities increased (with no land to grow one's own food), so too did the need for agriculture on larger scales, which led to the commercialisation of agriculture, cutting the necessary metabolic interaction between people and the soil. Vast tracts of land were mono cropped, the use of fertilisers increased and people were forced off the land so it could be used for mass production and industrial farming, leading to a depletion of soil quality. Imperial colonial expansion into Africa, Asia and the Americas was in part necessitated by the demand for food in Europe's expanding cities (Plumwood, 1993). With this colonial expansion came knowledge practices which Val Plumwood (1993) refers to as the *Mastery of Nature*. The mastery of nature

requires the formation of dualistic ideas of how we relate to nature. For Plumwood (1993: p42):

> Dualisms are not just free-floating systems of ideas; they are closely associated with domination and accumulation and are their major cultural expressions and justifications. But I do not mean to imply by this that accumulation, the material sphere, is the real motor and the cultural sphere merely its reflection, as assumed in some forms of Marxist theory. The material and the cultural spheres both do the work of domination and may be thought of as mutually selecting one another, just as particular technologies are both selected by certain social and political arrangements and select them, helping to maintain, strengthen and prepare the ground for certain types of social structures.

Accordingly, I asked in this study what the implications of Marx's and Plumwood's observations about the metabolic rift and the desire for domination over nature are for river management in Cape Town. Is it possible to think of clean water not as only accessible through pipes and taps and layers of infrastructure but also as a vehicle for rethinking and changing colonial and capital relationships to waterscapes in South Africa? (This is discussed in Chapter Six). As Haraway (2003: p7) argues, 'subjects, objects, kinds, races, species, genres and genders are products of their relating'. She highlights the importance of challenging the human-nature binary and suggests the use of feminist epistemology (which she ascribes to), which emphasises 'how things work, who is in action, what might be possible and how worldly actors might somehow be accountable to and love each other less violently' (ibid: p7). In these products of relating, the actors – human and non-human – are patterns in which the players are neither whole nor parts, but that exist in 'significant otherness', where states of being are interwoven within a system. Latour's (2005) actor-network theory (ANT) situates both actors and actants in the reconstruction of the network of interactions leading to the stabilisation of a system, bridging the binaries between human and 'non-human'. It is a paradigm that concentrates on the interactions and connections between systems – the social, the environment, politics, the economy and religion. This conceptual framework can be applied to my research when attempting to understand how material and social connections and interactions are manifested in the human-river relationship. However, ANT does not

demonstrate the varying levels of power within a system – the ways of relating within these systems and the outcomes of these relations within the system – and it fails to tell us how a network was put in place (Latour, 2013).

Latour (2013) revised ANT in An Inquiry into Modes of Existence (AIME). AIME concentrates on the plurality of the modes of existence of the actants and actors in a network, which essentially shape how relationships exist within the network. I use this theory to understand the different ways in which river communities exist with the river and its associated bodies, with infrastructures along its path and to think about the modes of governance that shape the everyday life worlds of the Kuils throughout the chapters. Ingold (2010) suggests that 'meshworks of entangled lines of life are about the way in which materials of various and variable properties, enlivened by the forces of the cosmos, mix and meld with one another in the generation of things'. This attests to the significance of material objects in shaping everyday life, essential to understanding the network of relationships.

Encounters with the river, communities and government pose some interesting questions. How is the relationship between people and water mediated by infrastructure, technology and science? And in turn, how are these informed and shaped by water? This led me to an inquiry into the materiality of water and the river as political and biopolitical (Bakker, 2012). As water flows through human and non-human bodies, across borders and boundaries, it becomes entangled in user conflicts, for instance, in our bodies (for fighting infections) or the in economic sector and communities living close to water bodies (Bakker, 2012: p619). Interrogating the biopolitics of the Kuils River, discussed in relation to unequal impacts of infrastructure in chapter three, colonial histories of settlement in chapter four and chemical toxicities in chapter five, brought attention to the materiality of water: its quality and its quantity, its composition (i.e., what exists in the water besides hydrogen and oxygen), over which geopolitical regions it flows and who controls those flows (Bakker, 2012: p619).

As a legacy of Cape Town's history of separate development (apartheid), rivers in distinct parts of the city are treated differently based on their geographical location and settlement patterns based on racial categories. The Kuils River itself is a single river that begins in the Kanonkop area of Durbanville (predominantly white Afrikaans residents with a higher income)

but is significantly different as it flows past the residents of Khayelitsha and Sandvlei (predominantly black and coloured residents). Its upper reaches, though impacted by stormwater drainage and canalising, do not pose a serious health risk (except insomuch as it excludes the mobile people who no longer have access to the spring), as it does to those living downstream. This brings to the fore the varied relationships that people, other species, sectors and government have with the river that shape the kinds of technologies and infrastructures used to 'make it do what we want', which are also entangled in the politics of who determines what 'what we want' is. The exploration of the material, political and biopolitical is a central focus throughout this thesis.

The idea of the 'uncommons' was developed by Mario Blaser and Marisol de la Cadena (2018) in the context of growing socio-environmental conflicts as a result of increasing neoextractivism in South America. For Blaser and de la Cadena (2018), neo-extractivism is a development model based primarily on the extraction of natural resources, and the idea of framing nature as property, justifying the closure of land and water (see Green, 2020: 17) supposedly for the common good but actually leaning towards privatisation or appropriation by the state[7]. Revenue generated by such extraction is intended for use by governments to tackle social issues, such as poverty and increasing social participation, and to ensure political stability. However, this approach requires the destruction and/or enclosure of the commons for the 'common good' of citizens. People living at the sites of extraction are impacted heavily and may resist, highlighting the environmental and social consequences of the destruction of the commons for humans and other-than-humans. This study explored the ways in which disciplinary practices have been captured to justify the use of the Kuils River as a resource for the common but exclusive good of Capetonians. However, science and engineering approaches often presented a homogenous way of living with rivers. John Law (2015) refers to this dominant homogenous way of interacting with the environment as a 'one world' world, such that other ways of living and being with the river (for humans and other-than-humans) are marginalised for not fitting the trope of doing it for the 'common good'.

[7] With the arrival of the Dutch East India Company in the seventeenth century, property ownership laws were imposed through military force (Green, 2020). The idea of property ownership made possible the territorializing of land and water through maps and mapping, translating spaces such as rivers which were a part of the commons, into natural resources governed by the state. This history of territorializing the Kuils is discussed in more detail in chapter 4.

The current multitude of sustainability and environmental challenges requires an urgent response at a local and global level. So far, however, responses have had to do with governance of the natural resources (by a few). Human beings have taken command of the Earth's resources through the use of infrastructure (defined and discussed in chapter 3) to command, control and predict water flow. Rivers respond to precipitation, with water levels rising or falling after the needs of the land, plants and atmosphere have been met. Rivers are a result of run-off, of networks relating to landscapes, carrying the nutrients and carbon necessary for sustaining life on the planet. Plants, rocks, sand, water molecules and critters all make up the river and can modify and reshape it, affecting its seasonal flow. It was not until humanity took control of rivers for agriculture and other domestic uses that the fundamental alteration of river flows became evident, disturbing the metabolic interactions needed to sustain life.

The role of science and engineering in mastering the Earth has allowed for the governance of river systems without considering their natural pulses and flows and the many relationships that form the river, distancing and underplaying society's dependence on nature. Consequently, particular modes of knowledge are ceded dominance, though they may not always agree, and other modes of knowledge and experiences of being with the river are side-lined. In current governance models, the 'hard' sciences and engineering are privileged because of their objective nature, which informs policy. Objectivity is considered important when formatting policy as it is believed removing the personal opinions and experiences lead to rational decisions assumed to be necessary for fair governance. However, the methods used to produce facts by these disciplines can be co-opted or controlled, and the inherent reductionist approaches of some of the disciplines can be exploited politically – for example, the inability of activists and the City to reach an agreement over terms produced a dead end, and the prevailing situation endures. As I demonstrate in Chapter Three, treating science as a belief system allows us to better understand the stakes and complexity of how knowledge forms gain ascendancy in state structures and how these may become solidified in ways that stand counter to the well-being of all players.

In conclusion, the way we come to know the river and enact this has geo-socio-political effects. This chapter began by setting the context in which this study occurred. The Cape Town drought of 2016/17 magnified the often-fragmented ways in which water in managed in the city based on the separation of the water cycle and disciplinary practices. This meant that the bodies of water in Cape Town elicited different responses, where dams where protected whilst urban rivers such as the Kuils were neglected and used as sinks for urban waste. In order to understand these differentiated approaches to water management in the city, the chapter draws on theoretical and conceptual frameworks to build my argument of the Kuils River multiple. I drew on the work of Stengers (2010) to elaborate on how "the metaphors of life" within different disciplines shape different cosmologies (belief systems) within water management in general and river management in particular and how these prompted varied ways of attending to the river. For instance, approaches in science that focus on the materiality of water place emphasis on water quality, asking questions such as "what makes up the composition of water?" whilst engineering priorities are on how things work. The separation of the disciplinary knowledge and practice privileges certain ways of knowing as legitimate whilst others are rendered to the periphery of governance and planning often resulting in what Foucault (2010) refers to as biopolitics and what Mbembe (2019) and Nixon (2011) refer to as different forms of violence. I therefore attempt to explore the Kuils River multiple using various methods such as those used in Science and Technology Studies (STS), Environmental Humanities, including those methods traditionally used in anthropology. In the next chapter, I provide a detailed description of how this study was conducted, highlighting how different approaches pay attention to the multiple aspects of the Kuils River.

CHAPTER TWO

Knowing the River: On Access, Methods and Ethics

This chapter highlights the methodological approaches used to explore the complex network of relating to an urban river. A focus on methodology is essential, especially as the discipline of the environmental humanities emerges on the African continent, where representation from the global south, and particularly from Africa, is still limited. Discourses in the environmental humanities are often grounded in northern epistemes and experience, and this chapter demonstrates that the methods used in the study were appropriate and relevant to the argument of the thesis, while also contributing to discourse in research into the Anthropocene from the global south.

METHODS

Meeting the Kuils River's People

After identifying the Kuils River as the site for my research, I conducted desktop research, mostly using Google Earth, to trace the flow of the river and draw from newspaper articles, publications by non-governmental organisations (NGOs) and faith-based organisations (FBOs) to explore some of the social entanglements of the river. I contacted the Environmental Monitoring Group (EMG), an NGO that has close links to the community of Khayelitsha and has supported residents over many years to address some of their struggles and challenges related to water. I was put in contact with Thabo, a project leader at EMG, and Mpumi, who often worked as a consultant in the organisation but was largely a connector for people seeking to work with people around Khayelitsha. Both Thabo and Mpumi worked with a permaculture training institution based in Constantia called Soil for Life, who were providing soil care workshops to a group of emerging urban farmers called Igalelo Labafazi.[8] Igalelo Labafazi is a small co-operative made up of about 10 women (the numbers often changed as people moved in and out of the area) and one man who all reside in the Makhaza area of Khayelitsha, close to the Khayelitsha Wetlands Park. At the request of the members of Igalelo

[8] The literal translation from isiXhosa to English is 'The contribution of women'.

Labafazi, I attended two workshops run by Soil for Life that were held in a temporary

government structure close to the entrance of the Khayelitsha Wetlands Park. Regrettably, the workshops ended prematurely when the facilitator left Soil for Life. Igalelo Labafazi continued growing organic food for their own consumption and selling their excess vegetables to supplement their income. As another potential income stream, the group was also interested in extending their work into recycling and upcycling some of the waste that was collected during wetland clean ups. Details of workshops conducted to assess the needs of the community follow later in this chapter under the section on workshops.

Mpumi regularly took me for walks around the Khayelitsha Wetlands Park, and on one of these walks I was introduced to the manager of the park, Shepherd Mdoda, who was very enthusiastic about maintaining the park at a high standard. Conversations with local residents often attributed the transformation of this space from a smelly swamp of polluted water and solid waste to the beautiful gem of the township to Mr Mdoda's willingness to get down and dirty when cleaning the area. Rather than delegating the tasks to paid grounds keepers, Mr Mdoda often trudged along with the workers in rubber boots and overalls, cleaning up with them. This inspired residents to participate in the clean ups organised by groups such as Igalelo Labafazi and by a group of young men who started the Khayelitsha Canoe Club (KCC).

I was introduced to Siyanda, a founding member of KCC, by Mam' Wana, a member of Igalelo Labafazi. The KCC was established by twin brothers Siyanda and Akhona in 2013 with only two canoes. The brothers hoped that establishing the club would motivate the transformation of the polluted wetland and create a place for the youth of the township to meet, thereby keeping them out of trouble. The KCC has grown tremendously since its inception and hosts about 45 children every weekend, teaching them how to swim at a local public pool and how to kayak and play canoe polo in the Khayelitsha wetlands on the Kuils River. The team of KCC facilitators also grew – I met Tshepo, whose formal job was as a taxi driver, but who would help coach the youth at the canoe polo practices on weekends when he was not working. Tshepo also joined some of the community-needs assessment workshops I organised. As my relationship with the KCC grew, I took some of my Anthropology students on a field trip, and

Themba, a founding member of the KCC, acted as our tour guide, sharing stories of the wetland and noting some of the changes that had taken place over the years.

I also approached an FBO called Arocha that worked with communities in the upper reaches of the Kuils River, in the neighbourhoods of Durbanville, Sarepta and Kuils River. I was put in touch with Sydney, a member of the Dutch Reformed Church in Durbanville, who was in charge of the environmental stewardship portfolio and was invited to attend workshops between members of different parishes as they planned activities to clean up and create awareness about the Kuils River. At one of these meetings, I was introduced to Rupert, a botanist who worked at the Kirstenbosch Gardens in Cape Town. Rupert provided essential information on plant life and paleo data and put me in touch with the manager of the Drift Sands Nature Reserve and officials in the Durbanville municipality charged with managing the upper section of the river. At the Drift Sands Nature Reserve, I met with the conservation manager, Teboho Maliehi, for an informal interview and was later taken on a tour of the nature reserve by one of the rangers charged with caring for and protecting the area. I also met with Mr X, a worker in the Durbanville municipality, who was tasked with managing the stormwater drainage and flows into the Kuils River. Mr X's insights were invaluable, as he enlightened me on how disconnected river management practices were and how difficult and near impossible it was to co-ordinate the management of the river as it flowed through multiple subdistricts and municipalities, all with their own mandates.

As I continued my research into the Kuils River, I came across a blog post by Ilva McKay that spoke about how climate change highlights the social issues in Kuils River. At the time of our meeting, Ilva was in her mid- to late twenties. She lived with her parents, two sisters, nieces and nephews in the home she had grown up in. The homestead was sizeable and could accommodate the multi-generational family. Ilva's home was adjacent to the river, and she often spoke about how the changes in the river had been 'in her face' since her childhood. She worked as a media and communications strategist for Women's Net before starting her own vintage clothing business. She is a core member of the KuilaLove project, which seeks to revitalise the neighbourhood of Kuils River and reconnect residents to the river by organising events such as soccer matches, goods markets and clean ups. They struggled to keep the momentum going, however, as Ilva said that the river had become a transient space, a space

where people just walked through and past, ever since the canal had been introduced. People no longer wanted to stop and linger by the river, both because of the stench that came from it and because it was now regarded as dead space.

In late 2018, Councillor Ganief Hendricks, the founder and leader of Al Jama-aha, a political party intended to uphold Muslim rights and interests in South Africa, was in contact with Prof. Green who notified me of a growing situation in the Zandvliet area, located in the lower reaches of the Kuils River, where it joined the Eerste River as a tributary before entering the sea in False Bay. Zandvliet is home to the small farming community of Sandvlei, and the Sandvlei residents had been complaining about and experiencing health issues, which they associated with the pollution of the river. As an official political representative of the community, Councillor Hendricks took the matter up with CCT, and we were invited to a meeting with the Mayor, where promises were made to look into the matter.

Hendricks introduced us to other members of the Sandvlei United Community Organisation (SUCO): Maryam Sallie, Noora and Nazeem. Maryam is an active member of the community who organises access to services such as water and electricity, organises clinic visits for residents and runs food drives. She is also a mother of four boys, and her youngest is a published author. Noora was in her second year at the University of Stellenbosch, studying biochemistry. She is a resident of Sandvlei and lives with her parents, with the river running right next to the property. Nazeem is a farmer who breeds and raises show horses. He had four horses in his stable but said that he had had many more before the pollution of the river reached such toxic levels. By mid-2020, two more of his horses had died, due to *E. coli* infections. He later moved his remaining horses to his brother's property, far away from the river.

In 2019, as part of a site selection process for the Liveable Neighbourhoods Project,[9] I went back to a different part of the KWP, where I met with Siviwe, who took us on a tour of the

[9] The Livable Neighbourhoods Project is an undertaking by the Future Water Institute (FWI) at the University of Cape Town which I sit on as a core member. The project is undertaken by FWI but is hosted by the School of Architecture and consists of transdisciplinary researchers in anthropology, architecture, hydrology, information and communication technology studies, engineering and city planning. The purpose of the project is to redesign an existing neighbourhood in order to increase water sensitivity and social and ecological well-being in the area. The Silver Town area of Khayelitsha was considered as a potential site for research, but the group eventually decided to focus on the Hangberg area in Hout Bay.

park closer to Spine Road, on the border of Silver Town and a thriving informal meat market. My encounter with Siviwe was rather brief, but her experiences and the walk in that part of the KWP left quite an impression, and I consider it important in my telling of infrastructure relationships along the Kuils River.

In July 2020, I met with Adrian van Wyk and Oom Jethro during the level 3 lockdown restrictions brought about by the Covid-19 pandemic. Adrian also lives in the Kuils River neighbourhood and had received my details from my colleague Dr Marlon Swai. Having completed a Master's degree at Stellenbosch University, Adrian was keen to shift the focus of his work to the Kuils River ecologies and art. We collaborated on a presentation focused on our research practice, which we presented at the Shape of Practice conference run by the Anthropocene Campus, Haus de Kulturen van der Welt (HKW) (https://shape.anthropocenecurriculum.org). Adrian also very serendipitously connected me to Oom Jethro, who I had been hearing about for years; Ilva had even tried on several occasions to set up a meeting with him, but he had always been unavailable. When I walked along the river and people asked me what I was doing, they often ended by saying, 'You should speak to Oom Jethro, he knows a lot about the river', so I felt my research had finally come full circle when I finally met him. Oom Jethro is a bush doctor in his community and has a formal job as a cleaner for CCT. He lives in a shanty settlement on the edge of the high-density suburb of Wesbank.

Participants were offered the option of anonymity in all cases, so where I have used names, they were happy to contribute and to put a face to their real, lived experiences with the river. I have used pseudonyms for those participants who wished to remain anonymous. I have used names in my description of the more controversial encounters with the City of Cape Town, as these encounters are a matter of public record.

The Gymnastics Of Research

As an introduction to a "Science, Nature and Democracy" class in February 2017, Prof. Green played a video of dancer Sergei Polunin performing to the song *Take me to church* by Hozier (https://www.youtube.com/watch?v=6GgTAD3t8ac). The class cohort sat enthralled by the

rhythms and thrusts, body contortions, slowing down and speeding up of Polunin's performance. After watching the video, she rubbed her hands together, looked at the class with a big smile and said "Right!" before delving into the lecture.

The purpose of showing the video to us was to explain that the material we were going to engage with in the class would require a form of 'mental gymnastics', as we would have to contort our way of thinking into ways we had not yet been trained to do. It would require us to unlearn certain assumptions – for instance, what it is to be human; ways of relating in the world; science as authority; economy as the solution to poverty; and so forth. Engaging with the multiple versions of the Kuils River required a similar practice of mental gymnastics. In the preface, I outlined how my previous learning had been informed by what I see now as a green neoliberal agenda, and it took me a long time to learn how to think outside these frameworks and to question accepted notions of 'progress', 'infrastructure', 'time' and the like. This was an epistemic exercise, but sometimes the work also shook me to my foundations and caused me to reflect deeply on my position as a black, middle-class female academic – what was the purpose and intention of my research? Because of the ethical sensitivity I had developed over the course, I could not conduct my research as 'business-as-usual' for the sole purpose of getting a degree, and it took me a long time to develop this thesis to be relevant to its co-creators. I was torn between producing work that mattered and just getting it done so that I could apply more energy and time to the project after completion of the PhD. I was thus completely affected by the PhD process and by the residents, stakeholders and Kuils River itself.

Walking as a Methodological Approach

As I drew up my proposal for the research, I took inspiration from Latour's (1992) advocacy to 'turn our exclusive attention away from humans and look also at nonhumans' and was guided by the work of Michel de Certeau, whose 'Walking the City' (1984) offers a theoretical framework for understanding the production of space in the city – how it is experienced and enacted through the everyday practices of its inhabitants. De Certeau advocates for walking in the city instead of viewing it, arguing that walking in the city allows pedestrians to see and learn and to develop their own style of seeing and creating meaning of the city beyond the

prescribed structures of knowing that result from viewing from a particular vantage point. My experience of 'walking the river' as a method drew on the following methodological approaches, all of which have been employed by social scientists and philosophers grappling with the challenge of learning to see a familiar set of landscape relationships differently:

• Questioning the authority of the 'god's eye view' of the map

The map has been central to representing landscapes; how mountains, rivers, cities, and streets to name a few, occupy spaces in relation to other objects in the environment. However, the representations of these landscapes are often flawed as they fall seriously short in representing the complex ecosystems, the socio-economic and political relationships that occur in these mapped territories, which often have geological effects far into the future. Green (2020: 34) points out, that the "securing of access to land and water required not only military might, but also maps and archival records based on a new knowledge: the science of mapping" during the arrival of the first settlers in the Cape. The science of mapping and maps not only hold/held the power to claim an objective truth of how the land existed or exists today, but they also hold/held the power to determine a "political cosmology of private property and water ownership" (Green, 2020: 35). As such, in my research I questioned this authority of the map and the implications this might have on how I read the Kuils River. To see the river from the map, was to see it as cut up with cartographical lines, cutting it into different sections, falling into different municipal jurisdictions therefore warranting different responses on how it is cared for, an approach that the City uses when managing the river. To see the river from a map, such as Google Earth, also meant that the river and its associated landscapes could be viewed from above, and judgements of the relationships of the Kuils could be made from a distance. These ways of knowing and the enactments occurred without immersing oneself in the environment to get a better sense of how people and objects move, shape and are shaped by their interactions in these spaces every day.

I therefore opted to ground myself in the Kuils River landscape, prompted by De Certeau (1984) on *Walking in the City*. In this work, De Certeau shows that pedestrians narrate stories of the urban environment through their movement, giving shape to and weaving places (i.e., interconnectedness of places, objects and beings in spaces) in ways that

potentially challenge the abstract map (a view from everywhere and nowhere) imposed as the singular authority in the work of representing, knowing and governing the world. My walking along, with and in the river gave me an unfamiliar perspective from what I had seen on Google Earth or had imagined when reading or listening to narratives of the river. Walking in the mud, getting my feet wet, breathing in the air and listening to the sounds associated with the Kuils River allowed me to experience a different kind of embodiment of the space. I noticed assemblages often overlooked in urban river management and focused my attention on the contact zones between the lives of humans, other species, infrastructure and technology as a counterpoint to the classical 'panopticon'[10] way in which Earth system sciences, conservation and engineering see these interactions. Walking the river allowed me to assign new meanings to places and points along its course different to those traditionally assigned to them and as argued by Stengers (2005), also allowed for the embodiment of experience, as one can only experience change by being present. It also prompted me to think about where and how I walked, to consider how other people and beings saw me as I walked which brought me to the question of; how does one queer walking the Kuils?

- Queering walking

Springgay and Truman (2018) highlight that walking in the city is not neutral but is shaped by, among others, gender, race, ableism, class and sexuality. This was made abundantly clear on a few occasions when my partner, Ian, and I walked or drove along the river in the Durbanville area, a largely white neighbourhood. I was often stared at but was never approached when I was alone or with another person. Ian, on the other hand, was reported as a suspicious black man driving the streets. He was often approached by private security guards armed with batons, pepper spray and sometimes guns and questioned as to why he was in the neighbourhood. After explaining that I was part of the university and was there to conduct research, they would offer an apology and drive off, but this was nonetheless an unsettling experience for us. Although concerned about my safety when walking the river alone, Ian often dreaded accompanying me because he hated the experience of 'walking while black' in Durbanville. Springgay and Truman (2018)

[10] Panopticon (pan=all, optic=seeing) is a concept that highlights a form of central observation from above, removed from the life experiences of 'the observed' on the ground (see Foucault, 2008).

argue that it is essential that 'we cease celebrating the White male flaneur, who strolls leisurely through the city, as the quintessence of what it means to walk' (p14). The authors call on us to *queer* walking and how it places a focus on what it is to be fully human (i.e., able-bodied, and in some spaces white, cis male) and non-human (natural), continuing the split between nature and culture, because walking is not neutral. One morning whilst preparing to head out to walk along the river, one of my students challenged my prioritisation of walking as a methodological approach on one of our fieldtrips, noting the kinds of exclusions this practice enabled. While walking methodologies are often framed as participatory and inclusive, Springgay and Truman (2018) argue that this kind of framing (of participatory and inclusive) "fails to undo the structural logics of racism, ableism, homophobia and colonialism. Participation as inclusion is a universalizing and normalizing practice" (p13). I will continue to grapple with this as an emerging researcher in the field. Walking as a research method in the social sciences and humanities emphasises situatedness, relationality and the material (Springgay and Truman, 2018). It is not neutral, and it is thus essential that we disrupt the notion of what it means to walk in the city.

- The arts of paying attention

Informed by Stengers' (2005: 996) 'politics of slowness', I often sat at the banks of the river alone or with Ilva, at other times with students on a field trip, to attune myself/others to the presence of other beings in the space. In slowing down, I also began to pay attention to the scale of these "others" (e.g., people, birds, crabs, weeds, fish, *typha capensis*) which also informed my thinking around different scales of time outside of human framings. Paying attention to the presence of others demanded a response-ability to the kinds of environmental injustices that have occurred, while also requiring accountability to present and future generations. It made me pay attention to how I walked in the space, making significant efforts to 'tread lightly', which became a metaphor for my interactions with people and the landscape. For Stengers (2005), attuning to the presence of other beings decentres the human and brings into question the authority of our ways of knowing, revealing how place-based research is entrenched in ongoing settler colonisation that has not sufficiently attended to indigenous relationships to the land, the more-than-human and time (Springgay and Truman, 2018). Attuning to the presence of

> multiple beings makes other ways of knowing possible that highlight different ways of relating, where humans and other-than-humans are entangled. For Barad (2003), the world is composed of intra-acting phenomena that become real, material and meaningful through relationships; objects do not exist in isolation, as single entities, but rather as a sum of their relationships.

Participant Observation

Participant observation is an essential part of anthropological work and of this research. Participant observation entails a deep immersion in the day-to-day practices of the interlocuters of one's research which provides a much greater insight into how people and the river navigate life in the everyday. The method of participant observation highlights the human and more-than-human storying of places, creating an opportunity for providing multiple perspectives and enactments in relation to the river. In engaging and understanding the multiplicity of the river's worlds, we are drawn into deeper "response-abilities" (i.e., to be responsible/accountable and the ability to respond/act) to communities that have been affected by the changes in the river, to the river itself and multi-species worlds that are part of the river. By using participant observation as a key method, I was able to provide thick descriptions of the river flow, entanglements with the river as well as the multiple enactments of river care practices, to name a few. To tell multiple stories of what is often thought of in the singular, i.e., the Kuils River. And yet, as Thom van Dooren and Deborah Bird Rose (2012) argue, and as the study will demonstrate –

> "Places are materialized as historical and meaningful, and no place is produced by a singular vision of how it is or might be. In short, places are co-constituted in processes of overlapping and entangled "storying" in which different participants may have very different ideas about where we have come from and where we are going." (van Dooren and Bird Rose, 2012: 2)

The method enabled the argument for the recognition of the river as multiple as I was able to highlight emplaced, embodied and enlivened enactments and expressions through multiple stories. With permission from community-based organisations (CBOs) such as AROCHA, Igalelo Labafazi, Sandvlei Community United Organisation (SUCO) and KuilaLove, as well as

from individual residents living along the river, I participated in activities related to the river to get a sense of the kinds of relationships that are enacted on the river. While I listened to what people said about the river, my focus was on how different ways of knowing is done to the Kuils (Mol, 2002). The stories I relate are mostly situated along the Kuils River on the urban edge of Cape Town. For five years, I went there sometimes daily, other times on a weekly basis, and at other times after a month of reflecting on the data collected on previous visits. I also visited City officials tasked with managing the river in the Cape Town CBD, the Durbanville municipality and the Khayelitsha wetlands. I walked along the river, participated in clean ups, sat in planning workshops with municipal departments and with residents. I took students on field trips, worked in community food gardens. And I observed. I introduced my purpose to explore the different ways of relating to the Kuils River to various potential interlocutors, explaining what made researching the multiple ways of relating to and enacting the river important for my research and what I hoped it would contribute to my work. My research plans were met with interest by some and scepticism of my intentions by others, who cited instances of researcher fatigue.

As a black female researcher, I played the role of insider or outsider depending on context. In spaces predominated by people of colour, I was treated as 'one of them', participating in activities side by side with residents; when I did not know what to do, I was taught, and I could engage in small talk and local gossip. In spaces predominated by white people, I was often approached as 'the expert' on the river even as I participated in activities; my reason for being in the space was interpreted as being to inform, and I would eventually leave. These experiences gave me a deeper understanding of how apartheid had organised lives around how people settled and were made to settle (i.e., the location of residential and informal settlements) and how this had left a geologic record on the Kuils River. I drew on Yusoff's (2018: 8) notion of geologising settlement: 'the consequences of how lineage is inscribed in territory and legitimating rights are established over that territory'. For Yusoff (2018:2), Blackness, historically a subcategory of the human, has been in relation to settler colonial rights and material practices of extraction. What this means is that people categorised as black and/or indigenous were seen as part of nature/landscape and therefore could be extracted from (through labour practices) and geographically displaced and relocated (through forced resettlement and transatlantic slavery) in order to realise the rights of the

colonial settlers access to land and water. The colonial settlement patterns are still visible along the Kuils River today.

Participant observation was very much a learning process for me, a method to explore how different ways of relating are done, shaping and being shaped by the river. By positioning myself as someone who wanted to learn from and with my interlocutors, I attempted to rid the process of hierarchical power relationships that are often implicit in researcher/researched relationships. However, this was challenging in many cases, as I was often positioned as 'the expert' on the river. I reflected on this and wondered how I might best use my knowledge of the river for the benefit of the research contributors, and consequently opted to engage in action research, discussed below. I also asked a lot of questions, which sometimes shifted the relationship from expert to learner.

Interviews

Understanding the context of how people interacted with the river, how the river flowed and how it was governed was important for how I engaged with interlocutors. I held semistructured interviews with City officials at middle management level who were tasked with engineering aspects of the river or managing the ecological structures of the KWP. I researched the different departments in charge of managing the various aspects of the river, for instance, the Parks and Recreation department in charge of the riverine section, the Transport and Roads department responsible for the stormwater, and the Human Settlements department, hoping for a response to requests for interviews. In most cases, I received no response, but I was sometimes referred to someone else in the management chain. When I finally found the right person, I sent an email requesting an interview, along with a statement of the purpose of research, an explanation of how it would be used and the ethical clearance I had received from the University. I had a list of open-ended questions, and I informed respondents from the onset that I was most interested in their day-to-day tasks that engaged with the river. When Mpumi introduced me to Mr Mdoda, we were walking in the KWP and Mpumi suggested we pop into the offices to see if the facilities manager was in. Luckily, he was there and was able to respond to some of my questions. I used the

semistructured interviews to start a dialogue and drew on his responses to ask further questions.

However, residents were often confused about how I conducted my research when I engaged in participant observation. Mam' Wana would ask me when I would be starting my research, as I spent several hours with her and the women of Igalelo Labafazi without asking questions. Their previous experiences with researchers had made use of formal interviews, often with an interpreter present. I explained that I was already doing my research, and that I was not solely focused on collecting survey data but was more interested in understanding how everyday life happened in the area. Mam' Cele responded by saying, 'I like this approach, it makes you one of us and not someone who just wants to extract from us.' As I continued to 'hang out' with my interlocutors, I engaged in informal interviews to collect background information and biographical data. Informal interviews also allowed my contributors to discuss whatever they wanted, which would not have been possible with more formal interviews.

Workshops

As I had joined the prematurely cancelled Soil for Life workshops, I made use of the weekly meeting time slot that had been set up to train the women of Igalelo Labafazi. My invitation to participate in my project was initially met with scepticism, as the group was already disappointed by the abrupt end to the Soil for Life training. Mam' Wana, the most vocal of the group, called me – and all the researchers that had come before – out. Researchers often came into the space to extract knowledge, she said, and when I had what I needed I would walk away, leaving the participants in the same state they had been in before. I was not prepared for this conflictual encounter, but I sat and listened to their frustrations. After much discussion, I asked the group what they expected from me. Mam' Wana looked at me with a frown, then looked at her grandson, whom she had had to bring to the meeting because she could not afford day care, and said:

> I want our children and grandchildren to be able to play safely around the wetlands. I want to be able to provide food for my family. After the government promised us

> change and that we would have access to the basics, they changed their tone. They said 'Vuka uzenzele' (meaning "Get up and do it yourself") – and look, this is what I am doing right now. But it seems there is just no support for us when we try and do things for ourselves. Look, I am sitting in here, in a workshop wanting to learn how to grow organic food, but look what has happened.

I decided that from that point on, my approach to doing workshops would change, and that the workshops must be of benefit to my interlocutors. I discussed the encounter with Dr Amis, who was leading the project commissioned by the WRC, and we set up workshops to understand how the wetland was currently being interacted with. Discussions in the first workshop were about what was being done on the wetland; we mapped out the various parts of the wetland on pieces of paper, and participants were encouraged to draw on them and use varied materials to represent different activities. We then discussed what they would like to see happening in or to the wetland in the future. Some wanted a cleaner environment and many highlighted concerns about safety and livelihoods.

After several walkabouts along the river and through the neighbourhood, having informal conversations and sharing meals in people's homes, we came up with a business plan that incorporated upcycling materials collected during clean ups, harvesting invasive reeds to make materials for selling and increasing the number of backyard and school yard organic gardens. Word had gotten out about the workshop, and more people interested in working with the wetlands attended the second workshop, which was organised to consolidate all the ideas and identify sources of funding for the projects. I compiled a document and shared it with the group, and Igalelo Labafazi used it to source funding for a community garden at a local school. I hope to continue working with the community to realise the other projects.

While this was a rather unconventional approach to conducting research, I was, as mentioned earlier, attuned to some of the ethical sensitivities of conducting research in spaces impacted by colonial histories of settlement and displacement, and I actively tried to avoid perpetuating such extractive relationships. I hope that these interactions presented a 'win-win' situation, as the contributions from the Khayelitsha residents were invaluable to this thesis, and I hope I was of equal value for them.

Image 2.1: Workshop with Igalelo Labafazi, EMG and Soil for Life. (Photo: Author)

Archaeological and Archival Research

In an effort to understand the near and deep histories of the Kuils River, the entanglement of geology with political questions of colonial settlement, development and futures, I assembled archaeological and paleontological data from literature reviews, making connections to ethnographic accounts of residents living on the landscape (Yusoff, 2018). I came across the concept of bio-geo-chemico-socio relationships through a proposal developed by Prof. Green and colleagues for a project that seeks to understand peri-urban metabolisms in critical zones in various parts of Africa. The term bio-geo-chemico-socio, an amalgamation of the words biological, geological, chemical and social, refers to interaction and material flows between these different spheres. A “bio-geo-chemico-cocial science” that focuses on material flows into soil, water, air and through societies is essential to inform policy that responds to problems of the Anthropocene. Drawing on this method was useful in revealing to me the deep intimacies between geological time and societal time, and how these shape enactments of the Kuils River. I found most of my resources at the University of Cape Town library and also conducted desktop research. I found some maps through these sources and found others from the National Geo-spatial Information (NGI) department, a component of the Department of Rural Development and Land Reform (DRDLR).

Water Sampling

After an invitation to visit the community by Cllr Hendricks I collected water samples from the lower reaches of the Kuils River in November 2018, and again in January 2020. I wanted not only to understand what was in the water that might have been making Sandvlei residents sick, as they believed, but also to refrain from creating a singular linear understanding of what the Kuils River meant in and its role in Cape Town. As Mol (2003) argues:

> It is possible to refrain from understanding objects as the central points of focus of different people's perspectives. It is possible to understand them as things manipulated in practice. If we do this – if instead of bracketing the practices which objects are handled, we foreground them – this has far-reaching effects. Reality multiples. (Mol, 2003: 4)

While it was important to understand the composition of the water, I also wanted to understand how water sampling was conducted and how such practices might be manipulated. Within the scientific domain, water samples are collected according to specific procedures. A sterile bottle must be used to collect water, and samples should be collected upstream and downstream of the point of interest, from the middle of the river. Samples for testing biological materials such as bacteria should be incubated below 5^{o}C and should be transported to the lab within 4 to 6 hours (see Waterwise, 2017). It was important that this was done 'by the book' so that the results would withstand any scrutiny. And indeed, when we presented our results to CCT, our water collection methods were questioned. CCT collected their own water samples on a bi-weekly basis from the same point of the river every time, using a cut-up plastic bottle, which, according to interlocutors, did not look sterilised. Noora often witnessed this water collection and said that samples were unsupervised and collected from the middle of the stream. When news of high volumes of poorly treated effluent from the Zandvleit WWTW were being pumped into the Kuils River surfaced in the media, the CCT increased their water testing to once a week, always at the same time and from the same part of the river.

By contrast, we collected samples from the riverbanks at approximately 2 pm for the first water samples. After a discussion with the Sandvlei residents, we became aware that the highest flows of effluent usually occurred in the mornings and evenings, assuming that this was a result of Cape Town citizens high water volume usage in their homes, and therefore subsequent tests were collected in the morning. The Sandvlei residents identified points of concern, where the water was stagnant or running slow, as this is where people and livestock were most likely to have contact with the river. These points of concern along the river became our water sample collection points. When the river was low, biological and chemical materials collected in the mud, and when it dried up, they could be carried into the air. By foregrounding these practices of water collection, I learnt that the sampled water does not passively wait to be considered from different perspectives, but that its liveliness emerges or disappears depending on how sampling is done (Mol, 2002: p5). As sampling methods differed from one practice to another, the reality that is the Kuils River multiplies (ibid). Sandvlei residents, City officials, the lab, frogs, the water, the soil and much more make up the Kuils River multiple, which begs the question of how they are related (ibid). Attending to the multiplicity of these realities opens up dialogue for collective problem solving and more democratic approaches to river management in Cape Town.

