

**Ebbs and flows:**  
**More-than-human encounters with the Cape Flats Aquifer in a  
context of climate change**

Deanna Polic

Student number: PLCDEA001

A *minor* dissertation submitted in *partial* fulfillment of the requirements for the award of the degree of Master of Philosophy in Environmental Humanities

Faculty of the Humanities

University of Cape Town

18 June 2021 (Corrections: 21 October 2021)

**COMPULSORY DECLARATION**

This work has not been previously submitted in whole, or in part, for the award of any degree. It is my own work. Each significant contribution to, and quotation in, this dissertation from the work, or works, of other people has been attributed, and has been cited and referenced.

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## **Acknowledgements**

This is a dedication to all the bodies of people, land, and water who made my enquiry possible. Firstly, to my family, friends, and love, whose adoration and patience were my pillars of strength and guidance throughout the trials and tribulations of dissertation writing, you know who you are, on earth and beyond. Secondly, to my supervisor, Nikiwe Solomon and co-supervisor, Lesley Green, including the entire Environmental Humanities South department at the University of Cape Town, whose sharp intellect and caring mentorship enabled me to discover my niche as a researcher of water's complexity; and whose challenging reasoning and cosmologies allowed me to situate my conceptual frameworks in an actual and immediate context of climate change crisis. I would like to give a special thank you to Vivienne Toloni, whose door was always open for any administrative request, no matter how big or small. Thirdly, to the Philippi Horticultural Area Food & Farming Campaign, whose unwavering resilience and dedication to protecting the fragile land and water bodies in the city inspired my study from the beginning. Fourthly, to Judge Kate Savage of the Western Cape High Court (whose ruling arrived just in time for the final edit of this dissertation) for acknowledging the value of groundwater and farmlands in achieving inclusive justice. Above all, I would like to thank the Andrew Mellon Foundation for funding my research. Finally, to the ebbs and flows of water itself as the shared lifeblood to which I owe my bodily existence.

## **Abstract**

### **“Ebbs and flows: More-than-human encounters with the Cape Flats Aquifer in a context of climate change”**

This dissertation advocates inclusive and integrated more-than-human relations as humans, technoscience, and nature become increasingly entangled in contexts of climate change and socio-ecological crisis. Researching in the environmental humanities between 2017 and 2020, I situate my study in Cape Town, South Africa, where the fluctuations between water’s abundance and absence—as evidenced by the 2018 drought—have necessitated new approaches to ontology and epistemology that critically disrupt dominant systems of thought. Using the Cape Flats Aquifer and its aboveground area, the Philippi Horticultural Area, as my primary field sites, I focused on the legal battle that has surfaced between various human actors over land and water use, to explore how different human-nature relationships emerge, and to evaluate the social and environmental implications thereof. The overall inquiry guiding my research is how the Cape Flats Aquifer can make the case for multispecies relations by examining how it flows, or is brought into, existence. First, I present the different kinds of evidence that make the aquifer and its aboveground area un/seen; second, I assess whether alternative ways of evidencing the aquifer exist with a focus on farming practices in the Philippi Horticultural Area; third, I question what ought to be part of the aquifer evidentiary if sustainable, adaptive, and resilient human-nature relations are to be achieved? I argue that humans, multispecies, and earthly bodies such as the aquifer ought to be understood as relational, multiple, and intimately implicated in each other in the face of unpredictable climatic conditions.

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## Chapter one: A watershed moment

### Introduction

#### Box 1

Standing in the fertile heart of the Cape Flats, the scene was full of contradictions. Under me an unseen aquifer feeding the wetlands, full of birds beside cesspools of contamination. Freshwater overflowing in the middle of a drought, becoming grey then black water. Huge holes left by the extraction of sand dunes, remnants of an ancient landscape that built the contemporary city. Farms in different sizes and shades of green juxtaposed against informal settlements and abandoned plots-turned-dumpsites littered with plastic, metal scraps and tyres. Patches of indigenous fynbos struggling against invasive Port Jacksons. The watershed was a place of possibility and pollution, potential and pathogens, its ebbs and flows far from passive as they permeated every part of the landscape.

*Field notes, 3 October 2016, first visit to field site*

This dissertation uses the case study of the Cape Flats Aquifer during and after the 2018 drought in Cape Town to foster more-than-human relations in contexts of climate change.

Underlying my study is a critical analysis of how knowledge is produced and functions in the face of overlapping socio-ecological crises. Researching in the environmental humanities between 2017 and 2020, I use ethnographic methods to bring the aquifer into existence, physically and politically, through its un/seen entanglements with non/human places, bodies, and forces (Kohn 2013; Rose & Robin 2004; Rose et al. 2012; Whatmore 2002; 2015). First, I explore what knowledge counts, or is discounted, investigating the conflict in the aquifer's aboveground area between authorities and citizens over how land and water should be treated in times of scarcity. Second, I examine alternative human-nature relations that already exist and are emerging in the urban space that move towards adaptive, resilient, and liveable futures. Furthermore, I question what ought to be part of the aquifer body of knowledge to achieve socio-economic and ecological justice. I propose a radically different relationship in which water, weather, rocks, sand, soil, flora, fauna, and people are multiple, responsive, and sensitive to changes in their surroundings while intimately implicated in one another at a time of climatic unpredictability.

Before I begin, some hydrological and historical background is in order. This introductory chapter sets the stage, situates the reader within the context shaping my enquiry, and outlines the central problems I address. It provides an overview of the research methodology and chapter outline, concluding with the ethical commitments underlying my study.

## Contextualising the crisis

### Box 2

“Times of abundance should be regarded as the anomaly in the system, not times of scarcity. We need to embrace the fact that water scarcity is the New Normal and all our future planning must accept that we are living in a drought-stricken area. We all need to change our approach to scarcity. It does not mean that our lives should be diminished, or the economy negatively affected.

The New Normal is an opportunity for us to significantly change our approach to water. It is about building resilience, which is the capacity of individuals, communities, institutions, businesses, and systems to survive, adapt and grow no matter what kind of stresses and acute shocks they experience. [...]”

*Statement by the City’s Executive Mayor, 2 June 2017*

I situate my enquiry in the City of Cape Town (“CoCT”), whose once-abundance, and now-absence, of freshwater, sets the stage. Known to the Indigenous Khoekhoen as *Camissa*<sup>1</sup>, the “Place of Sweet Waters” (Anderson & O’Farrell 2012; Mellet 2013; von Zeil 2011), and to colonial settlers as “the Refreshment Station” (Kotzé 2010; 2011), these names alluded to the presence of perennial freshwater as a naturally unique and historically significant feature in the Cape. The city was built above—and because of—its waterscape, formed by springs, streams, deep and shallow aquifers, rivers, lakes, streams, *vleis*, estuaries, deltas, swamps, and wetlands (Sorensen 2014; 2017; Turton 2016). Cape Town has a typical Mediterranean climate with warm, dry summers and cool, wet winters during which precipitation is plentiful. The city receives ninety-nine percent of its drinking water from the rain-fed dams situated in the mountainous catchments in the region, that divert water through the complex network of drains, pipelines, and tunnels of the Western Cape Water Supply System (WCWSS).<sup>2</sup> Nevertheless, the region has been characterised as semi-arid, prone to effects of climate change, such as rising sea levels, biodiversity loss, and extreme variability between drought and flood (Ziervogel, Shale & Du 2010; Ziervogel, New & Liu 2019).

In 2015, the city began enduring a severe hydrological drought, defined by meteorologists as an extended dry-spell and lack of rainfall caused by rising global temperatures. The drought, described by (former) Premier of the Western Cape, Helen Zille, as “the worst in a hundred

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<sup>1</sup> A Khoekhoen expression, where -issa denotes the people of a place and //Amma (pron. “khamma”) translates into sources of water, e.g., springs or rivers, alluding to the freshwater streams flowing down Table Mountain.

<sup>2</sup> The WCWSS consists of six major and eight minor dams jointly owned and operated by the CoCT municipality and the National Department of Water and Sanitation.

years” (2017) was unprecedented in its magnitude and extent, exceeding decision-makers’ expectations and predictions (Conradie 2018; Wolski 2018a; 2018b). The absence of freshwater was made visible in the diminishing dams and dwindling rivers that supply the steadily growing urban population, resulting in a water-shortage crisis at the centre of political concern. In 2016, water restrictions since the previous drought (2004-5) were increased from Level 1 to 2, and by year-end the situation had deteriorated, pressuring authorities to impose Level 3 restrictions to reduce demand on the WCWSS (CoCT 2016). As 2017 entered its hottest months, the drought was declared a municipal (de Lille 2017a) and provincial (Zille 2017) disaster under Section 55 of the Disaster Management Act, No. 57 of 2000 (Republic of South Africa (RSA) 2003). It was at this stage that my research began. Approaching another dry winter in mid-2017, the height of drought was broadcast with the lowest rainfall on record (Wolski 2017), while Level 4 confined daily water use to 100 litres per person. Three-quarters into 2017, with a scorching summer ahead and no rain in sight, Level 5 limited daily consumption to 87 litres per person with a target to curb citywide use to 500 million litres of water per day. At the start of 2018, with dam levels alarmingly low and Level 6 limiting 50 litres per person per day, the drought was elevated to a national disaster (Ramaphosa 2018). This was followed by an apocalyptic announcement by (former) Mayor of Cape Town, Patricia de Lille (2017b; 2017c), who estimated five months of available water storage remaining before the urban water system failed and triggered an extreme scenario that would render the city uninhabitable.

Most notable was the impending “Day Zero”: the once-hypothetical, now-realistic “day the taps run dry”, culminating in early 2018 as Cape Town became one of the first modern international cities to potentially run out of potable water (Gosling 2017; Kretzmann 2017; Winter 2017). This created an atmosphere of anxiety as nearly five million Capetonians anticipated to collect a daily water ration of 25 litres per person at military-armed and police-protected “points of distribution”. A parched future in the face of climatic unpredictability had become the lived experience for all inhabitants (human and nonhuman) forced to accept, and adapt to, a denial of life’s essential source, albeit unequally, in a rapidly drying waterscape. This was further expressed in the official narrative of the “New Normal”<sup>3</sup> asking (human) Capetonian citizens to collectively “change their relationships” to (nonhuman) water in adjustment to a scenario where “water-scarcity is here to stay” (de Lille 2017c; 2017d).

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<sup>3</sup> The “new normal” describes society after a crisis unable to return to its former state, i.e., the moment Cape Town was marked as permanently water scarce. Yet for many people in the city, conditions of scarcity were not new at all, but rather defined their “normal” daily lived experiences.

I identify the drought as a “watershed moment,” in other words, a pivotal turning point to which this thesis responds. Derived from German *wasserscheide* (translating into “water divide” or a “parting of the waters”) the term “watershed” defines the geological boundary between one drainage basin and other, or a large freshwater body into which smaller streams and rivers collect, eventually seeping into the ocean. Hence, originates the phrase “watershed moments,” meaning events, or periods in time, during which unexpected or unusual events occur, profoundly and often permanently altering reality such that “history seems to flow in a new direction” (Trombley 2018: 108). Anthropologist Jeremy Trombley interprets the watershed both literally and figuratively, as a simultaneous temporal shift and spatial rift, that marks both a beginning and an end. Watersheds can be “*material artefacts, features, or sites that are indicative of a temporal regime—a watershed moment or period—as well as a particular configuration of relationships that shapes the landscape*” (Ibid.: 112). As environmentalist Christine Colvin states, “one of our most important watershed moments has to be to pay attention to the watershed itself” (2017), to which I now turn.

### **A case study of the Cape Flats Aquifer**

#### **Box 3**

Farmer 1: “The aquifer is replenished by its catchment area. Rainwater soaks into the soil and regenerates the groundwater. But it is now mostly covered with roofs, roads, pipes and drains. And in a drought, there is no rain to fill up the aquifer.”

*Conversation with “Farmer 1”, 16 February 2017, Philippi Horticultural Area*

The watershed in focus is the Cape Flats Aquifer, an extensive, shallow body of groundwater underlying greater Cape Town. Located to the north- and south-east of the city centre, the aquifer is massive, spanning an area of approximately 630 square-kilometres beneath the low-lying plains of the seasonal Cape Flats wetlands. Located within a major catchment area of South Africa, this watershed is the primary drainage basin of the Western Cape and forms part of the largest aquifer system in the southern hemisphere (Adelana 2009; Adelana & Xu 2008; Hartnady 2018). The aquifer is of paramount importance, holding substantial amounts of freshwater that at times exceeds 600 million cubic litres (Blake et al. 2010; CoCT 2018b; de Lille 2018). Groundwater quality in the Cape Flats Aquifer has (until recently) been accepted as “good” (Adelana, Xu & Vrbka 2010; 2014), with vast potential that, according to hydrogeologists, ought to be harnessed as an alternative water source to meet the city’s double-edged problem of mounting demand amid plummeting supply (Xu 2016).

An aquifer needs an aboveground area to replenish. Yet, the recharge area of Cape Flats Aquifer has undergone significant transformation since the city's establishment and expansion over three centuries, exponentially so since the spatial planning policies of the 1950s (Adelana 2014; Aza-Gnandji et al. 2013). The waterscape was transformed into "apartheid's dumping ground" in a single generation (Katzschner 2013: 205), to where humans not politically included as "white" were forcibly relocated. Today, more than half of the city's population resides in the Cape Flats, where the impoverishing effects of racial economic segregation persist. Presently feeding the aquifer are a few isolated sand dunes, sparse patches of endangered endemic vegetation, several highly polluted rivers (e.g., Diep, Eerste and Kuils Rivers), open-water bodies (e.g., Zeekoevlei and Zandvlei), and farmlands in the Philippi Horticultural Area (PHA) (Gerber 1981; Giljam 2002; Gobin 2018; Govender 2004). The once sand-covered wetlands have become increasingly imperilled, susceptible to pollution from several anthropogenic land-use practices, including urbanisation, mining, and agriculture, that pose a threat to groundwater quality and quantity (Mehlomakulu 2000; Seward, Mbunquka & Holveka 2009; Wright & Conrad 1995). In response, increasing demand has emerged to protect and preserve the aquifer in contexts of climate change. Thus, the first formulation of my research problem was to examine *how* the aquifer is rendered visible, politically, and physically, and *what* is at stake in these renderings (Spiegel 2013: 84).

## Research problem

### Box 4

Engineer 1: "Because groundwater is invisible, engineers and authorities often have the rigidity in thinking that "oh, it's so difficult to manage" because they are not monitoring it long enough or very often."

*Conversation with "Engineer 1", 10 February 2018, PHA Food & Farming Campaign centre*

One way to conceptualise the problem is through philosopher Bruno Latour's *an Inquiry into Modes of Existence* (2013), that questions how different "things"—e.g., "aquifers," "bodies," and "evidence" in my case—come into existence through different knowledge making practices, each with various considerations of what is important. These involve not only ways of knowing, but also ways of being and living, customs of habit and habitat, and manners through which (individual and collective) human beings compose, and are composed by, the nonhuman world around them (Latour 2014a; 2014b). In other words, how different actors in the waterscape think and theorise about water metaphorically, translates into how water bodies

are treated, and acted upon, materially (Neimanis 2014; Tiitsman 2011). To illustrate, I briefly narrate the Hindu parable of the Blind Men and an Elephant, a story of several blind men who, having come across an elephant for the first time, attempt to bring the unable-to-be-seen creature into existence, each by feeling only one part (e.g., tusk, trunk, tail, etc.). Upon describing their limited subjective experiences to each other, they discover that their descriptions differ greatly. A discussion with two possible outcomes ensues: either disintegrating into disagreement over whose interpretation is true; or developing into a democratic debate in which each interpretation is recognised as partly true (Goldstein 2010: 492; Nyamnjoh 2012). Applying this to my case study I ask, who are all the “blind men,” i.e., actors in the waterscape, and what are their various renderings of “the elephant,” i.e., the Cape Flats Aquifer?

Anthropologist Andrea Ballestero identifies two conflicting metaphors through which aquifers are imagined within the scientific paradigm. The first imagines an aquifer in anthropocentric terms as an “infrastructural formation whose social life is determined by a single function: supplying water for human use” (2016a), valued instrumentally as an economic resource. Aquifers exist as passive reservoirs waiting to be activated by human technoscience, e.g., drilling, simplified to a mathematical equation, i.e., the rate of abstraction (Ballestero 2019). Geographer Jamie Linton argues that modernity’s greatest hydrological accomplishment has been to construct the idea of water “as an abstraction”, removed from the social, ethical, and political contexts in which it flows (2010: 8). Political theorist Achille Mbembe explains that such assumptions arise from “epistemic traditions that claim detachment of the known from the knower”, premised on the division of reason/nature, or subject/object, “as an ontological a priori” (2016: 32). The knower (the human subject) is situated independent of and is (supposedly) able to produce objective knowledge about the known (nonhuman objects). Latour argues that such “matters of fact” (Latour 2004: 227), devoid of affective or moral values, tend to remove the responsibility of the researcher to that being researched at the root of contemporary crises. The problem, argues Mbembe, is that this kind of knowledge production has become hegemonic, not only “[generating] discursive scientific practices and [setting] up interpretative frames” that are difficult to think outside of, but also “actively [repressing] anything that is [...] articulated, thought and envisioned from outside of these frames” (2016: 33).

The executive response to mitigate and manage the drought remained top-down and technobureaucratic, depending on large-scale, expensive, and often-exclusionary engineering

“solutions,” such as seawater desalination plants and groundwater abstraction schemes (CoCT 2018a; 2018e; 2019a) to secure water to existing, although inequitable, distribution channels. The Cape Flats Aquifer was politically targeted for its freshwater quantity, with authorities expecting to extract up to 80 million litres of groundwater per day to augment the city’s depleting reserves (CoCT 2019b). Despite promising a “cautious approach” to groundwater abstraction that is “both environmentally and ecologically sensitive” (de Lille 2017e), recent actions in the watershed have brought this into question. The Cape Flats Aquifer is extensively used for irrigation—evidenced by over 22,000 boreholes registered in the city’s database—but to date, no water has been used for municipal water supply. In January 2018, the CoCT and UMVOTO Africa (Pty) Ltd conducted tests to determine freshwater quality in the Cape Flats. Yet, in its 2018 Water Outlook Report, the city stated that “in general, groundwater [in the Cape Flats] is not suitable for immediate human consumption and must be treated to potable standards before it enters the reticulation system” (CoCT 2018b: 7). The report, however, excluded important information, such as “the level of pollution in the aquifer” and “the sources of pollution” (Kretzmann 2019). Then, as quickly as it appeared so the threat of drought dissipated. No longer instrumental for human use, the contaminated Cape Flats Aquifer swiftly lost its political significance, returning unseen, underground, to wait for the next drought to bring it to the surface.

The second metaphor through which aquifers can be imagined resembles that of a sponge, as absorbent, and fibrous, shifting, seeping out of, and saturating the ground (Ballestero 2016b). This image contradicts the first, understanding aquifers through their form rather than function, unable to ever fully be understood by the scientific apparatus due to “constantly changing” their multitudinous dimensions (Ibid.; Neimanis 2017a). This requires types of knowledge that can envisage the “subtle and sometimes dramatic spongy movement [that makes] hydrogeologists’ efforts to determine an aquifer’s precise boundaries incomplete” (Ballestero 2016b). Visualising aquifers in this way depends on a dialectical double move, requesting the researcher (and reader) to experiment with simultaneously “pulling the imagination downward and pulling the hydro-lithic structures upward” (Ballestero 2019). This speaks to the difficulty faced in determining the exact parameters and perimeters of an aquifer, which causes “a huge gap in [...] knowledge about what is a sustainable rate of extraction [or] how one aquifer might bleed into another” (Ballestero 2016a), and what non/human, in/organic or un/seen matter might be absorbed into the aquifer.

## Field site

### Box 5

Dr Yongxin Xu: “We are here because we care about the Cape Flats Aquifer. From a bird’s eye view, you will see this entire area [points to map] is the aquifer, that is distributed right from this south-eastern corner all the way up the north-west. The aquifer is huge, and its water is in endless circulation. But there is more pollution entering into this cycle, that, once it is in, is nearly impossible to get out.”

Dr Thokozani Kanyerere: “This is the largest sand aquifer in the Western Cape and is easily accessible to residents in the Cape Flats. This is important in the context of global warming, like Cape Town is experiencing right now with Level 3 water restrictions, as people are depending on groundwater even more. We have to take care of it.”

*Field notes: 18 February 2017, PHA Food & Farming Campaign centre*

Latour’s redefinition of seemingly objective “matters of fact” into subjective “matters of concern” becomes convenient in reinstating the responsibility of the researcher to that being researched. Concerns are value-laden “gatherings” of actors, actions, agencies, agendas, and arenas (2004: 231-33) which come into existence because they are relevant within the geological, historical, and political contexts in which they are produced. This section opens with excerpts I recorded at one in a series of seminars held at the PHA Food & Farming Campaign (PHA FFC) centre in Schaapkraal, Philippi. Amongst the speakers were two professors from the University of the Western Cape (UWC): Dr Yongxin Xu, who has a PhD in hydrogeology, holds the UNESCO chair in Geohydrology, and has published over 50 papers on groundwater recharge and pollution; and Dr Thokozani Kanyerere, an environmental hydrogeologist with more than 18 years of experience researching groundwater-surface interactions, both of whom have been informing authorities on the potentials of and risks to the Cape Flats Aquifer. I argue that scientists, such as Dr Xu and Dr Kanyerere, frame their facts as concerns, actively engaging with the public (as witnessed on numerous occasions during my research), while politicising their calls for groundwater protection and preservation of recharge zones.

