

Water risks of coal driven mega projects in Limpopo: the MCWAP and the EMSEZ



Figure 1. Artist impression of proposed Electro Metallurgical Special Economic Zone (EMSEZ) between Musina and Makhado (from EMSEZ website).

**Victor Munnik,
Society Work and Politics (SWOP) Institute,
University of the Witwatersrand
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Preface

The proposed Electro Metallurgical Special Economic Zone (EMSEZ) threat in Makhado is both a huge risk to water users and the environment in the Limpopo valley, and difficult to take seriously, since it has so many irrational aspects. For that reason many NGO researchers have been reluctant to become involved in a complicated issue in what could be a waste of time and money. A word of thanks is thus due to Richard Worthington at Friedrich Ebert Foundation who commissioned this piece in order to get this work done. I sincerely hope that this will be useful to fellow activists and to decision makers. This report focuses specifically on the water aspects of the EMSEZ, which I believe is a major threat, although together with other activists I wonder about the likelihood of the EMSEZ plans. The Mokolo Crocodile West Augmentation Project (MCWAP) is also discussed in this report, as an example of how fossil fuel development can still have dire water implications five decades after the start of coal mining and coal fired power generation, and a caution that even failed mega projects, as the EMSEZ is likely to be, have a cost to people and the environment.

This report relies on a close reading of the Department of Water and Sanitation's 2016 Limpopo Water Management Area North Reconciliation Strategy, as well as the October 2018 DWS Master Plan.

Declaration of interest: the author grew up in the Limpopo province, in Lephalale, next to the Mokolo river and has an enduring love for the non-perennial sand rivers of the greater Limpopo area.

Victor Munnik, Johannesburg, May 2020.

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EXECUTIVE SUMMARY

This report focuses on the risks to other water users of two coal based mega projects in the water scarce area of the northern Limpopo province.

The old: After five decades of coal based development in the Waterberg, originally spurred on by apartheid fears of a lack of coking coal for steel production, the Mokolo Crocodile West Augmentation Project (MCWAP) project is now planned to bring in water for sulphur dioxide scrubbers on Eskom's faltering Medupi power station, (their installation being a contractual obligation to the World Bank), and in the hope of expanding coal mining and electricity generation. The water will be from the heavily eutrophied Hartebeespoort dam on the Crocodile River, infested with water hyacinth and burdened with effluent from waste water works. Ultimately this water derives from the Lesotho Highlands Project.

The new: the Electro Metallurgical Special Economic Zone (EMSEZ) between Makhado and Musina, is a proposal for a 120-year mega project constellation in the context of post-apartheid South Africa and political conditions in its Limpopo province. This is against the background of the growing international influence of the People's Republic of China and has serious international implications for the shared Limpopo river.

This report specifically looks at the risks these schemes hold for competing water users in the Limpopo area. It uses the concept of risk as the product of (1) the scale of the possible impacts and (2) the likelihood of these mega projects going ahead (or in the case of the MCWAP, the completion of the next phase). The report aims to provide reliable and up-to-date information for all interested stakeholders, particularly social and gender justice activists, to support public debate and democratic engagement with relevant authorities regarding water security and access in the face of increasing demand; explore the status of on-going and proposed infrastructure projects and associated processes relevant to water supply and demand into the medium term, especially demand associated with fossil fuel production and use, and inform community-based education and advocacy regarding proposed industrial developments.

Water scarcity

Water is scarce in the Limpopo area. This scarcity is not only the driving force behind the completion of the MCWAP, but also a constraint that could derail plans for the EMSEZ or, if the EMSEZ proceeds regardless, could exert extreme and disastrous pressure on other water users and their livelihoods.

The international Limpopo, shared by four countries – Botswana, South Africa, Zimbabwe and Mozambique – is home to around 18 million people. It is a dry area, most of which receives less than 500 mm/year of rain, which generally falls in a fewer than 50 rainy days between October and April. Irrigation is the dominant water use at 50%, then urban use (including industries in urban areas) at

30%, and mining, power generation and rural water use each at 6%. The majority of residents in the catchment are poor, female, small scale or subsistence farmers who run livestock and grow crops that are only successful for two out of every five years. Their water resources are insufficient and climate change will make this worse.