Image 2.2: Nazeem collecting a water sample along the Kuils River. (Source: Author)

Activist Research

The activist orientation requires a clear political stance and alignment with the people and communities being worked with (Loperena, 2016), an approach that differs quite significantly from the calls for neutrality and impartiality I learnt during my undergraduate work. As I moved into the graduate space, and particularly when I joined the EHS (Environmental Humanities South), a programme that practices the pedagogy of presence, I became increasingly aware that black, indigenous, feminist and queer scholars have all drawn from their subjective experiences of the world to develop analyses of the social and cultural processes they observe and mobilise for political purposes. Political issues can no longer be relegated to the margins of our disciplinary debates because we are not neutral, passive observers in the world – we are a part of the world and part of the worlds of the communities we research. It therefore begs the question of how we can practice anthropology in contexts of environmental injustice, extreme poverty and racial and gender injustice, to name but a few.

I thus set out to think about how I could use the tools of my discipline to conduct 'critically engaged activist research' (Speed, 2006). I set out to understand my interlocutors as cocreators of this research and therefore allowed my dialogue with them to shape each phase of the project. By understanding the different 'matters of concern' (Latour, 2004) that were iterated in the river multiple, I became aware that my research required different responses within different time frames. There were thus different outputs throughout separate phases of the project, such as opinion pieces in newspapers, videos shared on different platforms and engagement with journalists who were covering matters related to the Kuils River. I also attended meetings with CCT as an ally of the Sandvlei community to explicitly demonstrate my solidarity with residents affected by the river pollution.

ETHICS

Different ethical considerations shaped how I conducted my research. My training in scholarly critique and environmental justice guided the kinds of question I asked in the study and the methods I used to collect data, as the concern shapes the question.

Do No Harm

Ethnographic research emphasises the importance of reflexivity and one's positionality in relation to the groups with which the research is conducted (for example, see Ross, 2010), enabling an understanding of the knowledge produced by revealing the underlying assumptions and social context in which the knowledge is produced. The dynamics between the researcher and the researched affect the information that the respondents choose to reveal (or not to reveal). To this end, it was important that I be open about the purpose of my research and its potential impacts on the communities I engaged with. I was also conscious of the cultural aspects of the communities and the potential sensitivities inherent in dialogue with government officials, and accordingly attempted to the best of my ability not to offend them or place them in compromising situations.

Accountability and Reciprocity

In the past, anthropologists regularly developed their research topics and research questions without the input of the communities they worked with. While there may often be a commitment to share research findings upon completion, no mechanisms are in place (in the university or elsewhere) to ensure this happens, and it is usually left to the individual researcher. I was fortunate to have my confrontation with Mam' Wana (under the *Workshop* section of this chapter) early in my research, as it led to me asking myself: What is the purpose of my research? Who stands to benefit from it? What is my responsibility to the communities who participate in the research?

I knew that my research might require a lengthy process, and I understood that sharing my results upon completion might well be ethical, but I wasn't sure how relevant or useful it would be to do so. I therefore made an ethical commitment to practice a different kind of anthropology, not just to contribute to theory but also to ensure that my research would be of value to the communities I worked with. My interaction with Mam' Wana showcased the reciprocity that can occur through ethnographic research.

Language and Translation

My work in this study has been to really pay attention to the river, how it flows and its relationship to people and multi-species communities, to ask: what does it do, how is it used,

how does it use, how is it known, how does it know, who knows and what does it mean for the river and how it is managed? I did this to open up other ways of knowing, challenging the notion that dominant Western modes of knowing are the only legitimate ways to understand the river. As such, I wondered, how does one pay attention to the river, how do I truly listen to what the river has to say? And if I did finally figure out how to listen, what does it mean and how do I translate this responsibly.

In attempts to grapple with the ways of knowing the river, language and translation became critical. In disseminating my research, I often relied on the popular parable of the "Blind men and an elephant" which originated in India but has been used in many a scholarship ranging from systems thinking, computer science and anthropology for instance in Francis Nyamnjoh's (2012) work, *Blinded by Sight: Divining the future of Anthropology in Africa*. There are many versions of this story and I hope that this metaphorical comparison demonstrates the complexities and multiplicities of knowing the Kuils River for my particular research. In this story, we have a group of blind men who have heard of a strange creature called an elephant but they had never encountered this strange, worldly creature, not knowing its form or shape. A merchant came to their village one day and offered to take them to this creature. The merchant took one man to feel the left front leg. The second man was taken to the rear of the elephant and felt its tail. The third man was put on top of the elephant and felt its ears, the fourth man felt its trunk and so on it went until each of the men felt different parts of the creature. After each of these men had touched the elephant, they were excited, and each believed they had figured out what this creature was. They left the site together bubbling with anticipation, eager to share their findings. On arriving back in their village, sitting together, the second blind man who felt the tail decided to take the lead. He said "This creature is like a rope with tufted ends". "No, no, no" exclaimed the first man, "this creature is like a tree trunk without branches", referring to the left foreleg. The one who felt the trunk was adamant that is was like a thick snake, and the one who felt the ears was convinced that creature was similar to fans. And so the disagreements continued. The versions of the outcomes in these disagreements differ, with varying levels of lash back, with some arguing that the methods of analysis were flawed, some said the language used to describe it were problematic, others argued that the others were dishonest and incompetent. But each believed that their version

of knowing the elephant, their methods and modes of translating were legitimate and the truth.

This metaphorical analysis has been useful for my research and thinking about the river, for like the blind men, their exploratory encounter was reduced to knowing the particular, based on how they have been guided to pay attention and to disseminate the information they have gained. In the case of knowing the Kuils River; the blind men in this story could have been a conservationist whose ultimate goal is to protect ecosystems and focus less on people. Perhaps another was an anthropologist whose interest was on how the people benefit from the river and not really be concerned about the ecosystems that are supported by its flows. Perhaps the other blind man was a resource economist who was interested in how the natural resources can be exploited for economic benefit but not considering the philosophy of financialising the commons or the other an engineer interested in building canals and stormwater drains to prevent flooding of nearby settlements and not speaking to the climate scientist on the reduction of natural spaces for carbon capture and what this means for urban spaces in a time of climate change. Perhaps the blind man was a government official whose strategies have to be thought of and implemented in accordance to electoral cycles because they lack the certainty of being present in that job beyond the term.

Whatever the case might be, this story helps us think about the language, the methods and ways of translating that we have inherited in thinking about river management through various disciplines Even the term “management” can be challenged as it implies a particular approach to encountering and knowing the river. My intention is not to deconstruct particular modes of knowing, governance or practices, but rather to ask what is silenced when we think in particular frameworks, focusing on the particulars and not seeing the big picture. And like the blind men, when we focus on our “expertise”, we begin to confuse this as the nature of the world, as Lesley Green argues, we then lack the capacity to think outside our disciplines, to imagine. What does the river and the communities who experience it every day have to say, when their ways of knowing and being are often discounted in so called legitimate disciplines?

In my research, I endeavoured to pay attention to how language was used and for what purpose. For instance, in the meeting between the City, SUCO members and academics described in the introduction, I question how the language of the expert was often used to shut down or counter the retelling of the experiences of people living with the Kuils. I was attentive to how translations of numbers in water tests played out in boardrooms of the City, when presented in academic halls and when presented to the community. Each of these spaces elicited different responses and the challenge was on how to build consensus whilst acknowledging the diversity of experiences. Important to consensus building was to include a more diverse set of voices in thinking about the democratic management of the river.

Activism and Public Engagement

When I first arrived in Sandvlei, Cllr Hendricks introduced Prof. Green and I to the members of SUCO. My presumptions about the local struggle stemmed from articles published in local newspapers and in a pre-directive issued to CCT by the Green Scorpions, a unit of the Western Cape Department of Environmental Affairs and Development Planning tasked with investigating environmental crimes. The pre-directive (see Appendix 1) precedes a directive that is issued when environmental laws have been contravened. I thus had a slight insight into the significance of the Kuils River pollution in the lower sections, but I was not aware of the magnitude of the existing political tensions or of those that were still to come. On one side, communities like Sandvlei were struggling with the effects of a polluted river, while on the other side, City officials' efforts to address the problem were being delayed by bureaucratic processes (see response to pre-directive, Appendix D). The insertion of anthropologists into this situation again raised questions: What is the purpose of the research? Am I right to choose a side? Will this prevent me from 'seeing the other side of the story'? If so, what will I miss?

Upon publishing my water sample findings and my response to our encounter with the authorities (Green et al, 2018; Green et al, 2019), and after muddling through the research process and ethical conundrums, I eventually began to understand the politics at play. It is a politics that presents the city as one of the best run metropoles in South Africa, a number one tourist destination on the continent, with Blue Flag beaches and beautiful landscapes. To position the city as otherwise positions one as an enemy of progress and economic growth. However, the activist work we engaged in made it even more evident that the Kuils River was

not the only urban river in the Cape to be affected by pollution and poor management, and this work created an opportunity to mobilise communities across the Cape to hold polluters accountable for the damage they have done and continue to do to the land.

Looking at the methods I intended to use at the proposal stage and comparing them to what I practiced as the research unfolded, I realise that I learned many lessons. The methods toolbox that I originally proposed contained the classic anthropological approaches, such as participant observation, interviews and archival research, which were particularly important and helped ground my research. The only 'out of the box' method I proposed was to 'listen to the river', which elicited questions of how to listen to a river and what I would listen to and for. This opened up my methods toolbox a little more to include water sampling and engaging with material in the field of Science and Technology Studies (STS). STS troubles the notion of science as objective truth and places it as a social construct and force that informs and shapes governance, society and life. In the field of STS, the concern is on how science and technology impacts society, politics and culture and how these in turn shape how science is done and technologies are developed. Through an analysis of water infrastructure (identifying the kinds of infrastructure along, in and associated with the Kuils), water samples, geological archives of the Kuils River, this study drew on the information usually based in science and engineering disciplines, to better understand how scientific and technological interventions shaped and were in turn shaped by the social worlds, politics and governance of the river.

In conclusion, this chapter outlined the process of engaging with research on the river multiple and methods used to explore the complex network of multiple ways of knowing and experiencing the Kuils River. Using different methods of inquiry supports my argument that the Kuils River is multiple and therefore requires different ways of knowing. Understanding the different ways of knowing showed how these shaped how the river is responded to, cared for and governed which in turn produces multiple versions of one river. How does one therefore build consensus on how the river should be governed? I argue that other ways of knowing outside what is considered as expert knowledge must be included to achieve more democratic forms of governance. To do so requires that science and technology are seen as a social system that shape and are shaped by society and life. The following chapters demonstrate how science and technology are part of the socially constructed, beginning with

Chapter Three, which argues that like society, infrastructures are laden with meaning, shape and are shaped by everyday practices and can therefore be paradoxical in nature.

CHAPTER THREE

The Kuils River as an Infrastructure Paradox

This chapter addresses some of the paradoxes that became apparent after I walked along the Kuils River on several occasions over three years of this study and I how many construction and landscape interventions were happening in the river and its surrounds. While some newspaper articles highlighted upgrades and improvements being undertaken by the City along this watercourse, others showcased the struggles experienced by the communities. During my conversations with residents indicated a more complex relationship with the river and its infrastructures than was discussed when development was the sole focus of the interventions proposed and enacted by the City. By examining how infrastructural upgrades, degeneration and permanence present as paradoxes in the Kuils River, this chapter builds on the work of Annemarie Mol in *The Body Multiple* (2002) to challenge the idea of a singular, unified and objective approach to river management and water governance.

The chapter is divided into three sections, with the first outlining the paradoxes of the upgrades, degeneration and permanence of the Kuils River infrastructure. The second section examines the dominant belief systems/cosmologies that have informed infrastructure development and implementation and led to such paradoxes, while the third section interrogates what is made invisible when particular logics (such as economics) are prioritised in the water sector of a neoliberal city.

The first paradox of infrastructure, that of upgrades, suggests that even as infrastructure promises improvement, connectivity and efficiency for some, it does so at the detriment of others. The upgrading of the Zandvliet WWTW was to benefit a growing city, but the people living closest to it (as a result of colonial and apartheid spatial planning) did not benefit directly and were instead negatively affected by an increase in poorly treated effluent. The second paradox highlights that while infrastructure is sometimes set up, managed and imagined in a way that suggests it is separate to its environment, its close relationship to the river's materials and how people use it intimately shapes how the infrastructure functions and

degenerates over time. For instance, upgrades required to the Zandvliet WWTW after deterioration repeat the strong and arguably misplaced faith in cement as a preferred conduit for the transport of waste out of the sight and mind of some citizens. I argue that this form of degeneration it not limited to the materiality of infrastructure but filters into conceptual and social relationships between governance and communities. Interlocutors in the study often described how the nature of community development had consistently fractured and degenerated their relationships with government over time. The third paradox of permanence explores the implied solidity and durability that would defy time, bridging the past, present and future. I argue that engineers advising on river maintenance believe that the cement with which they propose to line the river to control flooding and prevent water stagnation see this material as able to perpetually withstand the corrosive nature of chemicals pumped into the river, plant growth (which we often saw thriving through cracks), heat and the shifting of the land. Yet cement degenerates and is in regular need of maintenance and upgrades. How then can water management that is fixated on the supposed permanence of cement rethink its relationship to infrastructure, understanding that its materiality, and therefore its effects on society and multi-species, changes? To better inform policy that prioritises citizen well-being over economic priorities, it is critical that we understand the multivalent nature of infrastructure and how it asserts political, social and environmental effects (Larkin, 2013).

INFRASTRUCTURE AND SERVICE DELIVERY ALONG THE KUILS

> People on the other side [referring to the area of Khayelitsha on the other side of the R310] are always protesting about the poor services in their area. When they need proper taps, they will block the highways. When they need more toilets they burn tyres and things. But it looks like it works for them. We don't do that. For so many years, we as the greater Zandvliet community have been asking for better services. We have been here for much longer than them [pointing towards Khayelitsha]. We have followed the right channels to report problems and request assistance, but for some reason no one seems to listen… Or they just don't care. I swear, I am going to take a bucket of cement and pour it in that 'Kak River' of theirs. Let them see how they like dealing with shit flowing through where they

> work. At least they don't have to deal with it when they go home. For us, this is our life, all day every day.
>
> • (Conversation with Nazeem, 25 January 2019)

Service delivery is an integral part of municipal government, taking up time, resources and effort from City employees to ensure the proper functioning of infrastructure to meet the needs of its citizens. Melosi (2008: 1) highlights that most contact between government and citizens is because of service delivery needs and is often a site of contention when infrastructure fails or is incongruent with the needs of citizens – as evidenced by conversations with Nazeem (discussed in more detail later in this chapter) when the 'Kak River', a man-made canal, was built to discard effluent from the Zandvliet WWTW into the Kuils River, which flowed past his farm. The Kuils River itself features all manner of infrastructure, the main purpose of which is to control the flow of water, shaping how it moves, how it is interacted with, and what thrives and what dies in it. The infrastructure also affects the temporal rhythms of natural processes, as evidenced by a canal introduced into the Kuils River over 50 years ago to prevent flooding in nearby residences. A perhaps unintended consequence of the canal was that removal of the river wetlands to make way for the concrete resulted in faster water flow rates and the loss of the natural filtration processes carried out by plants and soils in the stream (Magoba & Brown, 2008). These temporal rhythms and the changes brought about by infrastructural interventions are often incongruent with bureaucratic time, which is based on the likes of management strategy development and implementation, electoral cycles and financial calendars, which create different priorities at different times. The effects of infrastructure therefore become visible or are experienced beyond the bureaucratic time in which they were developed. I discuss this further in Chapter 5, where I argue that different versions of time produce the Kuils River multiple.

The 'Kak River' canal described by Nazeem was not just a way to transfer waste from the WWTW into the Kuils River; it also shaped how residents living along the river moved, experienced and perceived the Kuils. A once-idyllic space for recreation and connection to nature for spiritual and/or religious purposes became a source of growing concern as a health

and safety hazard. Technical infrastructural interventions, presented as symbols of progress, are here also experienced as symbols of neglect and waste. Understanding the multiplicity of infrastructure therefore presents an important opportunity for exploring the paradoxes of infrastructures and their relationships to people and the environment of the Kuils River. Knowing and understanding the relationships between infrastructure, people and the environment matters, because the current financialised infrastructure development model championed by Cape Town's current government, often presented as progressive and developmental, also creates a brutal enactment that does not see its effects on the relationships between environmental processes and citizens located along the lower reaches of the Kuils, who, importantly in light of South Africa's history, are mostly black.

I argue that it is critical to understand what Isabelle Stengers (2010) refers to as the 'metaphors of life' – the cosmologies or belief systems that inform how people act and think the water, beings and infrastructure of the Kuils in particular and the city in general. In this study, I discovered that the cosmologics of how rivers and their infrastructure should be managed are often drawn from the disciplines of engineering, science and fiscal management. This is characteristic of a neoliberal approach to governance, which advocates for the introduction and/or strengthening of market mechanisms and private ownership and operation, as well as economic efficiency and profitability to improve water infrastructure and management. However, this work of governance, engineering, and science - and the approaches to dealing with infrastructure - are sometimes taken for granted because of the perceived invisibility of what happens in the background to ensure the functioning of the city's water and waste networks.

In *The Sanitary City*, Melosi (2008) argues that American urban life is supported by invisible infrastructure. She traces the history of sanitary systems in America from the eighteenth century through to the late twentieth century, providing a comprehensive analysis of 'technologies of sanitation' and focusing on issues of water supply, sewerage and solid-waste. The book is divided into three broad periods, 'The Age of Miasmas' (colonial times to 1880), 'The Bacteriological Revolution' (1880 – 1945) and the 'The New Ecology' (1945 –2000). The management of urban water, wastewater and solid-waste services evolved within these broad periods and contexts in response to dominant scientific assumptions informed by

knowledge and practice from municipal authorities and experts in the fields of law, public health, engineering, financial specialists and, more recently, community organisations. Those scientific assumptions, in turn, informed the development and implementation of technologies in response to the environmental challenges of urbanisation. However, these different knowledges and practices do not always complement each other and can be contentious because of competing ideas, misinformation and myth; the disparity occurs because service delivery infrastructure is often 'unseen' and performs 'hidden functions' (Melosi, 2008: 1).

But for whom and how are these services and functions 'unseen'? Perhaps in wealthier neighbourhoods, where interactions with water occur via taps, toilets and sinks, the infrastructure services can pass 'unseen'. In lower-income areas on the edge of the city, however (as for Nazeem, Siviwe and Mam Wana, whose stories I tell later in this chapter), leaking sewer pipes, canals into the Kuils River, WWTW that pump poorly treated effluent into the river, low-pressure taps and fences around the Khayelitsha Wetlands Park (KWP) are very visible in the residents' everyday lives.

Governance views infrastructure as a tool with which to manage, control and predict the flow of water in the urban and peri-urban areas of the Kuils, devoid of history and therefore assumed to be free from bias and human influence. However, when infrastructure is seen simply as a tool for water management, the so-called objective management of the rivers and water in the city can become invisibilised and have real life consequences. Building a fence around a wetland park once easily accessible to the community fundamentally changes how people occupy, walk through and interact with the space and is not a neutral approach to the conservation of the Khayelitsha wetlands. The location of WWTWs in the middle and lower sections of the river is not just about suitable terrain but is linked to histories of settlement and displacement and race and class in the city. The 10-year delay to the upgrade of the Zandvliet WWTW is not just a result of bureaucratic maladministration but affects human health and ecosystem well-being as well. These cases (discussed in more detail later in this chapter) demonstrate that while infrastructure can represent progress and development, it can also enact paradoxical relationships and outcomes.

By seeing waste-processing infrastructure as multivalent and integrated with the Kuils River, I explore how – in a context dominated by discourse about development and progress – upgrades, degeneration and permanence present as paradoxes in this waterscape (Howe et al., 2016). I consequently ask how these paradoxes shape hydro-geo-socio-political relationships in Cape Town, drawing on 'hydro-geo-socio-political relationships' as it was used in an Environmental Humanities South (EHS) grant application for a critical zones research approach to understanding soil well-being as the basis of human well-being. The focus of the application was on a 'BioGeoSocial Science' that sought to understand material flows into and through soils to create policy capable of responding to societal needs and to restore the capacity of society to re-design generative everyday relations with soil. While the EHS application focused on relationships to soil, the current research focuses on hydrological relationships. This chapter documents the effects of hydrological infrastructure on urban relationships, noting how to improve them.

Drawing on multi-disciplinary perspectives, infrastructure in this study is therefore further understood as material (stormwater drains, river canals, WWTWs, bridges), social (institutions, communities interacting with the material aspects of the river, economic systems, politics) and philosophical (ontologies, belief systems in the mastery of the environment and the permanence of cement). This chapter thus also highlights how infrastructure is laden with social meaning and in this instance reflects the priorities and attention of water management and governance in the CCT.

Before delving into the paradoxes of infrastructure in the Kuils River, the section below provides a brief background of and context for Cape Town's infrastructure.

> The settler's town is a strongly built town, all made of stone and steel. It is a brightly lit town; the streets are covered with asphalt, and the garbage cans swallow all the leavings, unseen, unknown and hardly thought about … The town belonging to the colonised people … is a world without spaciousness; men live there on top of each other, and their huts are built one on top of the other. The native town is a hungry town, starved of bread, of meat, of shoes, of coal, of light.
>
> (Fanon in Anand et al., 2018)

City planning in Cape Town was historically designed to provide services to an elite white and wealthy minority through infrastructure such as roads, water pipes, sewage removal pipes and power lines; the City offered limited services to people of colour. As such, wastewater and potable water infrastructures in the City were intended to serve a small populace on the overall grid, and waste was diverted to rivers and oceans with little thought about cumulative pollution levels over time. As Fanon describes above, the disparity in services offered to spaces with white residents and black and coloured residents produced different versions of urban living. Homes in the wealthy areas of the Atlantic Seaboard, Southern Suburbs, West Coast and Northern Suburbs had effective sewer systems and had water piped into their homes, giving residents little cause to consider how water shaped their daily lives.

Residents in the lower income neighbourhoods, mostly located on the Cape Flats, had substandard infrastructure in the more formal areas, while informal settlements often had no water and sanitation services at all, placing different pressures on the environment and human health. The poor or non-existent infrastructure in lower income areas heightened residents' awareness of the precarity of water availability and waste removal, but also the symbolic meaning, where the lack of adequate infrastructure implied an impermanence (temporary stay in urban spaces for people of colour) and fostered an identity as second class citizens. As a contemporary example, Sandvlei is a predominantly coloured Muslim community and the nearby eastern section of Khayelitsha also affected by the Zandvliet WWTW is a black community. Most informal settlements in the city are not connected to the water and wastewater infrastructure, where wastewater infrastructure (or the lack thereof) is 'a sociomaterial terrain for the reproduction of racism' (Anand et al., 2018: 2), or what Ruth Wilson Gilmore (in Anand et al., 2018: 2) describes as 'the state-sanctioned or extra-legal production and exploitation of group-differentiated vulnerability to premature death'.

The racial necropolitics of Kuils River settlement patterns show that the infrastructure along the Kuils River is embedded with differentiated experiences, resulting in covert and difficultto-prove cases of harm. Limiting the epistemics of harm to proof of direct causality, as required by the rhetorical statements of CCT political leaders and officials, enacts a form of necropolitics. Mbembe (2019: 66) describes necropolitics as the ultimate expression of power

by a sovereign (or state), deciding who thrives and who does not. By exploring the necropolitics of the Kuils River, this chapter reveals how exposure to chemical pollutants, poor and inadequate infrastructure and, sometimes, *too much* infrastructure along the river creates harmful spaces that are a perpetual threat to the well-being of people and the environment. These threats are experienced in covert and limiting ways, making it difficult to prove harm and giving the State the power to determine what should be deemed life threatening and what should not.

Mbembe uses the argument of necropolitics to extend Michel Foucault's (2010) notion of biopower, which expresses the power to control, manage and determine life. In the case of the Kuils River, biopower and necropolitics are manifest in the centuries of displacement of people of colour and the ongoing destruction of the environment, exposing communities (human and other-than-human) to hazardous landscapes through covert forms of violence. The violence enacted on such populations and multi-species communities is considered slow and subtle, often gaslighting its victims though a lack of catastrophic or spectacular evidence to demonstrate injury; infrastructure often invisibilises this harm (Nixon, 2011). Under the guise of development and the rhetoric of upgrading and improving urban river functions (and by extension citizens' lives), the paradoxical nature of the destruction of other lives and systems is not seen or is ignored.

UPGRADES: TOO MUCH, TOO LITTLE, TOO LATE?

Inherent in South Africa's water sector is the assumption that water supply and demand is stabilised by proper management through investment in the right infrastructure and expertise. The required 'rational' technical and scientific expert knowledge is then often framed according to calculative logics of capital (Green, 2012), which Hayek (1945: 519) critiques as an assumption of a 'rational economic order' that will fix societal problems if correctly managed. The assumption is that the world exists within a predictable, balanced closed-loop system that can be managed should any destabilisation of the system occur, closing the loop and returning it to its original state of balance and functionality. As argued by ecologists, economists and environmentalists and evidenced by the 2016/17 South African drought, however, disruption to the system has complex, long-ranging impacts on humans

and ecosystems (Halpern, 2020). Neither the end of the drought nor a decrease in water use by the citizens of Cape Town during the drought returned the water supply and demand system to their past relationships between people and ecosystems. Rather, the City politics of water and waste management were amplified, briefly making visible the purportedly rational, objective, market-led management of water resources and infrastructure.

In 2018, for example, the Zandvliet WWTW, located between the Khayelitsha township and the Sandvlei farming community, became embroiled in controversy due to its discharge of poorly treated effluent into the Kuils River, which joins the similarly polluted Eerste River before entering the Indian Ocean at False Bay. The Zandvliet WWTW, one of four WWTWs discharging effluent that ends up in the Kuils River (including the Macassar WWTW, which discharges into the Eerste after its confluence with the Kuils), services some of the fastestgrowing areas in Cape Town, treating effluent from the south-eastern parts of the City (namely Kuils River, Delft, Blackheath Industria, Blue Downs, Eerste River, De Wijnlanden, Thembokwezi, Mxolisi Phetani and Khayelitsha) (IOL News 1.7bn upgrade underway at Zandvliet WWTW, 2019; Bone, 2020).

Over the last few years, South Africa has experienced significant electricity supply shortages, with rolling blackouts and load-shedding, which has had a massive impact on the optimal functioning of WWTWs. Typically one of the most energy-intensive activities mandated to local municipalities, the electricity shortages have been cited as another reason for the infrastructural breakdown of the WWTWs. The Zandvliet WWTW, with a capacity to treat 72 megalitres per day (Ml/day) was scheduled for an upgrade, delayed by ten years of litigation over five tender process disputes and a land claim dispute (Frankson, 2019). The upgrade finally commenced in 2019 and is scheduled for completion in 2023 and is expected to provide additional treatment capacity of 18 Ml/day, bringing its total capacity to 90 Ml/day. The upgrade of the Zandvliet WWTW was valued at R1.7 billion and is financed by a loan from the German KfW Development Bank. By February 2020, the facility had been extended by 18 hectares, with the following specifics:

Description	Quantity
Volume of earth excavated	245 048 m³
Length of pipes laid	4 631 m (over 4 km)
Area of adjacent ERF acquired	18ha
Area of ground cleared	157 978 m²
Volume of concrete poured	10 333 m³
Mass of steel fixed	1.09 million kg
Area of new roads laid	3 187 m²
Kerbs installed	2 465 m
Fencing installed	1 826 m

Table 1: Extent of upgrade work completed at Zandvliet WWTW by February 2020. (Source: Bone, 2020)

In a report by Bone (2020), Alderman Xanthea Limberg, Mayoral Committee (MayCo) Member for Water and Waste in the City of Cape Town, was reported to have said 'Despite the massive scale of the task at hand, as shown above, the team have demonstrated remarkable attention to detail, especially in terms of environmental compliance. A total of 6343 plants of ecological value were relocated prior to construction.' The City is diverting 8 Ml of flow per day away from the Zandvliet WWTW to the Bellville WWTW. The upgrade will include the construction of a membrane bioreactor (MBR),[11] sludge dewatering facilities, new inlet works, pump stations, primary settling tanks and maturation ponds, where effluent is purified before discharge (Frankson, 2019). Further expansion is planned to cater for urban growth in the vicinity of the WWTW.

[11] A membrane bioreactor (MBR) is a wastewater treatment process that integrates a perm-selective or semipermeable membrane with a biological process (Judd, 2010). The process is now widely used for municipal and industrial wastewater treatment where there are populations of up to 80000 (Beddow, 2010). The MBR is a highly technical process that requires expert knowledge and skills; it is an expensive but efficient treatment option that may be used to upgrade old wastewater plants (Stauffer & Spuhler, n.d.).

Image 3.1: Proximity of Zandvliet WWTW (red) to Kuils River (blue) and Sandvlei community (green), connected by the 'Kak River' canal (yellow). (Source: Google Earth, 2021)

The Zandvliet WWTW upgrade was delayed by nearly 10 years. The tender for construction services was initially advertised in May 2010 and awarded in September 2010. The award of the tender was appealed by competing companies in September 2010, and the appeal was upheld in January 2011. The cycle of advertising the tender, awarding and then appealing happened five times during the period between 2010 and 2018, when the appeals were finally turned down, and construction commenced in 2019. In addition to the bureaucratic and legal challenges of appointing a construction company, a land claim was lodged in March 2014 which restricted any work on the WWTW being done to just planning. The land claim was resolved in June 2016. During this long drawn out legal battle, the Sandvlei community downstream of the WWTW on the Kuils River reported an increase in animal deaths and a general decline in resident health, with complaints of respiratory and skin infections. Even contemporary teenagers remember that the Kuils River was once home to otters, fish, birds and a multitude of frogs, but it now carries solid waste and chemical particles flushed down the drains of thousands of homes through the Sandvlei community, depositing what the City insists is foam and not raw sewage along the river banks. When living with the river became unbearable and life-threatening, residents reported these incidents to the CCT authorities charged with wastewater management.

a

b

c

d

Image 3.2 (a–d): Local farmers collect water samples from the Kuils River for testing. The CCT insisted that this was not faecal matter but foam. Regardless, the foam is a strong indication that the Zandvliet WWTW is struggling to cope with the amount of sewage it needs to process in a day. (Source: Author)

Farmers reported the death of their livestock and mothers worried about their children when they went out to play. One farmer, close to tears after the death of many of his horses, said,

I loved my horses. They were show horses. Each one was worth about R100 000. I put all my money into them. But to me, these horses are not just my animals. They were also a way to send my daughters to school, to feed my family and to think I am not the only one around here who has lost so much. They have asked us to wait. We have waited, we have been patient, but what has this done to my family. Look at us now. I will take that cement they took to block that 'Kak River' and those channels they are using to poison the river. Others down there in Khayelitsha have done poo protests, thrown poo on the roads. Maybe that's the only way they will listen to us. Make them deal with poo we have to deal with all the time. (Interview with Nazeem, 2018)

The Sandvlei community have been intensely frustrated, because not enough was done with any urgency to alleviate the problems of the river while the CCT waited for the litigation to be completed, which raises the question; does a corporate entity's right to appeal and contest a tender outweigh citizens' rights to a clean environment? No precautionary measures were taken to ensure the health and safety of the human and multi-species communities along the river, thereby exposing them to slow forms of violence (Nixon, 2011) and a health risk that could lead to premature death (Mbembe, 2019). Steve Lerner (in Bullard 2011) proposes a compelling argument for why prevailing environmental management must be re-examined to place emphasis on the precautionary principle, prevention and commensurate protection. This argument, the result of two years of research and work with twelve communities in the middle of toxic 'sacrifice zones' in the United States, is backed by irrefutable evidence that not all Americans are created equal (Bullard, 2011). Bullard's book, *Sacrifice Zones*, reveals that one of the most important indicators of an individual's health is their ZIP code, which correspond to histories of segregation between communities of colour and white communities. For Lerner (in Bullard, 2011), this pattern of unequal protections constitutes environmental racism, as these spaces are often occupied by low-income people of colour, a trend we also see in the Cape Town context. In such spaces, the well-being of people and the environment are side-lined in the name of 'economic development' and 'progress', often brought about by technical proposals and responses assumed to be objective and neutral. Therefore, while upgrades to the Kuils River and its associated landscapes are deemed necessary to societal goals of development (more often than not determined and imposed by society's elite), they have often resulted in the creation of sacrifice zones where lives (human,

flora and fauna) are regarded as cheap and disposable in the interests of economic and political opportunity.

Like the permanent and unbending relationship that concrete is meant to have with water, bureaucratic relationships with citizens have not shifted or bent to ensure the well-being of the Zandvliet community, following 'procedure' for ten years. In the meantime, the growing demand for housing in the upper sections of the catchment required more stormwater pipes to divert surface runoff into the river, an upgrade of the Zandvliet WWTW, and the building of the 'Kak River' canal to increase the flow capacity into the Kuils River. The result was too much wastewater being pumped into the river from the WWTW, large volumes of earth being excavated, and concrete being poured in an area characterised by critically endangered sand dunes. Too little had been done over many years to ensure the well-being of those living along the river, and the upgrades came too late for people such as Nazeem, who lost his entire livelihood.

As Howe et al. (2016: 7) argue, for infrastructure to function over long periods of time, it must be upgraded and retrofitted to meet new demands. The upgrades to the WWTW raise a paradox through its infrastructure, an ontological oxymoron attempting to bridge timelines between the past, present and future (ibid: 7). Upgrading the WWTW and, by extension, the stormwater drains, canals and gabions of the Kuils to improve its functioning as a conduit and transporter of waste beyond the city (a process from the past) has compromised the quality of life and well-being of people and the river in the present. The growth of the city necessitated the upgrade of the WWTW and Kuils infrastructure to deal with future problems, bridging the unequal service delivery of colonialism and apartheid to the rapid development and increased demand for service of the present and the population growth and climate change of the future. Spaces such as Sandvlei have become sacrifice zones that bear the burden of these upgrades in the contemporary moment (Lerner, 2010). By increasing the volumetric output, the city's resilience and waste management future planning has not taken into account its effect on the people and multi-species communities in close proximity to or reliant on the river.

The cheapening of nature has occurred over centuries in the Cape and was made even more visible during my field research. The upgrades of the Kuils River infrastructure and, particularly, of the Zandvliet WWTW came at a cost to the endangered sand dunes of the False Bay coastline, which have been mined for decades to manufacture cement. Cape Town's coastal line is made up of rocky shores separated by small beaches and long sandy coasts. Many of the sand dunes are considered migratory due to the often forceful seasonal winds that influence the sand deposits and erosion of the summer months (particularly from January to March) and the strong gale force winds of the wet winter months (May to August). Prior to urban development, the mobile coastal dune systems were extensive, but the dunes have been transformed and compromised over the last few centuries, especially in the last 80 years, endangering plant and animal life unique to the Cape coastal region (IOL News Call for probe into Macassar Dune Mining, 2008; CCT Coastal Management Report, 2015; CCT, 2019)

All the surviving sand dunes in Cape Town, including those that are degraded and threatened, form essential buffers against weather elements that affect human-made infrastructure (e.g. buildings and roads), rivers, wetlands and aquifers around the city. The dune plumes that extend up to 15km inland along the False Bay coast, where the lower section of the Kuils River flows and the Driftsands Nature Reserve is located, were formed over millennia, a result of intense winds causing calcareous and, to a lesser extent, barchanoid dunes to form (Cape Nature, 2015). As these dunes migrate inland, they become stabilised by vegetation. However, due to the boom in infrastructure development over the last few decades, these mineral-rich dunes have been extensively depleted, leaving a fraction of what was previously there along the coast, with some dunes only surviving because of their location in protected areas such as the Driftsands Nature reserve. The role of these dunes as essential 'green infrastructure' has been underplayed or largely ignored, perhaps due to the influence of the multi-billion-rand construction industry. The mining of these dunes has been largely unregulated and, according to the CoCT's own report (2015), few dune-management plans are in place due to the coastal management portfolio being 'historically neglected and underresourced, often to the cost of the City and its ratepayers' (CCT Coastal Management Report, 2015).

In addition to protecting human-made and natural landscapes from surging storms, these dunes provide a habitat for a host of multi-species communities and regulate environmental and weather conditions (providing green spaces in an urban jungle). The exploitation of these dunes without active management intervention has resulted in fewer and fewer natural dunes (CCT Coastal Management Report, 2015). While the landscape is changed by more layers of concrete in the name of 'development' and 'upgrades', the marine environment and climate conditions function as they always have: sand is naturally deposited along the coast; strong seasonal winds blow the sand inland, changing the expected profile of the sand dunes; copious amounts of sand are deposited on roads and buildings; and the changed shape of the dunes makes them more susceptible to erosion, so the vegetation that usually stabilises the dunes can no longer establish itself.

a 

b

Image 3.3 (a–b): Location of sand mining sites in close proximity to the Zandvliet WWTW. (Source: Google Earth 2020)

In the images above, the growth of the mining area behind the Zandvliet WWTW can be seen expanding towards the sea. This places the WWTW, a billion-rand investment, at considerable risk in the coming years. A study commissioned by the CCT (City of Cape Town Coastal Management Report, 2015) and a report generated by the CCT's Environmental management, Coastal Management Branch (2017), which have since been ignored, indicated that dunes that are stripped of vegetation cover have their natural processes of trapping and retaining windblown sand compromised. When the sand dunes can no longer trap and retain sand, it affects the advancement and retreat of dunes, compromising their ability to act as effective coastal barriers. Should the sea levels continue to rise as anticipated, seawater will eventually breach what remains of the dunes, making the infrastructure susceptible to flooding and causing the salinisation of the Cape Flats Aquifer (CFA). The 2020 flooding of the Sandvlei community, when the Kuils and Eerste riverbanks broke after heavy winter rains, also indicates a real risk to this project. The WWTW could be flooded by seawater on one side and freshwater on the other. The rise in sea level is also likely to affect the freshwater that flows in the Kuils and Eerste Rivers close to the rapidly degrading sand dunes, compromising the soil's productivity for local farming communities and for one of the last remaining farmlands within the Cape Town metropole, the Philippi Horticultural Area (PHA), which relies on CFA groundwater for irrigation.