Here, they positioned their discussions in the PHA, a large tract of “unique agricultural land” (Western Cape Government (WCG) 2017), carrying rural status, situated amid the highly urbanised Cape Flats. It is both a source of contamination and critical replenishment site for the aquifer (Adelana & Xu 2006; Aza-Gnandji et al. 2013; Battersby-Lennard & Haysom 2012; Battersby-Lennard et al. 2012) and is thus significant in my study. It was here where the Cape Flats Aquifer was initially brought to my attention, during a field trip with the University of

Cape Town's (UCT) Environmental Humanities South department in October 2016. This was my first visit to what would become the primary field site for my ethnographies (see below). We attended a meeting titled "Defending our Commons" held at the PHA FFC Centre in Schaapkraal, Philippi, where campaign convenor and small-scale farmer, Nazeer Ahmed Sunday, and campaign volunteer, Susanna Coleman, spoke of a constant struggle to protect the aquifer and the agricultural area above it.

**Box 6**

Susanna: "We are in a fight against turning our agricultural area into industrial and urban development. We are also fighting against cementing over our freshwater. The PHA is one of the last remaining catchment areas for a huge underground water source, the Cape Flats Aquifer, on top of which two million people live. This water is what enables the farmers in the PHA to provide fresh fruit and vegetables to the city all year round. But the aquifer and the farmlands are under threat. We must protect these as important sources of water and food in the context of climate change."

*Field notes: 3 October 2016, first visit to field site*

**Box 7**

Nazeer: "We don't just want to protect the area as it is. We are already putting an alternative model into practice that can fix the water, hunger, housing, unemployment, poverty, and climate crises the city is facing. We also have the potential to make the whole city drought-proof and become a model for climate change resilience."

*Conversation with Nazeer, 16 February 2018, PHA FFC centre*

Additionally, they pointed to the legal battle between the public, politicians, and private entities over how land and water should be used ongoing in the PHA for over a decade. Involved were provincial authorities, municipal decision-makers, and property developers on one side, pushing for economic development at the expense of fragile ecologies and communities; and citizens, small-scale farmers, scientists, activists, and civic organisations (e.g., the PHA Food & Farming Campaign, the Water Crisis Coalition, and Reclaim Camissa) on the other, calling for social and environmental issues to be attended to first. In dispute are several controversial spatial-planning decisions, approved by the CoCT and the Province of the Western Cape, that would allow a sizeable portion of the PHA to be converted from agricultural to industrial and commercial purposes, effectively eliminating farmlands and reducing the aquifer's natural replenishment area. It was in response to this that the PHA FFC, originally known as the Schaapkraal Civic Environmental Association (SCEA), was founded by Nazeer in 2008. Nazeer grew up on his grandfather's rented farm in the PHA in the 1960s, but in the 1970s, his family,

classified as “Coloured” under apartheid, was forced to relocate to Grassy Park. Originally a baker by profession, he returned to the PHA in 1991, where despite land still reserved for “white” farmers, managed to obtain a one-hectare plot to practice small-scale farming. “By 2015, I was the last man standing pushing for activism in the PHA,” Nazeer explained, “but then I met Susanna who had a completely new approach to force the city to listen to us through appeals and litigation”. I was surprised to discover that Susanna (a white female from the southern suburbs), with her eloquent articulation of the law, was not an advocate but an optometrist. They represented the voices of those humans, many who live directly above the aquifer and experience its ebbs and flows daily, concerned about the city’s failure to resolve compounding social, economic, and ecological crises prevalent in the Cape Flats. The information pamphlet handed to me during my first site visit states that:

**Box 8**

“[the] PHA campaign was born out of the need to protect the PHA and to promote food and water security, and agroecological farming. All energies are directed towards opposing the development proposals and creating awareness about the PHA’s value for the consumers in the city. For over a decade, the PHA Campaign has fought to protect the PHA from being paved over and eliminated by urban creep. Despite participating in all municipal processes, and making submissions after submission, we have been left with no option but to go to court.”

*PHA FFC pamphlet*

Two parallel court cases punctuate my study: the municipal court case in progress when my research commenced in 2017, and the constitutional court case of 2019-20, that, in anticipation of the outcome, entailed longer fieldwork than expected (PHA FFC v MEC 2020). “Most importantly,” says Nazeer, “the PHA Food & Farming Campaign has been active in educating citizens about where their food and water comes from” by cultivating a farming model that considers the intersection between people, plants, land, water, and climate. I also witnessed alternative perspectives, that acknowledge the aquifer as more than a mere economic resource, but as an invaluable source of life, irremovable from its physical and political setting, that must be valued *intrinsically*. Due to its size and the scope of my study, I was unable to take the entire watershed as my field site, which could be interpreted as a limitation for excluding/overlooking other potential human-land-water relations in this research. I therefore explicitly acknowledge, and apologise for, the inevitably “partial truth” (Clifford 1986) offered by my account that can be enriched by supplementary research.

## Methodology:

The main question framing my enquiry is, how does the Cape Flats Aquifer come in and out of sight and/or visibility, both materially and metaphorically, as drought waxes and wanes in Cape Town. My exploration is three-fold:

- a) Which kinds of evidence do decision-makers, scientists, citizens, activists, and farmers use to bring the aquifer into existence?
- b) Are there alternative ways of evidencing the aquifer?
- c) What ought to be part of the aquifer evidentiary to foster more-than-human relations in contexts of climate change?

My research is rooted in the environmental humanities, a field of transdisciplinary enquiry that disrupts the authority of—and subject-object divide assumed by—dominant Eurocentric systems of thought (Merchant 1980) by bridging gaps between the natural sciences, humanities, and non-academic knowledge. The inability of quantitative science alone to solve compounding environmental crises has necessitated innovative approaches to ontology and epistemology that focus on *connectivity* and *complexity*, rather than separation and simplification, to critically reposition the human in the more-than-human world (Rose & Robin 2004). I propose a qualitative methodological approach to interpret the different, and often-diverging narratives, perceptions, and imaginaries of the watershed, and to evaluate implications thereof. Because unseen, aquifers should be studied *dynamically*, in relation to the landscape in which they are located (Margat & van der Gun 2013). Trombley describes the watershed as a place of *confluence* (2019), where the non/human, a/biotic and in/visible converge and bifurcate in hidden and concealed ways. I use ethnographic methods to discern the spatial, material, and temporal dimensions of such confluences, providing a “thick description” (Geertz 1973) of the aquifer as both a site (place) and participant (body).

I began with three months of intensive fieldwork in 2017 (February-May), using participatory observation and active participation in the events preceding, and leading up to, the abovementioned court cases in the PHA. The PHA FFC centre was the primary field site upon which my fieldwork was conducted, where I engaged in direct dialogue with farmers, activists, citizens, engineers, and hydrogeologists, who became participants in my research. I collected both primary and secondary data sources, using text as well as images to trace how the aquifer is evidenced by various media and modes of representation. These included field notes,

unstructured interviews, informal conversations, verbal anecdotes, audio recordings, transcriptions, social media and blog posts, newspaper articles, archival and historical records, pamphlets, court documents, climate data, government publications, official statements and speeches, legislation and policy, reports, soil and water samples, photographs, satellite images and maps. I also attended community gatherings, meetings, protests, and demonstrations in various sites around the city<sup>4</sup>. I used qualitative methods of analysis, concentrating on the case study of the Cape Flats Aquifer, primarily to interpret how narratives and meanings are created about the aquifer and its surrounding ecologies.

The PHA FFC centre was built on the Vegkop Polyculture Farm (hereafter, Vegkop), owned, and operated by Nazeer Sunday, that emerged not only as a site of political activism but also as a place where more-than-human entanglements are put into practice. In seeking alternative ways of evidencing the aquifer, I lengthened my fieldwork sporadically over three years (2018-2019), focusing on the farm itself as the field site. Anthropologists Eben Kirksey and Stefan Helmreich develop “multispecies ethnography” as a potential toolset that pays attention to the political, social, and geographical lives of animals, plants, fungi, and microbes that sustain human existence; in which “creatures previously appearing on the margins of anthropology—as part of the landscape, as food for humans, as symbols—have been pressed into the foreground in recent ethnographies” (2010: 545). This method rejects the assumption that only humans are actors, examining the possibility of humans and nonhumans co-existing alongside each other. I was given the opportunity of active involvement in the PHA FFC’s affairs and first-person access to meetings and discussions, while Nazeer personally allowed me entry to his daily routine on the farm itself to conduct my research. Here, I was not only a passive observer of, but an active participant in the farm, getting my hands dirty and dirt under my nails. The soil, seeds, insects, mushrooms, and organisms became my lively and “alive” co-participants, interdependently contributing to the wellbeing of the farm.

Due to the many manmade and more-than-human elements and entities that make up the watershed, it was easy to lose sight of the aquifer itself, without which life in the watershed might not even be possible. Yet neither empirical nor ethnographic means alone could truly “observe” the aquifer as it was obscured underground. Thus, other ways of seeing and knowing

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<sup>4</sup> Including (but not limited to) the Municipal Court at the Cape Town Civic Centre; the Cape Town High Court, the Cape Town City Hall, the Cape Town Press Club and St George’s Cathedral in the Central Business District (CBD), the Cape Town German Club in Gardens, Soil for Life in Constantia, UCT Upper Campus in Rondebosch, CASIDRA Head Offices in Paarl, a number of farms in the PHA and various sites of the Cape Flats Nature Reserve and the Table Mountain National Park.

had to be used. Coming back to the *Blind Men and an Elephant*, anthropologist Francis B. Nyamnjoh asks: "is it possible to achieve the level of objectivity needed to see and represent the elephant [read: aquifer] – a complex and nuanced reality that cannot be easily reduced to its constituent parts of limited sensory perceptions? Does it matter what the elephant [read: aquifer] has to say (if it could speak) about how it is perceived and represented?" (2012: 65). Participatory observation is a method of "becoming witness" (van Dooren & Rose 2016: 89) to the nuanced connections that form (on) the field site.

Anthropologist Tim Ingold proposes that "participation is not opposed to observation but is a condition for it, just as light is a condition for seeing things" (2011: 129), proposing a radically new practice and perspective between researchers and the places they study through "being alive" to what is happening, unfolding, and occurring on site (Ingold 2014; Shah 2017). I cultivate an ethnography that makes visible the "unseen" (de la Cadena 2014; 2019) and gives voice to the "unheard" (Spivak 1988), bringing the aquifer and its entanglements into existence imaginatively through deep time and unknowability (Mbembe 2016; Neimanis 2017a), with a lifeworld and timespan far beyond the human.

### **Ethical considerations**

This study obtained ethical clearance from multiple lecturers in the Faculty of Humanities at UCT, including Assoc. Prof. Hedley Twidle (Dept. of English Literary Studies), Dr Ian-Malcolm Rijdsdijk (Centre for Film and Media Studies), Assoc. Prof. Frank Matose (Dept. of Sociology) and Assoc. Prof. Virginia MacKenny (Michaelis School of Fine Art) upon presenting my research proposal on 6 December 2016. I pledge that consent was given by participants, whose views were represented fairly and accurately, and whose dignity was upheld throughout by regular communication via WhatsApp, Facebook, email, and meeting in person on whether sensitive information ought to be included or not, the sending of transcripts of recordings to confirm whether speech and intention was captured correctly, and the sharing of dissertation drafts at various stages to give transparency to the argument and fairness to those being represented.

Informed consent is a dynamic and continuous process at the core of ethnographic research that creates an open channel of dialogue and communication between researcher and participants to ensure the data is valid and trustworthy (UCT, online). I inevitably cultivated personal relationships with several participants during my time in the field, in particular, Nazeer Sunday and Susanna Coleman of the PHA FFC, to whom I refer in the first person, and whose

sentiments motivated this study. In cases where participants were unavailable/unwilling to meet (e.g., political persons and corporate individuals) and direct informed consent was not possible, I relied on published statements, prior interviews, and publicly available media releases. To preserve the identity of participants who asked to remain anonymous, I have named them according to their profession and numbered them in the order of appearance (e.g., “Farmer 1,” etc.).

An underlying theme running throughout my dissertation is an ethical commitment to undo manifold crises that have arisen in the environmental, economic, and social contexts of modernity. In an African, specifically South African context, the “environmental humanities” is a move to decolonise knowledge production and return to cosmologies in which “knower” and “known” are inextricably linked (Green 2013a; 2013b; Mbembe 2015; 2016). Access to knowledge is a contested issue that calls for self-reflection on the researcher’s part; thus, it is imperative to add a note on my positionality here. As a white female growing up in the Atlantic Seaboard, attending an international school, and studying at UCT since 2012, I have always had privileged access to information, resources, and water. It was in 2015, my fourth year (completing an honour’s degree in political sciences), that this was laid bare to me as the student-led #RhodesMustFall and #FeesMustFall movements triggered massive debates opposing institutional, structural, and systemic inequality. I illustrate this reality with an anecdote: although raised in Cape Town, to my astonishment, it was only in 2016, my fifth year (beginning a master’s degree in environmental humanities) that the existence of the Cape Flats Aquifer and the events unfolding in the PHA were brought to my awareness. This concerned me not only as a researcher, but also as a citizen, and was a catalyst for further inspection into why core issues that concerned the entire city remained on the periphery.

In this way, I foster a “response-ability” (van Dooren & Rose 2016: 89)—that is, the ability to both respond/be responsive and be responsible—to problems (and perceptions thereof) that persisted in my study site. “Response-ability” is a capacity that all living bodies share and is a starting point to move away from human exceptionalism in the production of knowledge. Each being responds to the world in different ways, and it is through this difference that the world is constituted. Ultimately “[we] are accountable for—implicated and at stake in—the worlds that our actions bring into being” (Ibid.). I invite the reader to decipher the following dissertation with openness, intuition, and constructive criticism, as one fragment of a much wider truth that cannot be captured by a single study, thus laying a foundation for prospective future research.

## **Chapter outline**

This dissertation includes an introduction (chapter one), three data analysis chapters (chapters two, three, and four) and a conclusion (chapter five). My conceptual framework and theoretical background developed throughout the dissertation as the evidence is introduced and therefore a standalone literature chapter is unnecessary. Ethnography is about telling stories, and how stories are told matter, bringing some parts of the world into focus, while leaving other parts in relief (Wong & Christian 2017). The ethnographer is the author at the heart of storytelling, which is a self-reflective and reflexive exercise (Geertz 1988). I present my findings thematically and (somewhat) chronologically in a creative nonfiction narrative in an effort to give voice to the unheard and make visible the unseen.

In chapter two, I use concepts in political ecology to analyse uneven human-nature relationships in the aquifer's aboveground area, particularly in the PHA.

In chapter three, I interpret the relations being practised on-the-ground at the Vegkop Polyculture Farm through the new materialist turn to disintegrate human-nature dichotomies into a plurality of multispecies entanglements.

Chapter four embraces posthuman feminist frameworks to re-negotiate the human in terms of the spatial and temporal scales of the aquifer, as preconceived categories and hierarchies collapse and emerge as new modes of embodied and bodily relating.

The final chapter concludes with a discussion of my findings and arguments presented throughout this dissertation and provides directions for further research that can move towards adaptive, resilient, and liveable more-than-human futures.

## Chapter two: Ruptures in the watershed

### Introduction

#### Box 9

Every chair in the centre was full. People were sitting on the floor and tables, leaning against the walls full of newspaper cuttings and spilling out the doors, including students, farmers, citizens, volunteers, professors, scientists, urban planners, and lawyers. The scene was accented by colourful hand-painted posters all over the room, that read:

*“Stop cementing over the Cape Flats Aquifer!”*

*“Protect the PHA from land grabs!”*

*“Save our city’s future!”*

*“No land, no food, no water = no life!”*

The chattering quietened down as Nazeer, wearing his trademark leather hat, gumboots and slogan t-shirt, began the meeting: “Welcome everybody for coming, taking the time to join us here. This is our second Annual General Meeting, and we are happy to have a whole room full of people that we believe are our stakeholders in the campaign. [...]”

“I just want to apologize because the electricity has been going on and off the whole day. You all know I pay all my bills on time [laughs, audience laughs]. I have my suspicions that the authorities or developers or whoever else doesn’t want us to be having this meeting right now is doing it on purpose. This is not the first time they have switched off our power during one of our meetings” [laughs]. [...]”

The electricity did not return for the rest of the two-and-a-half hour meeting.

*Field notes and audio recording, 10 February 2018, PHA FFC centre*

In the previous chapter, I introduced the reader to the aim of my activist research, that is, to foster inclusive and integrated more-than-human relations using the case study of the Cape Flats Aquifer and the PHA in the context of climate change.

This chapter is the initial step in my analysis, where I examine what counts, or is discounted, as evidence in contrasting human understandings of nature. I present my preliminary ethnographic findings, based on three months of intensive—and three years of intermittent—fieldwork conducted in the PHA between 2017 and 2020. Central to my case study are the ongoing legal disputes between authorities and activists over how the aquifer’s aboveground area should be treated in contexts of socio-ecological crisis. Several spatial-planning and land-use decisions prioritising urban economic development in the PHA have come under scrutiny, with rising demand to protect the area in terms of its hydrological, agricultural and heritage significance. The discussions I engaged in, recorded, and transcribed during my participant observations with the PHA FFC are presented thematically, rather than chronologically,

through the lens of political ecology. Alongside ethnographic fieldwork, political ecology applies material, historical, and discursive modes of analysis in which the unequal effects of economic development, ecological change, and social crises are enmeshed “across multiple temporal and spatial scales” (Neumann 2009). I illustrate how complex human-nature interactions in the past surface as contradictions in the present (Ogden et al. 2019) that perpetuate uneven power relations and create “deeply unjust urban landscapes” (Swyngedouw & Heynen 2003).

This chapter begins with the municipal court case in progress as my research began in 2017 and the constitutional court case that was finalised as my research concluded in 2020 to assess opposing perspectives of the watershed. I then investigate distinct historical moments that define human-nature relations in the Cape Flats, highlighting three major threats to the aquifer and its aboveground area, namely, urbanisation, sand mining, and agriculture. I end this chapter by situating such threats in the lived experience on the field site, concluding with an alternative to nature that transitions to the next chapter.

### **Project “pave-over” the Philippi Horticultural Area**

#### **Box 10**

Nazeer: “We are gathered here today because we feel that we are under severe pressure in the PHA in protecting our area. Our area is very valuable for us as farmers, but it is as valuable for the city. We have been taking part in a public participation process, submitting comments around the application for developers and companies who want to eliminate our farmlands. In total about 1300 hectares are at risk of being lost. We are exercising our right as a community by participating in the environmental impact assessments (EIAs) on every mining application and development rezone in the area. We are also trying to get the support of the community, and all the citizens in Cape Town, because what is happening in the PHA affects everyone in the city.”

Susanna: “One of the reasons that we are happy to see the press here is that it is in these documents [holds up papers] that the *skandaal* lies. Because we are here talking about farmlands and heritage, and it's not necessarily the most exciting idea upfront, so I hope I can convey to you the significance and the essence of this court case.”

*Audio recording: 27 February 2017, PHA FFC press conference*

I investigate two overlapping court cases over how the PHA should be used and managed between municipal and provincial authorities on one hand, who have earmarked certain parts for urban development; and citizens, activists, farmers, scientists, citizens, and civic organisations on the other, who advocate the area’s socio-ecological and economic significance. The PHA FFC—backed by 33 civil society organisations—applied to review and revoke several

land-use and spatial planning decisions made by the City of Cape Town Municipality and Western Cape Departments of Environmental Affairs and Development Planning, and of Agriculture and Economic Opportunities that risk removing an estimated 20 percent of farmland in favour of the Oakland City Development Company (Pty) Ltd (hereafter, Oakland) and Exclusive Access Trading 570 (Pty) Ltd, a division of Multi-Spectral Properties (MSP), also known as UVEST<sup>5</sup>.

One of my earliest participatory observations was at the PHA FFC press conference held at the Press Club (Riebeek St, Cape Town City Centre) on 27 February 2017. The campaign had invited several newspapers to report on the outcome of the municipal court case regarding the rezoning of 281 and 97 hectares respectively from “rural” to “urban” to accommodate a 6000-unit commercial-residential complex in southwest Philippi. The land is owned by Exclusive Access Trading 570 (Pty) Ltd, whose claims of “strong environmental ethos” and “highest ethical standards” (Olver 2019: 104) have been criticized concerning the sustainability of its development. On 31 July 2013, the city’s Mayoral Committee (MAYCO) authorised the rezone upon approval by MEC Anton Bredell, who withdrew his decision on 27 January 2014, citing the preservation of the Cape Flats Aquifer as a primary reason (Coleman 2016a; 2016b). This decision was appealed by developer John Coetzee, who in October 2015 was granted permission to rezone without conducting an Environmental Impact Assessment (EIA). EIAs in a South African context, are important anticipatory and participatory tools introduced with the National Environmental Management Act (No. 107 of 1998), hereafter NEMA (RSA 1998a), to ensure democratic environmental decision-making and “sustainable development”, i.e., equitable economic development without negative impact on natural resources (Murombo 2008; Wood 2002). On 25 May 2016, Heritage Western Cape (HWC)—the leading provincial heritages resources authority established by the Minister of Cultural Affairs and Sport of the government of the Western Cape province in terms of the National Heritage Resources Act, No. 25 of 1999 (RSA 1999) to identify, protect and conserve the rich and diverse heritage resources of the Western Cape—turned down Coetzee’s appeal (see also HWC 2015). The conclusion reached was that the heritage of the PHA is under threat due to erosion of farmlands from encroaching urbanisation yet was appealed a second time.

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<sup>5</sup> Respondents included the CoCT, HWC, the Western Cape Departments of and Members of the Executive Council for Environmental Affairs and Development Planning (DEA/DP) (MEC Anton Bredell) and Agriculture and Economic Opportunities (MEC Alan Winde), and National Departments and Ministers of Agriculture, Forestry and Fisheries (Senzeni Zokwana), Mineral Resources, Cooperative Governance and Traditional Affairs (Nkosazana Dlamini-Zuma), Rural Development and Land Reform (Gugile Nkwinti), and Water Affairs and Sanitation (Nomvula Mokonyane).

**Box 11**

Susanna: “We are appealing both the rezone and the rezone that was granted without – what we are arguing was a proper EIA. But with the [UVEST] development, the builders and bulldozers could literally move in on that land tomorrow. [...]”

“We’ve appealed it, and when that appeal is denied, we have to go to the high court. But the precedents that are dangerous are that if local government is allowed to override the requirements of NEMA, of the National Heritage Resources Act, of the National Water Act, and so on, and is taking those decisions into their hands, a precedent is set for municipalities across the country to be able to go ahead with anything they want to. [...]”

*Audio recording, 27 February 2017, PHA FFC press conference*

A week before the press conference, Nazeer had mentioned an upcoming announcement that would represent a watershed moment for the campaign: “We’ve just received the documents. One arm of government, for the first time, has come out and said that they will not stand for the destruction of this area. So now not only are we saying it, but a government body is saying it. Next Wednesday we will be releasing these documents to the press” (*conversation, 20 February 2017, PHA FFC centre*).

**Box 12**

Nazeer: “In all the time that we’ve been putting input and commenting and opposing these developments, what happened was, we didn’t have much support from any authorities. But that changed. Last year, HWC turned down the appeal, turned down the rezoning, of a portion of land in our area, right on top of an aquifer, and where vegetables are growing. So, we found that to be very, very significant. For the first time, a government body has come out to protect our area. And so, this is extremely important for us. The developer, UVEST, appealed HWC’s ruling, and we were invited to an open hearing, where the developers, and the campaign, and other interested and/or affected parties could forward their arguments as to why each supported their position. We, of course, went there, and we went with lots of arguments, and we provided lots of data around why the area needs to be protected. The Heritage Appeal Panel then found in favour of us. The developer then went on to appeal again, this time to an independent tribunal, set up by [MEC Bredell] [...]”

*Audio recording: 27 February 2017, PHA FFC press conference*

This “small but important victory” (Ibid) was a landmark ruling, shifting the narrative in favour of the applicants that would at least momentarily secure the farming future of the area.

**Tribunals, trials, and tribulations**

The initial HWC ruling states:

**Box 13**

“Evaluating the documentation provided and after visiting the site, it is clear that a bigger picture emerged, essential to gain a better understanding of the context and complexity involved in permitting the rezoning of several erven in the south-western corner of the [PHA] from agricultural use to sub-divisional overlay zone.

The fact that there is no clear and reliable source of information that could serve as the basis for designating this formally protected Heritage Area with clear boundaries and lack of policies for management, should not be seized as an opportunity for development.

However, the fact that the authorities, Provincial and Local, have in the last ten years not mobilised a plan of action [...] to review the heritage grading of the resource, raises great concern. Should this omission not be addressed soon, the Peninsula is in danger of losing one of its greatest urban agricultural heritage systems and history will be lost.”

*HWC Tribunal Finding, 25 May 2016*

On 24 February 2017, the second appeal was dismissed by the HWC appeal committee—and unanimously agreed upon by an independent appeals tribunal—who, in asserting its mandate to protect and prevent irreversible damage to heritage resources, submitted that the PHA is worthy of conservation and must not be rezoned (Isaacs 2017). The tribunal noted that approving the rezone would set a precedent for future land-use applications that prioritised property rights over food production in the face of the city’s mounting food crisis. Further reasons included the area’s historical importance as the city’s “breadbasket” (see chapter three) and its role in aquifer replenishment. On 20 April 2018, HWC gazetted its commitment to protect the PHA in terms of the Natural Heritage Resources Act (No. 25 of 1999), describing it as one of the last remaining natural landscapes within the urban space that is “a result of a dynamic relationship between topographical form, climate, geology, usage, history and settlement typology of the Cape Flats” (WCG 2018)<sup>6</sup>.

Despite being a significant victory, the municipal court case exposed a deeper decade-long dispute in the PHA that I explored through the hearing (15 and 16 October 2019) and ruling (17 and 18 February 2020) presided over by Judge Kate Savage of the Western Cape High Court. Under debate was another controversial development, “Oakland City”: a 472.65 hectare commercial-industrial complex proposed in Schaapkraal, Philippi (Map 1). The 22 erven were purchased from the CoCT Spatial Planning Department by developer Wenzel Oaker, trading under Rapicorp 122 (Pty) Ltd in 2007. In 2008, a land-zoning application was submitted to the

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<sup>6</sup> UVEST has since elevated the matter to the Western Cape High Court (case number: 14894/17) for further consideration that was still in the pleadings stage at the time of this writing.

city, requesting the inclusion of Oakland land in the urban structure plan requiring agricultural land to be redesignated to urban use. Despite being turned down by the National Minister of Agriculture, Senzeni Zokwana, the urban edge shift was nonetheless approved by municipal and provincial government, escalating into a highly publicised court case. The PHA FFC framed the debate around the four legislative steps that should have been followed, but were not, in permitting the rezone.

**Box 14**

Nazeer: “Let me quickly tell you about the due process that happens when you take agricultural land out of production, and you rezone it for something else like mining or urban development. First, you must apply to the Minister of Agriculture in terms of Act 70/70, for permission. Secondly, you must, at the municipal level, shift the Urban Edge. [...]”

“Then, the developer has to ensure an EIA takes place. Then, and only if the EIA is approved, a rezone takes place. All these steps need to be followed if a developer wants to use the land for something other than agriculture. Now in this instance, with this development, the city gave the developer permission to skip asking permission from the National Minister, skip drawing the urban edge, then, skip the EIA process, which is all areas we as a community can and did participate in to oppose or agree with, and go straight to rezone. And in doing that, they also asked the [provincial] Department of Environment to then allow the rezone to take place without having to do an EIA, and the department, the custodian of our environment and our resources, gave the O.K.”

*Interview with Nazeer, 12 March 2017, PHA FFC centre*

The first step, i.e., gaining the Minister of Agriculture’s permission to rezone “rural” into “urban” land, was rejected in 2008 on grounds of food and water provision in a context of climate change in terms of the Subdivision of Agricultural Land Act 70 of 1970, hereafter Act 70/70 (RSA 1970). Section (3)(a) states that “no agricultural land should be subdivided” unless there is a clear case for both “need” and “desirability” and/or only if there is no other land available for this purpose. Zokwana further stated that the PHA was protected by the Physical Planning Act (No. 125 of 1991) as “high potential and unique agricultural land” under the National Policy on the Preservation and Development of Agricultural Land (Department of Agriculture 2006). On 12 May 2009, the CoCT Planning and Environmental Portfolio Committee (PEPCO) and Housing Portfolio Committee established the PHA Task Team, who recognised the area “as an agricultural resource asset of current and/or future potential value, as delineated by an urban edge line, and is protected and managed accordingly” (PHA Task Team 2009). On 26 November 2009, a full city council meeting decided not to amend the original urban structure plan, confirming the PHA’s importance for food and water security.

**Box 15**

Susanna: “The urban edge is an arbitrary line that separates the city from its rural and natural areas. It is an important tool used by urban planners to make sure the city does not sprawl out but is built upwards and more densely, so that we don’t lose our green lungs and the areas where our food comes from, and so on. [...]”

*Conversation with Susanna, 22 April 2017, PHA FFC centre*

Yet on 27 May 2011, MEC Bredell (with Mayor de Lille’s full support) went straight to the second step and shifted the urban edge, overriding the minister’s decision and disregarding the PHA Task Team’s recommendations. The Cape Town Spatial Development Framework (CTSDF) published in 2012 (CoCT 2012a) clearly depicted the amended urban edge within which Oakland land was now included. The city justified the construction of low-cost housing developments on what has been portrayed as “unused land” as a compromise it had been forced to make because of the critical housing need (Rose et al. 2016; Horn 2020). A backlog of 320,000 units in 2018 increased to over half-a-million in 2020 indicating a prevalent housing crisis that has given rise to informal settlements and urban sprawl (Gontsana 2017, 2020; McGaffin 2018). The city’s legal counsel, Ron Paschke, argued that the Oakland land is not productively being used for farming (despite my ethnographic findings indicating otherwise, see chapter three), describing it as “neglected, underutilized, and underdeveloped”. Paschke stated that it was in the city’s right to develop the land as the urban edge had already been shifted. The province, represented by Nazreen Bawa, defended the city’s arguments, asserting the city’s need to fulfil its mandate of seeking new development opportunities to address the housing, poverty, and unemployment crisis (Charles 2019; Yauger 2019). Yet the campaign argued that it was also within the city’s mandate to protect the environment and solve the food crisis, especially when the municipal Densification Policy in 2012 identified 11,000 hectares of land more suitable for affordable housing (Battersby-Lennard & Haysom 2012; CoCT 2012b) that made it less evident why ecologically sensitive and economically productive land had been selected for a rezone that was neither desirable nor necessary. The campaign additionally questioned why the city is conducting business with a developer who is under fraud investigation on suspicion of land speculation (Olver 2019)<sup>7</sup>.

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<sup>7</sup> Susanna explained how since the early 2000s, property developers have been buying rural/agriculturally zoned land, that is much cheaper, in the PHA to speculate, i.e., to inflate the property value. Wenzel Oaker, for instance, bought the land for R36 million in 2007, then sold it to himself for R550 million. Five years later it was valued at R890 million. “So that’s R36 million to R890 million in a few years, and now they are proposing a R4 billion development” (*conversation with Susanna, 12 March 2017*).

Instead of negotiating these concerns, the city and province accused the campaign of being “pro-poor,” “ant-capitalist,” and “anti-development” and for misleading the court through “myth-making”. Susanna, instead of taking offense, had the following response: “What we are trying to say is that an agricultural economy, that is, a productive economy, is far more valuable than the kind of economic development the city is proposing, which is a consumption economy. Replacing farmland where 6000 people are employed with two shopping malls, 30 000 houses, a private school, and even a private prison, and right on top of an aquifer in the middle of a drought, is not sustainable economic development” (*conversation, 15 October 2019, High Court*).

### **Box 16**

Activist 1: “This development is not adequate to solve the housing crisis. Each unit is going to be marketed to the middle class at roughly R1 million. This is not affordable housing. The families in need, some on the waiting list for years, cannot afford that.”

Activist 2: “The city is ignoring its own studies in which over 11,000 hectares of land better suited for housing has been identified that is closer to the city, has existing infrastructure, and doesn’t have the problem of winter flooding due to high water tables.”

*Conversation with “Activists 1 & 2”, 18 April 2018, PHA FFC centre*

To allow the urban edge shift, the third step in the process would entail a vigorous EIA. To enforce the constitutional Bill of Rights<sup>8</sup>, an EIA must include an integrated public participation process, that individual and collective community members directly affected by any decision take part in to voice their concerns, oppositions, and/or approvals. Section (2)(4)(f) and (o) of NEMA, public participation provides a platform in environmental governance for all interested and affected parties to address environmental concerns related to a specific project by the capacity to create equitable, effective and informed decisions, especially by vulnerable and disadvantaged persons, while at the same time protecting the environment as part of the public trust and common heritage (RSA). According to Section (2)(4)(f) and (o) of the Act, - the participation of all interested and affected parties (I&APs) in environmental governance must be promoted and all people must have the opportunity to develop the understanding, skills and capacity necessary for achieving equitable and effective participation, and participation by

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<sup>8</sup> Section 24 in the Constitution of the Republic of South Africa (Act 108 of 1996) specifically refers to the environment in the context of human health, stating: “Everyone has the right—(a) to an environment that is not harmful to their health or wellbeing; and (b) to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that—(i) prevent pollution and ecological degradation; (ii) promote conservation; and (iii) secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development.

vulnerable and disadvantaged persons must be ensured, and - the environment is held in public trust for the people, the beneficial use of environmental resources must serve the public interest and the environment must be protected as the people's common heritage (RSA 1998b; Department of Environmental Affairs (DEA) 2017). Only once an agreement is reached by all participants, and the action, e.g., the Oakland rezone, has been proven to not negatively impact the environment or communities, can it be officialised. "This is what the PHA campaign has been doing since we first learnt about these developments," says Nazeer, "but we kept hitting a wall. Not one word in our 19-page and 47-page environmental reports were included in the final document" (*conversation with Nazeer, 18 April 2018, PHA FFC Centre*).

### **Concrete coverings over fluid flows**

One central argument against the development is that it would negatively impact the aquifer. Urbanisation has been identified as a threat to groundwater quantity and quality, as hard surfaces increase freshwater runoff into the ocean while limiting infiltration into the ground. Moreover, human settlements are a considerable source of pollutants (Adelana & Xu 2006; Adelana et al. 2010; 2014). The campaign argued that the groundwater study conducted by the developer was inadequate as it was not conducted by specialists and did not consider the impact of the development on the state of the aquifer and its recharge requirements in the broader context of climate change. The city/province stated that the developer's inclusion of a groundwater monitoring system to prevent groundwater pollution and stormwater management within its design was sufficiently water sensitive. It cited groundwater studies and geohydrological reports conducted in 2001, 2012, and 2013, in particular the Agri Informatics 2008 report compiled by Francois H. Knight, that stated agricultural activities are responsible for over-abstraction of groundwater and are potentially a more harmful source of pollution than urban development, due to harmful chemicals, e.g., fertilisers, filtering into the aquifer. The report proposed that using the land for non-agricultural purposes would reduce the risk of groundwater contamination and argued in favour of the Oakland development, stating that its presence in the waterscape would limit negative impacts on the aquifer from unauthorised land use. In chapter three I explain this argument depends on the agricultural methods being practiced, that do not necessarily depend on agrichemicals, e.g., agroecology. During my research, the campaign had appealed twice at the municipal and constitutional courts, first against the granting of environmental authorisation, and second against the EIA process itself, but lost both times.

**Box 17**

I met Nazeer, Susanna and other campaigners outside the civic centre, whose municipal court appeal against the authorisation granted to the Oakland City Development Company on 13 May 2016 by the DEA/DP to use the land for “mixed-use” had just been refused by the City’s General Appeals Committee. The determination in Nazeer’s voice, however, had not faltered:

“We are appealing again, this time the EIA process itself, saying that it was fatally flawed and did not comply with EIA regulations or with NEMA. This just proves there is a relentless will to keep the area run down and neglected on purpose, to serve certain people in the city’s government who have no interest in sustainable environmental policy or public participation with communities affected.”

*Field notes: 22 March 2017, Cape Town Municipal Court*

**Box 18**

The second floor of the civic centre was crowded with campaigners and supporters wearing matching t-shirts and holding placards. This was the second appeal against the environmental authorisation granted to Oakland City; the first of which had been denied in March.

As we waited for the hearing to begin, a man with a lanyard approached Nazeer to inform him that “we were being disruptive and had to wait outside”. Nazeer responded: “We have every right to be here, and I refuse to let the city and developers hold secret meetings behind closed doors.”

Eventually, a few of us were summoned inside, me included. After an hour-and-a-half, the campaign was given a chance to make their case but were silenced within ten minutes. The city had reached a verdict: the appeal had been refused. Again. This was peculiar to me. Barely two weeks ago the mayor announced that water shortage was the “new normal”, reminding each citizen of their responsibility to look after water. Yet, the decision the city had just made would directly impact one of its most important aquifers.

Nazeer, as usual, remained motivated: “We might have lost a battle, but the war is far from over. Now we are going to push the matter before the constitutional court to decide.”

*Field notes: 13 June 2017, Cape Town Municipal Court*

Susanna mentioned that the campaign would also be taking issue with the procedural fairness of the appeal decision, as they were only given six days’ notice of the hearing, were not permitted to respond or postpone and were not given sufficient time to voice their arguments. This demonstrated the two different narratives at play, each with different consequences for the aquifer and agricultural area. J.T. Rose, A.K. James and Z. Patel’s article, “Contesting the Edge”, states that “these differing positions are upheld by separate groups of actors, largely due to their dependence on very different knowledge bases. A lack of explicit acknowledgement of alternative frames and their associated value sets limits the possibility of effectively debating such issues and of making effective inclusive decisions in these complex policy situations”

(2016). Furthermore, these viewpoints appear to suggest that decision-makers understand the complexity of issues in the city better than other actors, e.g., the public, and, claiming neutrality, argue that they are the only ones capable of making responsible decisions. The evidence used by the campaign was extensive, encompassing almost every study, quantitative and qualitative, that had been published since 2009. They had submitted over 4000 pages of arguments and annexures to the high court that made the case particularly complex (PHA FFC v MEC 2020). On what “evidence” (or lack thereof) the city based its decisions would only become clear later (see below).

**Box 19**

Nazeer: “The bigger picture is this. There are many developments being pushed through by the city, such as Maiden’s Cove, Kommetjie, Observatory, and others where the housing will be put in with no capacity for sewage, for roads to cope with traffic and that sort of thing. The added factor with our area is that you are going to be paving over productive farmland. [...]”

“The current narrative from the city is that they make the final decision because they know what is best. This is in line with the national requirement that powers are devolved down to local government. This is where all the trouble started in Cape Town, when the city decided that they have the decentralised authority to make planning decisions. “Ours is the final authority,” is the narrative that you will always hear. If you phone and say, “hey, how come you are paving over our farmland when the Minister of Agriculture said you can’t?” The mayor will say, “We are the final authority.” You ask, “why are paving over a conservation area in Maiden’s Cove?” “We are the final authority.” “How come you’re doubling the population of Kommetjie which can hardly even cope with services like water and electricity?” “We are the final authority”.”

*Conversation with Nazeer, 28 April 2017, PHA FFC centre*

The city’s authority over such decisions was also a subject of concern. On 1 July 2015, Cape Town became the first municipality in the Western Cape to implement a land-use planning by-law in terms of the Western Cape Land Use Planning Act (LUPA), No. 3 of 2014 (WCG 2014), simultaneously issuing the 2015 Municipal Planning By-Law (MPBL) (CoCT 2015) and the Spatial Planning and Land Use Management Act (SPLUMA), No. 16 of 2013 in terms of the Municipal Systems Act, No. 32 of 2000 (WCG 2013; 2000). These tools effectively replaced the Land Use Planning Ordinance (LUPO), No. 15 of 1985 (WCG 1987), permitting the municipal government to act as the “final authority” on all land use and spatial planning decisions and enabling the city to override the decisions on both provincial and national level. On 18 May 2012, MEC Bredell withdrew the Physical Planning Act, No. 125 of 1991 (WCG 1967; 1991) urban structure plan and the CTSDP, with the already-amended urban edge,

became the operative spatial-planning instrument. This remained effective until the 2018 Municipal Spatial Development Framework (MSDF) that despite explicitly stating the threat of formal and informal housing settlements and declaring that a farming area within the urban footprint is “unique and elevates the status of the [PHA] beyond that of an area of cultural significance” (CoCT 2018d: 146), defined the area as a mixed land-use category supporting residential urban development, sand mining, an industrial node and agricultural activities.

### **Box 20**

Me: “What are some of the concerns you will be addressing during the hearing?”

Susanna: “The city must justify why it is favouring the financial interests of a few over the constitutional rights of millions. Furthermore, they must prove that it is rational and reasonable to [counts on fingers]: one, continue with already concluded development applications and explain that this is not a wasteful expenditure; two, ignore their mandate to protect prime agricultural land; three, approve upmarket housing in a rural area against their own densification policy that identifies other land for residential purposes; four, jeopardize the right to work, eat, be healthy, and make a living of the PHA community, including 6000 workers and 150 farmers; five, delete a globally unique opportunity to sink carbon emissions into already-existing farmland thereby saving millions of dollars in tax and becoming a world leader in climate-change resilience; and six, deny every Capetonian access to clean water and a safe environment.”