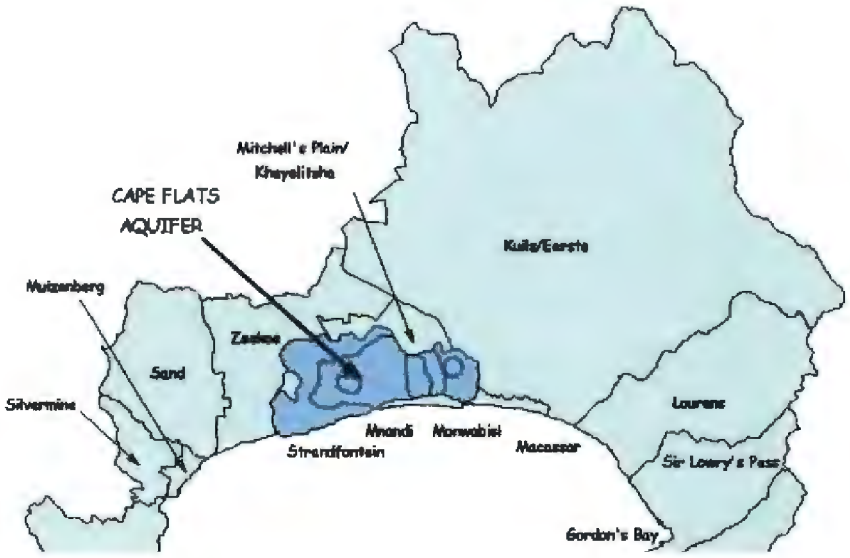

Image 3.4 Location of the Cape Flats Aquifer. (Source: Giljam, 2002)

The reliance on concrete to upgrade the urban environment, devoid from its relationship to dunes and temporal scales, ignores the vital flows of materials, energy and nutrients that make up urban ecosystems and facilitate urban metabolisms. The authority of this understanding of cement also overshadows the experience of communities like Sandvlei, which have had to endure the most effects of failing infrastructure. In addition, the upgrade of the WWTW, which is costing billions of Rands (in loans), is premised on a fixed population and a fixed understanding of urban metabolisms. What happens in another 10 years, when the population of Cape Town has significantly increased again? Will another loan be taken up to upgrade failing or overwhelmed infrastructure? Given the many unknowns of climate change, what will happen in 20, 50, 100 years?

DEGENERATION: BREAKDOWNS OF INFRASTRUCTURE AND RELATIONSHIPS OF THE KUILS

The constructed, solid materiality of the WWTW and the 'Kak River' canal can be juxtaposed with its fragility, as the impact of water, chemicals and climate degrades the infrastructure over time (Howe et al., 2015). Infrastructure requires upgrades over time, which are implemented incrementally and require negotiation with multiple users, designers, planners and more, all with different intentions and priorities. These intentions and priorities intersect

with material life, making the reality of the infrastructure multiple, as demonstrated by the different experiences of city officials and the Sandvlei community with regards to the Zandvliet WWTW – and as Mol (2002: 7) argues, 'If reality is multiple, it is also political'.

The political nature of infrastructure was demonstrated in the way relationships between river communities and those who work directly on infrastructural projects (at technical and governance levels) are reconfigured or break down with time, because of this fragility of infrastructure. For instance, I often walked in the winding backstreets of the informal settlement, jumping over puddles of murky grey water, side-stepping dirty diapers and heaps of garbage. Siviwe often accompanied me on these walks and commented, with a mixture of embarrassment and dismay on her face, 'You see, this is what we get when we vote. Vote or not, nothing changes around here.' I asked, 'What do you mean? Every time I come here, something has changed – look, those shops there in the containers were not there before, and that church looks bigger and has a parking lot.' She looked at me from the corner of her eye, with an expression of curiosity – one that, upon reflection, was of surprise at my ignorance. She replied, 'The thing about this place is that it is great for those that already have money, they can get the support they need from the government. But for people who come here with nothing, they must live next to those (pointing at public toilets), and when they stop working (the toilets), the poo and everything flows through their homes.'

I looked to where she pointed, and right next to the toilets was a tap, with water bottles and buckets of laundry, all in a line waiting for their turn to access the water. The toilets and tap were installed by the city to address the rapid growth of the Silvertown informal settlement and prevent the pollution of the Khayelitsha wetlands, thereby preventing the spread of waterborne diseases. Only three of the fifteen toilets and one of the three taps were working, however, and some of the drains under the taps were blocked by paper bags, tissues and food scraps. Siviwe then took me to the nearest informal house, a shack, and pointed out a small dugout trench that was meant to divert the stream of waste away from the homes and into the Khayelitsha wetlands of the Kuils River.

a

b

c

d

Image 3.5 (a–d): Images of toilets and water collection points in Silvertown, a township adjacent to the Khayelitsha Wetlands Park. (Source: Author)

We followed the waste stream and came to a fence and a gate that provided access to the Khayelitsha Wetlands Park (KWP). Within the buzzing township of Khayelitsha, right next to where Siviwe and I had walked, was this natural gem valued as a significant natural water

filter of the Kuils River. As we walked through the gate, I saw brightly coloured outdoor gym equipment and children's play areas with jungle gyms. We walked towards thick dark green grass and shrubs to where the river was flowing, where we were hit by a putrid smell as we saw piles of faeces along the path. With our t-shirts pulled over our faces, Siviwe waved her hand over the wide, grassy KWP and said to me,

> You know, people love this place, it is beautiful. Look at the space. But what can you do when your toilets are not working? You will find the closest place that has a bit of privacy… and guess what, for us, it is here.

In 2010, the CCT was taken to court over the erection of 'open-air' toilets in the Makhaza settlement, which is also adjacent to the KWP. A group of African National Congress Youth League (ANCYL) activists, a branch of South Africa's political ruling party, took to the streets and engaged in what was eventually dubbed as 'poo protests', where the contents of from portable flush toilets are flung at motorists on Cape Town's major highways or at the steps of government buildings to draw attention to the inequities of sanitation in the city (Robins, 2014). The ANCYL accused the local and provincial government, which are controlled by opposition party the Democratic Alliance (DA), of racism, taking the matter to the Human Rights Commission (HRC) and the Western Cape High Court. The City released a report stating there was no evidence of wrongdoing on their part and that their solution remained better than the national norm. The CCT said the installation of 1 316 toilets in Makhaza and other informal settlements in 2009 was done on condition that residents would erect their own structures around the toilets for privacy. Of these, 1 265 were enclosed by residents, i.e. walls were built around them, and the rest remained open. After the outcry, the CCT enclosed the remaining open toilets with corrugated iron sheets, but this was deemed inadequate by residents, who tore them down. In response, the City removed all the unenclosed toilets ('City of Cape Town loses…', 2011).

The CCT believed they had met their mandate by providing each household with a toilet, supposedly a better option than the national norm that provides a communal toilet to be shared by five households. In April 2011, however, the Western Cape High Court ruled that the CCT had lost sight of the constitutional rights and needs of the poor ('City of Cape Town

loses…', 2011). The erection of these toilets was deemed a violation of section 10, the constitutional right to dignity, and section 26, which requires the implementation of housing in a reasonable manner (South African Constitution, 2003: 1247). In 2013 and 2017, the protests against poor service delivery in Cape Town became known as 'poo protests'. Clearly, the decisions made about toilets in particular and infrastructure in general impact the built and natural environments and determine how bodies, behaviours and communities are controlled and regulated in the everyday (Jaglin, 2002; Hanson, 2010). In this case, the problem was a lack of adequate toilets; the technical solution was to provide said toilets. The CCT felt they had met and delivered on their mandate, making it clear that in their understanding, meeting mandates and adhering to bureaucratic expectations superseded the citizen needs of democratic governance.

In the cases described above, the material form of infrastructure is only variable and durable to those that work directly with infrastructural projects. Concrete used to form pipes, canals and major infrastructure is seen as flexible, fragile and vulnerable by those who create and design with it. However, the recipients of the infrastructure may encounter it as a solid form: unbending, unmoving and unmalleable, and may have to adapt their environment and lives to suit said structures. Lack of understanding of context facilitated a governance and management of infrastructure 'from above', from the proverbial 'gods-eye-view', removing decision-makers from the actual lived realities of the people they were intended to serve. The perspective from above comes with specific power and provides the authority to shift and shape citizens' lives, but these outcomes were often made invisible or underplayed by the 'hard disciplines' of engineering and science. A better approach with mutually satisfactory outcomes might have been to make an effort to understand the community's struggle to meet every day needs and work in dignified partnership rather than apply top-down enforcement.

When infrastructure is presented as neutral, rainfall, rivers, streams, wetlands and human excreta are seen as a problem to be managed by human problem-solving in the form of dams, stormwaters, flood alleviation strategies and sewage management. This positions water flows as dependent on human labour and interventions and further highlights the idea of human exceptionalism and mastery that excludes relationships outside of the modernist framing of water. Therefore, while waste-processing infrastructure is positioned as necessary for

development and 'the good life' in governance, scientific and engineering discourse, infrastructure also degrades, degenerates and sometimes compromises the well-being of communities, both human and more-than-human.

I was introduced to the KWP months before my walk with Siviwe, and for several reasons I ended up at various parts of the expansive park, asking more questions. The KWP is a pleasant urban wetland park, the CCT poster child of sustainable development in townships. The area was selected as a critical biodiversity hotspot worthy of conservation because it is a functional ecosystem that supports various plant and animal species and carries out essential regulatory services, such as flood attenuation and water cleansing. Local communities enjoy the wetland park for recreational activities, collecting medicinal plants, ritual cleansing, watering and feeding livestock and more. Over the months, I witnessed many changes to the wetland as the CCT introduced more infrastructure to 'benefit' the local community and attract tourists.

When I did my preliminary visits in 2015 (before my meeting with Siviwe, whom I met in 2018), the KWP was still open, without any fencing. As my research progressed, however, I noticed the introduction of concrete palisade fencing along Spine Road, one of the boundaries of the park. The fence marked the area as separate from the formal and informal housing in the area, but sections of the fence were quickly taken down by residents to create access points for locals and livestock, not allocated in the earlier planning for the park. Conversations while digging in the vegetable gardens and picking up litter with waste picker entrepreneurs suggested that this was no surprise. Mam' Wana, a woman in her late 50s who was one of the gardeners, said:

> But what did they [the CCT) expect? They do these things without talking to the people and expect us to just be okay with it. Before they started doing these development things, people could just easily go to the wetlands and feed their goats and cattle. You could even just go and get some special plants. But now they put up this fence, and people have to walk all the way around to get in. Even with the water meters that they have put in other houses. They don't even explain what it is, next thing you see you have a R10 000 water bill. I will never have that in our house. They just want to make money from us. (Translated interview with Mam' Wana, 16 May 2016)

Mam' Wana's statement above and my later conversation with Siviwe in Silvertown highlight the CCT's natural resource management practices, predicated on the separation of people from the natural environment of the KWP and Kuils River.

The CCT commissioned several environmental assessments of the wetland park and the potential economic opportunities and environmental benefits that might be derived from it. But for many of the residents I spoke to, the marking of space for the benefit of the community implied the imposition of parameters by the state, a command and control approach (which could have been unintentional) for the use of the commons – how it could be accessed, and by whom or what.

Societies transform their environments to suit their needs and aspirations, but how this is done (Mol, 2002) highlights different concerns and priorities and enacts different outcomes. Over the years of my research, I often heard Khayelitsha residents describe their relationship with the CCT as one that lacked care, while they (the community) interacted with the KWP with care. Conversely, some CCT members tasked with managing the wetland were frustrated because the locals did not seem to appreciate the beautiful space, which explained 'why they were able to just defecate in the space'. Fences were erected to conserve the natural state of the KWP, and outdoor gyms and braai areas were constructed so that the locals could enjoy the space too – so why were they (the locals) not vested in keeping the wetlands clean? After all, keeping it pristine would make it an attraction for tourists, which would mean money and jobs coming into the community.

Image 3.4 (a–d): Earlier improvement of the KWP. The improvement included additions of play and exercise areas as well as cleaning the river itself which led to arrival of more bird life in the area (Source: Author).

In interviews and informal conversations, many residents living with and along other parts of the Kuils River described their interactions with the river in the same way that Siviwe and Mam' Wana had. They also described their relationships with ward councillors, park and natural resource managers as having broken down over the years, characterised by an increasing lack of care at both the local and government level. They also focused on what they called the proliferation of 'development', with an emphasis on the multiple meanings, understandings and expectations that come with the term. A common understanding of all the development was that provincial and CCT authorities (e.g. CCT Waste Water and Informal Settlements; Environment and Development Planning; Human Settlements) had allowed their obsession with development to be skewed towards those that already had, and less advantaged communities had to endure the waste from that development.

Toilets, taps and the KWP were part of the upgrading of the Silvertown informal settlement (established in 1989, making it the second oldest settlement in Khayelitsha) as part of a CCT

commitment to providing housing for residents, granting them access to formal tenure and entry into the housing market and providing green spaces for health and well-being. It can be argued that in this case, these infrastructures are symbolic of political promises for a future in which residents have access to basic services, better environments and, by extension, better lives. 'They are a material and aspirational terrain for negotiating the promises and ethics of political authority, and making and unmaking of political subjects' (Anand et al., 2018: 20), because how they are imagined, created and distributed occurs through negotiations between the state and the people it governs. It is therefore important to consider the materiality of infrastructure (e.g. how it degenerates), but also to consider how politics is enacted in everyday life by the mobilisation, management and control of infrastructure that determines how people live. Thomas Lemke (2014:14) argues for an exploration of the role of liberal modes of governance through material forms, paying careful attention to the 'matter of governance and the governance of matter'. As such, Anand et al. (2018: 21) argue that 'to govern infrastructure … is to govern the politics of life, with all its inequalities'.

PERMANENCE: CONCRETE RELATIONS

> Infrastructure, like science, is 'politics pursued by other means'.
>
> • Bruno Latour (in Anand et al., 2018: 10)

Residents along the river believed that government was run like a business focused on the economics (making profits), engaging in politics to control the resources. But interviews and conversations with government officials, particularly those who worked with natural resource management and engineering, again suggested they believed the same lack of care applied to the residents. In a working group where I presented some of the challenges of the KWP, a natural resource manager responded by saying:

> You know, we do all of this for the people. We built a beautiful space where people can enjoy nature and be with each other, but then they still go and destroy things, pulling down the fence, dumping trash in the wetlands and

> using it as a toilet. They just don't take care of the amenities built by the City. Of course it is not everyone, but those bad apples just make it worse for everyone.

Government officials whose expertise was in natural resource management and infrastructure development were less interested in the broader context and were more invested in 'things running well' for their own portfolios.

When talking about the river, I was fascinated by how something that at first glance seemed neutral unravelled different ideas of governance, development, economics, well-being and politics. Depending on who sees and interacts with the river, and under what circumstances, the Kuils River was viewed by some (usually river communities) as political, while others emphasised an apolitical stance based on infrastructure and technoscientific interventions. In all the cases described above, infrastructure is at the interface of community struggles, government mandates, economics, law and, often silently, the environment. Andrew Barry (2001) describes infrastructure as 'political machines' because of the ongoing negotiation and contestation embedded in them. For Barry (2001: 7), scientific and political methods similar to the ideas of the Department of Water, Waste and Informal Settlements discussed in the introduction of this thesis are imagined to 'provide solutions which transcend ideological differences'. And that was often the case in my encounters with scientists and engineers for this research, with one professor stating, 'The thing about us engineers is that when we see a problem, we fix it. We don't have the time to think about the politics or the conflicts of what we have engineered; that is for you social scientists.'

The different concerns and priorities that enact different outcomes can also be demonstrated by how 'hard disciplines' can underplay the impact of infrastructure. When I was invited to guest lecture in a civil engineering course at UCT, I presented a map that showcased the population distribution along the Kuils River. For the most part, high-income white Capetonians settled in the upper reaches of the Kuils River, with black and coloured communities settling along the middle and lower sections of the river. WWTW effluent was only introduced into the river from the middle section and continued into the lower sections. One participant in the class argued:

> It's not always about race, these things. If you can see the geology of the terrain, WWTWs need to be placed where they are at a higher level and can be carried down at less of a cost because of gravity. It's simple engineering and not necessarily politically motivated. Making it about race is divisive and can prevent people coming up with actual solutions to the problem. (Class discussion, 2017)

While I was glad to have been invited as a social scientist to speak to future engineers and to have an opportunity for dialogue across disciplines historically kept separate, I was troubled by how the histories of coloniality, settlement and forced removals were so easily erased through the language of rationality, economic development and technical efficiency in an industry that has a legacy of racial discrimination. Narratives such as 'It's over 20 years after democracy, why are we still talking about racial discrimination?' are still very present in the halls of academia. The inequalities and unfairness of infrastructure projects can be easily subsumed by so-called rational approaches to modernity and development while further reproducing, amplifying and generating social inequalities. And so we return to the point that wealthier citizens (and in Cape Town's case, the wealth gap correlates with race) enjoy better public services than their lower-income neighbours (largely comprising people of colour).

The class discussion also challenged my own thinking in relation to the limitations of one perspective on the physical aspects of infrastructure once built and the resultant ripple of socio-technical effects. An exclusive focus on the social impacts of infrastructure does not necessarily shed light on the long and often arduous processes of planning, negotiating legalities, political buy-in and costs required before projects can even be implemented. Ignoring socio-techno-political entanglements would render invisible the role of power in making cities and the processes involved therein. The important (but generally ignored) questions that need to be asked are: Who is doing the planning, and what understanding do they have of experiences of relationships at local levels? Who or what will be impacted, and who are and what remains 'unseen'? Addressing these questions in the planning processes would highlight how infrastructure does not exist in a vacuum but is produced through relational networks, connecting the local with the global, the social to the economic,

technological and political. These relational networks of infrastructure are created through a series of economic, legislative, planning, construction and engineering intermediaries, often determined by who is in power and who has sufficient political and economic resources to see projects to fruition.

To avoid political disagreements, politicians rely on the fiction that technoscientific interventions serve as neutral arbiters. The rationality of science and the objectivity of technology are often called on to inform approaches to 'fair governance' in order to ‘resolve, bypass or defer political disagreements’ (Barry, 2001: 8). However, social and political thinkers (Barry, 2001: 9) have questioned the notion that political controversy can be avoided through the application of such 'expert' knowledge. They argue that the local experiences of society or the public sphere can offer up more rational solutions than those provided by science and technology. But technologies are an integral part of what makes up society, and to think that technologies can exist autonomously, without a connection to its users, is naïve. Infrastructures are thus an assemblage of a multiplicity of experiences and 'expertise', enabling complex interactions of solution and problem at the same and at various times, at local and further afield geographical locations (Edwards et al., 2009: 365). Infrastructures continuously configure and reconfigure relationships between individuals, multi-species communities (including humans) and governance.

Infrastructure also carries and embodies different meanings that are vital to how they are enacted. The language of rationality, objectivity, individualism, hierarchical authority, assertiveness, command and control are considered as characteristic of masculine sensemaking, while collaboration, locality, care and distribution of power are considered as feminine (Siemiatycki et al., 2019). These characterisations are in no way totalising, and nor do they describe individuals in the infrastructure space, as each gender is capable of either form of sense-making in different spaces and at separate times. However, understanding these enactments is important, as it has an impact on how the management of the Kuils River is performed, on how certain practices are brought to the fore and others are downplayed. Access to good infrastructure – how it is designed, built, maintained and managed – affects people differently. People of all genders and abilities, along the lines of race and histories of colonialism, are all impacted by infrastructure in different ways (Wellenstein & Gill, 2019).

Historically, water infrastructure planning has treated society as homogenous, and it is primarily designed from a male perspective as an 'end of pipe solution', with little regard to children's needs, caregivers' use of space, householder needs to produce food or women's needs for spaces of safety.

The water sector in Cape Town and South Africa has historically been dominated by (white) men, though there was a slight shift in these demographics due to the considerable efforts of Professor Kader Asmal during his tenure as Minister of Water Affairs (1994–1999). The Department of Water and Forestry, renamed the Department of Water Affairs under Prof. Asmal, had previously been run under particular ideas of governance from a largely white male Afrikaner perspective that prioritised the distribution of water and infrastructure to agriculture, industry and white minority populations in urban centres. This approach was highly technically and scientifically driven, but Prof. Asmal, a human rights lawyer by training, overhauled the department to focus on human rights, social justice and environmental sustainability. While they may have improved, however, the logics, practices and enactments of the water sector still lean towards masculine ideas about how spaces are occupied and controlled, privileging certain unquestioned assumptions of empire building, conquering of territory, mastery of nature, progress and development that feminists have long critiqued (Plumwood, 1993; Eisenstein, 2008; Aguinaga et al., 2013; Siemiatycki et al., 2019).

Extending the observation that people use infrastructure as an indicator of socio-technopolitico-economic interactions, I suggest that residents living along the Kuils River and CCT authorities both use infrastructure as a means of making sense of spatial and temporal relationships that are not easily visible or knowable only through the language of science and engineering. Infrastructure, which epitomises the convergence of materiality, social interactions, expert knowledge, economics, technical efficiency and usefulness/aesthetics (to name a few), is a useful vehicle through which to think about relationality along the Kuils River throughout this thesis. There is therefore a focus in this chapter on the materiality of infrastructure and its entanglement with bureaucratic and technical efficiency, the materiality of concrete and its entanglement with ideas of the flow of water and capital in a neoliberal city.

Image 3.5: Xanthea Limberg, Mayoral Committee Member for Water and Waste, at the Zandvliet Wastewater Treatment Works upgrade. (Source: https://www.bizcommunity.com/Article/196/604/192917.html)

The infrastructure placed in and along the Kuils River, such as canals and stormwater drains, are largely to control or stop the flow of water. The case of the Zandvliet WWTW and the larger Cape Flats area highlights the limitations of thinking about urban flows in expert/discipline-siloed ways. I met with City management officials at the request of some of my interlocutors living in the Durbanville area, who had been involved in river clean-ups in the upper reaches of the Kuils. They wanted to organise a cross-neighbourhood clean-up and were looking for guidance as to how to go about it and whether the City could assist in coordinating this.

The response from Mr X of the Durbanville municipality was:

> That's an engineering issue. We can look at certain programmes that we can put into place and obviously the City working over a few districts, we can look into something. Also something to mention, the river system is divided into different sections of responsibility, which make it quite difficult for one person to take ownership. If you tell me, 'You have from one house boundary to the other, and it is a 100 m stretch, which is the river system, and that is your responsibility', then I would look at it in a different way. Now the river is council property, there where you walk with your boots where it's wet, that's our responsibility. And all engineering structures allowing water into that stream, that's our responsibility. The embankment next to the stream is not my responsibility. That would be Parks' responsibility, because it is part of their open space. Our responsibility as engineers is to make sure that the rivers function. We don't like seeing litter next to a river or embankments, however, our focus is to make sure that the river will flow, and the inlets which the river will allow water into, so we don't get flooding in the developed area. So our responsibility is purely to make sure that the river is flowing.
>
> (Interview 17 September 2017)

Here the City's management practices, as if the river is cut up according to municipal boundaries, go against the ideas of flow, of ecosystem and as mentioned earlier, of urban metabolism. Furthermore, understanding of infrastructure is limited to the realm of 'man-made' and the 'master' that exerts dominance over nature and subjugated bodies. And yet, as with the sand dunes, 'nature' provides a multitude of infrastructures that make Earth habitable for humans. The building blocks of soil sustain life and capture carbon, the migration of sand dunes separates land and sea, rivers carry nutrients and transport energy from one point to another. Our limitation of seeing infrastructure as one thing blinds us to the many things that it is and can be.

At one of our first meetings with the City to discuss the state of the river and its impact on the oceans, at the City's gleaming new building for the Department of Water and Sanitation (DWS), we showed the city officials images of chunks of foam and what look like faeces that had settled on the river's edge. When the river was low, the foam and faeces settled on the mud of the riverbanks and dried out, to be carried away by the wind as dust. We informed

the CCT representatives that the Sandvlei community struggled most with sinus and chest infections when the river was low and its edges were exposed and dry. Our research team reasoned that the thousands of chemicals that end up in the Zandvliet WWTW, as well as the ammonia and other chemicals used to treat the wastewater, accumulate and settle along the banks of the river, carried away on the air when dry. The City dismissed our reasoning out of hand, stating there was no proof of causality and we could therefore not make such associations. This despite having Prof. Leslie Petrik in our team of researchers, a chemist and expert in the field of organic pollutants with years of experience of working with such compounds. Another response from the City was that a canal could be built to prevent the accumulation of mud along the banks, so the water would flow right past people's houses. Again, cementing the river was seen as the best way to tackle the problem. We objected, as such a solution would have killed off the vegetation already at work filtering and cleaning the water and further increase the amount of chemical pollutants ending up at sea and affecting marine ecosystems. It would actually be better to plant more vegetation, such as palmiet, which could extract heavy chemicals and pollutants from the river. Seeing the river in sections, serving a particular purpose as a sink for the metropole's waste, limits the possibilities of urban rivers.

COSMOLOGIES OF INFRASTRUCTURE

'THEY SEE US AS SEPARATE': ON INFRASTRUCTURE AND METABOLIC INTERACTIONS

I use the term 'cosmologies' to refer to the belief systems that make us conceive the world in particular ways. The term is drawn from Isabelle Stengers' (2010) *Cosmopolitics I,* where the author cautions us to be wary of science's assumed superiority over 'alternative' knowledges often rendered as myth, folklore and esoteric world views. Stengers' work suggests that the construction of science is fundamentally created in the same ways as these 'alternative' knowledges. The purpose of the work is not to dismiss science or to see it as lacking objective validity but rather to challenge the notion of science as the ultimate truth at the expense of other discourses that are criticised as superstitious, irrational and/or grounded in the simple act of belief. Stengers (2010: 1) pushes us to explore the authority of science by asking, 'How do the sciences force us to conceive of the world? What do they teach us about the possibilities of understanding it?' and what gets invisibilised when the world is conceived of

in these particular ways. Material infrastructures have for a long time fallen under the domain of science and technology and are therefore conceived of as free from human bias – but as demonstrated throughout this chapter, infrastructures permeate, shape, push and pull social life. Even infrastructure design, in this case water and sanitation infrastructure, is based on ideas and assumptions of the populations the structures are being built for.

So what is implicit in the belief system of cement and what does this do to relationships? Concrete's qualities of endurance, weight, stability and perceived permanence are valued in the making of modern life, particularly in the age of rapid and disorienting change. Concrete exemplifies the mastery of nature by humans, holding natural forces at bay, directing flow, keeping materialities separate. For Green (2015: 10), cement is imagined to be 'immune to all states of matter and matters of state'. The belief that cement is able to keep Earth's planetary processes separate and not be transformed by them through space and time confers on it 'god-like' properties, characteristic of human belief in our own exceptionalism, as if existing outside of its environment (Green, 2015). However, its imagined permanence of 1 000 years, akin to the Roman colosseums, is a delusion. Studies have shown that cement, especially when reinforced with steel, has a much shorter life span because of climate change (e.g. extreme weather events) and corrosion from increased atmospheric carbon and chlorination, which causes acid rain (see Zivica & Bajza, 2001; Saha & Eckelman, 2014; Lee et al., 2018; Kaewunren et al., 2018). Increases in temperature can significantly impact the diffusion coefficient of carbon dioxide seepage into concrete (the rate of the chemical reaction between carbon dioxide and calcium hydroxide) and various chemicals dissolution in water. A critique of some of the models used to predict the lifespan of cement is that, while measurement of the material takes cognisance of the presence of degrading molecules such as acid rain, variation of climate such as global warming are not included in the calculations (Kaewunren et al., 2018). Many of these studies perpetuate a blind faith in concrete, with some recommendations being to increase the tensile strength of the materials or increase the amount of concrete used to reinforce built infrastructure; this is the same logic and approach that CCT uses in its response to failing infrastructure.

My interest here is not to undermine the role of concrete in providing services to people, but rather that the narrow focus on the materiality of cement, outside its entanglement with

multi-species worlds and society, makes it seem like a neutral substance, an indifferent object that exists in isolation in 'extra-terrestrial zones' (Green, 2015). But it is not. Its manufacture requires the mining of limestone, shale, silica and iron, brutal processes of extraction that degrade the environment and produce high carbon emissions, while its use requires the removal or covering of living material. In the case of Cape Town, tonnes and tonnes of sand are mined from the sand dunes along the coast to make cement structures, ironically making the city more vulnerable to the sea level rise that attends global warming.

While water is deemed a precious resource and a human right, clearly only particular waters fit into this framing of a 'precious resource', and the humans that are able to pay for water are automatically given the right to access it. The focus on potable water provisioning has seen billions of Rands of investment into mega-infrastructure projects, such as dams and water pipelines, over the last 40 years, with repairs, refurbishment and the clearing of invasive alien plants a priority to facilitate the movement of water over vast distances, particularly during the drought of 2016/2017. Streams such as the Kuils, located on the periurban edge, are not envisioned as part of this precious resource and are not given the same protections. Sewer leaks take longer to attend to, and wetlands, particularly in the Kuils, have been diminished to make room for faster and more efficient wastewater flow into the environment from upgraded WWTWs (with increased volumes of often poorly treated effluent). Interventions highlight different versions of water planning: one for potable water and the other for waste removal, as if these are not part of the same urban water cycle. These interventions are further delineated by technical interventions, which constrain the ideas of what water is and what it means, and, by extension, what the river is and what it means. As such, the water that flows in the Kuils River is positioned and understood as a dilutant for waste and is not suitable for human contact. Technical interventions such as canals, stormwater drains and bridges are used as barriers to 'protect' people from the river. These interventions also shape temporal rhythms of flow and natural cycles – how people move in, around and along the Kuils and how capital flows and politics are shaped in the City.

Although infrastructure can be valuable and even essential for addressing basic human needs, technical approaches are often limited, and those who produce them are generally blind to the power embedded in them. They are presented as neutral approaches to addressing

societal problems, failing to also account for infrastructure's conceptual and material capacities. As such, in the current moment the Kuils River presents as a paradox of infrastructural management, where technical responses to sewage and waste disposal problems are often incommensurate with addressing histories of (un)settlement, controlling the movement of people and the environment, unequal service provision and environmental justice in the everyday at grassroots level. With the advent of democracy and the inclusion of the majority of the population in service delivery and a focus on shifting to more sustainable cities, the place and role of the Kuils River as a necessary extension of Cape Town's waste infrastructure must be rethought. Coupled with growing climate uncertainty and the effects of the severe Cape Town drought in 2016/2017, infrastructural planning strategies for the future must include how the river is managed and interacted with and how it shapes everyday practices.

During the Keynesian era, development in the global North was evidenced by the installation of infrastructure to serve various human needs, but they are having to deal with its failure decades later (Howe et al, 2016). With the growth of neoliberal policies that supported the decrease of government spending on public goods and infrastructure, “infrastructures have been neglected, abandoned and left to deteriorate” (Howe et al., 2016:4). In the global South, ‘a high-functioning Keynesian infrastructural apparatus never existed. It is important that we distinguish between infrastructure that goes to ruin and infrastructure that never was. In some parts of the world, persistent infrastructural breakdown, or total absence, is the norm’ (Howe et al., 2016: 4). The Kuils River provides a fascinating case of the same, i.e. failing infrastructure contending with the absence of infrastructure and, in some cases, too much of it.

For instance, the use of infrastructure to separate the local communities from the KWP can be referred to as a 'metabolic rift', a concept developed by Clark and Foster (2010) as an ecological interpretation of Marx's theories on labour and separation from the land. The concept of 'metabolism' is inherent in social relations with nature, as it highlights the relations, exchanges and flows between people and nature, providing the conditions for labour. Marx explains that there is a ‘necessary “metabolic interaction” between humans and the earth’ (in Clarke & Foster, 2010: 2). The particular social metabolism is currently run by

'the capitalist mode of production, which influences the material exchange between society and nature' (Clark & Foster, 2010). The very endurance of capitalism and neoliberal approaches to the economy and development depends on its extractive nature to perpetuate the modes of exchange that remove the work from the labourer.

Another example is of residents living near the Kuils River who have complained about respiratory problems since the re-opening of a steel processing plant owned by DHT Holding, trading as Cisco. The plant originally operated from 1960 to 2010 and was shut down until it was bought by DHT Holding in 2012. In this period, the Kuils River was largely farmland and had a significant buffer area between the steel mill and residential areas. However, when the mill shut down, housing developments sprung up in the area, and the buffer area between the mill and residential area had decreased to about 70 metres when the mill reopened in 2018. While the health of residents living in the area is cause for concern, city officials and owner of the mill are hesitant n linking the growing respiratory issues to the mill, as there is 'no proof' of a direct link to the plant's emissions. DHT Holding argues that a significant R550 million from the company and an additional R230 million from the Department of Trade and Industry went into upgrading the facility, which included improving emissions from the plant. Moreover, the plant provides 300 jobs, which can ultimately improve the lives of locals. If there is already reluctance to conclude that emissions have affected the local human population, justifying an investigation into how air pollution has affected the river, transporting sediments downstream and into the ocean would prove even more difficult than proving harm to humans?

Image 3.8: Aerial photo of the Cisco steel mill in the Kuils River suburb, showing how close residential homes are to the mill (Source: https://www.iol.co.za/capeargus/news/kuils-river-residents-mad-at-steel-company-forendangering-their-health-20607475.

In the cases of both the KWP and the steel mill, the state's management of natural resources using neoliberal rationalisations capitulates 'command and control' solutions under the guise of economic growth, economic efficiency and social development for marginal and lowincome communities. In the discourse around 'green' development, the dominant claim is that many 'unpriced' and often unowned biophysical assets could, if inserted into global markets, create revenue streams able to support much needed socio-economic development (Dempsey & Robertson, 2012). This is the current discourse around the development in many parts of Cape Town. However, this approach fails to allow for adequate engagement in understanding the activities, importance and meanings drawn from the interaction with the KWP in particular and the various ecological processes in general. The services provided by the KWP cannot be separated from their embodiment in beings and lives. The benefits of the conservation, preservation and restoration of the KWP are often largely accrued by the state, private entities (e.g. tourist agencies) and donors, and less so by the locals. Neoliberal environmental policies based on scientific knowledge, in many ways like their economic counterpart, are grossly inadequate in addressing poverty and inequality.

As Kosoy and Corbera (2010) made an observation about ecosystem services (ES), 'When ES are commodified, they become the basis for new socio-economic hierarchies, characterised

by the repositioning of existing social actors, the emergence of others, and very likely, the reproduction of unequal power relations in access to wealth and … resources.'

THE NEOLIBERAL CITY

The main thrust of the neoliberal era is to use market mechanisms and technological fixes as a solution to environmental problems. For neoliberalism, it is essential that the economy and governance systems are run separately so that markets can increasingly determine everyday life. This requires less interference by governments in how markets are run, and so less funding is put towards government services and paradoxically there is a shift towards the privatisation of government services. Government services are then run like a business and citizens become customers, as with the Department of Water and Sanitation. But what of those who cannot afford the tariffs charged for water? In a neoliberalised Cape Town, the rights to freedom and democracy have been traded for the freedom to buy and consume for those citizens who can afford to. Ripple effects of this 'freedom' are the unequal distribution of and access to services, nature being seen as cheap and unfair labour practices, affecting how people are seen, identified and treated. In a neoliberal system, government services become corporatised, and citizens have to shop around for services such as schools, parks, water supply and even in cases of emergencies like social and natural disasters.

Key to the neoliberal agenda is the presentation of the public sector as under-equipped and unable to deal with the challenges experienced in society, suggesting that the only way for society to succeed is through the corporatisation of municipal services. Ironically, despite the environmental crisis we are in, markets are never blamed for rates of consumption; instead we are told that individual citizens must shop differently and consume better, while the 'new' economy is greenwashed but continues to operate under the same principles as before. This was evident in the drought period in Cape Town, from about 2016 to 2017, when water tariffs were raised to meet the demands of the city and to find or create alternative water sources, such as underground water and desalinated sea water. Citizens were encouraged to reduce their water consumption to less than 600 megalitres a day, which was achieved. The dams filled up again in the winter of 2020 and were almost 95% full at the time of writing, but the City has stated that a reduction in tariffs would be dependent on the consumption rate.

Mayoral committee member Xanthea Limberg highlighted that:

> It is important that the City cover its costs to ensure that the maintenance and augmentation programmes can be carried out. The current tariffs are for the projections and realities of the 2020/21 financial year. Costs of providing water to the City stay similar, even if residents drastically reduce consumption, and if maintenance is delayed, it can cause much more serious and costly problems down the line. This service includes maintaining a 11 500 km water network, 9 500 km sewer infrastructure, 5 600 km stormwater pipelines, 490 wastewater pump stations and 23 wastewater treatment works. (IOL News, City of Cape Town will not lower water tariffs despite dam levels being at 95.6%, 2020).

The neoliberal agenda is to privatise profits and socialise costs; there is a disconnect between the theory of neoliberalism and its actual practice and manifestation. If things go wrong in the markets, such as poor preparation for the drought, markets are held blameless and responsibility falls on the government or individual citizens. The free market espouses a level playing field, entrenching personal responsibility: if you are poor, it is your fault; if we run out of water, it is your fault.

The counterview holds that these market mechanisms and a strong belief in technological progress are themselves the main cause of environmental degradation (York & Rosa, 2003), but whether this ecological turn will go beyond the greenwashing of 'ecological modernisation' perspectives remains to be seen. A major challenge in addressing ecological crises is thus in how governance happens (discussed in chapter 5). Current governance of the environment refers to landscapes as space, as if it exists outside of planetary cycles (Green, 2020, RtA class seminar). For instance, a hydrogeologist could map the aquifer and its connection to paleo-channels such as the Kuils; based on the types of soils and filtration processes, a soil scientist might offer insight into the rate of recharge; and a climatologist could provide information about weather patterns likely to influence rainfall patterns in the PHA. However, these specific disciplinary processes, often used as 'sound science' to inform environmental governance and management, may be unable to provide information about the effect of air pollution from the steel mine in the upper reaches of the Kuils River on water

that enters the aquifer. The Human's theory of urban environmental management is to 'harden' the boundaries between solids, liquids and gas (Green, 2014), in much the same manner that we have hardened disciplinary divides, often resulting in a 'fallacy of equivocation' (discussed in the Introduction).