Nazeer: “The campaign has never been against development. But the city cannot solve the housing crisis by removing farmlands and creating a food crisis or fix water scarcity by eliminating an aquifer’s replenishment area. Oakland City was never intended for social housing. The city is disregarding its own studies done in 2009, 2012, and 2018, that we, the taxpayers, funded. Countless times we have invited the city’s departments to come out of their offices and visit our area to see the development site in context of where it is taking place. Not one has driven out to the farmlands. The 2012 Rooftops study by eminent food security scholars was of particular importance in determining the area’s significance in combating the city’s hunger crisis and clearly shows the PHA’s importance for organic food production, self-sufficiency, and aquifer sensitivity in contexts of climate change. Therefore, we state in capital letters that: IT IS NOT IN THE INTEREST OF THE PEOPLE OF CAPE TOWN TO DEVELOP THE PHA. The city has violated and interfered with constitutional mandates of agriculture, heritage, health, water, gender, land reform, and environment, which we are pursuing at a national level.”

*Conversation with Nazeer and Susanna, 27 April 2019, PHA FFC centre*

### **Setting precedents**

The news headlines erected citywide on 17 February 2020 marked a turning point for the PHA and Cape Flats Aquifer. In large white letters against a bright red background read: “PHA ACTIVISTS CLAIM COURT WIN” (*Cape Argus*), with photos of campaigners dressed in orange and carrying bunches of carrots, spilling excitedly onto the stairs of the courthouse. A

precedent-setting outcome was presented by Judge Savage of the Western Cape High Court, who ruled in favour of the PHA Food & Farming Campaign and ordered the city and province to review their spatial-planning decisions in the contexts of climate change, water shortage and food security. The ruling states that the rezone permission and environmental authorisations for the construction of Oakland City are suspended and must be returned to their respective appeal bodies for reconsideration, as not enough information was available to ensure “rational and reasonable” decision-making.

The City's 2011 decision to subdivide the Oakland land from agricultural use to urban development was also suspended. The Cape Flats Aquifer surfaced as a central matter of concern. The court agreed with the campaign that the groundwater study presented in the EIA was “wholly inadequate” as it was based on outdated information and old reports (the most recent being three years old at the time of the appeal). Moreover, none of the reports focused specifically on the impact of the Oakland development on groundwater, or on “the importance of the preservation of the aquifer, and how best to achieve this, in the context of water scarcity and climate change in the Western Cape” (PHA v MEC 2020). The court concluded that a wider focus beyond that of the stormwater management and groundwater pollution prevention plans included in the Oakland EIA was required, based on “a more recent assessment of the health of the aquifer given climate change and water scarcity in the area” (Ibid.) and sought for the MEC’s decision be reviewed in relation to the aquifer. The ruling document states:

**Box 21**

“I [Judge Savage] consider a just and equitable remedy [...] to set aside the MEC’s ruling on appeal and remit the matter back to him for reconsideration of new evidence and reports relating to the aquifer. This will necessarily require that the appeal must be reconstituted.”

“Extensive submissions were advanced by the applicants to the effect that relevant considerations in the form of environmental impacts related to food security, heritage, socio-economic impacts, climate change, heritage, land reform, the cumulative impacts, alternatives and issues of need and desirability were not appropriately considered by the relevant decision-makers. It is pertinent to reiterate that it is not for the Court to second-guess the evaluation of these considerations or revisit the merits of a polycentric and policy-laden decision by the decision-maker but to ensure that he or she has performed the function with which entrusted, with regard had to relevant considerations and material before him or her, in a manner which is rational and reasonable. [...]”

“The appeal against the environmental authorisation granted by [MEC Bredell] is set aside [...] in terms of Section 43 of the National Environmental [Management] Act 107 of 1998.”

*Primary source, 17 February 2020, Western Cape High Court*

The ruling directed that the city and province must consider the “big picture” in all future planning decisions, especially in contexts of unpredictable climatic conditions and water shortages. This outcome has demonstrated that the public participation process is critical to democratic and equitable decision-making concerning environmental concerns. I frame this as a critical “watershed moment” not only in the study site, but for the aquifer and city itself. The PHA FFC’s Facebook post written by Nazeer states:

**Box 22**

“We pulled together many interesting people from across Cape Town and the country to work together with the single objective to protect the PHA and aquifer. This victory is yours. This has been such an inspiring aspect of the campaign.

This is a victory for the Cape Flats Aquifer and the PHA farmlands, against future developments and land speculation in the area. This is a victory for 10’s of thousands of jobs and livelihoods dependent on the agricultural economy of the PHA. [...]

The Campaign hopes Mayor Dan Plato and DEA/DP MEC Anton Bredell will honour the Western Cape Cabinet decision of 22 August 2018 and not appeal the ruling.

We now expect the CoCT will amend the 2018 [MSDF] to re-include the Oaklands land back into our unique and irreplaceable PHA farmlands. We trust that this ruling will give developer Wentzel Oaker pause and reconsider paving over [...] thousands of jobs and livelihoods and the city’s food, water and climate resilience.”

*Facebook post, 22 February 2020*

**Plumes of pollution**

Despite the landmark rulings, long-term protection of the farmlands and aquifer necessitates a deeper look at the human-nature relationships that emerge in past and present. The many facts discussed during the court case revealed several issues affecting the materiality of the aquifer that continue to permeate the landscape. Here I frame sand and other substances as focal points through which to observe how previous and socio-economic and ecological changes play out in the watershed.

As mentioned in Chapter one, the water quality in the Cape Flats Aquifer indicated it was not suitable for human use as it had become a receptacle for human waste. The shallow water table is sensitive to direct and indirect sources of pollution from intense use of the land for waste disposal, urban development, and agricultural purposes (Adelana et al. 2014). Quantitative studies indicate high levels of faecal matter, bacteria, and pathogens in groundwater originating from human settlement patterns, a trend that has been steadily increasing over time (Adelana & Xu 2006; 2008). Major pollution sites include cemeteries that increase microbiological risks in

groundwater (e.g., colony-forming units, pathogenic bacteria, viruses, protozoa, and helminths (Engelbrecht 1998), informal settlements lacking adequate sanitation infrastructure situated directly above the aquifer, leaking petrol/diesel storage tanks, and land-fill sites and overflowing or faulty wastewater treatment plants (e.g., the Cape Flats Wastewater Works, Zandvliet Sewage Treatment Plant) historically situated in the Cape Flats (Ball & Associates 2003; Conrad & Peek 2014; Haricombe 2016; Parsons & Taljaard 2000). At the Bellville waste disposal site, a considerable plume was identified with high concentrations of potassium, sulphate, and heavy metals such as nickel and lead that even in minute quantities pose a serious human and environmental health hazard (Saayman 1999). Using a sequence of maps (see Appendix) obtained from the National Geospatial Information Centre at the Department of Rural Development and Land Reform, I illustrate how human-nonhuman relations in the watershed surfaced in the past overlap with socio-ecological crises in the present. Trombley conceives of the watershed as being marked by multiple “spatiotemporal ruptures” characteristic of modernity’s mutually reinforcing conceptions of “space” (defined by separations between the social and ecological) and “time” (as linear and punctuated by specific events of technoscientific advance). Such ruptures, underlain by the “violent logics of colonization and ecological exploitation” (2018: 108), simplify the complex spacetimes of the watershed (see Chapter four) to “obscure the violence [...] that constitutes progressive modernist ideologies” (Trombley 2019). The spatiotemporal ruptures in the Cape Flats watershed coincide with three distinct social engineering projects, namely colonialism, apartheid, and democracy.

The first map (map 2) displays study site (top left) in 1942, where the sands, swamps, and wetlands all but disappeared in a single human generation as the Cape Flats was engineered into “apartheid’s dumping ground” (Ernstson 2013). The pattern of residential segregation along racial lines surfacing in the Cape since the early 1900s was legitimised by the Group Areas Act, No. 77 of 1957 (RSA 1957). A spatial planning model closely influenced by topological features and lay of the land followed, and thus began the compulsory displacement of people of colour from the “core”, i.e., the mountain slopes full of ecological and economic resources, to the “periphery”, i.e. the inhospitable environment of the Cape Flats that “exposed, and continues to expose residents to harsh winds, flooding due to higher water tables, and large volumes of dust from mobile sands” (Anderson & O’Farrell 2012). Urban ecologists Pippin Anderson and Patrick O’Farrell state that “[there] can be little confusion about the fact that apartheid spatial planning took an informed view and disadvantaged certain people by placing them in uncontrollable, untamed, and difficult ecologies” (Ibid.). In map 3, published in 1959,

the onset of human infrastructure can be discerned, nearly tripling by 1979 (map 4) where the hexagonal shape of the wastewater works (commissioned in 1960) are visible alongside steadily decreasing water bodies. The water table was (in some places completely) drained and replaced with housing to accommodate the forced removals of apartheid.

Monitoring of the Cape Flats Aquifer began in 1979 by the Department of Water Affairs and Forestry (now Department of Water and Sanitation) and institution-based researchers at UWC and UCT, where an increasing trend in pollution was detected from the 1981 to 1982, prior to which no definite sign of groundwater contamination had been discerned (Tredoux 1984; Weaver & Tworeck 1988). Maps 5 and 6, published in 1981 and 1983 respectively, show the sudden eruption of Mitchells Plain, that, intended to be the “model suburb of apartheid”, is now statistically one of South Africa’s most dangerous suburbs (Haefele 2011a; 2011b). Encroaching urbanisation has caused a persistent increase of pollution indicated over time, correlating to the population influx since 1994 and contributing to urban sprawl, compartmentalising the natural landscape, as shown in maps 7-9, published in 1995, 2000 and 2010 respectively (Saayman, Adams & Harris 2000; Traut & Stow 1999; 2001). South Africa’s democratic transition and adoption of a human-rights based constitution to correct injustices of the past has yet to be fully experienced by the majority of Cape Flats residents and continues to be a dumping ground of waste and chemicals that have become part of the aquifer’s ebbs and flows.

### **Sand, silica, and cement**

The Cape Flats is predominantly composed of silica-rich sand that on one hand acts as a critical filter for groundwater, but on the other is susceptible to pollution from human land-use practices. Here, the sand, which I explore through encounters between past and present, becomes what feminist scholar Donna Haraway would describe as the “naturalcultural” (2003) medium or layer that links un/seen geographical, historical, and political forces and formations. Natureculture is the notion that “nature” and “culture” are interwoven to the extent that they cannot be regarded as separate phenomena but recognises that ecological relationships are formed both biophysically and socially (Fuentes 2010; Malone & Ovenden 2016).

The maps camouflage what Professor Rob Nixon calls “slow violence”, “a violence that occurs gradually and out of sight, a violence of delayed destruction that is dispersed across time and space, an attritional violence that is typically not viewed as violence at all” (2011: 2). This slow violence can be imagined as an earlier spatiotemporal rupture of ecological imperialism that

was to irreversibly modify the watershed in unforeseen ways. Two centuries ago, the Cape Flats was largely uninhabited due to the huge sand dunes, reaching heights of 65 metres, that drifted rapidly across the windy isthmus. In attempts to control the geological behaviour of the driftsands, but ignorant of the unique endemic biome of the Cape Floral Kingdom, the smallest and most biodiverse floristic region in the world, a specific piece of environmental legislation was issued by the colonial Central Roads Board in 1845 (Hay et al. 2015; Shaughnessy 1980). This was the policy of organized dune stabilisation that involved the widespread seeding of Australian *Acacia* (Port Jackson) and similar invasive alien species that reproduce and spread rapidly, taking water and space from endangered endemic plants (Avis 1989; Hertling & Lubke 1999). The removal of gigantic dunes were the beginnings of a rupture: the sand rich in silica, was ideal for cement and became a valuable resource with which the city was built; the sand was removed only to be returned to the land, but without its original constituents and in a different form. Geologically, the opposite of mobilisation is stabilisation (Quick 2006: 28); but geopolitically, it entailed a spatial intervention that led to a steady *destabilisation* of the socio-ecological relations in the watershed over time. Despite being preserved in certain places (e.g., Table Mountain National Park), the Cape Floral Kingdom in the Cape Flats has suffered extensively: out of thousands of species found nowhere else in the world, only two remain: The Cape Flats Sand Fynbos and Cape Flats Dune Strandveld, both severely endangered but poorly protected, although it is in the mandate of the DEA/DP (CoCT 2018c; Cowling et al. 2003; Holmes et al. 2012; Rebelo et al. 2011).

**Box 23**

Nazeer: “In front of us is one of the last standing sand dunes that were once part of the original landscape. These used to move across the whole Cape Flats, and you can still find some up to 65 meters high.”

*Conversation with Nazeer, 9 March 2017, PHA FFC centre*

**Box 24**

Farmer 2: “This land once flourished with all kinds of fynbos, many with medicinal properties. There are only two left on the Cape Flats, the Dune Strandveld and Sand Fynbos, which are the most endangered species in the city and have almost disappeared completely and still are not being preserved like on Table Mountain. Also, there are many nonindigenous plants that are very thirsty and steal all the water. This is maybe one reason why we are in such a bad drought.”

*Conversation with “Farmer 2”, 12 March 2017, PHA FFC centre*

Silica sand mining has become another major threat to the Cape Flats Aquifer and the topic of public participation processes, appeals and court cases. According to a 2011 report on economically viable resources in the Cape commissioned by the CoCT Environmental and Spatial Planning Department (Cole 2011), only three silica-rich sand fields exist in the Western Cape (south Atlantis, north Atlantis, and PHA), all of which are situated above groundwater. The sand field in the south-eastern section of Philippi is located 5 metres below the surface (Henzen 1973; Hill et al. 1992), parts of which is located on Oakland land, is “the most important” (Cole 2011: 6) and has been steadily exploited since 1925. In 1956, during the apartheid regime, CONSOL Glass (Pty) Ltd—now South Africa’s leading glass manufacturer—began, and continues, intensive sand excavation via dredge mining at depths of between 8 and 20 meters (Ibid.; Hill & Theron 1981). Just over a decade after, the rich silica sand deposits in the south- and north-east Philippi were reserved by the apartheid National Minister of Planning under Proclamation 1760 of 1968 for the benefaction of silica as an important building material for the manufacturing of cement and glass. Concerns over mining activities have been raised by the PHA FFC, particularly the irreversible ecological damage caused by open pit dredging operations. CONSOL Glass, already owning prospecting rights to mine on 250 hectares in the PHA, submitted an Integrated Water Use License Application (IWULA) in terms of the National Water Act, No. 36 of 1998 (RSA 1998b) in May 2015 to gain mining rights on a further 55 hectares.

**Box 25**

Nazeer: “Thirty years is the proposed timespan for the mine. By then it will resemble a pool of toxic water. Us farmers now know that there are pollution plumes in certain areas and make sure that we do not draw water there. Yet these are spreading, and this could gravely impact food production in the area known as the city’s breadbasket.”

*Interview with Nazeer, 25 February 2019, Vegkop Farm*

**Box 26**

Nazeer: “To our right you can see a giant hole in the ground. This is the original CONSOL Glass sand mine that has been in operation for over fifty years and the biggest in the PHA. This landscape can never be recovered. All the pollution that collects in there goes straight into the aquifer. Part of our case is opposing more sand mines in the area, using the problem of groundwater pollution as our argument.”

*Conversation with Nazeer, 15 October 2017, tour of PHA*

A third legal victory was claimed by the PHA FFC on 13 November 2019, after the DWS rejected the water-use license on grounds of the aquifer’s importance in a context of drought<sup>9</sup>. Nonetheless, multiple ruptures remained in the watershed, that had become physically and politically visible: sand and water merges into concrete, cement, and glass, freshwater turn grey then black, and what was once a source of life becomes a milieu of pathogens, pollution, and potential for disease.

### **Illegal dumping of rubble and rubbish**

#### **Box 27**

Farmer 3: “This area is the city’s unofficial dumpsite. One problem is that people buying land here don’t want to farm. What they do is first, put rubble in the soil to lower the water table because we have flooding in winter. Another problem is that the land is cheap. This is why the city and province are neglecting the area because they want the area to fail can apply a solution the developers want. I am not saying this lightly, there is enough evidence to support this.”

*Conversation with “Farmer 3”, 15 October 2017, tour of PHA*

The PHA FFC has further criticised the city for purposefully neglecting the area to make the case for its development. Upon entering the PHA Food & Farming Campaign centre, which is also the entrance of Vegkop Polyculture Farm, what caught my eye from the onset was a large pile of rubble with a colourful hand-painted sign above it on which is written, “*Mayor Patty Clean Our Farmlands!*” When I asked Nazeer about it first-hand, he explained to me that this was the “rubble monument,” an ode to the continuous illegal dumping that has been occurring in the area despite by-laws pushed for by the Campaign that forbid dumping of building debris, rubble, concrete and cement outside designated areas. According to the CoCT, there is a “zero-tolerance” enforcement programme to stop illegal dumping around the Cape Flats. On the city’s website, it describes illegal dumping as “the depositing, discharging, spilling or releasing of any kind of waste in or on any public space.” According to the Integrated Waste Management By-Law of 2009 (CoCT 2009), it is the City’s responsibility to “ensure a safe, healthy and sustainable environment and to ensure that the rights of individuals are protected”. Yet, as indicated through my ethnographic findings, this has not been effectively enforced in the PHA. Nazeer claims that this is intentionally done to devalue the land and to “keep it cheap”. Campaigners fear that these by-laws are not being enforced in the area not only due to lack of

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<sup>9</sup> At the time of this writing, CONSOL Glass had appealed the decision, and the campaign raised concerns of attempts to exclude the public from decision-making and the EIA public participation process in terms of NEMA.

policing but to intentionally push political agendas. Illegal dumping poses a risk to the aquifer as activities are reported neither timeously nor accurately, further complicating scientists' efforts to determine sources of pollution. In this way the Cape Flats, and its aquifer, continue to be treated as a “dumping ground” symbolising the lack of respect and sensitivity to the human and more-than-human livelihoods that make their worlds there.

**Box 28**

Nazeer: “When I bought this land, it was covered in bricks, concrete, rubble, debris, litter, plastic and rusted metal. Of course, this is one reason my initial farming model struggled. It was only after removing over ten truckloads I realised that this was a problem in the PHA. A few years ago, the campaign took it up with the city and we managed to get a by-law put in place to keep illegal dumping in check. Unfortunately, by-laws do not always apply to our area due to the spatial development agenda we constantly refer to in our discussions. This is why I have put a pile of rubble I extracted from my soil with a sign that reads: “Mayor Patty clean our farmlands” at the entrance of my farm.”

*Interview with Nazeer 13 June 2017, PHA FFC centre*

As alluded to in the opening extract of this chapter, service delivery issues across the Cape Flats also remain to be addressed by authorities. Basic services such as housing, access to fresh water, sanitation infrastructure (i.e., flushing toilets), sewage and solid waste collection/disposal, electricity supply, municipal health and protection services, roads and stormwater drainage and public green spaces remain for the majority of residents a non-existent luxury rather than a constitutional right. Service delivery demonstrations regularly escalate into violent clashes with police<sup>10</sup>. Despite its wealth of (albeit in some places severely degraded) natural resources of food, and water, and biodiversity, almost every community in the Cape Flats is to some extent poverty stricken, which in conjunction with a legacy of apartheid and lack of employment opportunities has paved the way for illicit trade and extreme gang violence. In the 2019/2020 global ranking, the Mother City was the eighth most violent, with the highest number of homicides—over 3000 in a year (Mexican Council for Public Security and Criminal Justice 2020)—concentrated in the Cape Flats. Escalating turf wars and lack of and/or corrupt policing forced the government to deploy the military (South African National Defence Force (SANDF)) to intervene. Fears have been raised that such a response, reminiscent of the authoritarian apartheid state<sup>11</sup>, is an inadequate solution to a problem emanating from underlying social crises

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<sup>10</sup> During service delivery protests in April 2019, protestors blocking busy roads with burning tyres, debris, and chemical toilets were met with rubber bullets, tear gas, and water cannons from police.

<sup>11</sup> Yet residents reported that as soon as the military left, gang wars resumed. I met a soldier during my fieldwork, who explained that the gangs have absolutely no fear of the army and continued their business as usual. “They

that ought to be addressed at the root cause through more democratic socio-economic interventions, such as the local community custodians and grassroots movements discussed in the next chapter.

## **Conclusion**

The protection and use of the PHA in the Cape Flats pose a unique problem for the city. This chapter explores how the aquifer is brought into existence by focusing on the court cases that have surfaced regarding land use in the aquifer's aboveground area, as well as evidencing the growing threats of pollution and contamination from past and present land use practices.

I began with an ethnographic account of the legal dispute that has surfaced in the PHA, revealing conflicting human-nature relations in the watershed. Authorities have largely ignored, and further imperilled the aquifer in earmarking its aboveground area for economic development, while activists have argued for the importance of preserving the existing socio-ecological landscape. I used additional historical and scientific data to determine how changing human-nature relationships have manifested in three major threats to the aquifer, namely urbanisation, industry, and agriculture. In the next chapter, I zoom into the human-nature relationships being practiced on-the-ground, that provide solutions to the city's compounding socio-economic and ecological crises through alternative understandings of the watershed.

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won't touch us so we can do nothing" he said, "they tell us that they are happy that we are here to protect innocent people" (*Philippi East, 18 July 2019*).

## Chapter three: Replenishing the watershed

### Introduction

#### Box 29

The scenery shifted from urban to rural as we entered Schaapkraal road. Houses made way for farmlands, stop-signs substituted traffic lights and tractors prodded next to us. The entrance to the Vegkop Polyculture Farm was accented by Nazeer's rubble monument. To the left was the campaign centre where I spent much time last year. I had returned seeking a slightly different perspective; this time the farm itself was the site of my participant observation. Diversity was in full bloom: sunflowers, strawberries, and carrots shared the soil. A clay pond in one corner, soon to be filled with freshwater fish. Indigenous plants strategically planted as windbreaks. Everything had a place and purpose, creating a symphony of symbiosis between human and more-than-human.

*Field notes: 5 May, Vegkop Farm*

In the previous chapter, I identified some problems in the research through an analysis of ongoing court cases regarding land use and protection of the PHA and aboveground areas of the Cape Flats Aquifer. I began to argue that there is a need to reconcile the divergent human-nature relations in the Cape Flats watershed that hinder the adequate protection of humans, land, and water in the context of climate crisis.

This chapter is the intermediary step in my analysis, where I examine what alternative ways of evidencing the aquifer exist and are emerging on-the-ground. I present my findings from prolonged ethnographic fieldwork that occurred parallel to my research discussed in chapter two. Here, I took the Vegkop Polyculture Farm on Schaapkraal Road, south-east Philippi, where the PHA Food & Farming Campaign centre is based, as my primary field site. I engaged in a multispecies ethnography in an effort to illustrate the “interconnectedness and inseparability of humans and other life forms”, being attentive to how more-than-human species are in continuous entanglement with “human lives, landscapes and technologies” (Locke & Münster 2015, see also Kohn 2007, 2013; Kirksey & Helmreich 2010). I focus on the agroecological farming methods, material relationships and meaningful interactions with water, land, soil, seeds, climate, and people that are being put into practice daily on the Vegkop Farm, as explained to me by Nazeer Sunday. In this way, I challenge the modernist dichotomy between nature/culture, human/nonhuman, and subject/object and present alternative models of more-than-human relating that are resilient and sustainable.

This chapter begins with a brief history of the PHA as the city’s breadbasket and explores different farming models practiced there. Then, using a narrative analysis to interpret my ethnographic findings, I assess how grassroots, bottom-up approaches are making the aquifer visible in alternative ways as potentially adequate solutions to the city’s socio-ecological crises, leading into a discussion of how an agroecological model not only enhances human-nature relations but also contributes to the city’s climate change resilience. I describe my experiences on-the-ground to bring the multispecies worlds that make their worlds in the Cape Flats watershed into visibility. I conclude by arguing that the PHA ought to be preserved not only as the city’s green lungs, but also as the “guardian” of the Cape Flats Aquifer critical to the present and future health, well-being, and liveability of the city.

### **Preserving the breadbasket and green lungs**

#### **Box 30**

“The heritage value of the PHA is a unique horticultural area producing over 150 000 [...] tonnes of vegetables and flowers each year, which is distributed in chain stores as well as many street-side hawkers around Cape Town. The close proximity of the PHA to consumers means an advantage thus ensuring minimal transport costs, helping to keep fresh vegetables affordable throughout the year. The PHA farmlands and seasonal wetlands are the last naturally occurring recharge for the Cape Flats aquifer. The aquifer is a free source of irrigation water for farmers in the PHA and it is also the future potable water for the city [...]. Paving over or allowing more silica sand mixing in the PHA will mean destroying the recharge function of the aquifer.

The PHA is said to be the “breadbasket” of Cape Town since 1885. It’s proximity within the city, access to a range of income group markets and its ideal microclimate enables the production of horticultural crops (vegetables, herbs and flowers), and the abundance water, despite droughts, makes these farmlands the most productive and unique agricultural area in the country.”

*HWC Tribunal Finding, 25 May 2016*

The abovementioned HWC (2016) finding alludes to the fact that the PHA has been the city’s “breadbasket” for nearly 150 years. The PHA is characterised as the most productive farming area per hectare in the country, providing the majority of fresh produce (including vegetables, fruits, herbs, and flowers) to the city (Battersby-Lennard et al. 2012; Indego Consulting et al. 2018). Inhabited by semi-nomadic Khoekhoen pastoralists for over two millennia, the first permanent settlement of what was then known as *die Duine* (Afrikaans: “the dunes”) was recorded in 1833—with an influx of German farmers until 1883—that were encouraged by the former government to establish an agricultural zone that would accommodate a growing urban population (Rabe 1992). Despite inhospitable sandy plains, seemingly infertile soil, and large

areas below the water line, farmers combined their own experience with indigenous knowledge to introduce the first system of organised agriculture in the Western Cape that is part of the city's unique heritage. Under the apartheid regime, the PHA was protected for agricultural/rural use (while also reserved for sand mining, see chapter two), under the urban structure guide plan in terms of Section (4)(1) of the 1967 Physical Planning Act and reservation notice Proclamation 1760 of 1968.

Although no official demarcation existed prior, the original area was much larger than it is today. The constantly shrinking urban edge has not only resulted in conflicting reports as to the area's size, but also poses a challenge in the preservation of its rural status (Battersby-Lennard et al. 2012: 23-33). A report compiled by food security scholars Jane Battersby-Lennard and Gareth Haysom titled: "*Philippi Horticultural Area: A City asset or potential development node?*", states that "this pressure is further compounded by a lack of current and accessible information about the viability, sustainability or potential of the area" (2012: 7). There have since been extensive studies addressing the gap in knowledge that foreground both the threats towards and potentials of the PHA not only for the Cape Flats and the aquifer, but for the entire city. An independent study by Indego Consulting et al. (2018), commissioned by the Western Cape Department of Agriculture, delineates the "greater" PHA as 3168.65 hectares, while the remaining "core" of 1844 hectares constitutes the agricultural hub, reduced to just over half its size in a matter of decades. Using various land-use estimates from municipal documents and interviews with farmers, Battersby-Lennard et al. calculated presently only 1250 hectares of viable agricultural land remain (2012: 34). Located a mere 40 km from the city centre, it has strategic significance in combating the prevalent food crisis in the city as well as having significant heritage, aesthetic, and cultural values. The PHA makes Cape Town as the only city in South Africa with a protected agricultural zone placed within the urban edge.

**Box 31**

Nazeer: "I want to bring to attention the importance of this area for you, the citizens of this city. It has been said that this area is very valuable, so what are the numbers? We are producing between 150 000 and 200 000 tons of veggies for the city, you are consuming it, and if you never knew where it came from, now you know where it comes from. 80% of those veggies are going through all the retail chain stores. 30% of that is going into the informal market, so that's your hawkers and spaza shops. Our area employs between 4000-6000 workers. Our area is the last remaining catchment area for the Cape Flats Aquifer."

"One of the reasons that I am invested in this campaign so much is because I'm fighting for a dream, and I want you guys to join me in that fight for this dream [audience cheers]. Yes, thank you [Nazeer responding to the audience]. And the dream is that we want to see this area protected as the country's first fully organic agricultural area [audience cheers]. Now

you know what that means? That means that, if we do this here, the price of organic food for you is going to come right down. It's going to be affordable for everybody, that's the one benefit. [...]"

*Field notes: 9 September 2018, PHA FFC centre*

One argument the city/province mentions against farming in the PHA is that agriculture is harmful as pesticides, repellents and toxic chemicals degrade soil, groundwater, and biodiversity. This is supported by quantitative studies, that trace excess organic nutrients causing freshwater eutrophication to the intensive application of fertiliser concentrated in the PHA, while elevated concentrations of nutrients such as silicate, nitrate, and phosphate used in agricultural chemicals are prevalent in the groundwater in Philippi south (Adelana et al. 2006; Grobicki 2000; Hay et al. 2015; Hartnady & Rogers 1990; Traut & Stow 2001). These chemicals also create groundwater salinisation (and algal blooms on the False Bay coastline) that is a risk for food irrigated by the aquifer.

Yet, it must be acknowledged that two differing agricultural practices exist in the area. The first group is the majority, including large-scale "generational" and mostly white farmers, many who have owned land for generations and whose farms are generally (but not always) over 100 hectares in size. To secure large amounts of fresh produce to supermarket chains, farmers often depend on increasingly expensive inputs such as pesticides, insecticides, and fungicides to ensure crops grow in infertile sandy soils that permeate into the aquifer. Although not entirely industrial, the high-input model has its disadvantages (groundwater pollution, water intensive, cost of fuel and electricity), as well as advantages (providing the city at least half of its fresh produce, Battersby-Lennard & Haysom 2012). Next, I recount one possible alternative agricultural practice as I experienced during my fieldwork.

### **Resistance is fertile<sup>12</sup>**

#### **Box 32**

Nazeer: "I bought this smallholding, which is now two hectares in size, because I grew up on a farm my grandfather rented. I never set out to be a farmer. I am a baker by profession, that's my trade. If you get married, I will make you a wedding cake [laughs]. Soon we are planning to build a clay and brick oven so we can start selling fresh bread. I started farming in 2007, when I received a small grant from the Department of Agriculture. In my mind I wanted to be a real *boer* farmer, with lots of land, a 4x4 *bakkie* and a holiday home in Betty's Bay, but it didn't quite work out for me."

<sup>12</sup> This section's title is borrowed from the slogan on posters and t-shirts of the PHA FFC.

Me: “What happened?”

Nazeer: “I’ll tell you through my story. I started out as a tomato farmer for PicknPay. Although I was supplying them with a tonne of tomatoes a week, I wasn’t making a profit. One reason is that start-up farmers struggle to compete against the generational farmers who have land, equipment, and skills. The second reason is that the market is rigged in such a way that as a farmer, the corporates dictate the price. So, if your production costs are R5 per kilo and they are paying R6 a kilo, you are not making money, especially as the selling price remains the same while the price of inputs [e.g., fertilisers and fuel] keeps increasing. Because I was unsuccessful, I realised I had to do something different. I borrowed all the good environmental practices from around the world and am currently applying them here. I am developing a small-scale farming model that is inexpensive, low-tech and sustainable; much like organic farming, but better.”

*Interview with Nazeer, 3 September 2017, Vegkop Farm*

Nazeer decided to completely restructure his practice according to agroecological principles. “I started my own research,” says Nazeer, “and what I discovered is that it all starts with the soil. I then started rehabilitating my own soil and I was shocked to discover that my tomatoes had not been growing in soil at all, but in rubble and debris that had been illegally dumped in the area. It took me three months, using tractors rented at my expense, to excavate this artificial layer that went three meters deep. It was only when I saw the first earthworm wiggling its segmented body that I had found the lush, fertile soil that my farm needed to flourish” (*conversation, 3 March 2017*).

**Box 33**

“The campaign’s primary goal is to create a start-up model for emerging farmers that is both economically feasible and ecologically sound. It only needs one or two hectares and follows four farming principles: no till, biodiversity, living root, and soil cover. Also, we use water-saving techniques. So far, it has been extremely effective especially in light of drought. Because of the aquifer our area is practically drought-proof.”

*Interview with Nazeer, 14 April 2018, Vegkop Farm*

“This what you see here is what I call ‘heritage farming’, Nazeer explained during a farm visit, the deeper symbolism of which is detailed on the Vegkop blog:

**Box 34**

[...] We are unearthing, making visible our traditional and indigenous farming knowledge, practise, farming ‘intuition and instinct’. We are healing and regenerating the natural world on the farm and nature’s cycles AND heal ourselves farming the land. We are the colonised, evicted, unemployed farmworkers and landless farmers. The “*weggoi mense*” [surplus people].

Why [...]?

Because we need to reclaim our own self, our history, and our heritage from a history of colonial and Apartheid oppression. We [are] still a colonised people. [...] Nowhere is this more true than in our farming—who and how we produce our food; that which we eat 3 times a day every day 365 days of the year.

Our farming has its roots in colonialism and colonial-settler farming. This has destroyed the soil—as it destroyed the colonised person and communities, destroyed our natural landscape, AND colonized our imagination to make us—the colonized—think that is a good thing; that it’s a superior system, that this is progress; that the environment is there to be exploited by the farmer, that farmworkers are just inputs.

But the food produced out of this colonial-settler farming system is toxic. It has its roots in slavery labour [...] and driven by technology that is equally toxic like GMOs and artificial intelligence as an extension of the dominion of the colonial-settler power structure over man and nature. But don't take my word for it. Google food + climate change, UN + soil degradation, cost + industrial agriculture nutrition and learn more. Plenty out there in the university of the internet if one cares to learn. This is not taught at school or universities, nor is it televised.”

*Blogpost by Nazeer, 28 January 2020*

A succession of newspaper articles protesting the city’s approach to land and water in the Cape Flats has raised the concern that genuine public participation in environmental decision-making “has been shut down” (Sonday 2016a; 2016b). An article authored by Nazeer in the *Argus* (Ibid.) explains that meaningful participation with affected communities is not optional but is a right attested by two constitutional court rulings<sup>13</sup> (Nyati 2008). “We are continuously rolling out the importance of the area in our presentations to citizens, and one of the things we do is, we ask people if they know where their food and water comes from? Because if they do not know that, then they also do not know the risks involved if we lose our farming area. I spend most of my time engaging in various public participation processes regarding environmental governance in the PHA, but, as you can read on my t-shirt, I would rather be farming!” (*Conversation, 27 March 2017*). The three victories won by the campaign in court, namely the heritage ruling, constitutional court ruling, and sand mining rejection, demonstrates that public participation in environmental decision-making from the local community is vital in land, water, and climate issues.

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<sup>13</sup> The 2006 Constitutional Court ruling notes: “The participation by the public on a continuous basis provides vitality to the functioning of representative democracy. It encourages citizens of the country to be actively involved in public affairs, identify themselves with the institutions of government and become familiar with the laws as they are made. It enhances the civic dignity of those who participate by enabling their voices to be heard and taken account of. It promotes a spirit of democratic and pluralistic accommodation calculated to produce laws that are likely to be widely accepted and effective in practice. It strengthens the legitimacy of legislation in the eyes of the people. Finally, because of its open and public character it acts as a counterweight to secret lobbying and influence peddling” (*Doctors for Life International v Speaker of the National Assembly and Others* (CCT12/05), 17 August).

## “I’d rather be farming!”

### Box 35

Me: “How would you describe “heritage farming”?”

Nazeer: “Basically it means going back to our roots and practicing ecologically-sensitive farming. In my activities I always consider how all the elements of the farm are interacting with each other. There are four main principles I follow. The first is “no till”. You see, most large-scale farmers prepare their soil before planting crops by driving over land with heavy tractors to push it down and smooth it out. This happens on farms, like the ones you’ve seen down the road, that are a hundred acres or more; where often a single crop, tomatoes, or canola for instance, is planted. This kind of practice results in a huge amount of carbon in the soil being lost. What I mean is that, as the soil is flattened out, the microorganisms, like fungi and earthworms, which live inside the soil, are disturbed and release carbon into the air. At the same time, you eliminate the biology that keeps the soil fertile. When we don’t till, we keep all these things, the organisms and carbon remain in the soil. [...]”

“The next principle is to plant cover crops, such as mustard seeds or soybeans, to prepare for planting vegetables. This is what I call ‘the protective skin of the land’ as it ensures the carbon and nutrients stay in the soil. Cover crops capture water, and certain plants hold more water than others, which slowly filters through and hydrates the soil. The protective layer is also a heat regulator and ensures the ground is at an ideal growing temperature in which organisms can thrive and moisten the soil. As planting begins, the cover crop is removed, gently by hand, so that the soil structure is not lost [...]”

*Interview with Nazeer, 3 March 2018, Vegkop Farm*

Tillage is the preparation and cultivation of soil through various types of mechanical agitation such as using tractors and ploughing to loosen the top layer of soil to facilitate crop planting. Nazeer argues that tilling destroys the organic matter and breaks the nutrient cycling in the soil: the microorganisms that eat nutrients (such as nitrogen) are removed, reducing natural soil fertility, and increasing the need for artificial fertilizers. In his early works, political philosopher Karl Marx, posited that fertility was not a natural quality of the soil but was rather a product of “metabolic relations”, that is, the interdependent processes of material exchange that link human society with non-human nature through human labour (Marx 1867). Writing in 19th century Europe, Marx noted that an increasing divide between the industrialised urban centres and agricultural countryside had caused a rupture between humans and nature that was compounded by capitalist modes of (agricultural) production. This, argued Marx, develops when human intervention prevents the return of constituent elements to the soil, hindering its natural condition of fertility and causing “soil exhaustion” (Ibid.: 673). Soil exhaustion also triggered unequal ecological exchange, as European imperial powers took resources from colonised places on the “periphery” (e.g., guano from Peru) and transferred them to the colonial “core”. Sociologist John Bellamy Foster interprets Marx’s notion as the “metabolic rift”, an

account of ecological degradation caused by the alienation of humans from nature that is still (and perhaps even more) relevant concerning contemporary socio-ecological crises (Clark & Foster 2009; Foster 1999; 2000; 2013).

Nazeer's self-taught and experiential learning model of agroecological farming is designed to mend the metabolic rift through regenerative methods that reintroduce life into the land. "No one taught me how to farm, I did, and am still doing my own research on the internet and through conversations on a local and global level. And that is actually one of the main goals of the [PHA FFC] campaign, is to share this knowledge." (*Conversation, 3 May 2018*). Agroecology is both a way of thinking and a practise, that places an emphasis on achieving and enhancing the balance between the human and nonhuman at the grassroots level (Dalgaard 2003: 39; Francis, Lieblein & Gliessman 2003; Wezel et al. 2009).

### **Box 36**

Nazeer: "If you look carefully, you can see all kinds of creatures wriggling around in the soil. Earthworms, for example, eat organic matter and excrete a mushy substance we call humus. This is crucial for soil fertility.

When I began removing the rubble, there was not a single earthworm in sight. After the first few months of rehabilitation, I saw the first signs of life and I knew I had begun reintroducing fertility into the soil. Now they are thriving. This means the soil is healthy and that my crops are nutritious.

I believe the farm itself is its own ecosystem, with the soil, the water underground, and the worms are in continuous interaction with each other. All these aspects must be healthy for the farm itself to function.

The different fungi and mushrooms are also crucial for a healthy farm. Many farmers think these do not belong on the farm and kill them with harsh chemicals which destroys other important elements in the process. I look after my mushrooms because they feed my plants. They have good bacteria which are not only beneficial but also necessary to our bodies. Mushrooms have another important function. They create networks of communication that gather information from different parts of the farm as a whole.

For example, if one part of the network is lacking nutrients or affected by something, the rest of the network is alerted and diverts energy into either healing it or cutting it off, so that the whole can continue to function. All these parts work together co-dependently to create the whole."

*Interview with Nazeer, 10 March 2018, Vegkop Farm*

## **Soil, fungi, and earthworms**

### **Box 37**

Nazeer: ““As you can see, I have lots of different crops growing on my farm. Now this is my third principle on the farm: biodiversity. There are a few reasons for this. First is the ecological reason, that certain crops attract insects and others repel them, so you need to find a balance and figure out which ones are the good visitors and which ones you want to kindly tell to stay away without killing them. Therefore, we don’t need to use harmful and expensive chemicals that destroy the soil, roots, and plants. These crops are always in rotation, which also keeps them resilient to pests. Every now and then I change the crops around, which keeps them immune to disease. [...]”

“Lastly, and the one we need to continuously maintain, is the concept of living root. Now this is simple, yet something basic that many people don’t understand about farming. If the soil is in a continuous cycle of nutrients and carbon, or energy and matter, that’s the soil’s metabolic cycle, then it must mean that the soil itself is alive. So then, in this soil, we plant what we call living roots, such as those plants that have deep roots that reach right down. These have a few important functions. First, because the roots reach deep into the soil, they can bring up all those buried nutrients in the deeper layers to the top for other plants to reach. Second, bacteria, good bacteria, forms a wall around the roots because the plants actually feed them. This then becomes our compost and fertilizes the soil. Therefore, in this way, we have no need for chemicals like fertilizers, we would rather attract beneficial insects, who you want to inhabit your farm. Finally, we plant live seedlings that we make sure are organically sourced, and locally sourced, so we don’t need to worry about where our seeds come from, and in planting organic food you definitely do not want to use GM seeds, because these need lots of chemicals to grow.”

*Interview with Nazeer, 17 March 2018, Vegkop Farm*

In environmental humanities, the idea of “composting” has emerged as a metaphor and material “repurposing” through which fertile soil is created through care and attentiveness (Hamilton & Neimanis 2018). Haraway reminds us that “we are all compost” (2015: 161). Interdisciplinary scholar Maria Puig de la Bellacasa submits that soil science is predominantly focused on “progress” and “productivity”, researching how to obtain the highest output from soil quickly to keep up with food demand in a capitalist market economy. Instead, soil care is to “protect the pace of soil renewal” by “[engaging] with soil as a living community rather than a receptacle for crops” (2015). Dr Christopher Mabeza’s research on Zimbabwean farmer Zephaniah Phiri Maseko demonstrates how combining metaphor and material practice can emerge as an adaptive strategy to interrupt and decolonise conventional soil science (2013; 2016). Maseko’s organic farming and water harvesting techniques in an arid environment refined over five decades include building deep contours (by hand) that ensure each drop of water is not wasted but “planted” into the ground, which he defines as “the marriage of soil and water”. As Mabeza’s ethnographic research demonstrates (2016), Maseko described the material relationships on his farm through metaphors and would often include the non-human elements

(e.g., water, soil, plants) as active participants in constant conversation with one another. His metaphors embody the importance of a symbiotic relationship between the individual and the environment.