'Hardening' and concrete relations are a useful aid to thinking about cement, which is used to control the river's flow and is a barrier to its sedimentation processes, taking out its relationships with plants, fish, frogs and soils, imposing a divide between solid and liquid forms of the river, and the atmosphere is seldom thought of. Cement hardens the boundaries between ecological relationships, but the logics of equivocation in terms of discourse on progress and development are also cemented into how space is imagined, as if land is distinct from river, river is separate from air, and so forth.

CONCLUSION

In the post-apartheid age of democratic rule in South Africa, promises were made to provide basic infrastructure for water provision, sanitation and waste removal 'for all' rather than 'all for some'. But inadequate WWTWs, breakdowns, infrastructure upgrades, sewage spills, canal construction, capital flow for maintenance and management along the Kuils River have come up against these promises for the future and highlighted the multiplicity of the infrastructure, experiences and enactments of the river. These have brought to the fore the entanglement between the social and material arrangements, unseen and assumed, of the river. While infrastructure is historically regarded as mundane, neutral and necessary to society's functioning, research in the humanities and social sciences has highlighted infrastructure's agency, performativity and dynamism (see Anand et al., 2018; Hetherington et al., 2019).

Infrastructure, considered in this study as canals, roads, drains, gabions, wastewater plants, taps and pipes, provides a networked technological medium through which the state has centralised power to control the flow of water (Swyngedouw, 2015; Usher, 2018), leading quite literally to the cementing of state power (Harvey, 2010: 33). The material properties of cement, i.e. its solidity, perceived durability, cheapness, waterproofness and fire proofness

make it a desirable material for the enactment of territorial expansion, enabling the rearrangement of environments and human relationships to environments.

The first of this chapter's three sections outlines the paradoxes of the Kuils River's infrastructures, the first being that of upgrades, whereby even as infrastructure promises improvement, connectivity and efficiency, it does so for some people to the detriment of others. The second paradox focuses on degeneration, highlighting that while infrastructure is sometimes treated as separate to its environment, its close relationships to the materials that flow in the river, or how people use it, intimately shapes how it functions and breaks down over time. This form of degeneration is not limited to the materiality of infrastructure but also filters into conceptual and social relationships between governance and communities. The third paradox of permanence explores the implied solidity and durability of infrastructure that attempts to defy time, bridging the past, present and future.

The second section of this chapter considers the dominant belief systems/cosmologies that have informed infrastructure development and implementation that led to such paradoxes, while interrogating what becomes invisible when particular logics (such as economics) are prioritised in the water sector of a neoliberal city.

The stories in this chapter thus demonstrate that while infrastructure such as toilets and palisade fencing are technical responses to the needs of the community and multi-species lives, they are also more. 'Infrastructure' often refers to the many physical and technical interventions layered across landscapes to meet the demands and needs of our society for connection and the facilitation of movement and exchange, such as telecommunications lines, roads, sewers, buildings, dams, pipes, bridges and more (Siemiatycki et al., 2019). As much as they are technically designed and implemented, they are also socially, politically and economically embedded, entangling beliefs, norms, laws, science, engineering and social relations. The geographic distribution of infrastructure has been unequal across time and space, easing access for some while excluding and creating barriers for others (Siemiatycki et al., 2019). Take, for instance, a thing as simple as a toilet, essential to the health and wellbeing of people and the environment across the world, is often a site of contention as demonstrated by the 'poo protests' discussed in this chapter. Globally, citizens with access to private

resources also enjoy access to better public resources, increasing the gap between the haves and the have nots (Siemiatycki et al., 2019). The following chapter explores the history of unequal water supply and distribution of wastewater infrastructure, and how this has shaped the human experience of toxic environments in contemporary Cape Town.

CHAPTER FOUR

The Kuils River as a Techno-Political Archive of Financialisation and Metabolic Rifts

> Our children and children's children will not know who they are. They have lost who they are, because they are no longer a part of the land. They don't know how to work the land, how to listen to it. They don't understand the rivers any more. Living in the city has made them forget, because all they want is money money money. When we lived on the land, we were rich, we had food, we had water, we had cattle. But someone came and told us that we were poor and needed development. And our young people left, and they became sick, and the land became sick, and we had to come to the cities to work for money, because this country [shaking her head), this country will take your land for development.
>
> • Mam' Wana, 23 June 2016

The emergence of new financial and development priorities and new financing instruments and actors has significantly reshaped the relationships between water, land and citizens, with people being framed as 'customers'. Reframing a citizen with rights to freely access water as a customer who can be billed for services profoundly reconfigures the household into what Allen and Pryke (2013) refer to as a human revenue stream for financialised utilities. As such, as Mam Wana's quote demonstrates above, it becomes a priority to earn enough money to live in the city, where there is to housing, piped water and waste removal services. This was not always the case, however; prior to colonial settlement, people living on the land were more attentive to the rhythms and flows of the landscape and configured their lives according to these rhythms and flows. A different form of world making was introduced to the landscape when the colonial settlers arrived, where great effort was now put into controlling the Earth's processes through infrastructural interventions that controlled and limited access to water. More recently, living in the infrastructurally developed city became aspirational for some, as

it is often presented as a sign of progress, while living on the land with fewer infrastructural interventions may be seen as backward.

In the previous chapter, I outlined the complexities and multiple meanings associated with infrastructure and how these are enacted in practice to produce contradictions and paradoxes. In this chapter, I extend the argument of paradoxical infrastructures to show how infrastructure and financialised logics have changed our relationships to water, landscapes and ecology over time (what Clarke and Foster (2003) refer to as the metabolic rift), adding a new complexity to the geo-hydro-social relationships. The chapter provides a techno-political analysis of water infrastructure by attending to how technical interventions in Cape Town's waterways became a political problem and how the development of infrastructure enacted biopower, territoriality and the financialisation of life. The purpose of the chapter is to expand the historical understanding of techno-politics as a crucial part of conquest and imperialism and, within the democratic state, as a mode for achieving development and participation in the global economy. The metabolic rift and financialised logics are particularly useful concepts with which to explore questions of techno-politics, as they highlight the mobilisation of infrastructure to control, command and predict how people and water move in the Cape and, particularly in this study, how they move in and along the Kuils River.

The chapter begins with an explanation of techno-politics within the context of this research and is followed by an exploration of the concepts of the metabolic rift and financialisation in relation to waterways in the Cape, setting the conceptual foundations on which I base the argument of the Kuils River as a techno-political archive. Drawing from literature that provides the historical accounts of settlement and water governance in Cape Town, as well as oral narratives, the chapter traces the history of human-river relationships in relation to technology, infrastructure and politics in Cape Town. The chapter explores cosmologies and ontologies of water amongst the Khoi and |xam to argue that relationships to water outside of extractivist and capitalist networks can exist. I also explore how ideas differ to the cosmologies of capitalism and property rights amongst the settlers in the Cape. Attending to different relationships to water can help address questions about the possibilities opened up when other modes of living and relating to water are taken seriously in the contemporary moment. This section of the chapter is followed by an investigation of geo-hydro-social

relationships shaped by infrastructure under the various state forms of colonial, apartheid and democratic rule. By analysing the patterns of colonial settlement, the introduction of technological interventions and changes in governance, I argue that different forms of state produced different techno-politics that have shaped how the Kuils River flows, how it is governed and how it is interacted with.

TECHNO-POLITICS, FINANCIALISED WATER AND METABOLIC RIFTS

Technical infrastructures and science, from the WWTWs and canals to water analysis, are often used to institutionalise and validate state actions and claims, creating what I argue is a financialised techno-politics (Foley & Miller, 2020). Techno-politics are often created and enacted by techno-political regimes 'grounded in institutions, and [they] consist of linked sets of people, engineering and industrial practices, technological artifacts, political programs, and institutional ideologies' (Hecht, 2001: 257). These act together to govern technological development and pursue techno-politics (ibid: 257). Using the conceptual framing of technopolitics and techno-political regimes to explore their impact on the Kuils River can support the analysis of how historical and contemporary actors and organisations have enacted techno-politics, shaping developments along the river and supporting the financialisation of everyday life: the orientation to 'money money money' of which Mam Wana spoke.

Financialised logic and governance are built into infrastructural relationships with the Kuils River but have differed throughout the precolonial, colonial, apartheid and democratic forms of state in South Africa. By exploring different ontologies through these state forms, I argue that the Kuils River can be understood as a techno-political archive of financialisation and metabolic rifts. The goal of this chapter is to demonstrate how ideas of progress and development were constituted through technologies and infrastructure and in turn enacted political and economic goals. The chapter is also an enquiry into how these have shaped relations to water in general and to the Kuils River in particular and how they have informed law across South Africa's different political regimes.

In the wake of a shift from liberal modernity to neoliberal postmodernity, advocates of neoliberalism have argued that infrastructure development is necessary to enable countries, particularly in the global South, to participate in capitalist global markets (Anand et al., 2018). This has seen countries like South Africa undertaking massive infrastructural projects, placing them in varied financial and engineering relationships with the private sector. This in turn has shifted political relationships and accountabilities and reframed expert knowledge: who gets to know and whose knowledge counts in the context of development in the democratic state.

In the last forty years, the power driving the global economy has shifted from industry to financial markets. Because profit motive is believed to motivate the private sector to run more efficiently than state enterprises, privatisation debates dominate discussions around South African state-owned enterprises. So pervasive are these debates and beliefs in the private sector, and by extension the markets, that we, the people, rarely recognise it as a neoliberal ideology. But neoliberalism is simply a belief system that places faith in markets over government to balance and shape how humans live and where power lies in society. It places emphasis on economic incentives over cultural ontologies, private enterprise over the collective. As expressed by Mam Wana above, to be fully human in a neoliberal society (i.e. not less-than, not poor, developed) is defined by one's ability to compete in the market, and one's citizenship status is defined by fulfilment of the role of customer, being able to buy and sell. The customer is rewarded, because 'they deserve it': the market ensures healthy competition, so everyone gets what they deserve. This becomes a closed loop that circulates wealth amongst the wealthy, and efforts to create a more equal society are deemed counterproductive and even morally corrosive.

The peculiar problems of reliance on the market for water services are based on particular cosmologies: the belief that human beings are separate from and masters over nature (metabolic rift) and the belief that capitalism and the markets can and will fix society's problems. The knowledge practices that proclaimed humans as the dominant species (e.g. biological sciences) and the market as the only way to extend that dominance (e.g. economics, natural resource management) position these beliefs as fact. Yet these 'facts' are fabricated within those same knowledge practices. How did these ideas of a rational, objective truth for knowing water and a reliance on technical efficiency for economic expansion arrive in the

Cape? Latour (2004) describes scientific objectivity, technical efficiency and economic productivity as the three gods of reason created within modernist and postmodern knowledge economies. They can be traced back to early colonial settlement by the Dutch and English, when the 'gods of reason' were used to lay claim to territory.

The concept of a 'metabolic rift' was developed by Clarke and Foster (2003) as an ecological interpretation of Karl Marx's ideas on the fundamental shift in the relationship between humans and nature, especially under capitalism. For Marx, 'metabolism' signified the interdependent processes and social relations in the whole of nature – of which humans are a necessary part – for the sake of survival for all.

'FRONTIER WATERS': CONQUEST AND WATER ALIENATION AMONG THE KHOENA AND |XAM

The Kuils River rises from Durbanville's Kanonkop area, joining the Eerste River (which begins in the Jonkershoek Mountains of Stellenbosch) about 30 km from its source. The Pampoenkraal Spring, used as a stopping point by the Khoekhoen (Khoe, plural Khoena) and |xam (considered as the first peoples of the Cape) to water their cattle, is in this area (Rusch, 2016). These nomadic groups lived primarily on the slopes of Table Mountain (called Hoerikwaggo[12] in the indigenous languages of the Khoena and |xam) and Lion's Head, travelling through the plains of the Tygerberg Hills and the Western Cape flats to access grazing land for their sheep and cattle, following the seasons and the changing patterns of the land. Water played a significant role in the life of the first people of the Cape, as it shaped how they moved on the landscape and connected with more-than-human worlds. They spent their summer months on the Cape Peninsula, known to them as ǁhui !gaeb, meaning 'the place where the clouds gather' (Camissa People, n.d.). In the winter, they migrated north, escaping the harsh cold wind and rain to temporarily settle on the more temperate west coast.

[12] Hoerikwaggo translates to 'the mountain of the sea' (Camissa People - https://camissapeople.wordpress.com/camissa/)

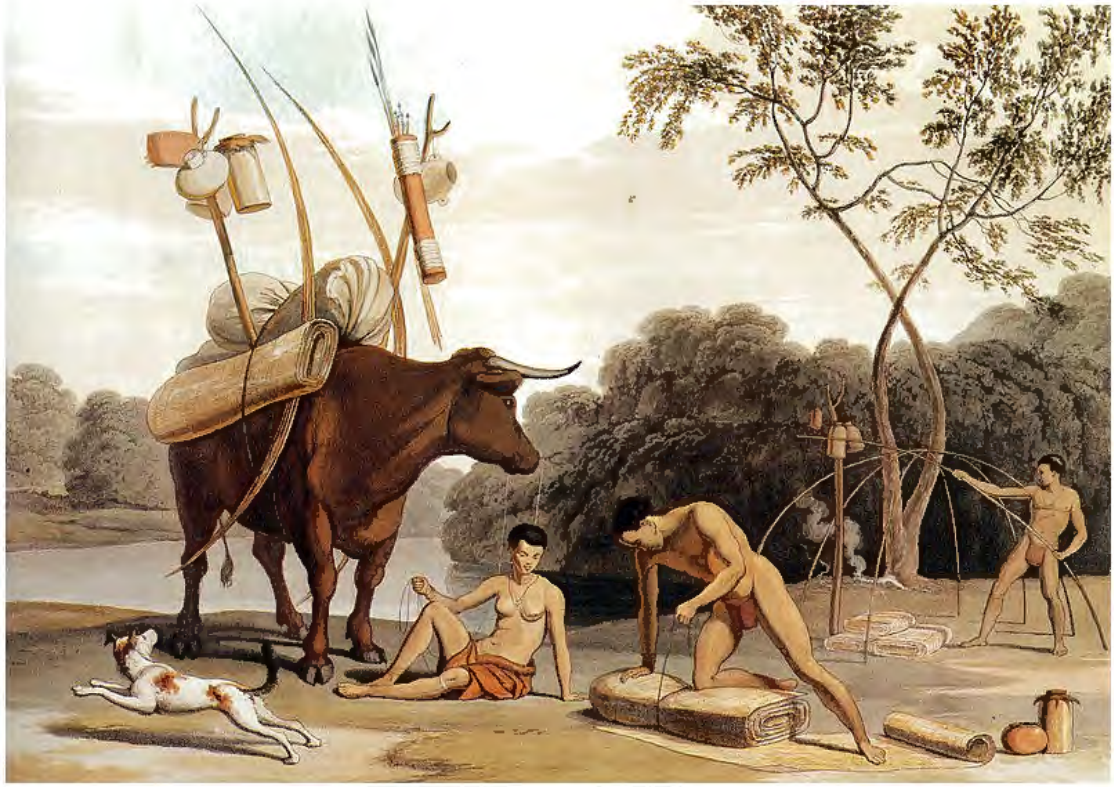

Image 4.1: Samuel Daniell's 1805 depiction of Khoena dismantling their huts and preparing to move. (Source: Smithsonian Institution Library)

The freshwater streams of the Cape were referred to as 'Camissa', a modern creolisation of ||amma, which means 'sweet water of the people'. !khwa, which simply means 'water, rain' (Bleek, 1956: 431), was more than just the wet substance that humans consumed, it was also considered a divine being. !khwa took many shapes and forms, two of which were the !khwaka xoro (water/rain bull) and the water snake,[13] symbolising water as a life-force that was beneficial and potentially dangerous (Hoff, 2011). Neil Rusch (2016) offers an analysis of the complex ontologies of the |xam and Khoena that challenges the objectified gaze of the West that views them as stone age people. By focusing firstly on notions of vibration, sound and rock engravings and secondly on !khwa – rain potency – Rusch explores the complex entanglements between matter and the metaphysical and spirituality of the watery worlds of the indigenous people of the Cape. For the author, 'There was magic power in the ringing sound of certain rocks such that they were deemed instrumental in the manipulation of rain' (Rusch, 2016: 2). The tops of mountains and waterholes were chosen as ideal places for the

[13] As a child, I was told stories of the water snake, a spirit in many Khoena, |xam and Bantu-speaking cultures that resides in water bodies and interacts with humans in multiple ways that are significant to healing traditions and as a way to contact the ancestors.

rain elders to 'fetch or cut the rain', which was considered as leading or restraining the !khwaka xoro (ibid: 5). The water snake, like the !khwaka xoro, lived in and was 'the source of springs, fountains [Afrikaans: fontein; |xam: xhwarra] waterholes and even gora [the seepage where water collects] in other words, always in naturally occurring water sources.' (ibid: 9). The !khwa-ka xoro and water snake also lived in and were the weather, particularly in relation to the rain. These beings were characterised as shapeshifters, transforming from !khwa-ka xoro and trotting down the mountain to become the snake, slithering on the landscape and evaporating to rise up again and become clouds, lightning and rain, then falling back to the earth and disappearing into the ground (ibid: 9). The water cycle is given animation through the !khwa-ka xoro and the water snake, providing a connection between people and !khwa (ibid).

Image 4.2: A tracing of J. M. Orpen's (1874) copy of rock art of the Sehonghong River in Lesotho, showing submerged men and women capturing a rain animal that is also a snake, a cosmology prevalent in many southern African Bantu-speaking cultures. (Source: Rusch, 2016).

Under African customary law, water rights in the area of the Cape were common knowledge and were rarely contested within the community (ibid: 694). When conflict did arise, it was

usually due to one community or tribe infringing upon or unfairly using water to the disadvantage of another community.

By the 17th and 18th centuries, European colonial settlers had ousted the Khoena and |xam from much of the Cape Peninsula, pushing them further away from fertile lands and water sources and shifting their ontological relationships to water sources through a strategic combination of technology and bureaucracy. Incoming colonialists thus "encountered" vast empty tracks of land that were underutilised, unmanaged and ready to be exploited for the benefit of the empire. The powerful technologies of firearms and horses enabled them to hold and defend lands taken from the indigenous people, and the colonisers settled and built. Through the gradual capture of ǁhui !gaeb (where the clouds gather) land and waters by the Dutch East India Company (Verenigde Oost-Indische Compagnie, or VOC), settler occupation was legitimised by granting rights to farmers (free burghers), giving them exclusive use of land they acquired in freehold or on loan (Guelke & Shell, 1992; Green, 2020: 28). The settlers took advantage of this policy and of the bureaucratic oversight of the property and water rights that cartographically mapped the landscape of the Cape to acquire fertile and well-watered land in the interior. The Khoena and |xam were denied these rights and were forbidden from driving cattle over the land, strictly controlling their access to springs, fountains, waterholes and rivers, and they found it increasingly difficult to sustain themselves (Guelke & Shell, 1992). In a slow and brutal way, the indigenous people were pushed off the land, creating a chasm in their connection to !khwa-ka xoro and the water snake. The settlers did not have the same sense of care for the water and the beings that made or protected it, believing instead that humans and nature were separate and that nature was to be exploited for human benefit, which 'reflected the spirit of the VOC' (Green, 2020: 31). Stone forts were built around water sources and military force was used to protect these 'new' lands and water sources from 'invading' Khoena.

South Africa has an unrecorded history of 'water apartheid' that can be inferred from the gradual separation of indigenous peoples from their lands (Swatuk, 2010). This transpired originally through conquest and then through the façade of the application of law (Swatuk, 2010: 527). When the Dutch arrived to settle in 1652, Jan van Riebeeck invoked Roman-Dutch Law, which recognises three classes of water rights: private, common and public (Tewari,

2009). Private water was for the use of individuals who had the right to water without limit and permission, common use water was for everyone to use, and public water was owned by the state and subject to state control (ibid). Initially, all water was for the VOC, and any other uses were at the discretion of the company, but water was subsequently declared a public commodity and made the responsibility of the state. Water was a precious commodity for the VOC, evidenced by the settlement, fortification and military protection (provided by the state) of water bodies.

Within the first three years of settlement, Governor Van Riebeeck came under pressure to regulate the use of water to allay health concerns. Settlers used water upstream for bathing and washing their personal belongings, but this impacted the water quality of water users downstream, who relied on the same stream for drinking purposes. The first environmental law was then passed, prohibiting the 'muddying' of water in the stream. Penalties were imposed on offenders, and the VOC took over the management of the streams in the Cape Colony. With the growth of the Colony, the proliferation of gardens and the movement of settlers (later referred to as Trek-Boers) into the interior, it became clear to the settlers and the VOC that, unlike the Netherlands, South Africa was a water-scarce country prone to droughts. By 1661, the Company had taken control of water usage, forbidding water irrigation so that the Company's corn mill could continue to run (Hall, 1947: 1). Water shortages were the cause of regular conflicts between the settlers and managers of property owned and run by the VOC (Tewari, 2009). The VOC managed these conflicts by granting rights to the settlers to take turns irrigating their produce, while the Khoena and |xam were not considered for such rights.

A new policy of privatisation of landownership and water rights was enacted with the arrival of the English in 1806. Devolving ownership from state to individuals, settlers were allowed to own or lease land on the condition that they paid taxes, and with this the 'owner' of the land had exclusive right and unlimited use of the water rising or flowing through the land, commonly known as the 'riparian principle' (Swatuk, 2010). For the first 150 years of British rule, ground water was treated in the same way as surface water, where rights of exclusive use were given to the first owner of the property, and subsequent settlers gained access after the first owner. The British regime reflected a bias towards intensive agricultural production

for the growth of the economy and empire, and water-resource development and governance were strongly in favour of the white agricultural community (Muller, 2001; Tewari, 2009). However, an 1856 court case in the High Court of the Cape of Good Hope, *Retief vs Louw* (reported for the first time in 1874), marked a clear shift towards state control of the waterways: a downstream water user sued an upstream land owner who had diverted the entire summer stream to their own land, leaving downstream users with no water (Tewari, 2009). Judge Bell's judgement (detailed below) formed the basis of South African common law in later years:

> I have come to the conclusion that the proprietors of lands throughout the course of a perennial running stream of water have each a common right in the use of that water, which use, at every stage of its exercise by any one of the proprietors, is limited by a consideration of the rights of the other proprietors; and it seems to me that the uses to which the proprietor of land lying on the upper part of a stream may make of the water of the stream are, from the very nature of things, to be classed in the following order: 1st, the support of animal life; 2nd, the increase of vegetable life; and 3rd, the promotion of mechanical appliances; and the enjoyment of any one of these uses would seem, also from the very nature of things, to depend consecutively upon how far it deprived the owners of the lower land of their enjoyment of water for the same purposes. If the upper proprietor requires all the water for the support of life, for human beings and cattle upon his land, the lower proprietors must submit; if the water be more than sufficient for such animal demands, sufficient must be allowed to pass for the supply of animal demands of all proprietors lower down the stream before the upper proprietor can be allowed to use the water for the support of vegetable life, or to improve his lands by irrigation. Again, the demands for the supply of animal life being answered, the proprietor of the upper ground is entitled to use water for the purpose of vegetable life … by irrigation or otherwise; so are the proprietors of the lower grounds in succession entitled to use water for agricultural purposes. Agricultural uses being supplied throughout the course of the stream, the natural use of water being thus exhausted, the proprietors are then entitled to apply water to mechanical purposes. But I apprehend that no proprietor on any part of the stream is entitled to use the water for all these three purposes, even consecutively in the order

> in which I have mentioned them, or any one of them, recklessly and without any regard to the wants of those below and above him. (In Hall, 1939: 35)

This judgement was influential in the changing of water law in South Africa at this time, as the judge distinguished between water rising on an owner's land, which was deemed private, versus water that flowed over their land, which was considered public and managed by the state. The judgement also highlighted the priorities of water use, for the support of animal and human life, agriculture and the promotion of mechanical appliances. If water was in short supply, water could not be used for a specific category (e.g. for mechanical use) if others along the river did not have sufficient water to achieve the higher categories (e.g. to sustain human and animal life). However, towards the end of the 19th century, conflict increased over the competitive use of water for irrigation and rapid development in the Cape (Tewari, 2009). While there was a clear distinction between public, private and common use in law, in practice, water use regulations were murky, resulting in poor governance over the common use of water (ibid).

The use of military force, maps and archival records based on new scientific knowledge of cartography secured rights to land and water. 'Maps soon translated ǁhu-!gais into farmsteads and a town based on a new political cosmology of private property and water ownership' (Green, 2020: 35). By around 1700, the first settlers had moved into the interior of the Cape, deciding to take advantage of the fertile soils around the Pampoenkraal Spring in the Tygerberg Hills and other parts further down the Kuils River. They began to farm and export produce to Europe, and the village around the Pampoenkraal Spring experienced its first growth spurt after 1801, when local farmer Jan Uys was granted land to build a corn grinding mill (de Waal, 2014). This prompted other settler farmers to grab at the reserve land and increase their own boundaries and production activities (de Jongh, 1977). At this stage, the landscape had changed significantly, with vegetation, people and animals being cleared off the land to create space for agricultural production on a large scale.

Image 4.3: Map titled 'Stellenbosch and surrounds', dated 1700. (Source: Brown & Magoba, 2008)

The spring and river in the area now called Kuils River were used as cattle outposts and watering stations by settlers travelling between Cape Town and the interior in the 19th century (de Jongh, 1977). Over time, the Pampoenkraal Spring became part of the apparatus of colonial conquest and control, 'harnessed and transformed to serve projects of agricultural improvement, industrialization and trade' (Adams & Mulligan, 2003: 3); this area later became known as Durbanville. The upper Kuils River was used largely for agricultural purposes during the colonial period.

Image 4.4: Pampoenkraal Spring. (Source: https://ingress-intel.com/portal/pampoenkraal-fountain/)

From 1902, water from the spring was supplied to Durbanville residences through pipelines. From the initial shift to relating to the land through agricultural practices, the introduction of piped water again shifted how people related to the spring and the Kuils River. This is Clarke and Foster's 'metabolic rift'. Water management practices and governance were transformed to focus on end-of-pipe treatment approaches rather than focusing on the source, with knowledge production being dominated by modernist, technological and engineered approaches that still inform governance today (Baker in Harris et al., 2013; Linton, 2010).

The historical use of maps to delineate property and justify forms of land ownership, law and technologies (such as the use of pumps and pipes) is significant, as maps impose a particular way of knowing a river that informs river management practices today. The science of mapping, measurement and building infrastructure assumes neutrality, but, as demonstrated above, these scientific practices have historically been informed by cosmologies of capitalism and property rights. Further evidence of this in Cape Town was that through the science of cartography, mapping, measurement and infrastructures were used to delineate property

boundaries in order maximise production on the land to supply the VOC of fresh vegetables and animals. This science of mapping was presented as 'neutral, independent and socially transcendent fact' (Green, 2020: 37), and enacted through law. The water and river management policies of the past, like today, were presented as separate from the environment, and social factors lack the capacity to challenge what Latour refers to as the 'divinities of the knowledge economy' – namely (technical) efficiency, (economic) profitability and (scientific) objectivity (Latour, 2007; Green, 2012). These trace back to the time of early European settlement, when these 'divinities of reason' informed new ways of knowledge production and ways of seeing the landscape that were accountable only to the cosmologies and ontologies of the VOC (Green, 2020). The scientific and technological intervention on Cape Town's (broadly speaking) and the Kuils' landscape and waterway were not just about doing politics and mastering nature, they also shaped our understanding of what it is to be human in the world, thereby erasing the existence of indigenous groups on the land (Green, 2020). These ways of knowing created the conditions for the presentation of the historical Cape as an empty wilderness ready for conquest and presented the rational human as living *on* the Earth (not in or with it), enabling settlement patterns and access to resources that remain evident today.

APARTHEID AND SEPARATIST DEVELOPMENT ALONG THE KUILS RIVER

The Kuils River flows from the predominantly white and high-income neighbourhood of Durbanville, through a mix of coloured and white households and into middle- to low-income areas such as the Kuils River neighbourhood and Wesbank, which have majority coloured populations. Thereafter it flows into a nature reserve called Driftsands and on into the township areas such as Khayelitsha, comprising both formal and informal housing.

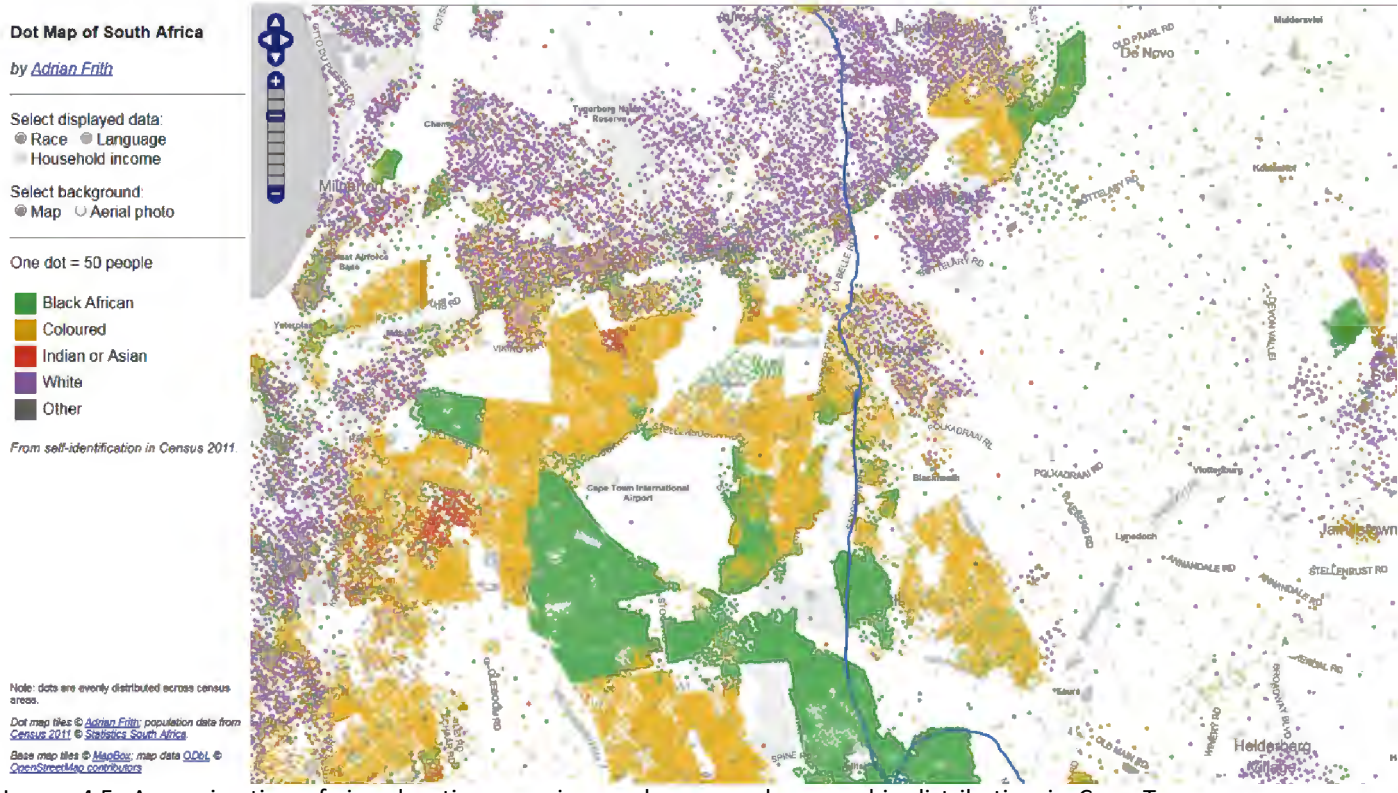

Image 4.5: Approximation of river location superimposed on race demographic distribution in Cape Town. (Source: https://dotmap.adrianfrith.com/ using statistics from 2011 census).

The map above was created using the QGIS application, overlaying the map (sourced from dotmap.adrianfrith.com) of Cape Town's geographical population distribution by race on a Google Earth image of the Kuils River (line in blue). The Cape Flats were the apartheid dumping ground for non-whites, and the image shows the racial segregation still evident along the river, with middle- to high-income areas in the upper reaches being predominantly white (in purple on the map) and neighbourhoods comprised more of people of colour in the middle and lower reaches (in green and orange on the map) on the Cape Flats. The national census of 2011 showed that the population of Cape Town was 3.7 million people, with 42.4% being coloured, 38.6% black African, 15.7% white, 1.4% Asian and 1.9% other (Stats SA, 2011), but the majority of the land in the metropole is owned by those who identify as 'white'. The core of apartheid policy and power revolved around access to land and water, a more brutal continuation of colonial settling. Official policy from 1948, South Africans of colour were forcefully displaced and settled on the outskirts of the city, where ownership of land was virtually impossible due to the high number of people that were relocated to those spaces, which lacked the basic infrastructure required for human settlement.

The Native Land Act of 1913,[14] Urban Areas Act of 1923[15] and the Group Areas Act of 1950[16] were important in the race-based decision making around the provision of services such as water supply and waste removal. It also informed how natural water resources were managed in the name of separate economic development and modernisation (Swatuk, 2010). Due to apartheid spatial planning, infrastructure was strategically built along the Kuils River and, with the demand for more formal housing in the 1980s, the Kuils River valley was identified for low-cost development (Magoba & Brown, 2008). Townships such as Mfuleni, Blue Downs, Kleinvlei and Delft were initially built on high ground, but as these townships grew, people settled closer to and in the floodplain (Brown & Magoba, 2008). The floodplain also increased significantly from runoff when the rapidly developing upmarket neighbourhoods such as Durbanville hardened the surfaces of the upper catchment (ibid: 259). The new industrial developments and conversion of farmlands into urban settlements led to population growth, which led to the construction of new and larger WWTWs, and the land and river was altered to the extent that parts of the river are now unable to sustain life. These areas, downstream from white neighbourhoods and WWTW, were allocated to black people under the apartheid government, for example in Khayelitsha, which was susceptible to flooding because of the series of interconnected wetlands along the Kuils River. By the mid-1980s, flooding was a frequent occurrence, with areas such as Zandvliet in the lower catchment being highly susceptible. According to Brown and Magoba (2008), the Eerste River (which has the Kuils as its tributary) was leveed to prevent backflow from the Kuils during peak runoff periods. This removed the necessary flood buffer of riparian vegetation in the wetlands, further reducing the river's capacity to contain floods and filter water to sustain a healthy ecosystem.

[14] The Native Land Act prohibited any persons considered black from buying or hiring land in 93% of South Africa. Essentially, despite being a population majority (well over 90% of the population), black people were limited to owning only 7% of the land.

[15] The Native Urban Areas Act enforced the compulsory residence of black people in townships and controlled their movement in and out of urban spaces, empowering the white government to remove black people considered as idle and disorderly. In addition, the Act impeded the property ownership rights of black people on the argument that they were not permanent residents and should only enter urban spaces to serve the white population. This also justified the lack of development in the townships, as these were officially regarded as temporary settlements for people of colour.

[16] The Group Areas Act gave the government power to demarcate where each racial group could live in Cape Town and the rest of South Africa. This made the segregation of racial groups possible, which was mapped onto the allocation of land, so that only people categorised within the same racial group could reside and own property in a particular area. Those identified as not belonging to that group were forced to move. Aesthetically appealing areas and places close to business, schools, hospitals and recreational spaces were designated for 'whites only' and investment in development was largely funnelled to these 'whites only' areas.

South African law changed throughout the colonial and apartheid periods to facilitate the growth of cities and industries, mainly in the agricultural and mining sectors (Swatuk, 2010). Act 46 of 1934 (sections 14 to 23) made it possible for a water court to grant permission to 'anyone with secondary (i.e. industry) rights to use that water on non-riparian land. This was the first legal separation of public water and riparian land' (Bate & Tren in Swatuk, 2010). This meant that in areas where the river ran through farms (private property), that section of the river belonged to the holder of the title deed of the land, and they could do as they pleased with the water. Water was extracted to irrigate wheat and grapes for wine production, some of South Africa's biggest export products. These areas also received significant financial support from government in the form of subsidies and infrastructure development, such as piped water, as well as financing for the building of roads and dams.

As more support was provided for white South Africa in the 1950s, legislation to limit the movement and livelihood possibilities of people of colour was being passed. People of colour were forced onto the Cape Flats in large numbers, on small pieces of land with sandy soils and limited services, which included piped water and waste collection, to deter permanent settlement in urban areas. Overcrowding led to the disappearance of vegetation, which in turn increased the impacts of flooding in the middle and lower sections of the river. Poorly treated effluent from the Bellville, Scottsdene and Macassar WWTWs being pumped into the Kuils also contributed to the flooding of the river. The river, once seasonal, became perennial as a result of effluent and stormwater drainage from upstream. This pollution and surface run-off from urban areas, stormwater and pollutants from farms changed the composition of the river radically, wiping out 98% of the wetlands that helped filter the water before entering the sea at False Bay (Davies & Day, 1998).

Residents in the middle and lower reaches, such as Ilva (in blog post below), have had to withstand the worst of the growing toxicity of the river. In 2013, the Kuils River was declared a health hazard by the City of Cape Town, and Eyewitness News reported that there were increased cases of illness amongst residents and some reports of animal deaths (Kuils River Declared a Health Hazard, September 2013). The residents of Kuils River, Wesbank, Khayelitsha and Macassar were warned to avoid any contact with the river, with the CCT

cautioning residents about elevated levels of *E. coli* in water samples from the river. During my fieldwork, I found that many interlocutors felt animosity towards the river because of the dangers it brought, and towards the municipality for failing to manage it adequately.

One interlocutor asked me about the increased amount of effluent being pumped into the river:

> When do you think all of these things started to happen? All of this 'Development' [raising her hands to create air quotes]. I think it started with the World Cup. Perhaps the City wanted to prove a point, that Cape Town is an international destination. But guess who has to bear the brunt of this fast-track development.

Timeline: Kuils River canalisation	
circa	
1970	Source canalised
1988	Kuils River wetlands bulldozed to create Khayelitsha
1990	Artificial canal built to drain new Blue Downs development to join Kuils River
1991	Detention dam constructed in the Driftsands reach. Khayelitsha reach channelised by dredging
1991-3	Kuils River business centre canalised due to restricted river reserve. First phase canalised - section of Bottelary River between Van Riebeeck and School roads
1992-4	Second phase canalised between Van Riebeeck and Rietvlei roads. The section below the railway bridge included full canalisation
1992	Runoff from Polkadraai Hill directed to Kleinvlei Canal via a subsidiary canal
1992	Span added to bridge at Macassar Wastewater Treatment Works to facilitate flow of floodwaters
1994	Macassar reach, just before Eerste River confluence, straightened and canalised
1995-7	Third phase of canalisation - a natural earth canal over last one kilometre before Nooiensfonteinvlei

Table 4.1: Timeline outlining the technological interventions along the Kuils River (Source: Brown & Magoba, 2008)

Apartheid Water Laws

The apartheid government introduced large water projects to encourage economic development in rural areas, where its largely Afrikaner base was settled (Turton et al., 2004). The Water Act of 1956 was hailed as the most progressive act so far, as it steered the country towards more equitable water use in the highly competitive and water-thirsty but most economically productive sectors of agriculture, mining and industry (Tewari, 2009). This

resulted in strict regulations around 'abstraction, use, supply, distribution and pollution of water, artificial atmospheric precipitations and the treatment and discharge of effluent' (Tewari, 2009). The Water Act replaced the riparian act, which had worked when water was used primarily for irrigation purposes, but the growth of industry and domestic use (growing populations) required a greater control of water resources. The Water Act placed final control of water resources in the hands of the state, and the strict regulation of water use by the mining, agricultural and industrial sector was advocated for (ibid). The public discourse was framed as desirable water use for 'public' or 'national' interest. Of course, because this was during the apartheid era, the 'public' and 'national' interest referred to the advancement of the interests of the white population. Colonial and apartheid water rights policies excluded the black population, who could not compete due to the lack of government resources or support enjoyed by their white counterparts and the legislation and disenfranchisement that made it impossible to participate in the economy fairly.

A RIVER ON THE GROWING URBAN EDGE: DEVELOPMENT IN POST-APARTHEID CAPE TOWN

> If you're from the right side of the tracks, you can enjoy idyllic views of Cape Town and spacious parks. If you're not, however, expect to find a divided community, 10-year-old drug addicts and a gut-wrenching stench from the town's namesake: the Kuils River. For years, the Oostenberg council has allowed the Macassar sewage treatment plant to pump effluent waste into what was once a river which hosted an entire eco-system of flora and fauna. Beyond the health implications which irresponsible dumping on land close to living spaces brings, lies the very serious issues about the leeway created for social demons[17] to invade these forgotten spaces. (Extract from a blog post by Ilva Mackay, 2012)

I came across Ilva's blog post while doing desktop research on the Kuils River in 2016, after a few months of walking along the upper and middle regions of the river. Her story captivated

[17] For Ilva, social demons refers to the "social ills" or societal problems that become prevalent in spaces of neglect such as theft, drugs and violent acts.

me, as for months I had walked along the river and seen very few people interact with it beyond using the walking paths for jogging, cycling and walking dogs in the Durbanville area. In Sarepta, Kuils River and Wesbank, footbridges were used to get from one side of the neighbourhood to the other, and the river was just in the way. I was naïve to the local histories and had a romanticised idea of what kinds of relationships people would have with an urban river. The opening two lines of Ilva's blog post show how the histories of the Kuils are entangled with infrastructure, the making of neighbourhoods and who and what is granted access to state resources. Her blog highlights how the colonial and apartheid planning of the City of Cape Town has had far-reaching implications, transforming political and social relationships, economies, nature and landscapes and creating new environments and relations between humans and non-humans (Adams & Mulligan, 2003). This planning has shaped how resources are distributed, how nature is managed and how cities are planned, even in the 'modern era'.

Ilva's story and experience of the Kuils River and its subsequent transfigurations elucidates the fascinating ways in which a 'divided city' has troubled relations with the land, its waterways and its inhabitants in the past, present and possible futures. For Ilva, the City's dumping of poorly treated wastewater into the river cannot be disentangled from the life worlds of people living in the area, nor from the life worlds of the local fauna and flora. To cause harm to the river is to cause harm to the social worlds of the people living in the Kuils River suburb. To Ilva, lack of consideration for the well-being of the ecosystems reliant on the health of the river translates into neglect of the local people, as evidenced by the creeping, growing control of drugs amongst the youth. The separation of humans and nature, the bedrock of European Enlightenment (Adams & Mulligan, 2003: 27), has informed South African natural resource management. South Africa's natural resource management was informed by scientific principles, especially in relation to water and soil. The European Enlightenment ideals were to usher in reason and create order by controlling nature and subjugated bodies (women and black/indigenous people). Science serviced this endeavour to conquer and tame the wild, creating technologies for controlling and exploiting resources for the sake of capitalism and the growth of empire.

With the promise of a new constitution, equality and economic empowerment, South Africa became a beacon of what a non-violent transition to a post-apartheid government should look like. Over the years and in our recent history, the country has often been described as a microcosm of the world, a place where civilisations meet, boasting rich biodiversity in plant and animal kingdoms, contrasted with vibrant and bustling modern cities. However, the legacy of apartheid and, specifically, the Native Land Act that denied most South Africans the right to own land, continues to have significant socio-economic and political consequences that still play out and are evident today (Hall, 2014). The wealthiest and most well-serviced provinces continue to benefit from the acts described above, which has led to a massive migration from the former homelands to the post-independence provinces of Gauteng, the Western Cape and KwaZulu-Natal in search of better job opportunities and an improved general living standard. This mass migration to the economic hubs of the country has been a great challenge for urban planning and development.

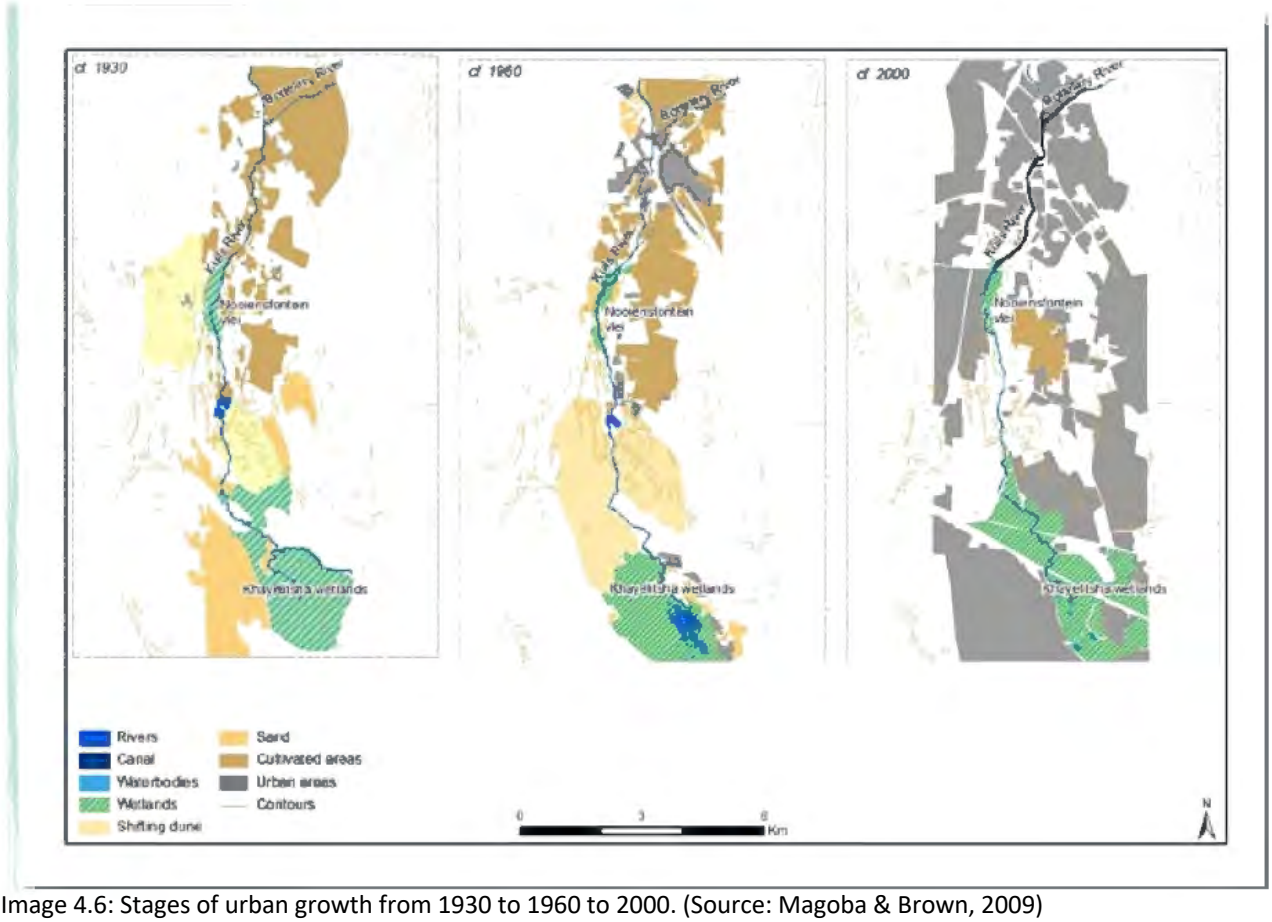

Image 4.6: Stages of urban growth from 1930 to 1960 to 2000. (Source: Magoba & Brown, 2009)

Over the last 50 years, the Kuils River catchment area has undergone tremendous changes. From largely agricultural land to developed urban spaces, there has been a significant increase

in the amount of stormwater drainage into the river. Due to the urgent need to address the unequal development of the past, open tracts of land are being developed for housing and industry, but planning for this occurs separately from the planning management of the urban rivers. River management originally fell under the ambit of the Transport, Roads and Stormwater Directorate, and then of the Directorate of Informal Settlements, Water and Waste Services. The initial location of river management in a department for transport and roadworks is indicative of how rivers were understood as an extension of the road and stormwater network, part of the urban drainage system. The City changed course in the 2000s in response to the National Water Act (NWA) of 1998. The NWA addressed the racially discriminatory Water Act of 1956, which was based on the legislation of water-rich Europe and was not suitable for the water-scarce context of South Africa.[18]

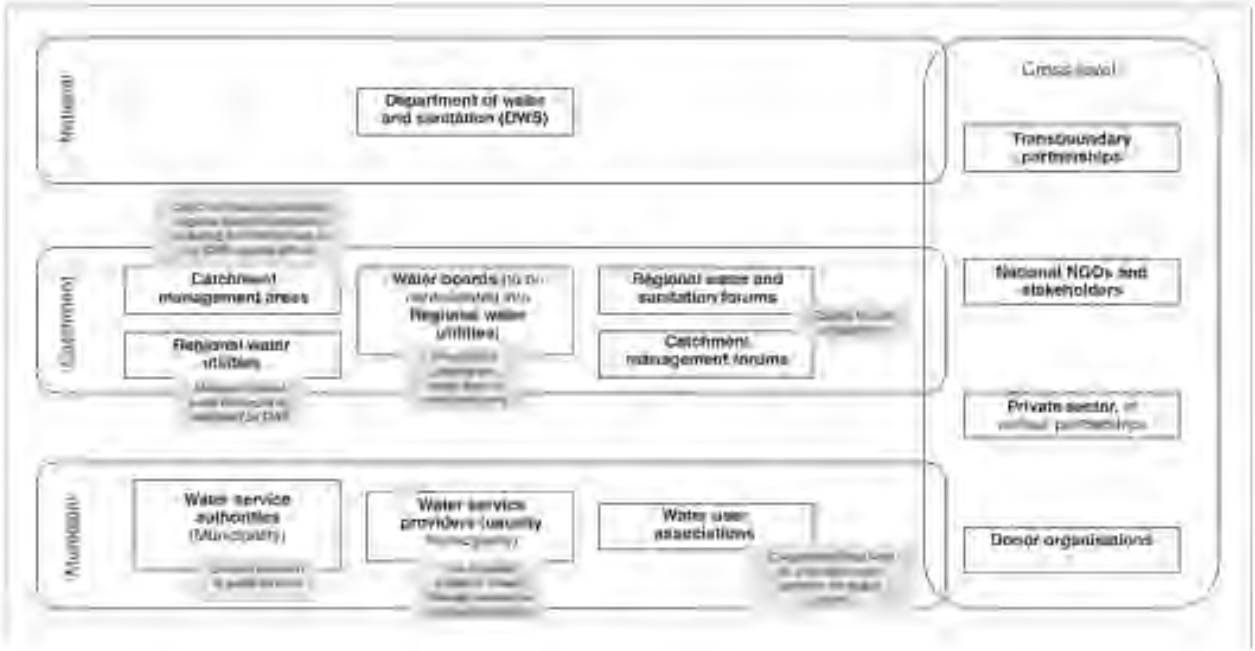

Image 4.7: Key agencies and organisations involved at various levels of water governance in South Africa. (Enqvist & Ziervogel, 2019)

To address the injustices of water governance in the past, neoliberal logics have dominated the human right to water access, resulting in uneven policy implementation and significantly

[18] The NWA core principle is that water is a scarce resource and should belong to all the people of South Africa. The use of water must be in the public interest (Schreiner, 2013). The act is premised on the equitable distribution of water for social benefit, economic efficiency and environmental sustainability. The legal framework around this act mandates the national government to 'protect, use, develop, conserve, manage and control water resources in the country' (Schreiner, 2013: 240).

affecting the lives of the poor and vulnerable populations of Cape Town and of South Africa more broadly. Lauded for its progressive constitution, critiques of South Africa's water governance highlight the embedded inequalities and injustices of managing water as a commodity (Dugard, 2010; Yates & Harris, 2018) and rendering its citizens as customers no longer under the protection of the democratic values and promises of the 1994 ANC government.[19] The government has since shifted to a free-market logic for the provision of services to its citizens, particularly around access to clean water and waste removal services in marginalised communities. (The neoliberalisation of water infrastructure is discussed in Chapter 3).

On the 16th of March 2017, Helen Zille, the white premier of the Western Cape, was embroiled in controversy after she published a series of tweets asserting the many positives of colonialism. Notwithstanding the Western Cape's violent history of the slavery and genocide of the Khoena and !xam and exploitation of migrant labour, Zille argued that the spread of European civilization was a good thing and that colonialism had brought about development. The public outcry on social media was widespread across different races, but Laterza (2017) argues that 'Zille's views are widely shared among white South Africans'.

Laterza argues that this was 'not a class or education issue' but a 'brand of colonial liberalism' that asserted it had opposed apartheid but 'supported the idea that European civilization spreading to Africa' was a good thing. This was also seen as a better outcome than Africans ruling themselves according to their own beliefs, traditions and aspirations (Laterza, 2017). For this brand of colonial liberalism, the idea of a non-racial world continues to prioritise 'European values', using the West as a blueprint for development and progress. This form of liberalism believes that countries in the global South and particularly in Africa were given the chance to 'catch up' and failed, but this perspective fails to acknowledge that the neo-colonial structures that exist today (e.g. global trade agreements and global tax havens) are as

[19] After the historic democratic elections of 1994, the African National Congress (ANC) came into power and inherited the enormous task of extending public services to the majority of South Africans previously disadvantaged by the apartheid system. The ANC campaigned on the promise of social welfare programmes that would increase or improve access to services for the majority black population of the country.

economically powerful and exploitative as the previous colonial structures and are as damaging to Africa's wellbeing as discussed in chapter five..

The colonial and neo-colonial structures that persist to this day fail to acknowledge the erasure of ontologies, ways of being in the world that are not tied to economic growth or global investment patterns. For Marisol de la Cadena (2015: 1), the 'anthropo-not-seen' is when multiple ways of being in the world that see themselves as part of nature are forced to accept the binaries of human and nature brought on by colonial conquest. Rob Nixon (2011) refers to this as 'slow violence', a violence not instantly visible or spectacular but whose effects become evident after years, decades or centuries. Four hundred years of colonialism in Africa have all but erased alternate ways of being in the world, and those that did not fit the idea of a cheap nature to be extracted for economic growth were often met with antagonism and exposed to forms of violence. A grandmother who contributed to my research lamented the loss of the sharing of intergenerational knowledge of being on the land.

CONCLUSION

This chapter demonstrated how law and governance have shaped the landscape in how humans and more-than-humans have settled along the river course, and the kinds of 'development' politics that are entangled in this. The idea of a 'one-size-fits-all' approach to development and modernisation requires an adoption of technology and the use of rational objective science to command, control and predict the flow of the river and harness nature for profit. In the case of colonial settlement and apartheid, these tools were used to justify separate development of the different racial categories in South Africa (i.e. white, black, coloured, Asian or other). The entanglement of capital, social and political forces with precolonial, colonial, apartheid and post-1994 state forms has resulted in laws and policies that have shaped infrastructure development for water and natural resource management. However, the threat of poor quality water, poor service delivery and tensions arising from inherited colonial spatial planning and development agendas have generated conflicts between nature, science, techno-efficiency, legal instruments and politics, resulting in a call for alternative ways of relating to water. This chapter thus outlines the historical sociopolitical and ecological entanglements to water more broadly and to the Kuils River specifically to

challenge the oversimplified and ahistorical scientific claims to objectivity that come with water resource management and governance. Instead, it asks what opportunities are opened up when the planning, governance and redress of social injustices for democratic river management address histories of settlement, unsettling and displacement.

In this chapter, I began by exploring the pre-colonial relationships of water in the Cape, drawing from archival material based on the lives of the indigenous Khoena and |xam. The indigenous groups saw water as a supreme being that was ever shape-shifting from water bull to snake to clouds, with rain then seeping into the ground. This understanding of water did not separate the human from the environment but saw the human as in and part of the environment. Living in this manner, water sources were treated with care and reverence. I described the arrival of the first settlers in the Cape and their impact on Khoena and |xam ways of being on the land and with water.

I explored the cosmology of the settlers and the VOC, which was grounded in merchant capitalism preoccupied with the making of considerable profits from cheap labour and resources. Only rational beings (the European human male) could know how to do this efficiently and should therefore have control over the wilderness of the Cape, including its people, land, plants and animals. Other ways of knowing the land, such as those of the Khoena and |xam, were rendered irrational.

Approaches to water resource management (WRM) in South Africa reflect particular cosmologies and the interests of dominant societal actors. In South Africa's changing state forms (colonial, apartheid and post-apartheid), political power was and is used to pursue control of water resources under discourses of progress, development, security and resilience (Swatuk, 2010). To locate the Kuils River as a techno-political archive, I explored the different entanglements of technologies, infrastructure and ontologies with politics and how they inform law and policy. I traced the dominance of the logics of private property and mastery in how politics, governance and law are enacted through different state forms, highlighting how various time periods and forms of state privileged different ontologies and how differential political economies in different time and state regimes produce different versions of water, as a commodity, a right, a sink for waste and a site of conflict, exploring how different versions

and meanings of water have informed contemporary water resource management thinking. In the following chapter, I interrogate the notion of time and temporality, demonstrating how they are fundamental to the different iterations of the river – the river multiple.

CHAPTER FIVE

The Kuils River in Different Versions of Time

The only constant in life is change.

• Heraclitus

The ancient Greek philosopher Heraclitus (520-470 BC) said life is like a river, with ebbs and flows, pits, peaks, troughs and swirls which are a part of life's journey (Rayner, 2008). For Heraclitus, nature is constant change, like a river, and even the nature of the flow is always changing with time. In this chapter, by understanding life and the river as constantly in flux, I draw your attention to the Kuils River in different versions of time. The goal is to demonstrate the processes and relations that make up the river in time. My argument is that there is no one version of time but rather that rivers exist in and through multiple temporalities because of the multiple relations that are constantly made with the landscape, social, political and economic changes to name a few. The problem exists when river management relies on one version of time, which often operates in terms of financial cycles, and assumes we are dealing with a singular set of relations which are economy-based and therefore can be controlled by human intervention.

This chapter therefore provides insight into multiple conceptions of time, namely geologic, capitalist/financial, bureaucratic, technological, chemical and political time of the Kuils. These versions of time are by no means exhaustive, but I use them to highlight themes that emerged from my research that were an intimate link between time, geo-logics and thinking around the processes of being human. The purpose of examining multiple versions of time along the Kuils River is to demonstrate the links between space and time as a provocation of river management that focuses solely on space. The question therefore becomes, how do we conjoin thinking-the-river-in-space-and-time and bring it into dialogue with policy that manages the river solely as space (as outlined in the previous chapters)? I explore emergent patterns while considering what Yusoff (2018) describes as the entanglement of 'geologic questions' with the 'hard political questions' necessary for us to decolonise geologic relations to the Earth and consider possibilities of futures. To explore these questions of deep and near time, I am inspired by the work of Wright (2015), which highlights that emphasis is not only

on progressive linear time, which looks at futures and pasts and underplays the complexity of time, but also on vertical time, which explores depth (e.g. how particular ingrained logics of time shape bureaucratic structures), and horizontal time, which explores histories, presents and futures that run parallel to the dominant progressive narrative of time. These parallel stories are only brought into the linear progression of time neoliberal and capitalist structures and institutions if they fit into the dominant narrative of 'progress'.

I have attempted to show how the different version of time along the Kuils River are entangled with capital, technology, chemo-socialities and governance. Deep time is not just about understanding the geologic formations of millions of years ago but is also about attending to ecological processes and seeing the connection to society's time. This chapter therefore explores emergent patterns related to deep time and near time by directing attention to our treatment of this ancient stream, the Kuils River, by exploring the 'treatment of the deep deep past and its material traces as a resource' (Farrier, 2019). The intention of this chapter is thus to establish the connection between societal and geological time (Yusofff, 2018) while recognising the acceleration of geological and ecological processes in the time of the Anthropocene/Capitalocene. To respond to current crises and futures of the river, we must think of time beyond its capitalist framing, and this chapter therefore explores questions around the larger thesis of the river multiple, asking what bio-geo-chemical processes made/make the river possible and how these are entangled with conceptions of time.

I investigate the importance of paying attention to the temporal and how different temporalities of the bio-geo spheres intersect with socio-economic and political temporalities of the Kuils River and its associated landscapes. How, if at all, does this shape or shift bio-geosocio relationships that make life in the Kuils River in particular and Cape Town in general? The chapter offers a critical assemblage of paleontological and archaeological data drawn from literature reviews and makes connections to ethnographic accounts of living on this same landscape millions of years later, revealing the deep intimacies between nature's way of timekeeping and its interruption by human interventions along the Kuils River and issuing a call to interrogate the distinction between human-centred and planet-centred thinking in the social sciences.

(GEO)LOGICS IN THE MAKING OF LIFE AND NON-LIFE

I had arranged to meet Adrian Van Wyk, a student from Stellenbosch University to whom I had been introduced by Dr Marlon Swai, a colleague in the Anthropology Department at UCT. I had called him one Tuesday evening after learning of his interest in my research and his intention to pursue similar research for academic purposes and as a resident of the Kuils River suburb. The river flowed past his home, and he wanted to learn more about how people were coming to know and become with the river. Adrian was keen to introduce me to Oom Jethro, whom I had heard of from Ilva much earlier in my research. Oom Jethro was considered the keeper of the secrets of the river, familiar with stories passed down from generation to generation about how it flowed, what plants it nourished and the spiritual beings that resided in it. We drove up to the Pampoenkraal Spring in Durbanville, where the river is believed to begin. I thought I would be the one to ask questions, as I believed Oom Jethro to be the most knowledgeable about the Kuils River, having lived along its banks for decades, paying homage to the ancestors, collecting water from the river, blessing and being blessed by it, so I was not prepared for Oom Jethro's many questions. I explained to Adrian and Oom Jethro that I was not very sure about the origin of the source of the river, as many assumptions have been made about where it actually begins. Durbanville residents suggested that it began at the Pampoenkraal Spring and flowed through underground channels until resurfacing in a canal between a baseball field and the neighbourhood of Morningstar. Academic papers were vague, and I read that 'the river rises in the Kanonkop Hills of Durbanville' (Magoba & Brown, 2006), while Google Earth only shows its emergence in the canal adjacent to Morningstar.

On our drive to Pampoenkraal Spring, Oom Jethro told me how deeply linked to the river he felt because of his ancestors. Going to the source would be full circle for him, as he would be able to 'understand better where he came from'. He also told me about how his ancestors relied on the river, not only to sustain their daily lives but also to connect them to their ancestors. He then related a story he had been told by his grandfather.

> *In the river was a being in the form of a snake that could transform into human form. It protected the river and ensured it could continue to support life, and on its head was a shining stone that looked like a mirror. When a person looked into the river, they*

were looking at this stone on the snake's head and saw a reflection of their true self. That self-reflection meant they had become a part of the river, a part of the snake, and were re-joined with the ancestors who had looked into that stone generations before. A white man arrived in the village and was welcomed. He was introduced to the snake and saw the stone on its head. One day the white man stole the stone from the head of the snake and rode off on his horse, far away, deep into the Karoo. (Some believed that the stone was not just a simple stone, but a diamond.) The snake gave chase after the man, and the further away this being was from the river, the more it lost its essence. The snake eventually caught up with the man, but because it had lost all its energy, it was unable to take back the stone and eventually wasted away in the open lands of the Karoo.

The death of the water being dried out the Karoo land, which is why that region is extremely dry now and receives such little rainfall. And because the snake no longer inhabited the river, the people lost their connection to the water and could not come to know their true selves.

I was fascinated by this story as a telling of different relationships to the river and the land, but also how it was tied to the history of white settlement and extraction from the earth beings in some African cosmologies (such as the water snake Oom Jethro speaks off) and because it is also a story of the loss of a deep connection to rivers and the land. Growing up in Zimbabwe, I had been told stories of this water snake too, and as children, we were often warned to stay away from deep water as this was where it resided. We had to respect its habitat and way of living, and if we did not, it would take us into the water to live with it, bringing seasons of poor rain until an offering was made to it. There are many versions of the story of the water snake in bantu languages in Southern African, which often speak of the generosity of the snake when it is respected and revered, it brought about rain and bountiful harvests. However, if the water snake was disturbed where it resided, it brought about misfortune for those that live around its environment.

We finally arrived at the Pampoenkraal Spring, and I saw the faces of Adrian and Oom Jethro fall. The spring had been covered up with a cement structure and was enclosed in a fenced-off area, so we could not do the ritual of reconnection to that Oom Jethro had envisioned.

Instead, we burnt herbs and sang as Oom Jethro thanked the river for life. He ended by saying, 'We do not know that we do not know, and hope by being here, we will come to know what river expects and intends for us.'

Oom Jethro's story shows how humans have always been intimately linked with their environment, however, many of the stories of human-environment intimacies are untold to a wider public because they do not fit into the narrative of progress and time. Geologic categorisation shaped environmental racism through othering and subjugating the Earth and black bodies in a quest to 'master' the Earth, and selective perspectivism has erased articulations of geologic events that do not fit into the story of empire building (Yusoff, 2018).

Geological classification organises categories of life and non-life, creating a distinction between matter as property (a thing that can be owned) and properties (characteristic of a thing), creating an opportunity for the exploitation of land and the dispossession of people and multi-species worlds (Yusoff, 2018). In this chapter I demonstrate how geological materials formed over millions of years are intimately linked and necessary for living organisms to survive. By creating categories of geology, we bypass relationships between the geologic and the biotic and often fail to take into account the histories of dispossession that run parallel to earth-writing and cartography (ibid). The Earth became conceived of in terms of measurement, forms, continents and landscapes, and fixing them all on maps. This distanced us from flow and movement and separate the human from the ecological processes of the planet. This distancing was not founded in fact, yet our epistemological framings and categorisations are grounded in this belief. Yusoff (2017) argues that map-making is a view from everywhere and nowhere in particular, taking the viewer out of the picture and showing a 'god's eye-' or government's eye-view. What is presented as scientific fact is actually just another way of seeing the world, in the same way that Oom Jethro's story provides a way of seeing and understanding the world.

It is important to pay attention to these kinds of geo-logics, as cartography is central to the building of empire, capitalism, colonialism and modern state practices. To do critical Anthropocene research, we must understand the limits of representing the world through maps. The graphical representation of geology is 'flattened', offering a unified depiction of

time and space and glaringly absent of ecological processes and multi-species worlds. It also presents a rather neutral stance on earth-writing, disentangling it from its history of empire building and violent dispossession (Yusoff, 2018). The process of mapping enabled a discourse of settler-colonial rights and the possession and dispossession of land as if it lay empty, and what existed on the land became the property of those who claimed it. At the supposed beginning of the Anthropocene, indigenous people and the landscape were deemed as property in order to justify extraction in the enactment of colonisation.

While 'Anthropocene' refers to a new epoch of geological history and time, Chakrabarty notes that it was also used 'from its very inception as a measure not of geological time but the *extent* of human impact on the planet' (2018: 6). The term draws attention to human activity having planetary-scale impacts as vast through time and space as geological forces marked by climate shifts and mass biological extinctions of the past (Archer, 2009). Although the Anthropocene is not the first climate-geology-changing event in the Earth's history, Archer argues that the impacts of our era will last thousands of years into the future. And yet humanity, climate science and politics often regard past and future time in terms of centuries at the most and often cannot project beyond these time frames into the thousands of years. This has made us think of the Anthropocene as operating on two separate time scales – of 'Earth history' and 'world history' (Chakrabarty, 2018:7), with the former dating back millions of years (seen as natural geology) and the latter dating back only five hundred years and coinciding with the emergence of capitalism (Archer, 2009). With the focus of the Anthropocene on the impacts of human activity on the geo-sphere, geological time is backgrounded. Yet global efforts and negotiations around climate change occur at a very slow pace as globalised industrial and consumer society struggles to imagine timescales beyond its limits. While 'the age of the human' is foregrounded, business as usual has continued under the slow pace of global climate negotiations, but the environment is largely regarded as a passive object in waiting as negotiations unfold.

The Anthropocene is also seen as occupying two different realms: one of science and measurement that calls for pragmatic objective enquiry and the other of the mind and body that elicits moral responses and 'behaviour change' (Chakrabarty, 2018: 9). If these realms remain separate, how we think of geological time in the social sciences, could render the

environment and geological relations as a space of dormancy until humans came along. Yet as evidenced by many geological periods over millions of years, the environment is above all else a temporal feature in constant flux, and it is never the same from moment to moment. When the Kuils River's geology, environmental connections and flows are rendered to the background of the human experience, what Aime Cesaire (2000) calls 'thingified', the river is regarded simply as space, and the geochemical processes that make the river possible get no attention. The flows and ebbs that make lives and worlds possible are invisibilised, and, using the same logics that justified colonialism, the kinds of harm enacted on it are justified because the spaces are 'empty' spaces of no significance. Paradoxically, when attention is drawn to the Anthropocene epoch (or to the Kuils River), discussion is dominated by debates about who is responsible for carbon emissions, sewage in waterways, chemicals in the soil and so forth, pushing those (human and more-than-human) most impacted by these activities to the margins of these debates. Geological time and Anthropocene time are again seen as separate, and responses to and framing of these elicit different time regimes. In the previous chapters, I showed how the Kuils River is understood and enacted in multiple ways, as a techno-political paradox and as an archive of river management practices in the city. In each of these interactions, time is conceived of and used differently (discussed later in this chapter).

How geologic time and Anthropocene time are conceived of also raises the question of what it means to be human. Viveiros de Castro and Danowski (2018) argue that one of the shortcomings of Chakrabarty's (2009) argument is the *universalising of humans* in the Anthropocene as if the current climate shifts were caused equally by *all* identified as the human species. Anders (in Viveiros de Castro and Danowski, 2018) argues that we have no right to universalise the human species existence, as there is an obvious distinction between 'the culprits and the victims'. Anders argues that the Anthropocene is not the age of mutual destruction, but rather 'the murder of one part of the species by another part of the same species' (ibid: 83). Authors such as Foucault (2003) and Latour (2002) reject the notion of *Anthropos*, as a universal subject, arguing that the just thing to do is to acknowledge the multiplicity of people and multi-species worlds who have been directly implicated in the Anthropocene crisis. For both Foucault and Latour, human beings are defined not by their autonomous existence in the world, but by the networks that they are a part of in the world.

For Latour (2002) and Viveiros de Castro and Danowski (2018), people that see themselves as of the earth and part of the Earth (the 'modernisation front' (Latour) or 'Terrans' (Viveiros de Castro and Danowski) live differently to how the 'Moderns' (Latour, 2002) have been taught. The 'Terrans' are people who follow and work with the rhythms and flows of the Earth's natural processes. Although humans always have Earth changing effects, 'Terrans' attempt to limit the negative impacts on the planet. The 'Moderns' see themselves as a civilising force sent out to command, control and predict Earth's processes and live as extra-terrestrials (i.e. living outside the earth); for them, the human role is to extract from the earth, manufacture and create an economy. Viveiros de Castro and Danowski (2018) predict that the problem of the Anthropocene will likely be resolved by a war between the Terrans and the 'Moderns', as we cannot live as extra-terrestrials, governing from maps.

I hope to demonstrate this through the exploration of different versions of time in this chapter. Acknowledging many versions of time and their intersection with issues of empire, race, capital, gender and so forth, one begins to see the complexity of how deep histories are told, by whom and for what purpose.

THE KUILS RIVER AND ITS DEEP PASTS

No man ever steps in the same river twice, for it's not the same river and he's not the same man.

• Heraclitus

Image 5.1: River catchments of Cape Town and Stellenbosch. (Source: Magoba & Brown, 2008)

Rivers and wetlands of the Cape Town region form a complex system that has been shaped by hydrology, geology, ecology and the climate over millions of years. The current flow of the river is shaped by the deep past and is influenced by rock formations, rainfall patterns, sedimentation processes, distribution of vegetation, water extraction and the introduction of waste into the rivers, to name a few. Understanding how to best care for these rivers thus requires an understanding of their geological history and an entanglement with the contemporary physical topography that enables or constricts their flow.

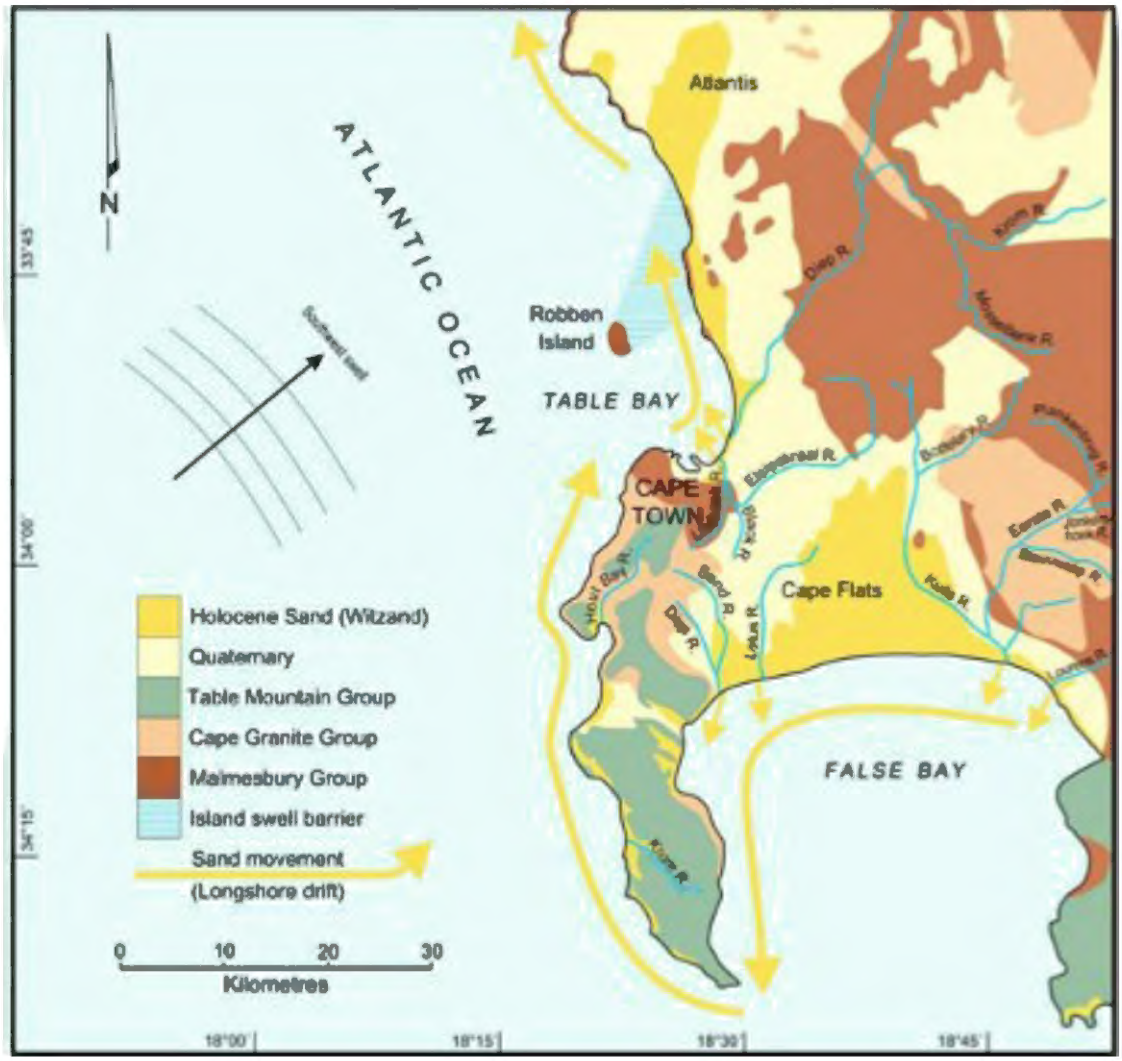

Image 5.2: The geology of the Cape Peninsula and adjacent areas. (Modified after Compton in Magoba & Brown, 2008)

About 540 million years ago (Ma), the Cape Granite Suite (late Proterozoic-Cambrian period) broke through the oldest geological rock formations in the Cape, the Malmesbury Group of rocks (late Proterozoic period), as molten rock and cooled below the surface of the Earth (McCarthy & Rubidge, 2005). Such intrusions are called plutons and are responsible for the higher areas of the Cape Peninsula, Kuilsriver-Helderberg, Stellenbosch and Paardeberg (Magoba & Brown, 2008). The geological and topographic characteristics of these plutons and the later rock formation of the mudstones of the Klipheuwel Group (Ordovician period) and the loamy and clay soils of the Table Mountain Group (middle Ordovician – early Devonian period) provided the right climate for South Africa's booming wine industry millions of years later (Bargmann, 2003). These characteristics also aided Dutch settlement in this region, where intensive farming was introduced to supply the VOC with fresh fruit, vegetables and

meat (see Chapter 2). These deep geological transformations are entangled with European expansion, where nutrients from the land formations were transported over vast distances to feed the colonial powers.