Similarly, Nazeer’s method embraces each part of the farm as a lively and living participant, that has a purpose and a place for being there. The most important, but least visible, participant is the Cape Flats Aquifer, the silent obscured life force without which plants or people would not inhabit the landscape. “At the root of indigenous farming is the Cape Flats Aquifer, the source of life and sustenance for farmers, the farming community and of the city. At Vegkop farm we follow the tradition of the original *Camissa* inhabitants, *the Watermans*, who for thousands of years lived sourcing their nourishment from the *Camissa* ecosystem, the land, rivers, wetlands, aquifers, and indigenous plants. They believed the creator gave them the land not only to live off, but to look after for future generations. Their philosophy was based on care, care for the community and for the environment. Passing this knowledge down was essential to their survival” (*conversation, 3 May 2017*). Nazeer describes his reflections on the multispecies relations on his farm:

**Box 38**

The complexity of life is showing itself on Vegkop Polyculture Farm. Species interact – at times as competitors, but more so as symbiotic communities – is incredible. In nature the web of life is held together by relationships. One species’ waste is a resource for another. Different species often work in cooperative enterprise for mutual benefit. [...]

Life on earth is built on biodiversity and driven by the interaction of species and the collateral ecosystem services those relationships produce. On Vegkop Polyculture Farm we work very hard to mimic nature’s organizing principles and apply them to farming systems by building biodiversity as the foundation for a healthy ecosystem that results in higher productivity. [...]

We want to grow as many different plants as possible. Growing a diversity of food crops enables us to offer a wide variety to our customers. That diversity is also a benefit to the soil, as a variety of plants feed the soil microbes a wider spectrum of nutrients when they break down and decompose. As a result of [*Watermans* (indigenous inhabitants)] farming practises, we have increased our soil organic matter from 0.5% to 2% in two active farming years, on the road to meet our target of 7% by 2024. Soil organic matter [SOM] is an indicator of soil carbon and soil health and a measure of our learner farmers!”

*Blogpost by Nazeer, 28 January 2020*

The broader goal of the PHA FFC is to expand the heritage farming model practiced on Vegkop Farm to the entire area to create a buffer against climate change and aridity. While intensive farming practices tend to deplete carbon from the soil and release it into the air, agroecological

practices aim to return carbon into the ground where it is naturally sequestered and stored long-term (Lal 2003; Swift 2001). This makes the PHA critically relevant in the question of climate change mitigation. The PHA has been identified as the city's "green lungs", i.e., a natural area within the urban landscape that replenishes air quality and acts as an ecological link to the coast (Battersby-Lennard et al. 2012: 28). For these reasons, the PHA must not only be protected and preserved by authorities, but its potential ought to be promoted and enhanced through regular public participation processes.

**Box 39**

Nazeer: "Soil loves eating carbon. That means, with a large area of farmland, all adopting an agroecological approach, you can create a carbon sink for the city. In fact, we have been told by scientists that, if used to its full potential with organic farming practices, the PHA could sink up to 20% of the city's carbon emissions. Can you believe that? And we can do this without investing billions of rands into technology. All we need to do is change our practice, which is exactly what we have been doing on this site."

*Conversation with Nazeer, 12 April 2018, Vegkop farm*

**Guardians of the aquifer**

**Box 40**

Nazeer: "We are by default the guardian of the Cape Flats Aquifer, which contains so much water that it can supply the city with 30% of its potable water needs. Why I say we, the farmers, are the guardians, is because an aquifer needs an aboveground catchment area. Unlike a dam, which is situated in high-lying areas like mountains, the aquifer is below the soil. What happens is, rainwater soaks through and permeates the soil to recharge groundwater. Our area is 3,000 hectares in size, and we are the last remaining recharge, full recharge, area for the aquifer."

*Interview with Nazeer, 13 April 2017, Vegkop farm*

**Box 41**

Farmer 4: "The aquifer keeps us resilient to drought. But an aquifer needs an aboveground area to recharge and is therefore in intimate relationship to the landscape in which it dwells."

*Conversation with "Farmer 4", 15 October 2017, Vegkop farm*

Most importantly, the PHA is the largest and one of the last remaining natural areas for freshwater replenishment of the Cape Flats Aquifer; the highest rate of recharge occurs in south-east Philippi (where Oakland land is located). This increases the PHA's relevance not only in

terms of food provision but also in the face of (potentially) permanent water scarcity in the city and is thus considered to be the “guardian” of groundwater in the Cape Flats.

**Box 42**

Lesley Green: “[...] If you take aerial photographs back to the 1920s when the first aerial photographs were taken of this area, you will see substantially much larger numbers of bodies of water that were feeding this aquifer. You cannot feed an aquifer on little parcels of land here and there that has been carved up. The water that runs off the streets is dirty.”

*Primary source, 2 August 2017, Prof. Lesley Green’s statement, PHA FFC centre*

**Box 43**

Susanna: “We’ve been saying this for a long time, that developers are ignoring the impact of developments on the aquifer. All they do is, they give us ‘desktop’ studies on groundwater, which is completely inadequate to address the issue of the aquifer. Now we know that since we have been talking to geo-hydrologists, who specialise in aquifers. I mean we have an academic in the University of the Western Cape who is the UN Head of Underground Water, the UN head, and he has come out in strong favour of more research and management and protection of the aquifer. So, they understand very clearly, if you develop over an aquifer, the aquifer will dry up and die. This is very important for us to understand that there needs to be a management in place for the aquifer. The aquifer, the issue of the aquifer needs to be highlighted.”

*Conversation with Susanna, 18 September 2017, PHA FFC centre*

Dr Yongxin Xu, Segun Michael Adenana and Petr Vrbka (Adelana, Xu & Vrbka 2010; 2014) have recreated the aquifer’s replenishment mechanisms in a two-dimensional model to demonstrate the effect of climatic variability and seasonal fluctuations on groundwater, as well as the interactions of water with mountains, clouds, rocks, vegetation, and land. The freshwater lens, in hydrological terms, is a convex-shaped layer of groundwater that floats above denser saltwater, physically delineating what defines a drainage basin, or watershed. Aquifers are replenished via precipitation that percolates through layers of soil and assorted geological strata before reaching this aqueous substratum. Lens thickness, which differs for each water body, depends on geometric proportions, physical composition, recharge rates, weather patterns, ecological exchanges, planetary cycles, and interaction with aboveground areas (Ballestero 2016a; 2016b; Giordano 2009; Margat & Van der Gun 2013). The collaboration of water, rocks, soil, sand, plants, air, and climate display remarkable symbiosis was what occurred to me and while on the farm I could almost feel the expanse of the aquifer under and around me. Only a

fraction of these interactions is visible on the surface, however, as water moves mostly underground, unseen, and hidden to the observer.

Recharge of the freshwater lens happens predominantly in two ways: one almost immediately perceptible to the observer, the other out-of-sight. The first mechanism of recharge happens vertically, via infiltration from precipitation, where rain falls directly onto the land, seeping through strata of sand, soil, and decomposed plant matter, to reach the freshwater lens (Adelana 2010; Adelana & Xu 2005). It is here where I “witnessed” the complex workings of the watershed as multiple bodies of shale, granite, minerals, salt, silica-rich sand, limestone, peat, marine clay, calcareous rocks and silcrete, which I return to in Chapter four (Henzen 1973; Mauck 2017; Schalke 1973; Seward et al. 2009; Theron et al. 1992; Wright & Conrad 1995). Rainfall records since 1884 reveal a localised microclimate in the Cape, where highly variable rainfall patterns follow the topological and geographical lay of the land (Adelana & Xu 2006: 265-6), which also define the urban ecological and social boundaries of the urban space. The low-lying semi-desert of the Cape Flats receives the least amount of rainfall in the region, that is concentrated in winter months (June-August), with an annual average of 400-800 mm, declining to as little as 20 mm in summer (November-January). In periods of high precipitation, flooding in the Cape Flats is a regular occurrence demonstrating the sheer volume of water that saturates the ground. Yet for those who live in areas with a high water-table, typically low-income areas, and informal settlements in the Cape Flats, this is problematic (Adelana & Xu 2008; Anderson & O’Farrell 2012). Nevertheless, water soaks the ground year-round, providing an important source of water for farmers in the Philippi Horticultural Area, that in turn, is an important source of food for the city.

The second mechanism through which the aquifer is recharged is the horizontal movement of water via underground rivers and ancient paleochannels at most 200 m (on average 50 m) below sea level (Adelana et al. 2010: 462; CoCT 2018b: 7). The isotopic signature of groundwater in the Cape Flats resembles that of rainwater, indicating its moderately young age and relatively quick recharge cycle, with the age of groundwater being approximately 20 years (Department of Water Affairs & Forestry 2008). Hydrologists have traced the origins of these waters to the mountainous flanks on either side of the Cape Flats, namely the Cape Fold Belt and Cape Peninsula Mountain ranges. Due to the sharply folded landscape, rainfall is concentrated on the south-western slopes of Table Mountain, which receives the highest amount of rainfall in the region, with some places catching 1700-2600 mm of rain during winter months (Adelana et al. 2008; Xiaobin 2014). This marks a notable distinction between climates within greater Cape

Town. This water then rushes down the mountain and across, or under, the landscape, and sometimes overflowing into the Cape Flats (Netili 2007). The fact that cloud cover colloquially known as the “Tablecloth” is visible above Table Mountain “almost daily” (Sorensen 2014; 2017)<sup>14</sup> means that the Table Mountain Aquifer acts like a giant sponge, absorbing water that percolates through the rock and eventually reaches the Cape Flats Aquifer, evidencing a complex interchange between two water bodies where one is protected and the other polluted. The presence of freshwater underground acts as a buffer against drought and aridity and increases the city’s resilience to climate variability. In this way, the PHA and the Cape Flats Aquifer combined with Cape Town’s unique water micro cycle, effectively make the entire area “drought-proof”.

#### **Box 44**

John Holmes: “We must create protection zones for the aquifer. It’s not optional. [...]. Now is the time to support what the [PHA FFC] campaign is doing [and] that we create protection zones for the Cape Flats Aquifer because it’s in a unique location. I try to be more positive than negative. [...]”

[My] positive prediction is that sometimes we humans can be very stubborn. We need to actually be brought to our knees to listen, and this is really hard. I think I saw a poster up there [points to a hand-painted poster on the wall] that says ‘NO EXTRACTION WITHOUT RECHARGE’ in large letters. This is a non-negotiable part of [Managed Aquifer Recharge]. [...] The funny thing is that anybody [like] farmers that are involved with growing anything, they understand; the people that work with the soil, because you guys understand and have a relationship with water. [We have] been speaking in lots of community meetings in very different places. You know five years ago, even two years ago, we had barely had anyone from the community attending a meeting about water [...] We would maybe talk to one person here and there. Now, they are standing outside waiting to talk to us!

So, my little bit of hope I want to give you is that [...] it’s sad that it had to come to this [...] but now people realize water is important, not just for the farmers [...] but for everybody. [...] I think we have a unique opportunity because of this crisis to fix this, and to make sure it’s done properly for the future [...]

*Field notes: 10 February 2018, PHA FFC centre*

## **Conclusion**

The perspective of utilizing the PHA as a solution for manifold socio-ecological crises poses a unique opportunity for the city. This chapter examines what alternative ways of evidencing the

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<sup>14</sup> This is even captured in the Khoekhoen name for the region //Hui !Gais, meaning “the place where the clouds gather” hinting at the possible scientific basis of indigenous knowledge (Hahn 1881).

Cape Flats Aquifer exist, particularly in the PHA, that foster more-than-human relations in contexts of climate change.

I began with a brief history of the PHA as the city's breadbasket, and compared two different agricultural practices, namely agro-industrial and agroecological. My ethnographic approach evolved into a multispecies ethnography to capture the complexity and plurality of human-nature relations on the site, especially in the Vegkop Polyculture Farm. I discuss the possibility of "heritage farming" as one possible alternative that not only preserves the farmlands and protects the aquifer but is also built on public participation as a cornerstone for democratic environmental decision-making. This model furthermore envisions the PHA as the first fully organic agricultural area in Cape Town, acting as both the city's green lungs and drought resistance. In this way, the city's potential to become a world leader in climate change resilience remains to be realised.

## Chapter four: The relational watershed

### Introduction

#### Box 45

Nazeer: “It’s time that we start thinking about the aquifer in a different way. I believe we should recognise the aquifer as a living body, as a person with rights, that is protected by the constitution in such a way as to be beneficial for the aquifer as well as the people.”

*Conversation with Nazeer, 23 March 2017, Water Justice Conference*

In the previous chapter, I examined potential solutions to the multifaceted socio-ecological crises in Cape Town, namely the Cape Flats, by discussing alternative human-nature relationships that are being put into practice in the PHA.

This chapter is the final step in my analysis, where I question what ought to be part of the aquifer evidentiary if socio-economic and ecological justice is to be achieved. I combine scientific data, i.e., “matters of fact” and experiential “matters of concern” to deliver a “thick description” (Geertz 1973) of the Cape Flats Aquifer, as a multiple and responsive body that is intimately implicated in the human and more-than-human in contexts of climate change. Here I present a creative nonfiction account of the aquifer as both a site (place) and participant (body) where it emerges as lively, vibrant, and sensitive to changes in its surroundings. I engage in what anthropologists Thom van Dooren and Deborah Bird Rose (2016) term “lively *ethography*” (note the spelling); where the prefix *ethos* (Greek: character, belief system or custom), in anthropologist Clifford Geertz’s words, is the tone, or quality of life, i.e., the moral attitude which humans (in society) reflect onto themselves (Geertz 1996: 127). In this case, however, the point of departure is that not only humans have *ethos*, the definition of which is reflexive and in reality, is diverse and each is distinct (van Dooren & Rose 2016: 79-80). Using “*recognition* as a mode of encounter”, such a method fosters expository and performative ways of writing that “enlivens our capacity to respond” (Ibid.: 77) to the more-than-human bodies in a multispecies-ed world. I delve into the premises of posthuman feminist theory which illuminates the vulnerability of the human body in the face of technoscientific and climatic change/crises in order to reposition the human not in terms of mastery, as Mbembe (2016) iterates, but in terms of possible extinction (Alaimo 2008; 2010 Åsberg & Braidotti 2018; Braidotti 2013; 2017; Haraway 2008). These frameworks theorise novel ways of representing the “social” to include material, physical and planetary forces, in which the human is embedded in its embodiment in the entangled world (Braidotti 2011).

I offer what posthuman feminist Astrida Neimanis calls “an aqueous imaginary” (2012; 2017b) bringing the aquifer into existence as a relational body, at once different and similar to the human body to disrupt the dualistic cosmologies inherent in Eurocentric thought. This chapter starts by navigating the aquifer through a deep time perspective to acknowledge that history reaches beyond human evolution and is shared with a multitude of earthly beings, entities, and forces (Mbembe 2015). I demonstrate that the aquifer is neither always, nor only, a body of water, yet has become enmeshed in the watershed moment with which this dissertation began.

### **An aquifer imaginary**

Water is the source of life. The same water has been endlessly circulating for the entirety of earth’s four-and-a-half billion-year-old lifespan; but less than one percent is fresh enough for most beings, including humans, to use. Of this precious freshwater, up to ninety-nine percent is unseen, found underground in aquifers that both contain and carry water (Fogg 2015; Franks 2000; Postel, Daily & Ehrlich 1996; Vitousek et al. 1997).

Aquifers are massively distributed in space and time relative to humans: up to thousands of kilometres across/deep and millions of years old<sup>15</sup>. While the amount of water in the world is constant, its form, quality, quantity, and rhythm are not (Blackstock 2002; 2008; 2009). Climatologists indicate that anthropologically induced global warming has accelerated the planetary hydrologic cycle, that has in turn catalysed extreme climatic conditions (e.g., superstorms, stronger storm surges, and fluctuations between droughts and floods, Huntington 2006; Ohmura & Wild 2002; Syed et al. 2010). Modern technoscience has, according to Linton, allowed for both the metaphorical and material abstraction of water (2010: 65), that has plunged the planet’s unseen waters into an out-of-sight crisis, one only visible when too late (Dimick 2014). The GRACE satellites<sup>16</sup> brought this crisis to light, revealing that two-thirds of the world’s major aquifers are being rapidly depleted<sup>17</sup>, while one-third remain gravely distressed

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<sup>15</sup> Some aquifers contain “fossil water”, that is between millennia and millions of years old; this water originates from melting ice during the end of the last ice age and is not replenished under current climatic conditions. South Africa’s two notable fossil water bodies (both part of a larger transboundary aquifer system) are both enmeshed in complicated technosciences: the Karoo Aquifer is at risk from hydraulic fracturing (oil/gas multinational corporations such as Shell and Anglo-American are applying for permission) while the Kalahari Aquifer hosts the country’s only radioactive waste-disposal facility (currently used by Africa’s only nuclear power plant, the Koeberg Nuclear Power Station in Cape Town).

<sup>16</sup> GRACE (Gravity Recovery and Climate Experiment) was a joint mission of NASA and the German Aerospace Centre in which twin satellites were launched between 2002-2017 to measure the movement and distribution of water across the planet.

<sup>17</sup> Some are being depleted in a single human lifetime, e.g., the Ogallala Aquifer, the largest in north America, irrigates the “breadbasket of the world” (e.g., where 90 percent of potatoes come from), water is 6 million years old but, in some places, depleted in 50 years and up to 100m below the surface (Sanderson & Frey 2014).

(Famiglietti 2014; Lakshmi 2016). Taking water out the ground faster than can be replenished is an instance of Marx’s metabolic rift occurring on a planetary scale, where the constituent elements (i.e., water) are not returned to the earth in their original state thereby hindering natural conditions for life (Sanderson & Frey 2014). Nevertheless, water remains the most anomalous substance known to science<sup>18</sup>, which Neimanis uses as a springboard to “open up a different sort of imaginative space” (2012: 2) that disrupts dualist ideologies inherited in dominant systems of thought. Focusing on water’s *unknowability*, which Neimanis submits as another way of understanding and relating to water through which alternative relationships between knower and known can be envisioned. Water does not exist in the abstract, but is always situated in time, place, and bodies. “Moreover,” as Neimanis *et al.* argue in *Thinking with Water*, “we are all situated in relation to water” (Chen, MacLeod & Neimanis 2013: 5). Situating ourselves (i.e., as researcher/reader/observer) in relation to water thus requires approaches to epistemology and ontology that understand how these relations are shared with more-than-human beings, entities, and forces (Carstens 2016: 255).

I develop a method of “lively ethnography” that attempts to narrate and “restory the relationships that constitute and nourish” diverse forms of human and more-than-human life with the aim of recognising and responding to the “meaningful lives of others” (van Dooren & Rose 2016). Here I situate myself in relation to the Cape Flats Aquifer using a multi-scalar analytical lens to resituate the human and aquifer as sensitive, cognisant, and adaptive. I describe the aquifer as what geographers Nigel Clark and Kathryn Yusoff call a “geosocial formation”, where “formation” is understood as both a process (verb) and outcome (noun), and “geosocial” refers to the “enfolding of dramatic geologic change into the space-time of social life” (2017) that defines modernity. In this concept, the planet itself is active and embedded with agency that is colliding with the human and prompts a repositioning of the human in terms of possible extinction. I present a “geo-ethnography” (Green 2014: 7) or “geostory” (Latour 2014a) of the Cape Flats Aquifer as neither only, nor always, a water body that reminds us that we are all to some extent bodies of water. In this way I attempt to make the aquifer visible as a multiple, relational, and responsive body that is implicated in the many multispecies bodies that share the watershed.

### **Not always a body of water**

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<sup>18</sup> There are at least 40 properties of water that defy laws of physics.

An aquifer in the simplest definition is a body of freshwater. Yet it is not always a freshwater body. Its formation has complexly occurred over vast amounts of time. Here our story reaches back through deep time and how it materialises in places and bodies (Ginn et al. 2018). As Martin J. S. Rudwick states: “Any scene from deep time embodies a fundamental problem: it must make visible what is really invisible. It must give us the illusion that we are witnesses to a scene that we cannot really see; more precisely, it must make us ‘virtual witnesses’ to a scene that vanished long before there were any humans to see it” (1992: 1). Here my ethnography, or story, reaches back through deep time to the moment of the aquifer’s creation (Carlson 2005: 3) almost a billion years ago (Norman & Whitfield 2006: 12) and its intangible connections to the “watershed moment” that defines the present. Tracing its geological formation, the aquifer emerges as both ancient and active, with a lively agency that must be taken into account as the gradual forces of earth enmesh with daily lived reality.