The younger Table Mountain Group rocks, made up of quartzitic sandstone deposited on the seafloor (before the waters receded) about 500 Ma, were compacted over time and solidified to create a geological formation that characterises many of the mountain ranges in the Cape Peninsula. These sandstones once covered the whole area, linking Table Mountain with mountains on the eastern flanks of False Bay, Gordon's Bay and all the way to Cape Hangklip.

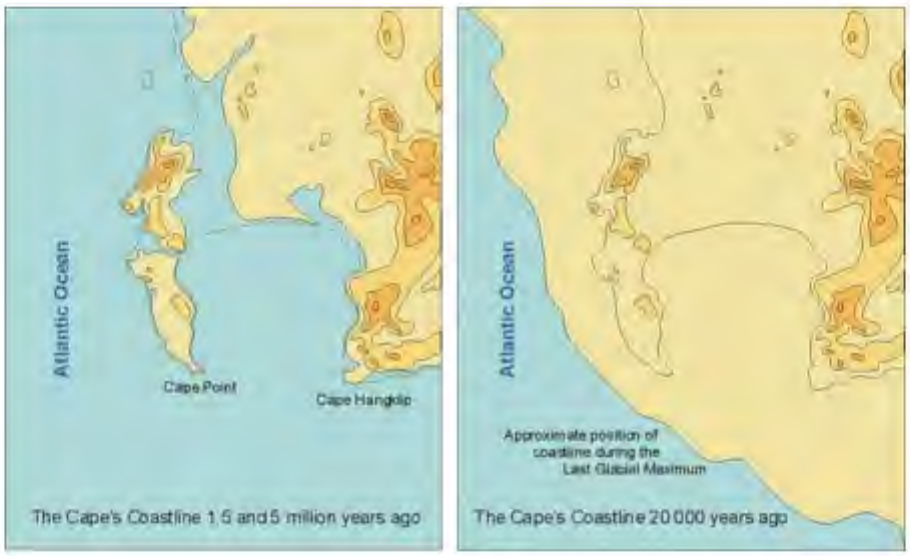

Image 5.3: L – The Cape Peninsula shoreline was 25 m higher than sea level (1.5 – 5 Ma); R – The shoreline was 125 m lower than sea level at the time of maximum ice build-up, as recently as 20 000 years ago. (Source: Compton, 2004).

However, over the last 400 million years, the sandstone linking these mountain ranges was aggressively eroded by strong winds and rain, creating the Cape Flats. The sands of the Sandveld Group are the youngest strata in the Peninsula and cover the Malmesbury Group and Cape Granite bedrock of most of the Cape Flats. These sands are made up of various sediments deposited from the sea, estuaries, rivers and the wind. This landscape formation set the scene for the geomorphological development of the Kuils River as one of the protorivers of the Cape Peninsula.

Image 5.4: Landsat image of Cape Town and environs. Table Mountain Range and Table Bay area in the foreground of the image, with Robben Island to the left. Gordon's Bay and Cape Hangklip Mountains are to the top right of the image. The oval indicates the location of the Cape Flats. (Source: https://en.wikipedia.org/wiki/Cape_Flats)

Image 5.5: Approximation of the location of the proto-rivers of the Cape Peninsula and False Bay. Under the low sea levels of the Last Glacial Maximum, approximately 20 000 years ago, the coastline would have stretched to the continental shelf. (Source: Magoba & Brow, 2008).

DIFFERENT VERSIONS OF TIME OF THE KUILS RIVER

On Political and Bureaucratic Time: Governance of the Kuils River and PHA

The Kuils and Diep Rivers, the proto-rivers draining the Cape Flats and False Bay, were greatly affected by the sea level rise, creating significant valleys on the ocean floor in the bay and on the flats, which have been buried by sands (Brown & Magoba, 2008). Below the bedrock of

these sands are important paleo-valleys that show the ancient courses of the proto-Kuils River and proto-Diep River directly to the sea (ibid). The Kuils River is also linked to the Cape Flats Aquifer (CFA) (which covers approximately 630 km^2) through the paleo-channel and acts as the main drainage of this area, discharging the water into False Bay. During Cape Town's recent severe drought, the CFA was earmarked as an alternative water source that could supply up to 30% of Cape Town's potable water. However, due to the number of pollutants entering the aquifer from WWTWs and agricultural chemical seepage in the rivers (the level of pollutants in the Kuils River was of particular concern), the water was deemed unsuitable for human consumption, and it was noted that significant cleansing was required before it could augment the city's potable water supply. The CFA is also significant to Cape Town's food security, as the Philippi Horticultural Area (PHA) lies above it. The PHA spans 3 000 hectares of the Cape Flats and was used by the Khoena and |xam peoples for grazing cattle and later by German farmers as far back as the mid-1800s. The mild climate and 'drought-proof' nature of the landscape encouraged farming activities to flourish, and the area currently irrigates about 80% of Cape Town's fresh vegetables. However, the PHA has come under threat from developers who have bought large tracts of land above the last few remaining recharge zones in the area. The developers aimed to pave over the bought land to build housing for 15 000 families, private schools and a private prison (but noted as other facilities in the High Court judgement of 2020). In later years, the proposed conservation and wetland areas as part of the mixed-use plan for the area.

As part of the Science, Nature and Democracy course in the 2015 graduate program, we took a field trip to visit Nazeer Sonday, a farmer with a piece of land on the PHA who is also the convenor of the PHA food and farming campaign (a voluntary association formed by the Schaapkraal Civic and Environmental Association (SCEA)). Mr Sonday and other activists have been working with academics, lawyers, residents (in the PHA and broader Cape Town community) and farmers to oppose and halt the development of this unique agricultural land, which was bought by Oakland City Development Company for commercial and residential use by the CCT and the developers. The Oakland land situated in the Schaapkraal area constitutes approximately 20% of the PHA, which was reserved in 1968 for horticulture, silica mining and dune sand removal (High Court of South Africa Judgement, 2020). This area is also considered

a key recharge zone for the CFA and could play a vital role in reducing the impacts of future drought in a water-scarce city.

The CCT and developers argue that the land is needed for the rezoning and development to address the housing backlog of up to 20 years and to increase economic activity in the area. But PHA activists have argued that these decisions are short-sighted and politically motivated, as the proposed developments on this land cater to those who can afford homes valued at R1 million, which the CCT would then collect rates and taxes on. People who already live in the area could not afford these houses, leading to forced removals of communities of colour with low income, reminiscent of the effects of the Group Areas Act of 1950 (based on racial lines) and later gentrification of Cape Town's inner city from the late 2000s to date (based on economic lines).

In *The Meaning of Water*, Veronica Strang (2004: 12) argues that water, like the poor, is always targeted for development. During my fieldwork, when I attended consultation meetings with the CCT about the health of our urban rivers, concern was always expressed by officials about how informal settlements are a great cause of pollution in the rivers, as such settlements do not have access to proper sanitation facilities. Concern was also expressed about how much water was used in these areas, and proposed interventions always had to do with the introduction of more infrastructure, such as canalising part of the river to accelerate the movement of polluted water down the river or the introduction of water monitoring devices (WMD, also ironically referred to as 'weapons of mass destruction' by local activists) that would shut water supply off should residents go beyond their monthly allocation. Residents living in what the City calls indigent households were allocated 350l of water a day in 2017/18, revised to 500 in 2021. The problem was the assumption that in this household, there would be a family of 4 or 5 people, and yet, as shown by numerous studies also conducted by the city itself, households can comprise of even up to 20 people. When a household reaches the maximum allocated amount for the month, the WMD either slow down the flow of water to a trickle, or the water is shut off completely. However, little attention was paid to how much water was used in the homes of the wealthier residents of Cape Town, however, or to what they flushed down the sewers – until the drought of 2017/18. And while concerns were raised during the drought period, these have since been toned down, and the wealthy are again

rarely targeted or held accountable for their water use or waste. The language of development in the CCT is entangled with power structures of command, control and prediction (of people and resources) to grant or deny access to water, which also grants a form of political enfranchisement (Strang, 2004: 4) for those who can afford it.

However, I do not want to fall into the trap of oversimplifying the history of settlement, forced removals and extraction along the Kuils, the aquifer and in the Cape region more broadly, as Wright (2015) highlights how a linear progressive narrative of time can often be used to define black (or in this case black indigenous) collective identities. For Wright (2015: 39), 'confining a collective through a progress narrative limits the group to a cause-and-effect framework, but the *cause,* not the collective, is what drives members forward'. However, because members of a group belong to many discernible cohorts rather than just one, attempting to confine a given cohort through certain *effects*, such as the protection of the PHA – which supposedly provides food security for all Cape Town citizens – creates an ambivalent confinement of citizens who require housing in the 'now'. For instance, some would criticise the economically marginalised activists who helped *cause* the judgement described below for fighting against development that would bring housing and services to the area, because the *effect* (protecting the PHA) has left them as poor and houseless as before. This linear narrative of progress (i.e. only development can address all the problems PHA residents face) reduces the complexity of environmental justice to something far simpler than it actually is. Linear narratives of time allow historical events that do not fit in neatly on the timeline to be erased. For instance, Nazeer Sonday's family was forcibly removed from the area when he was a child under apartheid, and they were resettled in Grassy Park, which was zoned for coloured people only. He bought land in the PHA to 'reconnect with his roots', but such narratives are not considered when making decisions about the development of Cape Town.

After 10 years of litigation, a high court judgement reversed the CCT decision to rezone the land from agricultural to residential and industrial use, with Judge Kate Savage calling on all involved to look at 'the bigger picture', wherein urban development should not be limited to economic gain but should take into account climate change and responsibility for future generations (High Court Judgement, 2020). This was considered a 'precedent-setting' ruling (Daily Maverick, 2020) that placed protections on urban environmental landscapes that were

often backgrounded to facilitate economic development and, by association, build political influence.

Multiple conceptions of time can be seen in this case, and it makes clear that the CCT is reliant on neoliberal market-based logics of territorial entanglements with capital (elaborated on later in this chapter). In this section, I bring attention to a version of time relevant to such cases – that of bureaucratic and political time. Such time includes electoral cycles, in which geopolitical relationships may leave a footprint on the soil, the river and aquifer for many years to come, juxtaposed with short electoral cycles that allow for quick regime shifts; regardless, each regime shift is accompanied by long-lasting consequences. Ironically, the bureaucratic structures put in place for river management are slow to change. I opened this chapter with a quote by the Greek philosopher Heraclitus, who said that one cannot step into the same river twice – because the river is constantly in motion and the water is always moving – water evaporates, rain falls, the wind blows. Even in stagnant water, the microbes, larvae and organic and inorganic matter that makes up water bodies constantly change the composition of those bodies. However, many bureaucratic institutions struggle to stay abreast of the risks and complexity of issues related to climate change, water governance and pollution. Academic literature (see Malzebender et al., 2005; Jonker et al., 2010; Nastar & Ramsar, 2012; Quinn, 2012; Herrfahrdt-Pähle, 2014; Toxopeüs, 2019) is rich with details of some of these responses to change on a local and global scale. The literature also shows that these responses sometimes fall significantly short, failing to account for the rate and scale at which environmental, societal and political shifts are occurring and failing to consider how these changes are (and will) fundamentally shifting how bureaucracies work. The minor changes being performed at the margins of these seemingly immovable managerial structures ignore the depth of our imminent challenges. A change in basic assumptions is required, one that focuses more on the needs of society (humans and more-than-human) than on the bottom line and calls for a different form of governance through bureaucracy.

On the Entanglement of Geological Time with Capitalist and Technological Time: Tin Mining in Kuils River

While the formation of the Cape Flats and the Kuils River proto-river over millions of years is intimately linked to political and bureaucratic time, the material traces of tin (Sn) provide a fascinating account of geological time entangled with capitalist and technological time. An accidental discovery of both lode and alluvial tin deposits was made while prospecting for oil near the Kuils River in 1904 (Rumbold, 1907). Six tin-bearing deposits associated with the Cape Granite Suite were identified in the vicinity of Cape Town, the Kuils River deposits being the first to be mined (Miller, 2020). The first occurrences were mined for cassiterite ($Sn0_2$), the primary ore of tin and one of four conflict materials in the world. Most economically viable tin production in South Africa was from alluvial deposits, which produced 700 tonnes of cassiterite, largely from the province formally known as the Transvaal (broken up to form the provinces of Gauteng, Limpopo and Mpumalanga after the fall of apartheid in 1994), with small but significant traces in the Cape region. South African tin made up 2% of the global tin trade. According to Falcon (1985), all the commercially significant deposits of cassiterite are associated with the Cape granites near Cape Town and Stellenbosch, with the younger granites being associated with the Bushveld rock in Gauteng, Limpopo and Mpumalanga, formed as a result of volcanic and plutonic activity nearly 2 000 million years ago (ibid: 333).

While very little history has covered how economic activity around tin mining was conducted before the arrival of white settlers, Falcon (1985) suggests there is evidence that this mineral was mined and traded by indigenous black people as far back as 750BC to 750AD. Falcon (1985) describes these mining operations as 'efficient and clean', using steel chisels, hammers and baskets, and in hard to reach places the rock was heated by fire and then immediately cooled with water to cause the rock to crack. Upon completion of their mining activities, they closed/covered up the shafts, perhaps a result of superstition or religious conviction (Falcon, 1985: 333). I found this suggestion quite fascinating, as returning the earth (as close to its earlier state as possible) was seen as an act out of the ordinary and peculiar. By contrast, the mines commissioned and operated along the Kuils River in the early 1900s by white settlers are still open today, posing a physical risk and a chemical risk from the seepage of toxic materials pumped into and released from the site for the extraction of casserite ore.

Again, I am cautious about oversimplifying these histories to pre-settler and post-settler worlds, as humans are always sediment-making creatures and are always moving sediments around. Falcon (1985) notes that archaeologists found evidence of the indigenous tools described above and of a high purity level tin In some cases, the tin had been mixed with copper to create bronze (ibid: 133). Falcon (1985) also suggests that the bulk of the tin was probably exported, citing descriptions of indigenous people having seen and traded with 'people "dressed in white robes" and wearing unfamiliar head-dress'(ibid: 133), suggesting trade with people from the Arab world much further up the north of Africa. The white settlers also traded tin, transporting cassiterite across oceans.

Tin has many uses due to its tensile strength, high malleability, low melting point, softness, non-toxicity, anti-friction qualities and appearance. It is also highly resistant to corrosion and is therefore used as a coating or mixed with other metals to prevent corrosion. It is used to coat cooking utensils as it is a good heat conductor, and in a niobium-tin alloy it is used as a superconducting magnet (Royal Society of Chemistry, n.d.).

Most window glass is made by floating molten glass on the molten tin to produce a flat surface. Tin salts sprayed onto glass are used to produce electrically conductive coatings. The most important tin salt used is tin(II) chloride, which is used as a reducing agent and as a mordant for dyeing calico and silk. Tin(IV) oxide is used for ceramics and gas sensors. Zinc stannate (Zn2SnO4) is a fire-retardant used in plastics. Some tin compounds have been used as anti-fouling paint for ships and boats, to prevent barnacles. However, even at low levels, these compounds are deadly to marine life, especially oysters. Its use has now been banned in most countries (Royal Society of Chemistry, n.d.).

While tin mining from the Kuils River mines was considered a significant contribution to exports and global trade in the early 1900s, operations ceased in 1956 when the amounts extracted were insufficient to turn a significant profit. The decommissioned mines are now a tourist attraction that tell a particular history of the area. However, with the increase in information and communication technology and a shift towards renewable energy, some studies have called for a re-exploration of the mines' economic viability to grow the South

African tech industry. Sn is used in tech in transparent circuit boards and as solder in electronic devices (Mining Mirror, 2018). The resurgence in the demand for tin and increases in regulation and environmental legislature have put pressure on the mining and production of the ore, which is expected to increase the price of refined tin over the next few years (Mining Mirror, 2018).

Image 5.6 (a–d): Remnants of tin mining on Zevenwacht Farm (Photography by Amour Venter, source: Miller 2020).

The boiler and hoist (Image 5.6a), open horizontal adits (Images 5.6c and d) and hazardous, partially filled shafts (Image 5.6b) on the Zevenwacht Farm in Kuils River might ordinarily be an unremarkable trace of history and infrastructure, but they provide fascinating evidence of humans terraforming the Earth. This infrastructure is located where the first tin in the Western Cape was found, and its entanglement in global trade, making visible our early addiction to fossil fuels (for powering extraction, processing the product and transporting it over long distances). Fossil fuels become part of the story of tin mining in Kuils River, of 'upside-downing' the Earth, a process that excavates deep earths that have gestated over very deep time and deposits them on the Earth's surface, changing landscapes and altering ecosystems deep into the future (Farrier, 2019). The excavation and deposit of deep earth

materials onto the Earth's surface 'shows how this newly apparent immediacy of deep time is evident in both material and immaterial traces we leave behind' (Farrier, 2019: 16). In images such as those above, we encounter different temporalities at the same time, which is also applicable to everyday materials such as laptops, toothbrushes, desks, canned food – we are continually indebted to geological and fossil materials for the making of our lives.

Today, the canning industry is worth billions of dollars in North America alone. The ability to preserve food through canning has benefitted society greatly, as food of relatively decent quality can be transported over vast distances to places affected by, for example, war, droughts and flooding. Natural ecological processes of decay were significantly slowed, while allowing for the acceleration of food production, enabling the transportation of nutrients to various parts of the globe and thereby altering our experience of space and time. The tin can is considered a significant contributor to the history of conquest by western civilisations, preserving the food that nourished soldiers in the navy and the army to sustain western power around the globe (Can Manufacturers Institute, n.d.). As a technological catalyst and a part of the economic and technological advancement of the late 18th and early 19th century, it can be argued that the tin can helped to set industrial farming in motion.

The deep mineral history of the Kuils River is therefore not limited to the geographical location of where tin deposits were found, but links to the bigger picture of how materials move across the globe and are connected through various relationships and encounters with technology and capital. Our relationship with geologic materials and processes seemingly so remote from the scales we humans experience is shaped by a deep and complex intimacy that reaches back to the deep pasts (Farrier, 2019).

The example of tin mining in the Kuils demonstrates how different time frames collide in this material. While tin is excavated from the deep earths in which it accumulated over millions of years, it is also embedded with meaning in the present and future, providing what de la Bellacasa (2015: 293) refers to as an 'ethico-political imperative to "advance" that remains solidly the orientation of linear, "progressivist" timelines'. It becomes a signifier of progress, used to create technologies for the present and future (e.g., in green energy technologies), even as it slows down time (preserving food). It shapes practice in the expectations of what it

can do for scientific innovation to drive political economies though further policies of extraction and consequent degradation of landscapes. Tin is situated in contemporary attempts to deal with the future and is aligned with capitalist strategies of productivism (de la Bellacassa, 2015). As a result of increased demand in the context of supply deficit, old South African mines are being prospected again (Mining Mirror, 2018) for the growth of the green energy sector, 5G network rollout and rising electronic sales (see Onstad, 2020; Roskill, 2020. The Kuils River could once again become entangled in the global capitalist network of commodities and futures trading, entangling these deep histories and the present with attempts to command, control and predict the future. With the increase in demand and difficulty in accessing such a resource, one could speculate that a least prospecting may begin again along the Kuils, if not full out mining.

Engaging with these different ways of experiencing time could also be useful for understanding the time scales of science and technology. For example, the language often used in spaces where technological innovation is proposed as the answer to current climate crises can be disrupted by questioning how much time is required to make these products (including the millions of years for raw materials to form), to maintain and repair them, and how much time it takes for them to break down. In so doing, technological innovation can take into account how lives (humans and more-than-humans) are affected by these extractive practices.

On Chemical Life Spans and Slow Violence

The small farming community of Sandvlei is on the False Bay coast, 15 kilometres from the town of Stellenbosch and 50 kilometres east of Cape Town's city centre. It is on fertile land, with the Hottentots Holland Mountains to the east and the Indian Ocean to the south. The farming area originally consisted of small farms, which were then consolidated into one farm, called Zandvliet, which subsequently gained municipal status in 1843. Zandvliet is made up of three areas, namely Sandvlei, the Kramat and Macassar. Sandvlei is the oldest and largest settlement of the three. The Kuils River runs through the community and is a tributary of the Eerste River, which goes into the sea at False Bay.

Prof. Green saw a Facebook post about the problems of water quality being experienced by Sandvlei residents and was subsequently contacted by Councillor Hendricks, who sent an invitation for us to visit and speak to the community. We drove out to the area, past the magnificent False Bay dunes covered in indigenous shrubbery. The road we drove on seemed quite out of place, as if cutting through the space. Then the landscape changed drastically, with shacks lining the sand dunes to the left and the massive Zandvliet WWTW to the right. The air quality also changed, leaving a pungent smell on our clothes and stinging our noses. When I got home, my children asked me to take a shower because of the smell.

We eventually arrived at our meeting point, the man-made canal dubbed 'Kak River' by the locals, which pumped poorly treated effluent from the WWTW into the Kuils River. As we walked along the canal, Nazeem, a local horse farmer, pointed out the remains of a *dadelboom*, the last of four date-palm trees planted for the early settlers in the area. The tree, named Sammak, is important to the largely Muslim residents of the area, as this place provided Sheik Yusuf with a place of refuge when he was exiled from Indonesia by the Dutch East India company. On his arrival at the Cape of Good Hope, the Dutch feared his influence over the slave community of the Cape and thought it best to seclude him far away from Cape Town. The tree became symbolic of preaching and teaching in a peaceful atmosphere.

Nazeem explained that he believed that the death of the heritage status palm trees was due to the condition of the river, because the Zandvliet WWTW's poorly treated effluent was having a significant impact on the once fertile soils of Sandvlei. He showed me a report from a veterinarian who tended local animals. The report contained images of Nazeem's horses, which had died from gastrointestinal issues, and the vet had told him that his horses' intestines were rotting, perhaps because of an infection from drinking river water.

Nazeem then took us to the home of his brother-in-law, who showed us all the medication he was taking for gastrointestinal and respiratory issues. He also showed us lesions he had developed on his legs. The brother-in-law's mother joined us and showed us her discharge papers after undergoing surgery to remove her cancerous uterus and a portion of her bowel that had become dangerously infected. Elevated levels of *E.coli* were detected in her blood work. For Nazeem, the Kuils River was making them all sick.

I could have easily left when I was overwhelmed by the smell of the river and feeling nauseous, but my guides could not. They *had* to stay, as this was their home. The Zandvliet WWTW, just one of the wastewater treatment assemblages along the Kuils River, released 72 Ml of water per day into the river (before the upgrade in 2019), which eventually ends up in the Indian Ocean. The wastewater treatment currently mandated by health and safety concerns does not extend to less visible and quantifiable concerns about well-being, health and death for communities that live downstream from this plant. It also invisibilises a slower 'state of injury' (Mbembe, 2003: 21) and enacts a slow violence (Nixon, 2011) on many.

I discussed chemical loads (of ammonia, chlorine and other nitrates) and the prevalence of *E.coli* and *Enterococci* in water samples collected from the river in the Introduction and in Chapter 3 of this thesis. I also discussed the responses from the CCT that focused on providing a causal link between the state of the river and the poor health of Sandvlei residents. The CCT argued that residents could only get sick if they were in direct contact with the water, for instance, by swimming in or drinking from it, for which the CCT had provided signage along the river warning of its hazardous nature. The scientific method used to justify this response fails to take into account the nature of ecological cycles, as if the water that flows in the river is separate from the mud along its banks and the particles that are carried into the air.

Ammonia, a colourless, strong-smelling gaseous compound of hydrogen and nitrogen used in the treatment of wastewater to prolong the effectiveness of chlorine, can have significant impacts on human health. In high concentrations in the air, it can cause immediate burning in the eyes, throat and respiratory tract and can result in blindness, lung damage or death. Inhaling it at lower concentrations can cause respiratory irritation. Although a stable agent in heat and light, it reacts violently and explosively with oxidising gases such as chlorine. As WWTWs cannot account for every substance or chemical flushed down sewer pipes, there is no way of knowing the range of reactions that occur in a WWTW and when treated effluent is released into the environment. There is also no way of knowing the full spectrum of how these interactions impact biological life, or the incremental damage they can threaten to bodies over a lifetime or that are passed on to generations that follow (Davies, 2018). Research by Petrik et al. (2017) and Ojemaye and Petrik (2021) which explores the impacts of

Cape Town's marine sewer outfalls on various marine life, such as fish, sea snails, seaweed and mussels, showed bioaccumulation of household and industrial chemicals in these creatures. Concerns about eugenic effects, such as the feminisation of species, were raised as they might affect species populations. Petrik et al. (2017; 2019) also highlighted the risk to humans who consume these, as traces of carcinogenic chemicals were found in collected samples. The impact of the WWTW is clearly not limited to its geographical location along the Kuils but cascades through the entire urban water cycle of Cape Town.

Rob Nixon (2011) interprets this interaction between time and environmental degradation using the concept of slow violence (discussed in detail in the Introduction). Violence is often understood as spectacular and immediate, but Nixon (2011) reminds us that it need not be to have damaging consequences. Slow violence is often a result of uneven social conditions, largely through the colonial project of displacement and dispossession. Those most impacted are often the marginalised members of society, settled in hazardous spaces through discriminatory geological categorisations. Under the history of settlement in Cape Town, white people settled in the upper reaches of the Kuils River, where their biggest challenge now is the pollution of the river by solid waste such as plastics and garden waste. From the middle reaches of the river (discussed in Chapter 2), however, effluent from WWTWs is deposited into the river, and by the time the water flows into the lower reaches, communities along the Kuils are burdened by the pollution from a great part of Cape Town. The settlement geographies have not changed much over hundreds of years, while pollution loads downstream have increased exponentially. Mbembe (2001) argues that such violence does not originate from a single event or power but is entangled in a complex assemblage of capitalist structures, government authority and corporate and legislative power. In such cases, environmental is often not intentional, but the structures of environmental management, scientific, governance and neoliberalism machinations (Davies, 2018).

Such cases call for what Stengers (2018) refers to as a slow science (rather than the fast science of a rapidly changing world) that does not overlook the gradual impact of toxic experience (Davies, 2018). Toxicity and time are intricately linked, where 'time is an important factor that determines the level of bodily damage that a toxic substance can enact' (Davies, 2018: 2). In my encounters with CCT government officials, no one seemed to consider that

the longer a person is exposed to chemicals and bacteria in the river, even in tiny amounts (which was not the case here), the more likely they are to be affected. Toxic materials can delay or postpone their harmful effects across time and space, creating a distance between the hazard and the people it affects, making it difficult to prove causality (Murphy, 2013).

TYRANNY OF THE URGENT

While the broader thesis has highlighted the tensions that arose between the technoscientific management of the Kuils River and the lived experiences of people on the ground, a central concern for communities, scientists, engineers and government was learning about livability in the current context of climate change and growing populations. The challenge is in how it was done, and the urgency embedded in dealing with crises. Historically, social emergency and uncertainty about water resources and practices are not new to practitioners in the field of freshwater and marine resource management, with water quality, quantity, biodiversity and transboundary relationships just a few of the concerns that water resource management has been called on to remediate. These instances of human–water relations can also be read in terms of how they expose a combination of anxiety in the face of future disasters (such as the 2017/18 Cape Town drought and the Zandvliet WWTW pollution of the Kuils) with innovations that reinforce the technoscientific productionist drive. After the fact, we can see that extractive relations to the river and using it as a waste sink have not changed, but technologies such as the upgrade of the WWTW and construction of desalination plants have increased the efficiency of extraction from the ocean and the deposit of waste into the river. In the current context, the urgency of creating a water secure Cape Town has catalysed expensive and highly technological interventions, which, while future oriented, have ironically been troubled by historical and contemporary dynamics. The tyranny of having to respond to crisis after crisis while managing anxieties and calculations about the future is tied up in industrial modernity's impossible efforts to manage and control time (Farrier, 2019)

CONCLUSION

This chapter examined the multiple versions of time of the Kuils River, namely geologic, capitalist, bureaucratic, technological, chemical and political time. These versions of time are

by no means exhaustive, but I used them to highlight the intimate link between time, geologics and the process of being human. The chapter offered an assemblage of paleontological, archaeological and ethnographic data to reveal how these are entangled with capital, technology, chemo-socialities and governance. Deep time is not just about understanding the geologic formations of millions of years ago but is also about paying attention to ecological processes and making the connection to society's time. Using socio-historical critiques of temporality highlights how various parts of society and epochs have enacted different experiences of time. Linking deep histories with present socio-political experiences shows that time is not linear and progressive but is embedded in landscapes, bodies (of human and more-than-human) that shape interactions with the river.

In this chapter, the objective was to highlight that time is about relationships and processes, and the problem is that when a singular notion of time dominates how environmental governance is done, what other sets of relationships and processes are ignored. Political and bureaucratic time often work in relation to electoral cycles in Cape Town. Decisions about the management of the Kuils River and its environments are often based on who was in charge at that moment and what their priorities are. So while the bureaucratic and political time may be seem like a drop in the ocean when compared to geologic time, the impacts of decisions made by politicians and bureaucrats can have impacts far into the future, shaping the social and environmental relationships of future generations. It is therefore important to acknowledge these different versions of time when governance of rivers are at play, to remain accountable to future generations. The current political and bureaucratic structures in environmental governance are shifting more and more to business models which are accountable to the markets and shareholders.

The market which operates on financial time (e.g. financial cycles, stock market trades) deals with a specific set of relations, which are often extractive. For instance, news bulletins often end with an analysis of how certain commodities, such as crude oil, gold and platinum, are valued after they have been extracted from the ground. The cost of this extraction to local communities (for instance sand and dune mining in the Kuils River catchment) and ecosystems (with compounds and minerals that have been formed over millions of years i.e. geologic time) are never a part of the reporting. In the chapter, I also discussed chemical time and the

long lasting effects these have in the Kuils River. Domestic, industrial and agricultural chemicals end up in the river, breaking down and amalgamating in uncontrolled environments. We have no idea how bonds are formulating in the river and how the life spans of chemicals operate in such environments. We also have no idea what the impacts of continued extraction of sand and minerals will have of the local river landscape and communities. What this calls for is 'response-able' management of waste and extraction in the current moment for the sake of future generations, whilst also addressing the histories of these relations and processes (of extraction and waste) to address violence enacted on black, indigenous and people of colour (BIPOC) in the Cape.

I have attempted to show what Yusoff (2018) describes as the entanglement of 'geologic questions' with 'hard political questions', interrogating the formation of the Kuils River landscape and how it allowed for settlement and, later, extraction. Such questions are concerned with the subjugation of black bodies and the environment for the benefit of the white man. They are also concerned with the universalising of the term 'Anthropos' in Anthropocene, which places responsibility on all of humanity for this epoch, despite all humans not being equally culpable. It calls for an acknowledgement of these different versions of the human for justice and decolonisation to prevail in an age of crisis.

If Cape Town is to address the problems of the Anthropocene, city managers must take note of how seeing and knowing the world is underwritten by these geo-logics and are carried into the future – in the case of the Kuils River, this is evident in a theory of urban management predicated on an understanding of a separation between human and the Earth. It becomes about hardening these categories, of separating multi-species communities from the geologic (what is considered as non-life), hardening the separation between solid, liquid and gas. But by hardening surfaces, we remove the relationships between river sediments, plants, fish and frogs, disrupting the nutrient cycle between fish, frogs, plants and birds and breaking the cleansing cycle of the river. Resolving the problem of the Anthropocene along the Kuils River will require a paradigm shift in how we think about our relationship with the Earth. Instead of seeing the Earth as separate from society, we must think of ourselves as 'Terrans' – beings who are of the earth and in the Earth.

CHAPTER SIX

Making Time for the Kuils River beyond Techno-Scientific Interventions

This chapter focuses on different relations with rivers and how these might be changing for inheritors of a 'damaged landscape' (Tsing et al., 2017). De la Bellacasa's work (2011) focuses on the significance of 'care' in the fields of Science and Technology Studies and of different versions of time and care in terms of human-soil relations (2015), and how these are shifted and placed at risk through technoscientific ideologies. Using an ethnographic analysis of 'care', I build on the work of de la Bellacasa to explore how different forms of care are enacted on the Kuils River. As demonstrated in the larger thesis, this management is dominated by technoscientific governance at the expense of other forms of relating to the river. Focusing on these alternative relationships will open a space for more democratic, dialogue-based problem solving that includes the experiences and practices of bodies (human and more-than-human).

Drawing on de la Bellacasa's (2011) work about care assemblages[20] as a vehicle for the exploration of the 'ethico-political, practical and affective dimensions of concepts and practices' of river care in the fields of engineering, the natural sciences and other forms of knowing the river, this chapter focuses specifically on relating to the river beyond measurement and control, asking what it means for urban futures to think of rivers beyond 'technoscientific futurity' (de la Bellacasa, 2015).

This chapter draws on feminist approaches that engage with care as a method for countering the belief that objective, engineered and scientific interventions are the only way to respond, experience and enact the Kuils. I hope to stimulate an acknowledgement of these alternative ways of relating to the river and recognise the possibilities for different 'livabilities'.[1] In the first section of this chapter, 'Science, Engineering and Values: How Can we Care?', I discuss the diversity of ways in which scientists and engineers demonstrate care, and I explore the disempowering processes that often inhibit its expression. Stengers (2018: 108) highlights

[20] Assemblage in reference to a gathering or collection of people and things in enacting care.

that within the hard sciences there is a separation of people 'from their capacity to envisage, to feel, think or imagine … which paralyses our capacity to resist'. How has this been enacted on the river through modes of enquiry in the sciences and engineering disciplines? What possibilities are opened up when creating spaces to care and slowdown in the 'hard sciences?

In the second section of the chapter, 'River and Relations: Ubulongwe, Soils and Water', I explore notions of care among residents living along the river. Like de la Bellacasa, I work to understand practices of care along the Kuils and make space for a diversity of understandings, keeping in mind the historical context that is brought to bear on the local environments. I consider the relationships residents believe to be essential and intertwined with the wellbeing of the river, soils and multi-species communities, and in this regard I explore how perceived objective, valid and authoritative ways of managing the river can help inform and change policy based on 'matters of fact' into 'matters of care' (de la Bellacasa, 2011). The latter notion is drawn from Latour's (2004) idea of 'matters of concern', which suggests the presence of politics in the domain of knowledge production that have world-making and changing effects. Latour puts an emphasis on care in how we study, theorise and practice that which we come to know. Accordingly, when we think, translate and enact the river, what are the concerns that will shape the way we react, treat and manage it? Attending to these matters of concern allows us to see beyond the river as a space outside of its temporal rhythms, but also to be aware of its liveliness through multiple entanglements, which in turn produce different versions of the Kuils River. Paying attention to the multiplicity of the river provides a conceptual tool with which to resist the notion of the metabolic rift, where nature is seen as separate to humans/culture; instead, the concern becomes about more than just one thing and creates a platform for more democratic encounters, as the concern is about the 'multiple'.

SCIENCES, ENGINEERING AND VALUES: HOW CAN WE CARE?

I presented my early findings in an Anthropology departmental seminar in March 2018. The focus of my talk was the Khayelitsha Wetlands Park – its restoration, community responses to the project and how the City responded (discussed in Chapter Two). Because my talk was

somewhat transdisciplinary in nature, students and staff from the Science and Engineering Faculties were also invited to participate in the discussion. I addressed the engineered responses and scientific priorities of this restoration project and spoke about how the engineers' focus was on ensuring the river continued to flow, building structures such as canals to control it. The focus of the natural resource managers was on protecting the wetland, to which end a fence was erected to control how people and animals moved in and out of the KWP. I also spoke about scientists' concerns, particularly water resource managers and ecologists, to ensure that the plants and wildlife could thrive in the wetlands. The KWP was also designed to have public amenities such as an outdoor gym, braai (barbeque) areas and jungle gyms for children to give the community a sense of ownership of the space. I noted in my talk that the primary point of contention was the fence (discussed in Chapter Three).

At the end of my presentation, the floor was opened for comments and questions. The first comment came from Prof. Sue Harrison, who was the Head of the Department of Engineering and the Built Environment at the time. "We know that we have shortcomings within our discipline about understanding the ways of relating and connecting between people and the infrastructures we build," she said, "For a long time, our discipline has worked on the assumption of neutrality of what we build. Still, with Rhodes Must Fall, Science Must Fall, the social inequalities and environmental challenges we face, we have had a reckoning with our discipline. We are aware of the need to start asking different kinds of questions. My presence here is to make an invitation to you and social scientists present to work with us and think with us on how to tackle these issues."

This comment caught me off guard, but I have worked closely with the Future Water Institute in the Department of Engineering to share knowledge across the disciplines over the years. Another exchange that challenged my assumptions was with a student from the Science Faculty, who questioned why I assumed that scientific approaches were framed as 'lacking care', when hers was a work of care. She worked in a lab with plants, animals, bacteria and viruses because she (and her colleagues) cared about knowing how things work and impact their environment and people. The comment also reminded me of encounters with scientists working for the CCT who demonstrated different care forms, tending to broken infrastructure, maintaining it and developing it to ensure the functioning of the waterways. However, these

forms of care were hidden: the tinkering, maintenance and repairing of said infrastructure often happens underground. The student's comment also reminded me of an interview with Mr. X, the engineer working on stormwater drainage in the upper section of the Kuils River (Chapter 4), who had shared the same sentiments. While his responsibility was to ensure that the river flowed, management practices were not coordinated because different municipalities managed different sections of the river. While he cared about the health of the river and the well-being of the communities along its path, the governance structure in place only gave him a mandate to work on infrastructure development and maintenance projects associated with the Kuils River.

My own walking of the river, the work of Green (2020) and the encounters outlined above taught me that the teachings of the academy in our respective disciplines do not give us the tools to 'think' of or imagine the connections that exist in the world. A significant amount of work, including this thesis, has focused on infrastructure failure, its entanglement with social worlds and how it can produce uneven and unequal experiences, especially in a context such as South Africa's, with its history of unequal development (Graham, 2010). However, significantly absent in the literature are forms of care practices that keep the water flowing. By way of example, Mr. X's focus on stormwater drainage pipes ensures that that which is flushed from our homes and our streets is removed to create healthy spaces of well-being for humans. Cleaning up the city often happens in the background to minimise disruption to residents, but as a relation of care, I suggest that the urban water systems have been backgrounded, and the practices of care work are invisibilised as a result. My argument is not necessarily that the people tasked with this work directly care about the drain in my street being blocked, but their activities are within a broader assemblage of infrastructure relations that enable water to flow in and out of the city. By tending to these issues, they practice care (Buser & Boyer, 2020). Tending to the network of infrastructure relationships expands the notion of care into domains that have been considered as such. However, the challenge arises when caring is limited to only what we see or caring only for what we are supposedly responsible for. What becomes neglected when the ambit of care is restricted to one section of the Kuils River? For instance, by focusing on infrastructure's functioning to enable human comfort, the river is excluded from 'the circle of care', becoming neglected and even exploited for the benefit of those being cared for.

Also missing from the disciplines is the aspect of 'ontologies', ways of being in the world often shaped by environments, politics, economics and technologies. Narrow focus on one's own discipline limits ways of seeing and being in the world. If one knows the world only through science and technology, its enactment (in this case on the Kuils River) is framed by 'matters of fact' rather than 'matters of concern' (Latour, 2004). Latour (2004) calls for a recalibration of the present focus on modes and technologies that produce more facts, to recognise the politics of how it is done – the accounts (how the stories are told), measurements (the methods used) and concerns (what curiosities inform the research question?). To recognise the politics of how it is done requires an acknowledgement that methods, theories and ways of telling stories in the field produce meaning.

It is not often that natural scientists, engineers and social scientists have an extended conversation with each other about their work. With the severe Cape Town drought of 2017/2018 and growing issues around urban river pollution, I witnessed more collaborative work being proposed. Learning about livability in these disciplines became paramount, and the focus on 'noticing productive crossings' was central to reimagining how we conduct research in our respective fields (Tsing et al., pM3). From the perspective of care, this section considers the work done in the background to keep urban water systems running.

I was invited to attend a workshop organised by the Provincial Department of Environmental Affairs and Development Planning (DEA&DP) to design and plan the introduction of artificial wetlands into one of Cape Town's major rivers. The wetlands were intended to improve the water quality (i.e. reduce *E. coli* levels and ion in the water) and slow the river to allow it to retain water, nutrients and carbon for the benefit of the various plant and animal nutrition cycles. The wetland was to be located next to an informal settlement with little water or wastewater services, and settlement residents used the river to support their livelihoods by fishing, harvesting reeds to make crafts and grazing their livestock. Creating the wetlands was ultimately intended to enhance these livelihoods, raising the question of how we might imagine enriching the settlement dwellers' lives through the wetland. Present in the room were two ecologists and an engineer from the Western Province Department of Water and Sanitation, the natural resource manager, a farmer who owned a piece of land that the river

flowed through and myself. Glaringly absent from this planning meeting was anyone from the informal settlement who stood to benefit from the wetland, begging the question of just whose future was being imagined.

I was interested and excited to be involved; reintroducing wetlands to the Kuils River was one of the aims of the KuilaLove community group in the middle section of the river in the Kuils River neighbourhood. The workshop was terrific, as it introduced me to systems of thinking about waterways and ecosystems, thinking about what type of grass should be used to protect the soils from erosion on the banks of the river, and the reeds in the stream that will allow for re-introduction of fish, birds and other wildlife. What kinds of reeds would grow fast enough for people to harvest but not too quickly to choke the river? Depending on soil fertility, what areas could be allocated for people to grow vegetables or for recreational purposes? The systems thinking approach allowed one to see how different 'nodes', i.e. the reeds, the soil, the birds, the river, the people, were all a part of the system. It allowed one to see the picture and know what 'nodes' made up this system. It also acknowledged the system's dynamism, the shifts and changes necessary for the system to thrive. After drawing and planning was complete, one of the ecologists said, 'We have to put a fence up.' Everyone but me agreed, and I asked, 'Why?' All conversation stopped, and the other participants looked at me in confusion, as it seemed apparent it was to protect the wetland. 'Protect from whom?' I asked. A discussion followed about how the fence had to be put up as standard practice for 'government land', that the wetlands were a resource that required a lot of capital investment and that the fence would protect this asset. I spoke about the KWP project, in which kinds of relationships were not seen and acknowledged, and described its impacts on the people, the wetlands and the government. My objection was tabled as something to look into, and I encouraged them to engage with the residents to understand the kinds of connections people already had with the space so that the wetland would be designed to be more inclusive.

There is a particular aspect of fundamentalism attached to the authority that such disciplines carry; fact-producing, unhindered by socio-politics, as if a specific way of world-making is the *only* way of making the world. Within the natural sciences and engineering, the world making of things (and caring for these things) often excludes the human, as if the human were not part of shaping and creating these worlds. The fence around the KWP, for example, might be

there to protect the wetlands from dumping or overgrazing of animals, but there are worlds of meaning implicit in the fence's dependence on the relationships and politics in which it is situated. While we cannot deny the importance of science and engineering to improve many human lives, problems arise when these disciplines are presented as the ultimate truth or solution to societal and ecological issues. The best form of science and engineering is interested in aspects of care and creates a space for other forms of knowing and being to exist and thrive in the world. As Green (2020: 16) writes:

The fundamentalism of science and engineering is also mirrored in how governance happens. The form of governance takes the methods of control and measurement into policy, overshadowing other ontologies. The governance through this mode might miss what matters to others (humans and multi-species worlds).

The natural resource manager in the encounter described above had invited me to attend the workshop because he heard me present at a Water Symposium organised by the Future Water Institute at UCT. My talk there highlighted the importance of bringing different voices to the planning and management of water infrastructure, highlighting some of the challenges experienced along the Kuils River when this had not happened. His invitation to the workshop demonstrated a willingness to do things differently and an openness to asking different kinds of questions by engaging with a social scientist in a governance space dominated by the natural sciences and engineering. A willingness to begin by asking how we might enhance the well-being of the people and multi-species communities also created a space in which to enact care. Consideration of people's needs is often overlooked when conservation projects seek to protect the environment by creating a barrier between humans and a protected space. The irony of this project was that, although well-intentioned, it tended to fall back into ways of knowing and practice within the domain of natural resource governance.

After I had left and taken time to reflect on the encounter, I considered a range of issues:

1. While the river was thought of as a system with interconnected nodes, i.e. water, plants, soil, insects and people, each of these nodes required 'expert' knowledge. For me, this raised the question of whose knowledge was not included in the system. Similarly, what kind of knowledge was considered expert? With my presence as a

social scientist, was I an expert on the informal settlement people? Did the absence of residents from the informal settlement in the workshop mean that their knowledge did not count as expert? It may be argued that this section of the government took on a paternal role as a representative of the people, positioning itself as knowing what is best for the people. This leads to Strang's (2016) question of whether taking on this role leads to empowerment that alienates those in charge from the people they are meant to serve. Strang (2016: 293) highlights that bureaucracies can become 'indifferent' when forms of governance are removed from the social and political networks of the people they are meant to serve.

2. The suggestion to put up a fence not only demonstrated who owned the land but who had the power to decide who controlled the natural resources and their access or distribution. Having 'experts' creates a hierarchy of knowledge and control, and evidence has shown that when these hierarchies are made, there is a trend towards enclosure and privatisation of the 'commons' (see Horan et al. 2016; Strang, 2016; Partelow et al. 2019), bringing about a shift in ways of relating in socio-politicoecological systems. Strang (2016) argues that dominant approaches to natural resource management disrupt different ontologies with the river, placing control of the resources in fewer and fewer hands while disenfranchising the majority of the people and more-than-human communities. The fence presents a 'quasi-privatisation' of the wetland and its surroundings.
3. This 'quasi-privatisation' and the shifting of ontologies may change how people are positioned to the wetland – and for the case of the rivers and wetlands in discussion, people's relationship to water. Reconstructing wetlands and water as assets or commodities is expensive and requires fundraising, and users are then positioned as consumers or customers, suggesting that the wetland is a government product rather than a common good or a part of 'Nature' that can be accessed by all (Strang, 2016; Green, 2020).

While the proposed technoscientific interventions may be embedded in care, they are also entangled in ecological, social and political interests. The mediation of introducing the wetland is not just about introducing the human into the ecology – or vice versa, ecology into human spaces – as interest in how to govern is intimately linked in the world making processes

on this landscape. Awareness of socio-eco-political intimacies can help us reframe how science, engineering and governance are done, from dealing with 'matters of fact' to 'matters of concern' (Latour, 2004). Highlighting this can point out the possibilities of different integrated modes of caring in science and engineering, rather than the limiting normative approaches of adding value (de la Bellacassa, 2011).

RIVER OF RELATIONS: UBULONGWE, WEEDS, SOILS AND WATER

It has long been argued that Earth's species are interdependent on one another for survival. In ecosystem studies, we learn that a species cannot exist without its environment, including water, the atmosphere and other species. However, as Tsing (2012) has argued, humans are often excluded from these studies of interdependency, and human entanglements with multispecies worlds have largely been disregarded in the anthropological research of society. Over the last few decades, however, we have seen anthropology shift to include more-than-human worlds when understanding world-making processes.

The Khayelitsha wetlands are made up of lush greenery and undefined water channels from the Kuils River, where some of the last few wetlands on the Kuils River remain. Mam Wana and I were on our way to see a piece of land that the women of the co-operative call 'Igalelo Labafazi', which was used to plant organic vegetables to feed their families, with the surplus sold to compliment household income. The land was considered fertile because of its location in the wetland channels, making it drought-proof. During the Cape Town's rainy winter months, from the end of May to August, the high flows of the Kuils inundate the wetland channels and cover them with a fresh layer of organic material, nutrients and soils carried by the river that make the space attractive for growing food. From walking the river, however, I understood that this water also brought many strange chemical combinations from WWTWs, stormwater drains, agricultural run-off and industrial waste. Even as the water recedes in the summer months, it is still close enough to keep the garden nourished.

A few months before my walk with Mam Wana, the women were evicted from this land, as it was privately owned. Mam Wana told me how much blood, sweat and tears had gone into making the soil alive again and how the soils were too sandy and were 'burnt out' by fertilisers,

where even *izibungu* (insects and worms) that made the soil well could not survive. That is when women decided to use *ubulongwe* (cow manure) to revive the soils. Mam Wana dug up the soil to show me how dark and rich it was and showed me the worms and insects that helped it become healthy. The women negotiated with a nearby kraal owner to help reduce cow dung in the kraal. They would take it away, and no money would be exchanged. However, with the growing number of gardens, the 'market'' for dung increased, and the kraal owner started to charge by the bucket load.

We walked over to the corner of the plot, where the remnants of a compost heap were visible. I saw a heap of reeds and learned that they had been brought over by Sisanda, who was part of the canoe club, because he knew Mam Wana was a traditional healer and used pieces of *ingcongolo* (bulrush (English name) or *Typha capensis* (scientific name)) to treat her patients. Sisanda had also brought water hyacinth. The canoe club had spent days removing the plant from the river in the park, as it blocked its flow and obstructed their usual activities. Although generally considered a nuisance as it clogs the waterways and reduces oxygenation, Mam Wana saw it also gold for the soil, as it is high in nutrients for the soil. The combination of *ubulongwe*, *ingcongolo* and the warm, damp climate along the Kuils invited the growing of organic vegetables by the women of Igalelo Labafazi.

But when the soils had recovered, the women's co-operative received the cease and desist order and were informed that the property belonged to someone else. Some women expressed how deeply hurt they were by this, as they were just trying to make ends meet in the township's limited space. The land lay idle for years before they could grow things on it again, but now they are seen as criminals for trespassing.

Supporting and enacting alternative ways of knowing the river beyond its biophysical reality is essential citizens, research, policy makers and City officials are to rethink the place of rivers in cities. Its chemical composition as H_20, its quality and quantity must be thought of as 'becoming-with' the social, cultural, political and infrastructural practices and the meanings embedded in water leading to the development of the hydro-social cycle framework (Bakker, 2002; Linton, 2010; Swyngedouw, 2009). Becoming-with aligns with Barad's work (2012) on agential realist ontology, where the world is not seen as being composed of discreet things

but is made up of objects in constant relation and co-becoming. Igalelo Labafazi engaged in practices that were aware of these co-becomings, paying attention to how the circulation of nutrients and energy between the river, soils and *izibungu* are entangled in a myriad of ways and were essential to achieving well-being for human and multi-species communities.

In South Africa, most large-scale farmers use chemical fertilisers on their soils. The run-off from these farms has contributed to the eutrophication of rivers, and the chemical compounds have presented a significant problem for aquatic life. Aware of this, the women of Igalelo Labafazi opted to use *ubulongwe*, a practice used for generations, to improve the soil. Workshops with the group discussed how chemical fertilisers 'burnt' the life out of the soils. Although crop yields in the early use of chemical fertilisers were significant, more fertiliser was needed with every planting cycle to produce the same yield, an expensive endeavour that was not sustainable. Mam Wana said that it was easy to switch back to what they had known and practised in the rural areas and, because there were several kraals in Khayelitsha, they had access to *ubulongwe* rather than having to leave the site to purchase fertiliser. The women also noted that *ubulongwe* brought life back into the soil: with chemical fertilisers, no earthworms and insects came to turn the soil or, as the women believed, enhance the soil's fertility with their excrement. To promote different forms of life in the soil, Igalelo Labafazi worked with decomposing plants from the wetland and with water, *ubulongwe* and *izibungu*.

Image 6.1: Mam Wana at one of the community gardens at an Early Development Centre (EDC), where organic waste (including cow dung) is placed into a biodigester (pointed at by Mam Wana). The gas it produces is used for cooking and heating in the EDC. Decomposed material that settles at the bottom of the biodigesters is used as fertiliser. (Source: Author)

The story above also highlights the practice of care – essential to the ways well-being is sought in Khayelitsha. For example, the nourishment of the soil with material from the river was a caring for the soil, which also meant they could nourish and feed the bodies of their families and the children that attended the Early Development Centres (EDCs) in their neighbourhood. As Mam Cynthia, a member of the women's co-op, said, 'You take care of the soil; it will take care of you, your children and grandchildren.' The women did not see themselves as separate from the soil or the river but referred to themselves as being of the soil and the river. In considering the embodiment of the soil and river, I draw on Astrida Neimanis' (2017: 3) phenomenological project of how:

Our own embodiment … is never really autonomous. Nor is it autochthonous: we require other bodies of other waters (that in turn require other bodies and other waters) to bathe us

into being. Watery bodies are gestational milieus for another – and for others often not at all like us'.

Image 6.2: Cattle grazing on the banks of the Kuils River in the KWP. (Source: Caboz, 2021)

This differs from production-oriented practices in modernist societies that focus on output and management efficiency in food production. Productionism reduces what counts as care, for example reducing our understanding of land to property and property relations – and limits the possibility of creating connections of care that fall outside its ambit (de la Bellacassa, 2015). Consequently, receiving the cease and desist order from the City that declared they were trespassing on private property interrupted care practices, because they existed outside of the framework of property and legislation. Mam Wana, who had lived in the area for 20 years, argued that the land had lain empty for as long as she could remember. Now, when they started to use the space, it suddenly belonged to someone. What frustrated the women the most was that no attempts had been made to talk to them face-to-face to understand the importance of the food garden. As far as they knew, nor had any attempts been made to reach the landowner to at least negotiate the use of the land while it lay fallow. This was a humiliating experience for the women, as they were prominent members of the Makhaza

area in Khayelitsha, which is troubled by crime. They had worked hard to keep their families out of crime, and now, by simply making a plan to feed their families, they were positioned as criminals. As we walked into the wetland and visited an EDC adjacent to the park, Mam Wana said in frustration, 'The government told us to *Vuk' uzenzele*[21] – we did it, we are trying, but they won't let us.'

So what can be learnt by highlighting tensions concerning the multiple ontologies of relating to the river? It is imperative to examine how economics and governance have obscured relations to the river by relying on classical forms of science and engineering for governance. The flow of a river connects people, places, soils, plants and animals, supporting different life forms and shaping world-making processes such as landscapes, economies, technologies, cultures, beliefs and politics. The concept of environmental flows provides a useful framework for improving our understanding of relationships between river flows, people and multispecies communities. Most approaches to understanding river flows remain grounded in the natural sciences and exclude the human, limiting focus to quantity, timing and quality of freshwater flows and the levels necessary to sustain aquatic ecosystems. However, the Brisbane Declaration and Global Action Agenda on Environmental Flows (Arthington et al., 2018) has revised the definition of environmental flows to include that these flows support human cultures, sustainable livelihoods and multi-species well-being. This presents environmental flow science with an opportunity to better consider the co-constitution of river flows, ecosystems and society and to explicitly incorporate these relationships into river management (Arthington et al., 2018).

The Declaration sets out six statements, all pertinent in the context of this chapter and the larger thesis:

1. Environmental flows are essential to protecting and restoring biodiversity, aquatic ecosystems and the ecosystem services they provide for all societies.

[21] The saying Vuk' uzenzele (in the language of isiZulu and isiXhosa) which means, 'get up and do it yourself', was often used by politicians such as President Cyril Ramaphosa during his tenure as vice president to encourage South Africans to rely less on the government for welfare, but rather focus on entrepreneurship and finding other avenues to sustain themselves as citizens.

2. Environmental flows are critical to protecting and safeguarding the world's cultural and natural heritage.
3. Environmental flows have been compromised and many aquatic systems around the world are today at risk.
4. Implementation of environmental flows requires a complementary suite of policy, legislative, regulatory, financial, scientific and cultural measures to ensure effective delivery and beneficial outcomes.
5. Local knowledge and customary water management practices can strengthen environmental flow planning, implementation and sustainable outcomes.
6. Climate change increases the risk of aquatic ecosystem degradation and intensifies the urgency for action to implement environmental flows.

Understanding flows makes humans, multispecies communities and the river part of the bodies that make up the hydrological cycle. In this conception, the river is not just a natural resource to be extracted from or a conduit with which to dilute cities' urban waste. Cities are the river, the river is the city; humans and multispecies communities and practices are the river, the river is them. A healthy river can only exist when all aspects of human and multispecies well-being, economics and technologies are included in what makes it. For Linton (2010), water carries the traces of its social relations, conditions and potential, and the same can be said of the river. From how we engineer the river to how it is managed, Linton emphasises that how we think about water (and by extension, the river) directly affects how it is treated, how we think it can serve us and what we think it should do (Neimanis, 2017: 20).

From Policy of Management to Policy of Connection

Linton (2010) argues that the way water has been planned for and managed since the Enlightenment can be described in terms of 'modern water', a way of knowing, measuring, accounting for and representing water outside of its social and, I argue, ecological context. Modern water replaced numerous earlier versions of water defined by its relationships to multiple beings and processes, to instead be represented by its compound, hydrogen and oxygen (H_2O). Rivers are similarly reduced to their capabilities as diluters of waste and a

natural resource to serve humans. Understanding rivers in this manner shapes how they are managed. We cannot continue with 'business-as-usual' when Sustainable Development Goal (SGD, developed in 2015) number six focuses on safe and affordable drinking water for all by the year 2030 and highlights the importance of protecting and restoring water ecosystems. This study therefore calls for different approaches to how the Kuils River is managed so that it includes hydrosocialities, recognising the complexity and multiplicity of the river to address the urgent social and ecological crises in our city. I propose a shift in governance from one that focuses on control, command and predict (management) to one that focuses on human–nature entanglements with the river, one that is connected to what is happening on the ground rather than working from outside the socio-ecological worlds it is meant to serve. This approach could inform policy that seeks to reconnect rather than increasingly separate the human from nature, which could increase the inequalities in the city.

I was invited to another workshop, this one focused on rethinking the place of rivers in urban areas, with the goal of restoring them to as close to their natural state as possible. People from fields and backgrounds as diverse as biology, anthropology, psychology, engineering, city planning, people living in communities affected by polluted rivers and many more spent days working as a think tank, sharing ideas of what a city that cared for its rivers would look like. The natural resource manager from the DEA&DP was present, and we spent a few days brainstorming and reflecting on the ideas and issues raised in the three-day workshop. For me, the most pertinent issues were:

1. The solutions developed to tackle pollution in the city need to be fit for purpose, as every river faces its own challenges. Different sections of the same river may need to tackle different problems.
2. South Africa's history of unequal and unjust development is visible on the landscape and the infrastructure, and issues of justice must be recognised when developing solutions. The goal of restoration of the rivers must also aim to address socioeconomic issues within the community.
3. There must be a shift from a heavy reliance on engineering the landscape to a focus on learning more from nature, such as investigating what nature-based solutions can be developed to tackle issues of pollution in urban areas.

It was agreed at the conclusion of the workshop that a fundamental shift is required in how water is managed, treated and interacted with, but this cannot happen without transdisciplinary collaboration or the support and buy-in of the government departments in charge of water affairs.

The conversations in this workshop were encouraging, as they showed me that many people were engaging with the practice of rethinking water relationships in Cape Town and surrounds, from different disciplines and contexts (though this group was largely white and middle class). I also became aware of several examples of river restoration projects in the Western Cape, one of which I believe captures the essence of governing differently. It is described below.

Genius of Space – Langrug

The Genius of Space Project uses biomimicry principles to clean up grey water, stormwater and solid waste in an informal settlement located on government land in Franschhoek, one of the wealthiest towns in South Africa. Langrug is home to approximately 1 800 families and was formed as a result of rapid urbanisation and people from the Eastern Cape arriving to find work on wine farms and wine factories in nearby Stellenbosch (Kenney, 2011). Today, this informal settlement faces many challenges, such as high levels of poverty and a lack of proper housing, water and sanitation services. The Genius of Space project was developed by BiomimicrySA (https://www.biomimicrysa.co.za/our-projects) to address the health risks that faced by Langrug residents from open sewers and water pollution that flows into the Berg River, which supplies the Berg River Dam, one of Cape Town's major dams, and forms part of the Western Cape 110% Green Initiative (https://www.westerncape.gov.za/110green/projects/genius-place-project).

Image 6.3: Images of the settlement of Langrug, highlighting the waste challenges faced by the community. Images also show some of the canals dug by the community to channel water away from homes. (Source: For the Love of Water (FLOW) https://www.flow.org.za/portfolios/genius-of-space-gos2/)

The project draws on natural ways of filtering and cleaning water to address the issues of water pollution in Langrug. The project set out to understand the challenges that the community of Langrug were facing in relation to wastewater and, with the residents' input, design a new water and waste system that would improve the health and well-being of the community. The project began by understanding the relationships entangled with the Berg River and identified various pollution points that affected the water quality of the river, notably agricultural run-off from farms and formal settlements and raw wastewater from Langrug. However, the focus of this section is on the processes of engagement that took place in Langrug, where the project practitioners set up workshops with residents, local municipalities and provincial government stakeholders and conducted walkabouts to understand the residents' daily lives. From this they were able to see the residents' ingenuity in dealing with wastewater, such as building their own wastewater canals to divert polluted water away from inhabited areas. While the community understood the challenges this posed to the environment, they had little choice. Flows of waste were tracked, and income

generation and community-managed infrastructure had to be incorporated into design development. Solid waste was to be recycled/upcycled, and wastewater would be filtered through an artificial wetland, with the end product being used to water food gardens and fruit trees. The designs and business plan were approved for implementation by all stakeholders involved, and the first phase of the project has begun. Project progress has slowed recently due to financial limitations, however (see https://vimeo.com/190529912).

While the project is still in development and issues have arisen or are yet to arise, the attention to alternative approaches (beyond the eco-hydrological) for knowing and understanding water in the Genius of Space project has led to an increased appreciation of the complexity of the relations between water, society and ecosystem processes. Although drawing from different disciplines and involving various stakeholders, there is the beginning of a shared understanding that water systems and society co-evolve and emerge through continued engagement over space and time (Anderson et al., 2019). The project also highlights that river restoration requires suitable frameworks, technologies and institutions (norms, rules, laws) and widespread social and political support and alignment with the needs and aspirations of people and multispecies communities living with and in the river.

Achieving SDG six (providing safe, clean water for all and improved ecosystems by 2030) and fulfilling the Brisbane Declaration requires a reconceptualisation of socio-eco-techno-political relations between humans and rivers. Key to this is for governance structures, researchers and water management committees to recognise the river as multiple, with different ways of knowing, experiencing and enacting it, in order to inform policy on how the river is to be cared for. Governance that recognises this multiplicity will also become aware of the intimate entanglements between social and river worlds, which will create fertile ground for more context-specific and situated approaches to address the challenges associated with the river and promote the mutually beneficial well-being of the river, multi-species communities and people.

CONCLUSION

As per Anderson et al.'s (2019) observation that relating to rivers and their landscapes is experienced differently across and within the Kuils, not everyone and everything that lives

along or in the river has the same experience. Different knowledges, skills and histories of settling contribute to ways of relating to the river. However, as this chapter shows, these different ways of knowing enact different practices of care.

This chapter outlined the practices of care in the fields of science and engineering that shape how rivers are governed in the city, and also detailed the socio-eco-political challenges that may be overlooked when techno-scientific interventions are employed in river care practices. I suggested that an awareness of these socio-eco-political intimacies could help us reframe how science, engineering and governance are done, from dealing with 'matters of fact' to 'matters of concern' (Latour, 2004). Highlighting this awareness can raise possibilities of different integrated modes of caring in science and engineering, rather than the limiting normative approaches of 'adding value'.

Boundaries, fences and property rights emerged out of colonial practices concurrent with the expansion of empire to exploit natural resources and labour to feed European and North American civilisations. Colonial ideologies of property rights and the separation of humans and nature continue to impact the residents living along the Kuils River and how they relate to and experience the river. The governance of the river is shaped by these ideologies of separation and modernist ideas of progress and productionism, which in turn continue to shape how people are permitted to interact with the river.

This chapter evidenced the centrality of rethinking river relations in the City of Cape Town, calling for a regime shift from governance through management to a governance through relationships. I evidenced how reliance on particular forms of knowledge, i.e. through science and engineering, creates hierarchies that remove and alienate governance from alternative ontologies, removing them from the experiences of the people and environments they are supposed to serve. For more democratic river governance, human and multi-species' experiences, ways of relating to the river and well-being should be at the centre of policy making on how rivers are cared for in the city.

CONCLUSION: A CALL FOR RETHINKING APPROACHES TO URBAN RIVER MANAGEMENT

Urban river management in the city is dominated by scientific and engineering approaches and solutions to water quality and quantity problems which emanate from what are claimed to be "objective" standpoints. However, these so-called objective approaches are not neutral, but are a result of a social, political and cultural imagination of the Kuils River as an extension of Cape Town's sewer network, and the interventions on the river are often geared towards making it work better by just attending to the technical aspects. When the river is presented as a singular unified object that exists in a landscape out there in 'nature' the river and surrounds are presented as "just space", taking it out of its relationships to people and multispecies communities. Drawing on one perspective of what the river is and what its role in the city is imagined to be, makes invisible the complex urban ecology in which service delivery protests are many, infrastructure is failing, wetlands and biodiversity are declining, the climate is changing and new forms of chemicals are entering into the environment. What this demonstrates and what this study argues is that the river is not one single thing, it is multiple because it is constantly making, unmaking and shifting relationships through landscape alteration, and acquires different meanings depending on context, time and how it is interacted with. This study therefore calls for is a paradigm shift in the way the Kuils River is managed and governed, to make space and acknowledge the multiple and varied relationships that exist with it. What is needed is much more than perfunctory 'stakeholder engagement' to understand the multiplicity of relationships, or limiting focus to managing risk and being reactive to environmental disasters. Rather, the goal should be the development of more democratic, evidence-based, big-picture thinking, problem-solving scholarship, governance and engagements to support river relations in the context of the Anthropocene era.

Society and nature are not separate. Human beings are affecting the Earth's different spheres (e.g. atmosphere, hydrosphere, cryosphere, lithosphere) in the Anthropocene era and therefore a separation between the sciences and technological subjects from the social sciences and everyday life is no longer useful in environmental governance.

When governance of the river occurs through techno-scientific management, it is believed to be rational and free from emotions. However, as the research has demonstrated, when emotions are removed, empathy is also removed. Communities such as Sandvlei and Khayelitsha deal with the pollution of the river, then struggle to prove the harm being caused because the emotions do not fit with the science. The number of *E. Coli* in a water sample collected on occasion, at one or two locations at a particular time of day carries more weight in techno-scientific governance, than the stories of illness told by Sandvlei community members because numbers are assumed to be free from bias, which they are not. The reliance on a particular way of knowing the river (i.e. through measurement and technicalities) allows for the ability to ignore the problem and harm, histories of injustice and extractive relations to the Earth and people of colour, since it does not fit with the science. But this is dehumanising and enacts violence on those that have to live with the Kuils. It breaks down relationships between people and the government, communities and the river. Understanding the number of E. Coli in the Kuils is an important tool for environmental governance, however, this should not be used to replace the experiences conveyed by communities. What this study therefore calls for is for an environmental governance that goes beyond techno-scientific management to include relationships and experiences on the ground, to include care and well-being as the basis for how the river is managed rather than the sole focus on what Latour (2004) refers to as the 'gods of reason' in any centre-right knowledge economy, which are economic productivity, technical efficiency and scientific objectivity.

Thinking the river through its multiple relationships enables the ability to make links to the bigger picture, which is to create an environmental justice that can address injustices and the extractive relations of the past and present, environmental challenges of the Anthropocene era in the present and accountability to future generations, geologies and ecologies. It is therefore necessary to create spaces where transdisciplinary dialogue, grounded in everyday experiences of communities living with the river, can occur. People and multi-species communities need to be a part of the conversations of how their environments are managed. Operating in disciplinary silos, where we 'know more and more about less and less' is no longer viable, because the world we live in and the problems unfolding are not disciplinary: on the contrary, they traverse multiple lives, landscapes, boundaries and cultures.

As such, the study has offered a markedly qualitative perspective on urban river management in Cape Town, whilst also attempting to step out of a 'siloed' approach to doing social science research by experimenting, engaging and learning from material and methods in science and engineering. It was conducted over a period of three years during intermittent periods. Due to the scope of the research, a few limitations need to be considered. Firstly, water (including in waterbodies) and waste management in Cape Town is a highly contested and political space, not least because of the severe drought of 2016-18 and the backlog in service delivery to previously disadvantaged communities. As a result access to data held by the City was extremely difficult and communication with some City officials often resulted in polemics against academics and researchers who dissent with the reigning dogma of current centreright environmental management.

Much of the data on water bodies in the city should have been publicly available, but since the City had not shared the data, until recent academic and public outcry for access to information, one had to rely on others to provide information. At times, people would not respond to requests for the data, or the process required navigating through many bureaucratic structural hurdles. Therefore, the study was not only a drawn-out process, but the information shared in the thesis is limited by my own understanding of how river, water and waste management works in Cape Town. In addition, because research on the Kuils River has largely focused on the science (specifically focused on quality and quantity of the water in the river) and engineering of this waterscape, there is limited social science research to draw from with regards to the human and multi-species dimensions. The available social science research either focused solely on the human, particular locations or suburbs along the Kuils or provided rather superficial information in the form of commissioned reports and environmental impact assessments. Thirdly, river management structures in the city are difficult to understand, not least because the river flows through multiple municipal districts, but also because different departments are in charge of managing different aspects of the river separately. For instance, until the third year into this study, the Department of Transport was charged with managing storm water drainage into the river; the Department of Parks and Recreation was tasked with managing riverine waterscapes, and the Department of Water, Waste and Informal Settlements saw to the management of WWTW, effluent disposal and

waste disposal from informal settlements. This was further complicated by the reshuffling of the departments midway through the research, and information of the new changes in structure were not easily available. Therefore, I relied heavily on the information, where available, from departments under the previous structure to understand the different ways on knowing and being with the river. This does however present an opportunity for research which could explore whether the restructuring of the departments resulted in different forms of governing the Kuils River.

"We live at the site of exponential material meaning where embodiment meets water", writes Astrida Neimanis (2017: p1). The water crises that our planet faces and the interconnected life of its inhabitants matters, not only because of the material meaning associated with water, but because it is a matter of our survival. As an ethnographer, I take seriously the experiences of my interlocutors, and therefore take care about how this is translated and written about in my work, to the best of my ability.

The state of the Kuils River has impacted Cape Town citizens differently depending on race, class, gender and historical legacies, to name a few. Addressing the injustices experienced by residents living with the river has often required political negotiations, confrontations and protest. The responses from the City about the crises of pollution of the river have been controversial, such as the confrontation with academics raising awareness on the plight of the river and communities, the encounters with members of the Sandvlei community that were often felt as dehumanising, especially considering the long history of intentional neglect of black and coloured Capetonian's needs through colonial and apartheid rule carried into the way neoliberal governance has favoured the wealthy citizens in the supposedly democratic state. Water justice requires the recognition of water rights, as well as more democratic processes of participation in decision making concerning this natural resource and its ecosystems. Crises such as the pollution of the river are therefore not just about issues around quality and quantity, they are also about a 'crisis of governance' (Ziervogel et al., 2017). Governance approaches often linked to dominant ideas of what is considered as 'good governance', for instance, participation in liberalised markets, public participation and justice, however, conflicts can arise when attempts to address injustices come up against other objectives such as increasing efficiency and cost recovery (Enqvist & Ziervogel, 2019).

Priorities then become about keeping the system working.

However, the severe Cape Town drought of 2017/2018 shed light of the massive inequalities of water distribution as well as evidenced who carries the burden of polluted rivers in the city (discussed in introduction). As a result, the City developed a water strategy (also discussed in the introduction) that aimed to provide "a roadmap towards a future in which there will be sufficient water for all and Cape Town will be resilient to climate and other shocks. It takes into account the important and yet complex relationships between water, people, the economy and the environment" (Cape Town's Water Strategy, 2019). While the document makes a significant leap from previous strategies that were more techno-scientifically oriented by including issues of social and ecological justice, water flows in the city were still compartmentalised, for instance, with water provisioning and waste being separated. The problem of this logic was made visible by the failure of the desalination plants (commissioned to subsidise domestic water provision in the city during the drought) to cope with the levels of pollutants in the seawater in False Bay and the Atlantic Seaboard. The water flows were depicted using pipeline logics, with water pumped in one end of the pipe and pumped out into 'nowhere'. The urban water cycle was still depicted as if humans were not a part of this process.

In addition, river management in the city has overlooked the many ways of knowing and being with the Kuils River which I argue has peripheralised concerted efforts to rethinking the place and roles of rivers in the city. I believe that this occurred to the extent that key management strategies are unable to see critical issues that need to be resolved. Therefore, not only was it essential to highlight, in this thesis, how river management in the city adopted a certain kind of 'seeing' and 'knowing' of the Kuils, which is characteristic of the modernist state (Linton, 2010), it can be argued that some state actors have become 'unseeing' in respect to relationality between water systems, human and multispecies communities and issues of justice. This is due to how they view their world through linear progressivist lenses adopted from Western modernity, to which the goal is the replication and application in a context that is very different to Euro-American waterscapes. What has not been considered are the local meanings embedded in Kuils River relations, nor have the exchanges, reciprocal and

cocreative relationships people have with the landscape been considered in approaches to how to manage it.

On 6 March 2019, an op-ed piece authored by Green et al., explored the need for paradigm shifts in the way the environment is governed in the context of the Anthropocene/Capitalocene without leading to relational breakdown between those who govern and the communities they are meant to serve. The piece highlights the tenuous positioning of Kuils River as an urban sewer and that it is not being understood as part of a complex urban ecology with infrastructural failures, deep social and environmental histories and new forms of toxicity that seep far into the future of humans and other species. At the same time, urban rivers globally are facing similar threats of pollution leaving them inhabitable for freshwater ecosystems and presenting health risks to people, usually located in low-income areas populated by indigenous communities and people of colour. With the deterioration of urban rivers' water quality linked to particular dominant ideas of the role of rivers as urban waste sinks (often located in the disciplines of engineering, science and natural resource management), attending to other ways knowing and being with the river can provide more democratic approaches to river management.

This thesis therefore aimed to understand how different ways of knowing and being with the Kuils River, are shaped and in turn shape the river and how this understanding can inform different practices for river management. The current management of water (in pipes and rivers) and the development of water infrastructure are deeply rooted in the societal development agenda embedded in discourses of empire, economic growth, state formation, sustainability and technological efficiency. When river management is informed by different agendas, the practice of management then differs, and multiple meanings of water emerge. This thesis examined how the resulting equivocation, a term that describes the conflation of arguments where the environmental management and protection is seen as one thing, but how it is done and enacted in practice differs according to context, discipline and practice, produces a "river multiple".

In chapter one, I set out the context in which the study was done, where the severe drought and increased number of service delivery protests shed light on the fault-lines of water and

waste management. The challenges of the drought and protests enabled an exploration into the dominant logics and practices that shape how managing the Kuils, its associated infrastructures and landscapes is done, and what is neglected in the process. Understanding the context set the basis for drawing on conceptual and theoretical frameworks in the environmental humanities, science and technology studies and infrastructural anthropology, which I discussed in the chapter. I drew on the work of Stengers (2010) to elaborate on how "the metaphors of life" within different disciplines shape different cosmologies within water management in general and river management in particular= and how these prompted varied ways of attending to the river, thereby creating the river multiple. The separation of the disciplinary knowledge and practice privileges certain ways of knowing as legitimate whilst others are rendered to the periphery of governance and planning often resulting in what Foucault (2010) refers to as biopolitics and what Mbembe (2019) and Nixon (2011) refer to as different forms of violence.

In chapter two, I highlighted my experimental methods in researching the river multiple, which required an engagement with transdisciplinary research. I highlighted the importance of grounding the work in the experiences of river communities through engaging with ethnographic research which places emphasis on ethically sound deep immersion into the everyday life of the co-creators of this study. The age of the Anthropocene requires a reimaging of how research within disciplinary limits is done, in order to respond to concerns with care and collective problem solving.