The layers of the aquifer can be read like chapters in a book, telling stories of previous climates and landscapes (Ibid.). Four-billion years ago the earth was a primordial ocean. About three-billion years ago the first continents appeared, parts of which are still visible in the north-western part of South Africa. In the south, this two-kilometre elevated landmass, pushed up by tectonic forces<sup>19</sup>, dramatically slopes off at the Great Escarpment towards the Cape. The oldest rocks in the Cape region are the sedimentary Malmesbury Group, between 980-million and 860-million years old, deposited by the interplay of continental collision and ocean currents as marine mud and sand, since solidified into the present shale, greywacke, sandstone, and slate (Compton 2004: 44). Largely unseen, these layers form the impervious bedrock of a much larger aquifer to which the Cape Flats Aquifer is connected (Conrad & Peek 2019). Approximately 630 million years ago, these rocks were intruded by Cape Granite, crystallised deep within the earth, consisting of pink feldspar crystals, glassy quartz, black mica flakes and dark hornfels (Theron et al. 1992). Freshwater gathered here to create conditions for the aquifer’s formation. A mountain range that was enormous long ago once covered the Cape, in some parts reaching over 10 km high, whose soft sandstone eroded over half a billion years to reveal the relief landscape of the Cape Fold and Cape Peninsula Mountains, and the Cape Flats isthmus connecting them that is my study site.

These mountain ranges, central to the recharging of the aquifer, were formed by tectonic plate collisions that ended 200-million years ago. During this time, the earth had experienced

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<sup>19</sup> Tectonic forces have also shaped a landscape rich in minerals, gold, and diamonds in the Gauteng province, which has placed South Africa as a controversial and strategic player in the global capitalist market.

multiple ice ages, where fluctuations between glacial and greenhouse conditions would determine the sea level. As geologist John Compton (2004) points out, the ocean has fluctuated between -120m and +200m of its current level: the warmer conditions between 5 and 1.5 million years ago, sea water covered the entire Cape Flats and the Cape Peninsula became a group of islands, the freshwater now found in the waterscape non-existent. As planetary temperatures cooled and the sea receded about 120 000 years ago, beach sand, shell fragments, and estuarine muds were deposited on the landscape, later cemented into calcareous sand dunes. During the ice ages, such as the last glacial period that began 20,000 years ago, the entire bottom of False Bay was exposed upon which an extensive system of sand dunes was formed (Ibid.). These shells are sometimes found on the study site. This returns us to the “watershed moment” triggered by the recent drought. As Cape Town becomes more vulnerable to rising sea levels due to global warming, the aquifer’s very existence becomes more endangered.

### **Not only a water body**

The aquifer is neither only a freshwater body. It contains rock, sand, shells, soil, peat, plants, fossils, and organisms through which water constantly flows. Sand is the main component of the aquifer. The white sand that constitutes the once-extensive sand dune system was formed about 10 000 years ago. The sand originates from two geomorphological sources: the first layer was formed by weathering followed by deposition, under marine conditions, of quartzite and sandstone; and the second was formed by aeolian processes where strong winds deposited dunes swept up from nearby beaches horizontally on top of marine sands (Adelana 2010: 33). A geologist describes the geostory of the Cape Flats sand:

#### **Box 46**

John Holmes: “The Cape Flats [is] a coastal aquifer. [...] As Nazeer said, there’s an area called the *Witzand* Formation. *Witzand* literally means white dunes. If you drive up the R27 you see them. Those are very young dune formations, they’re less than about 10,000 years old, what we call Holocene dunes. Essentially the sea level which was [...] 120 m below where it is now, about 17,000 years ago, started rising rapidly. There were the big advances or re-advances of the dune systems. We had very powerful trade winds, as you know, the southeaster or Cape Doctor, and that is what we in geomorphology call the aeolian process. It dominates the coastline in the southwestern Cape. Sand on the beaches is subject to wave action, sand gets picked up by very strong winds and then it blows inland and can actually ride up mountains, as you see those in Hout Bay for example and near Simon’s Town, you have sand dunes that have climbed right up the mountain. [...]”

“As the sea-level has gone up and down, the coastline moves in and out, and behind the coastline and behind the coastal dunes are the estuaries: the Zandvlei, the Zeekoevlei, areas around the Diep River and northern suburbs, those are areas where fine sediment accumulates, there are lots of wetlands around them, and they are fed by rivers coming in,

either from Table Mountain or from Tygerberg, or from the mountains out in the Hinterlands to the east of us. So those are the three systems we've got in this area: you've got the "aeolian process zone" which was active in driving sand inland [...]."

"Those estuaries then get overridden by the dunes, and then you've got the river systems with fine sediment such as quartz and so on, coming in, and then deposited at the base of the estuarine systems. So, all that system is moving in and outward. There's a very clear sequence [...], maybe sometimes gravel and sand, coarse sand, very clean quartz sands, then you get the clays and silts, sometimes some peats, which are the very materials, plant materials that have been overridden by the dunes, and then you get the sand, normally quite fine sand, which are windblown into the interior. And sometimes those are big, linear dunes, sometimes they are those dunes [...] that advance with their long thin sleeves bowing to the wind. You get those east of the airport, and sometimes just thin sand sheets. If you have ever been to Muizenberg when there is a very strong wind blowing you will see this layer of sand blowing along the road. And so that whole process now is what we have in the Cape Flats and what all has contributed and is continuing to aquifer formation."

*Audio recording: 10 February 2018, PHA FFC centre*

The unique combination of sand and freshwater has also given birth to the Cape Floral Kingdom, the smallest but most biodiverse floral region in the world, where fire-prone, shrub-like fynbos with over 9,000 species (of which 69 percent are endemic) have flourished for 33 million years (Cowling et al. 2003; Holmes et al. 2012; Rebelo et al. 2011). Inter-relational layers of plant, decomposed plant matter and geological strata act as a critical filter for freshwater underground. Yet this landscape is rapidly shrinking and is experiencing some of the fastest extinction rates in the world. Furthermore, the shallow nature of the sand makes groundwater highly susceptible to pollution from anthropogenic sources (Adelana 2014; Seward et al. 2009; Wright & Conrad 1995). As the sand and soil degrade, groundwater becomes more saline and thus no longer fresh. The very substance upon which our bodies depend, disappears, creating conditions of unliveability.

**Box 47**

Farmer 3: "These sand dunes are the memory of our land and people. They recharge our aquifer, they grow our food, and they build our city. We need to preserve our sand dunes. This is one of the last original remaining sand dunes of the area still standing."

*Conversation with "Farmer 3", 15 February 2017, PHA FFC centre*

**We are all bodies of water<sup>20</sup>**

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<sup>20</sup> This section's title is borrowed from *Bodies of Water* (Neimanis 2017b).

There is no substitute for water (Maracle 2011). Here I adopt a posthuman feminist lens to enquire what it means to be a body of water at a time when watery bodies are threatened by the out-of-balance water cycles and conditions on the planet (Neimanis 2012: 96). The concepts of “weathering” and “weather writing” (Neimanis & Walker 2013) attune to ways in which the human body and climate change are intimately implicated in often unseen and unequal ways. While we are all bodies of water – where a human body is anywhere between 60-90 percent aqueous; “our bodies are also of air, rock, earth” (Ibid., 2017b: 8). As geologist Monika Bakke points out, “all organic bodies [...] reach deeply into the material realm through metabolic systems” and through the “cast temporal dimension of the materiality of earth” (2016: 60-1). To paraphrase Bakke, the perception of human bodies as flows of matter and energy offers a geological perspective into the relational nature of existence (Ibid.: 63-4).

It is metaphors and the language used in knowledge production that provide a novel foundation towards thinking about more-than-human relationships in contexts of the Anthropocene. Medical anthropologist Annemarie Mol’s conception of the “body-multiple” is useful here. Not one body is singular because it cannot be removed from the multiple realities that sustain it (2002: 11). Moreover, the whole is not simply the sum of its parts, but a continuously repeating process of wholes within wholes (Ibid.: 119). This gives rise to ontologies and epistemologies that must become “fleshy and thick on the page” to “give rise to proximity and ethical entanglement, care and concern” (van Dooren & Rose 2016: 89). Neimanis (2017b) argues that accepting that “we are all bodies of water” surfaces a philosophy of connectivity, in which water must be respected as a shared life force. This is reflected in many indigenous cosmologies worldwide, that recognise water as the lifeblood of the planet (Wong & Christian 2017).

This leads to the first part of my argument, which will come full circle, mirroring the ceaseless cycle of water around the planet. Water is a shared source of life and therefore must be valued and protected intrinsically. Although it is beyond the scope of this dissertation to discuss the dis/advantages of legal personhood, the granting of thereof to New Zealand’s Whanganui River in 2017 (Brierley et al. 2019; Iorns Magallanes 2018) and Canada’s Magpie River in 2020 are examples of how alternative ways of thinking are changing protection policies. Water is not simply only intrinsically important, but it weaves us together through a common thread, for we are all made of the same water (Neimanis 2017b). Yet water cannot be protected in isolation. An aquifer is not one but myriad bodies of water, rock, sand, soil plants accumulating for eons, increasingly combining with pollution, concrete, cement, rubble, and waste. For this reason, the aquifer must be recognized as a “body-multiple” (Mol 2002): relational, sensitive, and

responsive to changes in its surroundings. Thus, the second premise of my argument is that to protect water, the landscape in which it flows must be preserved to allow enough clean water to flow. Upon attending the Water Justice Conference held at the St. Georges Cathedral in March 2017, the words of Anglican Archbishop of Cape Town, Thabo Makgoba paint a picture of water's importance:

**Box 48**

Archbishop Makgoba: “Many of us might not realize that beneath our city is a Cape Flats aquifer, a hidden treasure that holds vast stores of water. Studies have shown that it has the potential to supply two-thirds of the Mother City’s water needs, providing 49 million litres of water a day. But it’s under threat and as citizens we must call on City officials who are stewards of our resources to preserve this pearl. [...]”

“The city’s dams are only 28% full. I am calling on you to end the indifference to the importance of water and water shortage crisis now faced. [...] We have lived our lives by the assumption that what is good for us will be good for the world. We now need to change that into what is good for the world will be good for us. A balance between competing demands on scarce water resources needs to be found. [...]”

“Justice and water cannot be separated. [...] Most importantly, water is sacred. We as the citizens must find ways to committing to address issues that put sources of water, including rivers, oceans, and aquifers, under threat.”

*Water Justice Conference, 23 March 2017*

As I have demonstrated, the aquifer is more than its definition, and must be understood as a watershed. Geographers Nigel Clark and Kathryn Yusoff might define it as a “geosocial formation” (2017): not only a static site upon which political and social lives are enacted, but also embedded within a lively geological agency of its own that is mostly unseen and unpredictable and can spontaneously react to the livelihoods that are practiced in on its surface. Here, formation is both a verb, or process, and a noun, or the outcome, neither static nor stationary but in a continuous dynamic exchange with the more-than-human world.

**Conclusion**

Repositioning the human along spatial and temporal scales can offer a different perspective of the aquifer that makes it visible as a multiple, relational, and sensitive body.

In this chapter I explored how the Cape Flats Aquifer is a site not just of shallow water, but where the geological and social converge in deep time, it is also a multispecies and more-than-human body with its own lifeworld and timespan, but a body much like our own with a home, family, limbs, nervous system, and bodily fluid that sustains it. If we think of the watershed

moment as relational to us as a species, then we will also start thinking of the aquifer differently and protect it for present and future generations. My final argument revolves around the ethical commitments and moral underpinnings that come with framing concerns as “matters of care”: first, we need to protect water as an intrinsic source of life upon which all multispecies and more-than-human bodies depend; second, since water is always situated, we need to protect the landscapes and subterranean stratigraphies in which all water flows to preserve its quality and quantity; third, we need to find ways of communicating between each other and with multispecies worlds in order to ensure the health and wellbeing for all bodies on a shared planet.

## **Chapter five: Returning to the watershed moment**

### **Discussion of findings**

This dissertation explores the possibility of alternative more-than-human relations in contexts of climate crisis using the case study of the Cape Flats Aquifer and the PHA.

The questions framing my enquiry included what counts or is discounted as evidence in bringing the aquifer into existence; what other ways of evidencing the aquifer exist, and what ought to be part of the aquifer evidentiary, or body of evidence, if socio-economic and ecological justice is to be achieved. This chapter provides a summary of the chapters in this dissertation, suggests directions for future research and ends with my final conclusions.

Evidence, from Latin *evidentia*, means “obvious to the eye or mind” (*Oxford English Dictionary*), but an in-depth analysis of the types of data collected in my enquiry reveal that this is far from the case. The traditional notion of evidence in an empirical sense must be complemented by alternative ways of observing that which is not visible/easily discerned. To do so I used concepts and methods emerging in environmental humanities scholarship, including political ecology, new materialism, posthuman feminism alongside critical and multispecies ethnographies and lively ethography/storytelling. I presented my findings in three phases. First (chapter two), I outlined the problem being faced on the study site by focusing on the legal battle over how land and water should be managed and used. Here, I illustrated that one reason the PHA Food & Farming Campaign formed was to challenge how decisions are made and knowledge is produced in the context of climate change. Second (chapter three), I explore alternate ways the aquifer is made visible or brought into existence, that pay attention to human entanglement in a multispecies world. Here, I demonstrated another reason the campaign was created, to cultivate economically feasible and ecologically sustainable ontologies that create conditions of liveability in contexts of crisis. Third (chapter four), I offer a critical and creative approach to resituate the human in terms of the vast temporal and spatial scales of the aquifer. My final argument comes full circle: we must respect water first as a shared source of life; we must protect the more-than-human landscapes through which water flows, and we must preserve livelihoods that are sustainable, adaptable, and resilient while including the multispecies and earthly elements that would not be possible without water.

### **Directions for future research**

This dissertation was written as an innovative and imaginative text that introduced the reader to many new concepts and cosmologies that require expansion and research, particularly in the emerging field of environmental humanities. This requires studies that are not only situated in specific spatiotemporal contexts, but also pays attention to the entanglement of more-than-human worlds and multispecies entanglements. The unexpectedly extended timeframe this research entailed was both an advantage and limitation. Although a lot more resources, time, and funding were used than initially intended, the benefits of having more time outweighed the costs. The extended timeframe of my participant observation afforded me several advantages, namely, the ability to cultivate genuine interpersonal relationships with my participants, detailed insight into human-nature relations experienced daily and a more accurate awareness of events occurring in the field site as drought emerged then declined in the city. Anna L. Tsing writes: “to study encroaching unliveability, we need longer histories than fieldwork usually allows, as well as attention to far-flung and difficult-to-trace connections” (Tsing 2017: 61). This was exactly my experience in this study, as the timeframe extended far longer than initially intended, but was necessary to capture the full complexity and dimensions of my study. Paying attention to how time, space, matter weave into the body is also critical, and water’s centrality in these concepts must be brought to the forefront of future research that will be set against ever-more unpredictable contexts of climate change.

Critically, research should equally be grounded on evidence as well as compassion for that/those being studied. Furthermore, future research needs to adopt the reflexive-turn, accounting for the inherent bias in all knowledge production. This can be turned into a positive notion, as it might prompt a move towards matters of concern and care that positively impact the lives of all those directly impacted by environmental crises. Ultimately, I argue for a case-study and site-specific approach in dealing with ecological problems that cannot be removed from the economic, geological, and social contexts that shape them. To reclaim the bigger picture, researchers must engage with their readers to deepen our awareness of the multiform relations between the watersheds, earthly habitats, and diverse inhabitants in which we live. I embrace anthropologist Francis B. Nyamnjoh's call to open my "mind up to life-worlds unfolding themselves through the interplay between everyday practice and the manifold actions and messages of humans, ancestors and non-human agents in sites of emerging meaning-production and innovative world-making" (2012: 63).

Research in the environmental humanities necessitates inter- and transdisciplinary research to be conducted, as this study has demonstrated through active participation with scientists,

hydrogeologists, urban planners, city officials, decision-makers, historians, writers, the media, and citizens. In Susanna's words: "This is why we urge you to practice active citizenship. Ask yourselves, what can you do? Everything counts. Petition, write to newspapers, know the role of your political parties and urge them to make an environmental agenda in parliament" (conversation, 22 February 2019). The emergent notion of the "citizen scholar" can be useful here, "which encapsulates the idea that the role of universities is to promote scholarship as well as producing active and engaged citizens" (Hornsby, Arvanitakis & Moore 2015).

### **Final conclusions**

This dissertation advocates for more-than-human relations at a time of climate crisis using the Cape Flats Aquifer and its aboveground areas. I frame the watershed as both a moment in time and a set of material relations, where matter and meaning intermingle in hidden, concealed, and obscured ways. The aim of this research is to unearth the often-unseen entanglements between water, human, multispecies and earthy bodies, each of which are multiple, relational, and responsive to one another in a shared habitat. I argue that to protect ecological integrity and balance of life on earth, we need to advance ways of being and thinking that are inclusive, flexible, resilient, adaptable, and acknowledge the shared multiplicity without which our, and many other bodies, would not survive.

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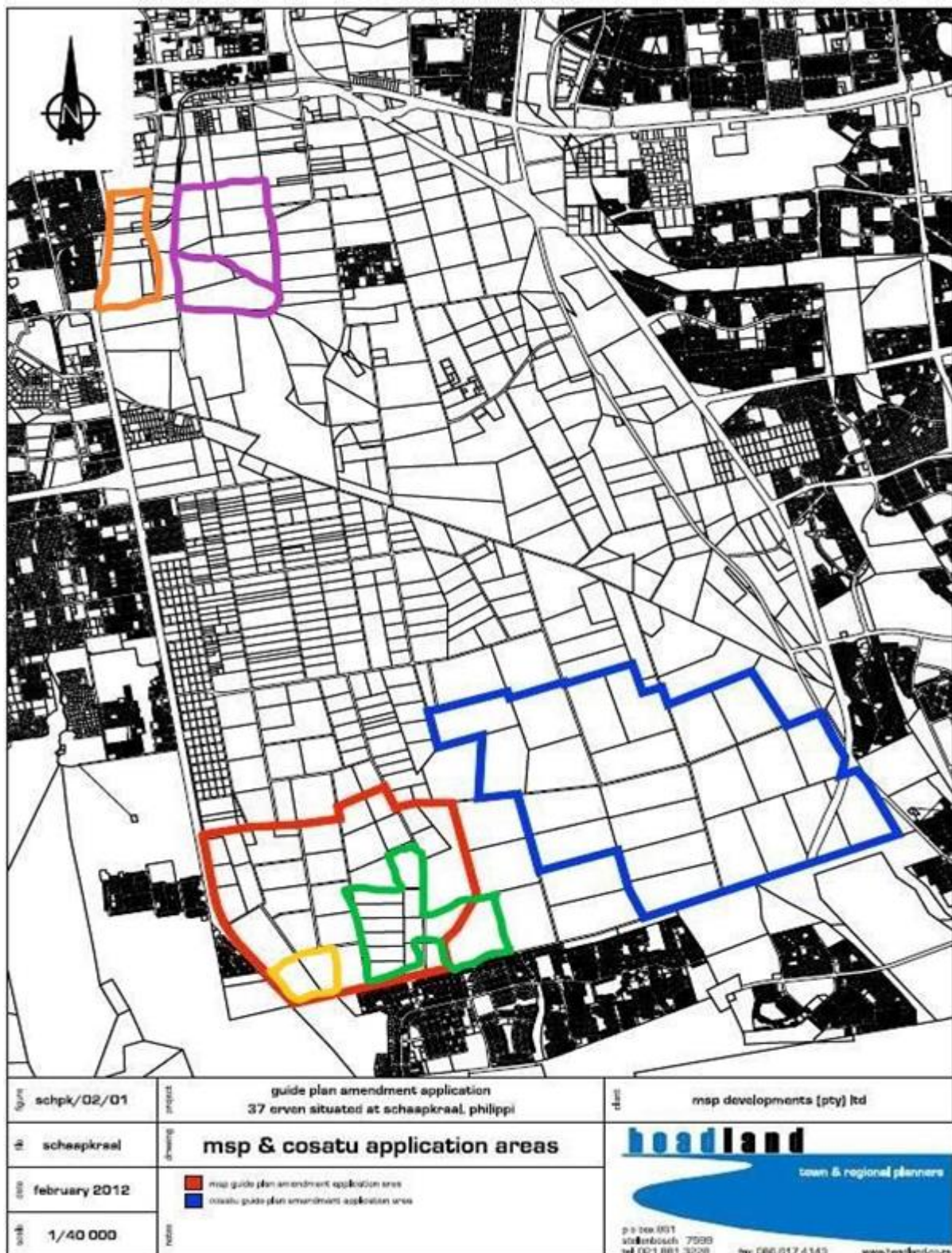
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## Appendix

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Map 1: Contested developments in the Philippi Horticultural Area, 2012-2021<sup>21</sup>



<sup>21</sup> Blue lines delineate Rapicorp 122 (Pty) Ltd land; red lines delineate the UVEST/MSP land; purple, orange, and yellow lines delineate various plots of land currently used and proposed for sand mining; green lines delineate agricultural land worth R20 million that the city offered to buy from the developer at R52.6 million if the rezone was afforded (Source: Guide Plan Amendment Application submitted to City 2012)