In chapter three, I explore the Kuils River as an "infrastructure paradox" and argue that while infrastructures are technical responses to societal needs, they are also more than that. Infrastructures are designed, produced and implemented in social worlds and therefore are entangled with the economic and political worlds. The challenge is that when infrastructure is thought of as a single-faceted object, other facets are rendered invisible. The chapter is divided into three sections outlining the paradoxes of infrastructure, the cosmologies that have informed infrastructure development, and what becomes invisibilised when particular logics are prioritised in the water sector of the city. I argue that three paradoxes, which by no means are exhaustive, emerged from studying the Kuils River infrastructures.

Firstly, the paradox of upgrades suggested that whilst infrastructures symbolically hold a promise into the future of improvement, connectivity and efficiency, it does this for some whilst others experience the burdens that come with these upgrades such as the deterioration and disconnection from the environment increased "efficient" volumetric output from the WWTW. The second paradox highlights that while infrastructures are imagined as separate add-ons to the environment, the way they degenerate indicates the material intimacies with chemicals that flow into the river, weather, plants and people that cause it to breakdown over time. I argue that the breakdown is not limited to the material capacities of infrastructure, but the observation can also be extended into relationships between the state and communities that the infrastructure was made for. For instance, river communities along the middle and lower sections of the Kuils expressed their frustration in how development was being imagined and done along the water course. The investments into the upgrades were incongruent with the daily lives and aspirations of residents along the river. The third paradox paid attention to the aspect of permanence, the implied solidity and durability of infrastructure to defy time and ecological processes through the use of cement. I argue that cement is not permanent and degrades over time, and therefore the way in which governance of the Kuils River, its associated landscapes and infrastructure must be rethought to consider how the materiality changes and what effects these have in human and multispecies worlds. I argue that this requires a paradigm shift, which is explored in more detail in the second section of the chapter. The concern about the Kuils River in governance constructs infrastructures as tools to manage, control and predict the flow of water as if it exists in a vacuum, devoid of relationships to people, ecosystems and histories. What becomes invisible when dominant knowledges and practices see infrastructure as merely a tool? It ignores the real-life consequences of how people are affected, move and interact with the river. The chapter then discusses the need to create policy that recognizes the multivalent nature of infrastructure which produces the river multiple, and policy that is capable of better responses to societal needs that can restore the capacity of society to re-design generative relations with the river.

In Chapter Four, I explore the Kuils River as a techno-political archive of financialisation and metabolic rifts by analysing the way in which water and waterbodies were governed through South Africa's pre-colonial, colonial, apartheid and democratic state forms. I argue that the

different state forms produced different techno-politics which informed the way the rivers in the Cape were used and how they flowed. The chapter paid attention to the ways technical interventions in the waterways became a political problem and how the development of infrastructure enacted biopower, territoriality and the financialisation of life, an important part of conquest and imperialism in the colonial and apartheid states and within the democratic state, a mode of achieving "development" and participation in the global economy. The concepts of metabolic rifts and financialisation were essential to my argument, of the "river multiple" as each demonstrated the priorities of governance which produced a different version of the Kuils River at different times in history. The chapter explores the river as an 'archive' in relation to the city, with a reminder of how histories of settling/unsettling, environmental law, management practices, urban growth and politics are inscribed onto the landscape and create different versions of the Kuils across different time regimes. This helps foster an understanding of how these historic patterns have shaped the well-being of communities and the river and emphasises that while a justification for colonial settlement was the use of 'empty' space, the land and its people have an independent, pre-colonial history. The chapter explored water as socio-material terrain for the reproduction of racism by highlighting the necropolitics of Cape Town, and I explore the history of how practices of water management emerged, with debt servicing on infrastructure openly superseding democratic governance. I address how we can reimagine these for more democratic river futures.

Chapter five takes a closer look at the concept of time in relation to the Kuils River and provides insight into multiple conceptions of time, namely geologic, capitalist, bureaucratic, technological, chemical, societal and political time. The versions of time are by no means exhaustive, and I therefore acknowledge the partial knowledge produced on the subject. In the chapter, I consider the river as 'deep' time, focusing on deep pasts, deep presents and deep futures by interrogating our obsession with rare earth metals that geo-forms the Earth, and how rocks and chemicals that have gestated, or are gestating in the present, seep into deep futures. By examining the multiple versions of time of the Kuils River and of the river as deep time, I explore the interruption of our conceptual understanding of scale, time, space and geology to show how these are entangled with capital, technology, chemo-socialities and governance. Deep time is not just about understanding the geologic formations of millions of

years ago, but is also about paying attention to ecological processes and making a connection to society's time. The analysis is therefore a provocation of river management that solely focuses on spaces, and therefore calls for policy that conjoins thinking-the-river-in-space-andtime. The call for different way of doing policy aims to address entanglement of "geologic questions" with "hard political questions" which are necessary to decolonize current practices of relating to the Earth. The emphasis then shifts from a sole focus future oriented, progressivist narratives of the Kuils, but also focuses on vertical time which explores depth, for instance current logics that inform the bureaucratic management of the river, as well as paying attention to horizontal time that pays attention to the past, present and future to address issues of justice for Kuils River and its human and multi-species communities.

With the call for different policies in river management, chapter six focuses specifically on relating to the river beyond measurement and control by asking the question: What does it mean for urban futures to think of rivers beyond 'technoscientific futurity'? This chapter draws on feminist approaches that engage with care as a way to counter the belief that objective, engineered, and scientific interventions are the only way to respond, experience and enact the Kuils River. The goal was to stimulate an acknowledgement of these alternative ways of relating to the river and recognise the possibilities for different of being with the river. By focusing on ways in which care is practiced in the science and engineering disciplines, I highlight some of the disempowering processes that often inhibit how this can be expressed within the so-called "hard disciplines". Stengers (2018) highlights that within the hard sciences, there is a separation of people "from their capacity to envisage, to feel, think or imagine… which paralyses our capacity to resist" (p108). The chapter therefore echoes the work of Stengers and calls for the creation of spaces to enact care and "slow down" within these disciplines. I also discuss other forms of relating to the river that would fall outside of the ambit of science and engineering by exploring the notions of care among residents living along the river. Like Puig de la Bellacasa, I work to understand practices of care along the Kuils, keeping in mind the historical context that bears on the local environments, while making space for a diversity of understandings. I consider the relationships that residents believe as essential and intertwined with the well-being of the river, soils and multi-species communities. It is in this regards that I explore how perceived objective, valid authoritative ways of managing the river can draw from alternative ways of relating to the river which can

help inform policy based on “matters of fact” into “matters of care” (Puig de la Bellacasa, 2011). Attending to these matters of care and concern therefore allows us to not just see the river as a space outside of its temporal rhythms, but also to be aware of its liveliness through multiple entanglements, which in turn produce different versions of the Kuils River. When attention is paid to the multiplicity of the river, a conceptual tool is provided to resist the notion of the metabolic rift, where nature is seen as separate to humans/culture, the concern becomes about more than just one thing. It creates a platform for more democratic encounters since the concern is about the “multiple”.

These research findings indicate the urgent need for more democratic approaches to river management. Recognising the Kuils River as “multiple”, requires a paradigm shift in how rivers and their associated landscapes and communities, are governed. Engaging in that paradigm shift is necessary for policy changes that address the failures of centre-right technopolitics of environmental management, and that address rivers and landforms as part of communities’ wellbeing. This study therefore sets the foundations for further analysis into how shifting paradigms within governance can be done and therefore how these shifts can inform paradigm shifts in the knowledge economy and policy formulation in natural resource management that better respond to injustices of the past and present, and that can restore the capacity of society to re-design generative relations between Cape Town and the Kuils River in this geological moment when urban relationships with rivers are in crisis.

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Websites

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APPENDICES

Appendix A

WWTW	Date commissioned	Capacity (Ml/d)	DWS licence (Ml/d)	Plant type
Cape Flats	1960	200.0	161.0	Activated sludge
Athlone	1923	105.0	110.0	Activated sludge
Zandvliet	1989	72.0	73.6	Activated sludge
Bellville	1950	54.6	56.0	Activated sludge
Potsdam	1957	47.0	43.9	Activated sludge
Mitchells Plain	1976	45.0	35.3	Activated sludge
Green Point	1993	40.0	27.3	Sea outfall
Macassar	1978	38.0	30.7	Activated sludge
Borcheds Quarry	1973	35.0	35.3	Activated sludge
Fisantekraal	2012	24.0	58.0	Activated sludge
Kraaifontein	1971	17.5	28.0	Activated sludge
Wildevoelvlei	1976	14.0	5.8	Activated sludge
Scottsdene	1976	12.5	10.0	Activated sludge
Hout Bay	1993	9.8	5.2	Sea outfall
Wesfleur Domestic	1978	8.0	6.9	Activated sludge
Wesfleur Industrial	1978	6.0	3.2	Activated sludge
Camps Bay	1977	5.5	2.3	Sea outfall
Melkbosstrand	1977	5.4	3.6	Activated sludge
Gordon's Bay	1994	3.1	3.4	Activated sludge
Simon's Town	1970	2.5	1.8	Bio filters
Parow	1976	1.2	0.8	Activated sludge
Llandudno	1973	0.28	0.2	Rotating bio disc
Philadelphia	1996	0.086	0.08	Oxidation pond
Klipheuwel	2000	0.07	0.07	Rotating bio disc
Millers Point	1996	0.06	to be determined	Rotating bio disc
Oudekraal	1996	0.03	to be determined	Rotating bio disc
Groot Springfontein	1984	0.01	0.01	Oxidation pond

The City of Cape Town currently operates 22 WWTWs to ensure treatment to acceptable standards before being discharged into rivers and the ocean (Source: www.capetown.gov.za)

Appendix B

SABS

TEST REPORT

University of Cape Town
ATTENTION: Nikiwe Solomon
AC Jordan Building
Private Bag X3
Rondebosch 7701

Microbiology: 2816
Enquiries: Millicent Julius
Date: 2018-02-06

E-mail: nikiwe.solomon@uct.ac.za

DATE SAMPLES RECEIVED: 2018-11-27
DATE SAMPLES TESTED: 2018-11-28
METHOD OF DELIVERY: Delivered by hand
ORDER NUMBER: CASH
PRODUCT IDENTIFICATION: Water Samples: [W1670] [W1671]
Borehole
Mosque H1
CONDITION OF SAMPLES: Samples received in a suitable condition for testing
REPORT NUMBER: 2816/F-1291

TABLE OF RESULTS:

TESTS REQUESTED	TEST METHOD	SANAS ACCREDITED	RESULTS	
			W1670	W1671
E.coli per 100 ml	SANS 6221	Yes	1	No 500
Enterococci per 100 ml	SANS 7899	Yes	1	76 800

1 Dabberk Parkway, Rosebank, PO Box 615, Rondebosch, Cape Town 7701
Tel: +27 (0) 21 681 6700. Fax: +27 (0) 21 681 6701

SOUTH AFRICAN BUREAU OF STANDARDS

SUID-AFRIKAANSE BURO VIR STANDAARDE

TEST REPORT No 2818/R1291
TOETSVERSLAG NO

Page/Bladsy
2 of 2

PRODUCT IDENTIFICATION: Water Samples
Sample 4 (27/11) [W1672]
Sample 5 (27/11) [W1673]
Confluence [W1674]

TABLE OF RESULTS:

TESTS REQUESTED	TEST METHOD	SANAS ACCREDITED	RESULTS		
			W1672	W1673	W1674
E.coli per 100 ml	SANS 5221	Yes	45 500	200 000	572 000
[illegible] per 100 ml	SANS 5221	Yes	468 000	1 275 000	1 795 000

Key: Cyanobacteria= Out of our scope of accreditation

Christel Jones – Technical Signatory

Nelisiwe Dingo – Technical Signatory

This report relates only to the specific sample(s) tested. All identified herein. It does not imply SABS approval Of the quality and/or performance of the item(s) in question and the test results do not apply to any similar item that has not been tested. (Refer also to the complete back of official test report.)

Hierdie verslag het slegs betrekking op die spesifieke monster(s) wat getoets is, soos hierin geïdentifiseer. Dit impliseer nie dat die kwaliteit en/of prestasie van die betrokke artikel(s) deur die SABS goedgekeur is nie en die toetsresultate is nie van toepassing op 'n artikel wat nie getoets is nie. (Sien ook die volledige voorwaardes op die agterkant van hierdie toetsverslag.)

vinlab H2O

Your partner in quality water analysis

Distillery Road
Stellenbosch
Tel: 021-8828866/7
info@vinlab.com
www.vinlab.com
23 Jan 2020

TEST REPORT
Water

Jo Barnes
Attn: Jo Barnes
Contact No: 021 855 2145
6 Palmyrastraat
Somerset Wes
7130

@VinlabSA

Sample Details								
Sample ID			DW Limit	W7554	W7555	W7556		
Water Type								
Water Source								
Sample Temperature								
Description				Riverwater Near Zandvliet Sewage works Sample1	Riverwater Near Zandvliet Sewage works Sample2	Riverwater Near Zandvliet Sewage works Sample3		
PO Number				UWC	UWC	UWC		
Date Received				22/01/2020	22/01/2020	22/01/2020		
Condition				Good	Good	Good		
Water - Micro								
ECoil*	cfu/100 mL	VIN-05-MW07		340000	300	2300		
Date Tested				22/01/2020	22/01/2020	22/01/2020		

Adelize Fourie
Laboratory Manager (Waterlab)

Test results relate only to the items tested as received. This Document shall not be reproduced without the written approval of Vinlab (Pty) Ltd. Opinions and interpretations expressed herein are outside the scope of SANAS accreditation. DW Limit applies to Drinking Water only.

VIN 09-01 29-08-19
Doc No: V18243

Link to Vinlab H2O

Page 1 of 1

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Appendix C

EXTENDING THE RESEARCH THROUGH CONTRIBUTION TO RESEARCH ARTICLES AND OP-ED PIECES

In the course of my doctoral research, I have focused on various aspects of community mobilisation, governance, food sovereignty, entrepreneurship and power as they relate to the Kuils River and the hydro-political-social landscape. The main output of this research has been this thesis, which represents an exploration of multiple ways of relating to the Kuils River. A key learning outcome of this thesis is that research is never carried out in isolation. The development of this thesis, the ideas and fieldwork, has benefited greatly from interactions at seminars, conferences and feedback from colleagues within and outside of the academic circles. My collaboration on two research reports, two newspaper article opinion pieces (listed in the table below), two conference papers, a water symposium paper and several departmental and online seminars with colleagues across the globe have been the most significant in enabling me to build and extend the ideas and arguments of each chapter of the thesis and engaging with additional theories.

The outputs have been collaborative pieces where I contributed to the development and analysis of materials. The two research reports deepened my understanding of water relations as an economic resource and how this informs responses and imagined futures for the Kuils River. The two opinion pieces were developed in collaboration with Professor Lesley Green (also my doctoral supervisor), Professor Leslie Petrik and Dr Jo Barnes as an urgent response to a poor response from the City of Cape Town after we shared water sample results that highlighted the appalling conditions of the Kuils River water quality. This deepened my understanding of biopolitics (discussed in this introduction) and the politics of water and infrastructure (discussed in chapter one and two) in South Africa, which then informed a shift in the way I thought about issues at hand and the dominance of certain ways of knowing and the erasures that come with this. Upon reflection, each output demonstrated an evolution of ideas and self in the doctoral journey.

Table 1. Situating other outputs of the doctoral thesis and their theoretical and empirical significance

Output Title	Theoretical and Empirical significance
1. Report to the Water Research Commission (2016) Exploring the Value of Integrating Green Innovations in Business	Economic growth in relation to environmental impact and management; norms of business practice and environmental governance in South Africa
2. Report to the Water Research Commission (2017) Exploring landscape innovations to improve aquatic ecosystem services for the benefit of urban and peri-urban communities: A case of the Khayelitsha Wetlands	Grassroots entrepreneurship, ecosystem dependencies in Khayelitsha; everyday reliance on the wetlands for sustenance, political economy and environmentalism
3. Daily Maverick Op-ed (2019) Environmental management needs to be democratized	Democratizing environmental management, techno-scientific management and the dehumanization that comes with it; nature and society are not separate; scientific fundamentalism and a need for accountability; a need for a paradigm shift in water governance
4. Daily Maverick Op-ed (2019) Distortions, distractions and falsehoods in the City of Cape Town's riposte to Kuils River Effluent article	Scientific integrity; fear of failure, conformism, competitiveness as resistance to doing a different kind of science; fear that science and governance will lose confidence of the public and yet this causes great harm.
5. The Kuils River Multiple - a video created for Haus der Kulturen der Welt	A short video of images and voice over that looks at the history of the Kuils River in relation to Cape Town and exploring its futures in line with activist stories and City responses to growing chemical loads. The project looks at the deep histories and

	deep futures (through lens of Persistent Chemical Pollutants) of the Kuils River in relation to infrastructure and modernity. There is often a fallout because of 'expert' and disciplinary knowledge in thinking about the place of rivers in Cape Town, this project explores the possibility of 'big picture thinking' with the river.

The report co-authored with Dr Mao Amis of the African Centre for a Green Economy (Amis and Solomon, 2016) aimed to explore the opportunities that arise when companies create shared value by effectively understanding their relationship to water. From this, the goal was to develop interventions that benefit business, the broader society and the environment within the shared catchments. In this research, businesses are situated in relation to water scarcity and poor quality of the available water in South Africa as risks towards their operations and society at large. In the report, my co-author and I focus on the shared risk between the environment, society, the public and private sectors when water is mismanaged and suggest that alternative and innovative approaches are required to rethink how business is done as well as highlight the opportunities of green innovation. Normative practices of green innovation, improved socio-economic outcomes and ecological integrity have become standards of corporate sustainability but their realisation is problematic. I began to question this thinking in my journey towards the PhD thesis, becoming more aware of dangers of 'greenwashing' and the continued obsession with economic and neoliberal logics in how we encounter nature. The picture of society and environment is shrunk to focus on the facts of a number (GDP (Gross Domestic Product)) and technologies as the redeeming feature from apocalyptic futures but does not see the entanglements of politics and power in imagining relationships and futures.

The second report also co-authored with Dr Amis (Amis and Solomon, 2017) focused on the Khayelitsha wetlands system and the ecosystem services it provides to the surrounding communities in a context of socio-economic and spatial disparities in relation to upstream

users of the Kuils River. The research explores the characteristics of Kuils River catchment as one cannot speak about the Khayelitsha wetlands without understanding where the water that gives it life comes from. The gap this research attempted to fill was that of understanding aquatic ecosystem services associated with urban and peri-urban areas. Most research on ecosystem services have mostly focused on intact ecosystems located in pristine landscapes away from areas that are perceived to be of little biodiversity significance (Gomez-Baggethun & Barton, 2013). Yet urban areas often possess critical biodiversity and provide vital services. These also occur in a context of socio-political and economic influences which shape the way that the wetlands are used and managed. As a result of little focus being placed on understanding aquatic ecosystem services in relation to various needs in urban and periurban areas, little research has gone into investigating the nature of innovative landscape scale interventions that could be implemented to secure the critical services such ecosystems provide. Again, through the process of learning and unlearning that comes with writing a PhD thesis, I became more aware of the limits of thinking of the environment as ecosystem services. This approach is highly anthropocentric, perpetuating the idea of the environment existing **just** to serve human beings. As mentioned earlier in the chapter where I discuss 'metaphors of life', the metaphor of ecosystem services limits the environment as a bounded thing, a constant, that can be plugged into the economics of the everyday. However, the river and the communities living along it are always in flux and unpredictable, calling for more fluid ways of relating so that we can see the various entanglements that make worlds.

The third, fourth and fifth outputs took on a different approach in terms of format and the kind of politics engaged. While the first and second outputs were largely academic and towed the line which meant subscribing to the expectations and requirements of the funder, the subsequent outputs endeavoured to engage with the publics through news op-ed pieces, with the intention of effectively intervening in a contemporary environmental issue, which was the high levels of *E.coli*, *Enterococcus* and nutrients present in the river, to understand and engage with the different forces and knowledge systems at play in how the river was being managed. These outputs called for more inclusive and democratic approaches to how the river is managed. These were not always well received, particularly by the CoCT and ended up in polemic debates (as highlighted in the ethnographic insert earlier in this chapter). The articles and video set out some of the politics in urban river management and I continue and extend

this in my dissertation by looking at the process of equivocation by actors to influence how the river is shaped and in turn shapes the everyday.

Appendix D

Intention to issue a pre-directive by the Directorate of Environmental Law Enforcement (Green Scorpions) for the contravention of the National Environmental Act and the National Environmental Management: Waste Act, 2008.

REFERENCE: 14/1/1/E1/4/2/3/0514/18
ENQUIRIES: Aqueel Yasin

BY EMAIL

The Municipal Manager
City of Cape Town
P O Box 298
CAPE TOWN
8000

Email: Lungelo.Mbandazayo@capetown.gov.za
Tel: 021 400 2451
Fax: 086 201 8928

Attention: Mr Lungelo Mbandazayo

PRE-DIRECTIVE

Dear Sir

INTENTION TO ISSUE A DIRECTIVE IN TERMS OF SECTION 28(4) OF THE NATIONAL ENVIRONMENTAL MANAGEMENT ACT, 1998 IN RESPECT OF A CONTRAVENTION OF THE NATIONAL ENVIRONMENTAL MANAGEMENT ACT AND THE NATIONAL ENVIRONMENTAL MANAGEMENT: WASTE ACT, 2008

1. During an investigation into allegations of pollution and/or degradation of the environment a joint site inspection was conducted at the Zandvliet Waste Water Treatment Works ("the facility"), Macassar by Environmental Management Inspectors from the Department's Directorate: Environmental Law Enforcement and the Directorate: Pollution and Chemicals Management, in conjunction with officials from the City of Cape Town and members of SUCCO (representing the community) on 24 August and 01 November 2018, respectively, it was confirmed that the effluent discharge emanating from the facility is causing significant pollution of the Kuils River and the surrounding environment.

2. The investigation further revealed that the effluent discharge standards are non-compliant with the chemical limits for the facility and has resulted in offensive odours and high levels of E. coli counts being found in the Kuils River downstream of the facility (based on the report provided by CSIR) which poses a serious health risk to the community living in close proximity to the facility.

Aerial map: Location of alleged illegal activity.

3. Section 28(1) of the NEMA provides that every person who causes, has caused or may cause significant pollution or degradation of the environment must take reasonable measures to prevent such pollution or degradation from occurring, continuing or recurring, or, in so far as such harm to the environment is authorised by law or cannot reasonably be avoided or stopped, to minimise and rectify such pollution or degradation of the environment.

4. In addition, section 16(1) of the NEM: WA provides that a holder of waste must, within the holder's power, take all reasonable measures to
   (a) avoid the generation of waste and where such generation cannot be avoided, to minimise the toxicity and amounts of waste that are generated;
   (b) reduce, re-use, recycle and recover waste;
   (c) where waste must be disposed of, ensure that the waste is treated and disposed of in an environmentally sound manner;
   (d) manage the waste in such a manner that it does not endanger health or the environment or cause a nuisance through noise, odour or visual impacts;
   (e) prevent any employee or any person under his or her supervision from contravening this Act; and
   (f) prevent the waste from being used for any unauthorised purpose.

5. Section 67(1) (a) of the NEM: WA provides that it is an offence to contravene a provision of section 16(1) (c) – (f).

6. The NEMA makes provision for the limited prosecution of officials of an organ of state (such as national or provincial government departments, municipalities or public entities).

7. On considering the evidence before me there are reasonable grounds to believe that you are causing significant pollution and/or degradation of the

environment and have not taken reasonable measures to prevent such pollution and/or degradation from occuring.

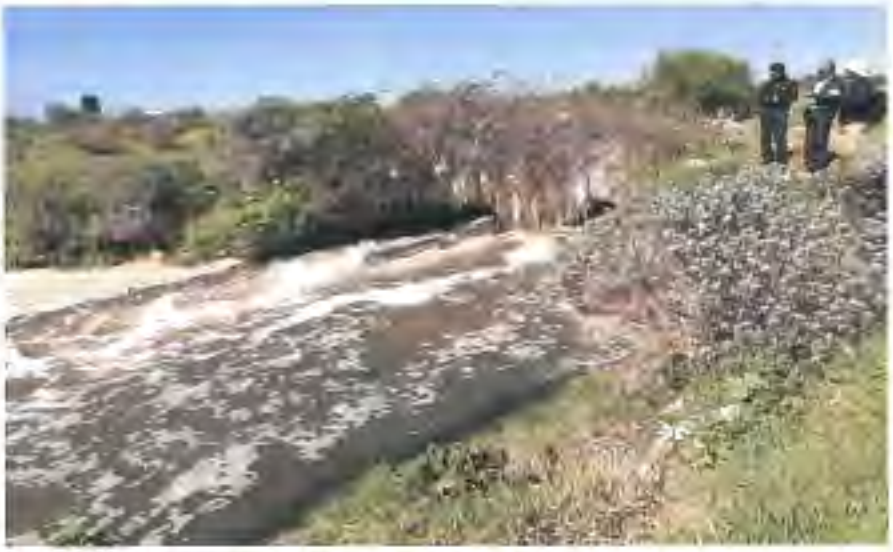

Photo 1: Effluent discharge point into a channel which joins with the Kuils River.

Photo 2: Fatty residue from the effluent settling on the surface of the water.

Photo 3: Point at which the channel joins with the Kuils River. Effluent from the channel to the right of the picture and water from the Kuils River to the left.

8 In terms of section 49A(1)(e) or (f) of the NEMA it is an offence to unlawfully and intentionally or negligently commit any act or omission which causes significant pollution or degradation of the environment or is likely to cause significant pollution or degradation of the environment.

9 As such, you are hereby given notice of the Department's intention to issue you with a Directive in terms of section 28(4) of the NEMA, which will direct you to:

9.1 Investigate, assess and evaluate the impact on the environment;

9.2 Inform and educate employees about the environmental risks of their work and the manner in which their tasks must be performed in order to avoid causing significant pollution and/or degradation of the environment;

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9.3 Cease, modify or control any act, activity or process causing the pollution or degradation;

9.4 Contain or prevent the movement of pollutants or the cause of the degradation;

9.5 Eliminate any source of the pollution or degradation;

9.6 Remedy the effects of the pollution or degradation;

9.7 Identify and implement the necessary actions to address the chemical non-compliance in the interim until the upgrade of the facility is complete;

9.8 Implement additional skimming prior to effluent discharge as well as exploring various temporary solutions (mechanical and microbial) in order to prevent fatty deposits from causing foamy patches in the Kuils River, until the upgrade of the facility is complete; and

9.9 The Risk Abatement Plan must be updated to address the current and other potential breakdowns and malfunctions that could occur at the facility.

10 In terms of section [illegible] of the NWA failure to comply with a Directive is an offence.

11 A person convicted of the above offence is liable to a fine not exceeding R1 million or to imprisonment for a period not exceeding [illegible] years, or to both such fine and such imprisonment.

12 You are afforded a period of **7 (seven) calendar days** from the date of receipt of this Pre-Directive to make written representations to the Department as to why a Directive should not be issued.

13 Should you inform the Department, in respect of paragraph 12 above that you intend to remedy the pollution and/or degradation you must immediately prevent and/or minimise the cause of the pollution and/or degradation on the

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environment and submit to the Department for approval **within 30 (thirty) calendar days** of receipt of this Pre-Directive, a Report and Action Plan with adequate timeframes outlining the requests stipulated in paragraph 9.1 – 9.9 above.

14 If the above report is approved by the Department, you will be obliged to take the necessary remedial / mitigation measures at your own cost.

15 I wish to make it clear that the instructions contained herein are made in the interest of responsible environmental management and with a view to a co-operative resolution of the issue.

16 Should you be unclear about any aspect of this Pre-directive, kindly contact the official indicated for enquires as soon as possible.

Achmad Bassier

Director: Environmental Law Enforcement

Date: 22/11/2018

Cc: (1) Mr Raheem Dawat (DEA&DP)	Email: [illegible]
(2) Mr Lingio Ndalo (CoCT)	Email: [illegible]
(3) Cllr. MGE Hendricks	Email: [illegible]
(4) Mr Ayub Mohammed (DEA&DP)	Email: [illegible]
(5) Mr Abbas Mbewan (DWS)	Email: [illegible]

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Appendix E

Response from City of Cape Town to intention to issue a Directive from the Directorate of Environmental Law Enforcement.

CITY OF CAPE TOWN
ISIXEKO SASEKAPA
STAD KAAPSTAD

[redacted]

[redacted] November 2019

The Director: Environmental Law Enforcement
Western Cape Government
Via email to [redacted]

YOUR REFERENCE 14/1/1/E1/4/2/3/03/[redacted]

Dear Sir

PRE-DIRECTIVE: INTENTION TO ISSUE A DIRECTIVE IN TERMS OF SECTION 28(4) OF THE NATIONAL ENVIRONMENTAL MANAGEMENT ACT, 1998, IN RESPECT OF A CONTRAVENTION OF THE NATIONAL ENVIRONMENTAL MANAGEMENT ACT AND THE NATIONAL ENVIRONMENTAL MANAGEMENT: WASTE ACT, 2008

Recall is hereby acknowledged of your pre-directive in this matter dated 22 November 2019.

The recipients will firstly set out relevant background information for your consideration, and will thereafter make representations as to why a final directive should not be issued. Thereafter it will set out responses to the specific questions contained in your paragraph 9, followed by final submissions.

1 **Relevant background information**

1.1 The Zandvliet Wastewater Treatment Works ("the plant") has been earmarked for an upgrade in terms of a process which commenced in 2017. Due to a few of tender appeals against the appointment of the engineering design consultants, including an appeal to the High Court, appeals against construction tenders and a land claim in respect of the land upon which the plant is situated, it has not yet been possible to commence with the construction work to increase the treatment capacity/refurbish/upgrade the plant. The intended work to be done on the plant will improve the treated water quality. The outcomes of two of the appeals meant that, in compliance with the Supply Chain Regulations, a 6 month period was required before the tender could be re-advertised.
Having resolved the tender appeals, there are, at present, three construction tenders now awarded specifically for the work to be executed on the site Zandvliet WWTP site. Another tender is in process going through the MFMA Section 33 process (i.e. for tenders longer than 3 financial years). Work on these tenders will commence shortly.

1.2 The plant currently operates within its design capacity in terms of flow rates, but is over the capacity in terms of nutrient load, and this has been exacerbated by the drought conditions, in addition the increased nutrient load is due to the growth in population in the area serviced by the plant during the course of the last approximately ten years.

The current environmental authorisation provides authority for the discharge of an average of 95 million litres per day (95 Ml/d). However the effluent which it discharges into the Kuils River is non-compliant with the Department of Water & Sanitation authorisation in terms of the quantity of nutrients discharged into the river, but not in terms of effluent volumes.

1.3 The envisaged extension will include another membrane to supplement the existing membrane plant and new inlet works with odour control, primary settling tanks and a new

[redacted]

Making progress possible. Together.

dewatering equipment for the entire plant. Furthermore, the existing aging infrastructure/equipment will be replaced and many of the 'bottlenecks' will be cleared.

1.4 The budget for the extension &upgrade is allocated and available to spend and amounts to R1.6 billion. It is envisaged that the works will be complete in 2023/24 with some sections of Plant becoming operational before then

1.5 The quality of the water in the river upstream of the effluent discharge point is further negatively impacted upon by the presence of a large informal settlement upstream which has no services (as a result of illegal land invasions in 2018) and possibly discharges its waste into the river as well as diffuse sources of pollution including septic tanks. This is evidenced by the bacteriological quality (*E.coli*) upstream and downstream of the discharge point.

1.6 In terms of the City's New Water Programme, 70 Ml/d of treated effluent of the average 90Ml/d received at the Plant will be diverted and reused in the water reclamation process for potable water at the Faure Water Treatment Plant. This will realise a reduction of approximately 78% in nutrient load discharged to the river by 2023.

1.7 The City is acutely aware of the need to minimise the impact of the effluent on the river and accordingly has undertaken and will undertake a number of measures to mitigate this impact, namely:

1.7.1 Diverting 8 Ml/d of flow, currently going to the Zandvliet WWTP, away to the Bellville WWTP (completion of diversion expected early 2019). This action was taken due to the delays experienced with the awarding of tenders for the extension/upgrading of the Zandvliet WWTP.
1.7.2 vacuuming off of the naturally-occuring foam portion of the effluent prior to discharge into the river;
1.7.3 secondary clarification in tanks via a spray system to restrict the build of foam/scum;
1.7.4 the addition of a polymer to settle out nutrients;
1.7.5 the smoothing out of the flow in the river by removing obstacles that cause turbulence, subject to agreement by the surrounding community;
1.7.6 the possible introduction of an anti-foam agent (still in the experimental stage).

Items 1.7.1 to 1.7.3 have already been implemented and the other two will be implemented shortly.

With respect to the foam/scum, it is expected in such a treatment process and can be excessive due to foam-forming constituents (such as surfactants) in the raw wastewater. Hence the action of introducing an anti-foam.

2 Submissions regarding purported NEMA Section 28(4) contravention

2.1 The discharge of the effluent from the plant into the river is authorised in terms of the plant's environmental authorisation. Thus it constitutes a lawful activity.

2.2 The effluent discharged to the river is sub-standard in terms of the Department of Water and Sanitation (DWS) authorisation for certain of the effluent constituents. However, the overall effluent compliance is 74% (July 2018 to November 2018 according to DWS Reg 991) the City is not complying completely in respect of the nutrient load, which is due to unforeseen delays in the upgrade together with the subsequent legal processes that followed, and the uncontrolled housing in the catchment – factors outside of the City's control.

2.3 Section 28 of NEMA, which is headed "Duty of care and remediation of environmental damage" imposes the following obligation upon the City:

Every person who causes, has caused or may cause significant pollution or degradation of the environment must take reasonable measures to prevent such pollution or degradation from occurring, continuing or recurring, or, in so far as such harm to the environment is

authorised by law or cannot reasonably be avoided or stopped, to minimise and rectify such pollution or degradation of the environment.

2.4 Although the activity of discharging wastewater treated effluent from a treatment plant into a river, as authorised by the City's environmental authorisation, is by its nature a 'polluting' activity, the City has done as is required in terms of the section quoted above, i.e. it has taken reasonable measures to prevent the pollution from occurring, continuing or recurring, as explained above, and to minimise and rectify the pollution.

Importantly, the Zandvliet WWTP does not discharge untreated (raw) sewage to the river and has taken accordingly taken all reasonable measures to prevent pollution from this source. To further put the City's activity into perspective, it must be noted that the alternative of discharging untreated sewerage into the environment, has environmental consequences far worse (by many orders of magnitude) than those occurring in the context at hand.

3 Submissions regarding purported transgression of the National Environmental Management: Waste Act

The City submits that the treatment of liquid portion of wastewater is not regulated by the NEM: Waste Act. This is evidenced by the fact that waste water management activities are listed in NEMA itself and not in the NEM: Waste Act. Accordingly, this part of the pre-directive is invalid.

However, it is to be noted that general standards of the National Water Act allow the discharge of 25 milligrams per litres of total suspended solids to the river.

4 Responses to directions set out in paragraph 9 of pre-directive

4.1 *Investigate, assess and evaluate the impact on the environment.*

The City is currently undertaking weekly sampling of the river water in the vicinity of the point of discharge, and undertaking tests via its Scientific Services Department, an accredited laboratory. Its results are being shared with the National Department of Water & Sanitation, and with the CSIR who performed the test referred to in the pre – directive. (It should be noted that arising out of a meeting with the researcher from the CSIR, it was established that the sample was given to her by the community and that it did not verify where the sample came from).

Tests done by our Scientific Services branch did not support all the findings of the CSIR. Agreement was however reached with regard to the nutrient levels.

However, it was agreed at the meeting mentioned above that Scientific Services and CSIR researcher would collaborate and the samples would be shared between the two labs. This is being done to ensure that the science is correct and would guide the City is its corrective actions.

4.2 *Inform and educate employees about the environmental risks of their work and the manner in which their tasks must be performed in order to avoid causing significant pollution and/or degradation of the environment.*

The plant operates according to ISO standards, which are taught to all employees and are enforced on an ongoing basis. In addition, the City seeks to educate the surrounding communities regarding the quality of the water, by way of signage, and community outreach initiatives involving mobile clinics and schools.

4.3 *Cease, modify or control any act, activity or process causing the pollution or degradation.*

The activity purportedly causing pollution and degradation is the discharge of treated effluent into the river. This cannot be ceased as the Zandvliet WWTP treats wastewater received from approximately an equivalent of 900 000 persons on a daily basis. The impacts thereof can be mitigated, as explained above.

4.4 Contain or prevent the movement of pollutants or the cause of the degradation.

As the discharge of treated effluent into the river is a fluid process, it cannot be contained. However, the impacts of pollutants forming part of the effluent can be mitigated, as explained above.

4.5 Eliminate any source of the pollution or degradation.

The discharge of treated effluent into the river cannot be eliminated. It is lawfully authorised and is the best environmental option available for treating sewerage in the area.

4.6 Remedy the effects of the pollution or degradation.

The pre-directive does not specify what the alleged effects of the pollutants are. However the City is undertaking all mitigation measures at its disposal, as outlined above.

4.7 Identify and implement the necessary actions to address the chemical non-compliance in the interim until the upgrade of the facility is complete.

The City cannot change the nutrient load nor the characteristics (with constituents such as surfactants) of the wastewater received by the plant. However, it is currently implementing all possible actions to address the impacts thereof.

4.8 Implement additional skimming prior to effluent discharge as well as exploring various temporary solutions (mechanical and microbial) in order to prevent fatty deposits from causing foamy patches in the Kuils River, until the upgrade of the facility is complete.

The City is currently undertaking activities as set out above, including the experimental use of an anti-foaming agent.

4.9 The Risk Abatement Plan must be updated to address the current and other potential breakdowns and malfunctions that occur at the facility.

The Risk Abatement Plan is updated on a continual basis.

5 Concluding submissions

The City submits that:

1 It would not be fair and reasonable, or administratively just, to issue a final directive, as the City is already doing whatever it can to manage and control the discharge of the treated effluent so as to minimise environmental impacts.

2 It is not necessary to issue a final directive, for the same reason.

3 The provisions of the NEM: Waste Act are not of application.

Dr G Kaiser
Executive Director: Informal Settlements, Water & Waste
(on behalf of Municipal Manager)