# Map 2: Cape Flats and Philippi Horticultural Area, 1942

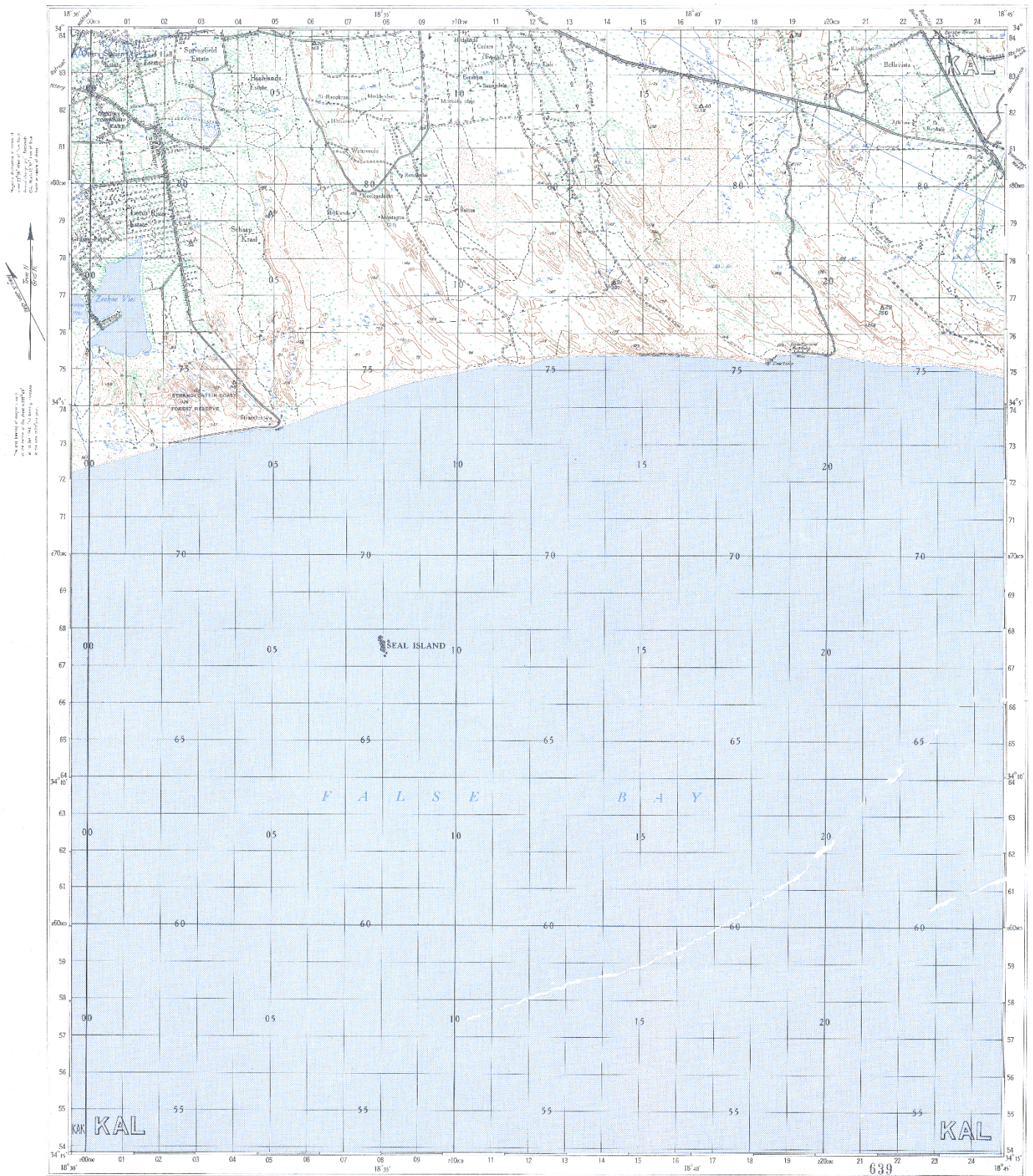
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FIRST EDITION FIRST PRINTING



# Map 4: Cape Flats and Philippi Horticultural Area, 1979

1:50 000 SOUTH AFRICA  
SUUD-AFRIKA

3418BA STRANDFONTEIN

Refer to the Map of SOUTH AFRICA 1:50 000 Sheet  
Verwys na Handle Kaart as SUUD-AFRIKA 1:50 000 Vm



As Philippi, 1925 Surveyed in 1925 and drawn in 1965 by the Supplemental Survey Office. Partly Revised in 1976.  
Lugwagwag 1925 Oopgetuig in 1925 en getuig in 1965 deur die Oorsonderingskantoor. Gedeeltelik herrevisie in 1976.  
T.S.O. 29024493

Contour Interval 50 English Feet  
1:50 000  
English Feet 5 000 0 5 000 10 000 15 000 English Feet  
Metre 1 000 0 1 000 2 000 3 000 4 000 5 000 Metre

Revised and published by the Government Printer, Pretoria, Rep. No. 189, Price R 1075  
Herrevisie en uitgegee deur die Staatsdrukker, Pretoria, Rep. No. 189, Prijs R 1075  
1979

REFERENCE	VERKLARING	VERKLARING
International Boundaries	Internasionale Grense	Internasionale Grense
Provincial Boundaries	Provinsiale Grense	Provinsiale Grense
Multiple Track Railways	Veelwagende Spoorwag	Veelwagende Spoorwag
Single Track Railways	Eenwagende Spoorwag	Eenwagende Spoorwag
Electric Railways	Elektriese Spoorwag	Elektriese Spoorwag
Motor Cycle Railways	Motorwagwag	Motorwagwag
Cable and Motor Vehicle Tracks	Kabel- en Motorwagwag	Kabel- en Motorwagwag
Roads	Weg	Weg
National Roads	Nasionale Pad	Nasionale Pad
Main Roads	Hoofpad	Hoofpad
Secondary Roads	Weg	Weg
Other Roads	Weg	Weg
Trails and Footpaths	Weg	Weg
Other Trails	Weg	Weg
Telephone and Telegraph Lines	Weg	Weg
Post and Telegraph Offices, Post Stations and Posts, Signal Stations, Schools and Places of Worship	Weg	Weg
Lighthouses and Marine Lights	Weg	Weg
Marine Beacons	Weg	Weg
The Boundary between light and night watch	Weg	Weg

The grid lines of the South African Co-ordinate System are indicated in this map by thin lines. In an English Foot scale, with a contour interval of 50 English Feet in blue.

All heights are given in English Feet to ground level.  
Alle hoogtes is in Engelse Voet tot op grondvlak gegee.  
Green Contour Projection, Central Meridian 18° East.  
Groen Kontour Projekie, Hoofmeridian 18° Oos.

Die rooster van die Suid-Afrikaanse Coördinaatsistiem word in die kaart deur dunne lyne aangedui. In 'n Engelse Voet skaal met 'n 50 Engelse Voet kontour interval, is dit in blou.

Kontour- en hoogtes is in Engelse Voet tot op grondvlak gegee.  
Groen Kontour Projekie, Hoofmeridian 18° Oos.

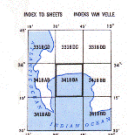
Alle hoogtes is in Engelse Voet tot op grondvlak gegee.  
Alle hoogtes is in Engelse Voet tot op grondvlak gegee.

Green Contour Projection, Central Meridian 18° East.  
Groen Kontour Projekie, Hoofmeridian 18° Oos.

Die rooster van die Suid-Afrikaanse Coördinaatsistiem word in die kaart deur dunne lyne aangedui. In 'n Engelse Voet skaal met 'n 50 Engelse Voet kontour interval, is dit in blou.

Kontour- en hoogtes is in Engelse Voet tot op grondvlak gegee.  
Groen Kontour Projekie, Hoofmeridian 18° Oos.

REFERENCE	VERKLARING	VERKLARING
Magazine Stations and Ground Signs	Weg	Weg
Police Posts	Weg	Weg
Cattle Kraals and Stock Pens	Weg	Weg
Drainage Canals	Weg	Weg
Windmills	Weg	Weg
Dams	Weg	Weg
Artificial Wells	Weg	Weg
Excavations	Weg	Weg
Perennial Water	Weg	Weg
Non-perennial Water	Weg	Weg
Dry Pans	Weg	Weg
Fountains, Springs, Waterfalls and Wells	Weg	Weg
Marbles, Steeples and Mills	Weg	Weg
Parvies	Weg	Weg
Prison Gates	Weg	Weg
Prominent Rock Outcrops	Weg	Weg
Towers	Weg	Weg
Cultural Landmarks	Weg	Weg
Crests and Wreaths	Weg	Weg
Antennae, Windmills and Steeples	Weg	Weg



# Map 5: Cape Flats and Philippi Horticultural Area, 1981

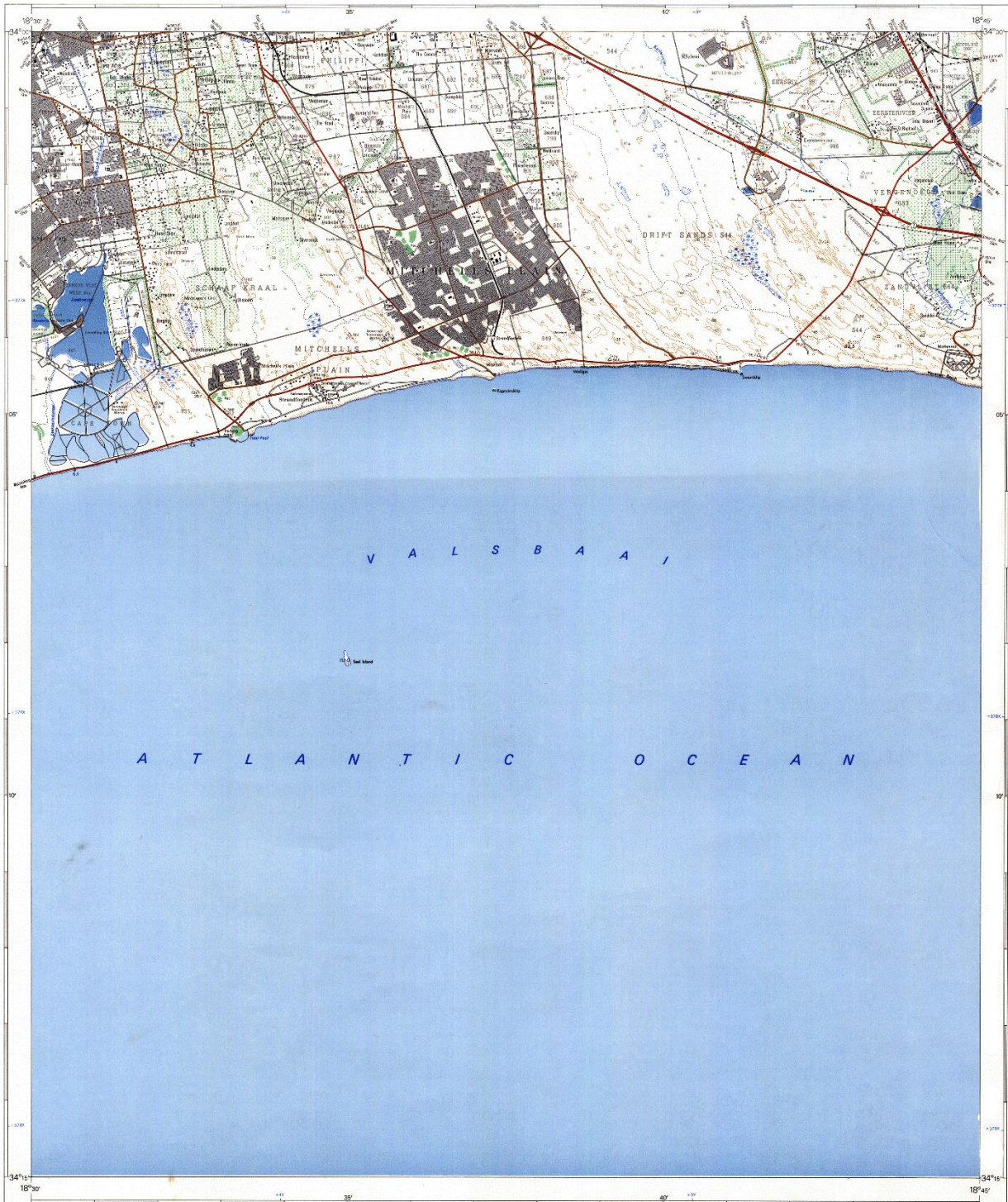
1:50 000 SOUTH AFRICA  
SUUD-AFRIKA

HEIGHTS IN METRES

3418BA MITCHELLS PLAIN

HOOGTES IN METERS

Refer to Map No. 3418BA of SOUTH AFRICA 1:50 000 Series 3418BA MITCHELLS PLAIN  
Verwys na Kaart no. 3418BA van SUID-AFRIKA 1:50 000 Serie 3418BA MITCHELLS PLAIN



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CONTINENTAL INTERVAL IN METRES

1:50 000

NON-DETERMINANT IN METERS

Printed by the Government Printer, Private Bag 303, Pretoria.  
Gedrukte deur die Staatsdrukker, Private Bag 303, Pretoria.

REFERENCE	VERKLARING	REFERENCE	VERKLARING
International Boundaries	Internasionale Grense	International Centre	Internasionale Sentrum
Provisional Boundaries	Provisoriese Grense	Provisional Centre	Provisoriese Sentrum
Military Train Routes	Wapenmag se Treke	Verreëde Boesmans	Verreëde Boesmans
Single Track Railways	Eenreëlspoor	Streekreëlspoor	Streekreëlspoor
Double Track Railways	Twee-reëlspoor	Streekreëlspoor	Streekreëlspoor
Service Railways	Diensreëlspoor	Streekreëlspoor	Streekreëlspoor
Industrial Routes	Industriële Reëlspoor	Streekreëlspoor	Streekreëlspoor
Major Roads	Hoofweë	Streekreëlspoor	Streekreëlspoor
Secondary Roads	Skoolweë	Streekreëlspoor	Streekreëlspoor
Other Roads	Andere Weë	Streekreëlspoor	Streekreëlspoor
Trails and Footpaths	Spoorweë	Streekreëlspoor	Streekreëlspoor
Power Lines	Stroomlynne	Streekreëlspoor	Streekreëlspoor
Telephone Lines	Telefoonlynne	Streekreëlspoor	Streekreëlspoor
Post Offices, Police Stations and Posts	Postkantore, Polisie-stasies en Poste	Streekreëlspoor	Streekreëlspoor
Stores, Hotels, Schools and Places of Interest	Winkels, Hotelle, Skole en Plekke van belang	Streekreëlspoor	Streekreëlspoor
Lighthouses and Marine Lights	Waaier- en Seeleëligte	Streekreëlspoor	Streekreëlspoor
Marine Beacons	Seeleëligte	Streekreëlspoor	Streekreëlspoor



Hoogte van 10 meter meer as 1000 m. Hoogte van 10 meter of minder as 1000 m. Hoogte van 10 meter of minder as 1000 m. Hoogte van 10 meter of minder as 1000 m.

Scale Contour Projection: Gauss-Merkator. 1° East. Date: 1981. Datum: 1981. Datum: 1981. Datum: 1981.

INDEX TO SHEETS INDEX VAN VELLE



REFERENCE	VERKLARING	REFERENCE	VERKLARING
Magnetic Surveys and Control Signs	Magneetmetings en Stuurmerke	Magneetmetings en Stuurmerke	Magneetmetings en Stuurmerke
Top Benchmarks, Benchmarks and General Heights	Top Bepalinge, Bepalinge en Algemene Hoogtes	Magneetmetings en Stuurmerke	Magneetmetings en Stuurmerke
Monuments	Monumente	Magneetmetings en Stuurmerke	Magneetmetings en Stuurmerke
Clipping Marks	Knipskeie	Magneetmetings en Stuurmerke	Magneetmetings en Stuurmerke
Wellheads	Wegkoppe	Magneetmetings en Stuurmerke	Magneetmetings en Stuurmerke
Quays	Wegkoppe	Magneetmetings en Stuurmerke	Magneetmetings en Stuurmerke
Auto-Station Marks	Wegkoppe	Magneetmetings en Stuurmerke	Magneetmetings en Stuurmerke
Essential	Wegkoppe	Magneetmetings en Stuurmerke	Magneetmetings en Stuurmerke
Provisional Water	Wegkoppe	Magneetmetings en Stuurmerke	Magneetmetings en Stuurmerke
Drainage	Wegkoppe	Magneetmetings en Stuurmerke	Magneetmetings en Stuurmerke
Sanitary Water Pipes and Wells	Wegkoppe	Magneetmetings en Stuurmerke	Magneetmetings en Stuurmerke
Vegetation	Wegkoppe	Magneetmetings en Stuurmerke	Magneetmetings en Stuurmerke
Power Lines	Wegkoppe	Magneetmetings en Stuurmerke	Magneetmetings en Stuurmerke
Telephone Lines	Wegkoppe	Magneetmetings en Stuurmerke	Magneetmetings en Stuurmerke
Post Offices, Police Stations and Posts	Wegkoppe	Magneetmetings en Stuurmerke	Magneetmetings en Stuurmerke
Stores, Hotels, Schools and Places of Interest	Wegkoppe	Magneetmetings en Stuurmerke	Magneetmetings en Stuurmerke
Lighthouses and Marine Lights	Wegkoppe	Magneetmetings en Stuurmerke	Magneetmetings en Stuurmerke
Marine Beacons	Wegkoppe	Magneetmetings en Stuurmerke	Magneetmetings en Stuurmerke

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Continued on sheet 3418BA/1. Gedrukte op bladsyd 3418BA/1.



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# Map 2: Cape Flats and Philippi Horticultural Area, 2010

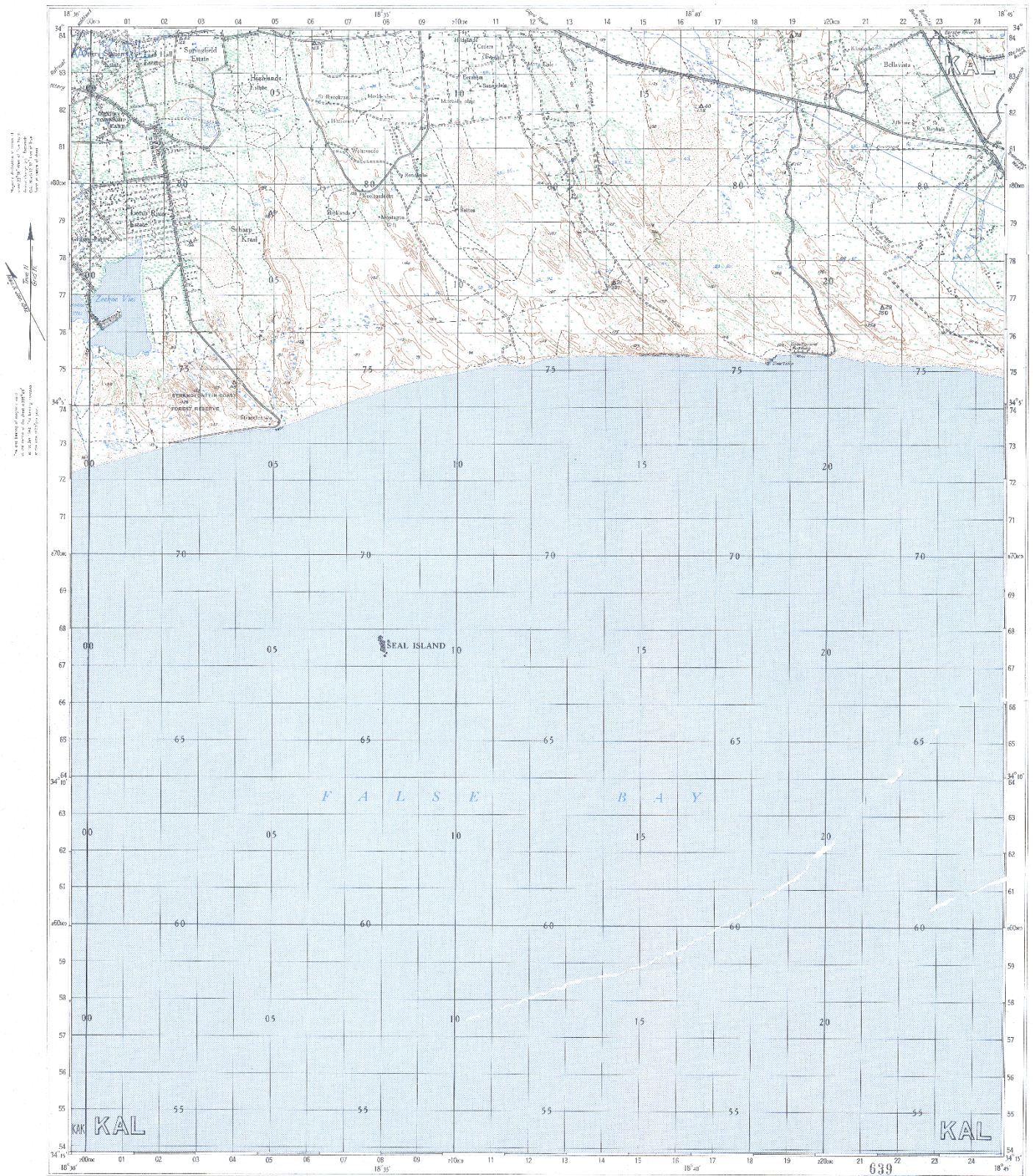
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Published on the Order of South Africa by the GOVERNMENT PRINTER, Pretoria: 1962

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