The International Limpopo is already a “closed catchment”, because all water resources have been allocated to activities already in operation. South Africa already transfers water from the Vaal system, and any new water use will require additional transfers – unless more groundwater is used. The international organisation responsible for managing the Limpopo catchment is weak, while South African interests, commercial agricultural lobbies and more recently, mining and industry interests have the strongest influence. Analysts have warned of the potential for conflict between different water user groups and states.

The Limpopo North Water Management Area (LNWMA), which together with the Olifants, Crocodile, Madikwe and other smaller rivers, makes up the South African part of the international Limpopo Basin, is also dry. Rainfall is between 300 mm to 700 mm per year, with high potential evaporation as a result of high temperatures, predicted to get worse as a result of climate change. The area’s water resources are, in the description of the South African Department of Water and Sanitation, heavily stressed. Water quality is deteriorating throughout most of the catchment.

The LNWMA includes the towns of Polokwane, Lephalale, Musina, Louis Trichardt, Mokopane, Mookgophong and Modimolle – with the exception of Lephalale, all of these along the N1 highway (see figure 6). Around 760 rural communities are scattered throughout the WMA, with concentrations in the former Lebowa, homeland areas. The total population in the catchment is estimated at just under 2 million people. The research found that the water requirements of these “diffuse” water users were not clearly visible in the planning. DWS planners also did not include any environmental flow requirements, arguing that these were not suited to sandy, non-perennial rivers, and, in their present form as “desktop assessments” (DWS 2016a: 4-5) would exhaust the area’s dams.

Commercial irrigation uses 72% of available water (464.8 Mm³/year), with 57% of that from groundwater, i.e. from boreholes; the rest from the Limpopo or from shallow sand aquifers in or next to the non-perennial rivers that are tributaries to the Limpopo (the Matlabas, Mokolo, Lephalala, Mogalakwena, Sand and Nzhelele-Nwanedzi rivers). Other big users are domestic (including urban industry) mining, industry and power generation which are both expected to grow from now to 2040, in the calculations of Department of Water and Sanitation planners. Irrigation is expected to stay the same as current. Livestock watering takes small amounts for commercial cattle running, small and subsistence cattle and goat farming, as well as for game farming. Although amounts are relatively small, this is a crucial category in terms of subsistence, small farmers and job creation.

Within the Limpopo North Catchment is the Mokolo catchment, with the non-perennial Mokolo river and its shallow sand and alluvial aquifer. The Mokolo dam, which collects water from the high rainfall Waterberg mountains, serves commercial irrigation farmers and residential users. An existing pipeline,

the MCWAP1, is capable of diverting the full yield of the dam to the coal developments between Lephale and Steenbokpan: a huge Exxaro mine inherited from Iscor and the Matimba and Medupi coal fired power stations, as well as potential coal mines and private power stations. It is this coalfield that now needs extra water by way of the MCWAP2.

The other important subcatchment for this report is the one around the Sand river. The Sand River catchment is where the EMSEZ is planned, together with a subsidiary SEZ not discussed in this report, the logistics (and possibly agricultural processing) hub at Musina. The catchment houses about a million people, more than half (51%) of the population of the LNWMA. A large part of the former Lebowa bantustan is in the catchment, making the issue of diffuse water users dependent on small quantities of water particularly important. The Sand contains 40% of the rural settlements of the LNWMA (DWS 2016). Polokwane, the capital of the Limpopo province, is by far the biggest urban settlement, with an estimated more than 700 000 people, of which 39% rural and 61% urban. It is also the centre of political decision making. Other important urban centres are Makhado and Musina. It is the driest catchment in the Limpopo North WMA with very limited surface water resources. However, it has exceptional groundwater reserves which have been fully and possibly over-exploited, mostly by irrigation. Irrigation is again the largest water user, followed by domestic use, and then industrial use. The catchment uses far more water than it has available. Urban requirements are already met through pipeline transfers from other WMAs.

What are the risks if the projects go ahead?

MCWAP

For the MCWAP, there are risks both to completing the project, and not completing the project. If the project is completed, dirty water would be brought into the Waterberg and eventually contaminate streams including the Mokolo. The availability of water may open the region for further fossil fuel development. It will also decrease the water in the Hartebeestpoortdam, increasing the risk of oxygen depletion events, leading to fish kills and hammering what is left of the aquatic ecosystem in the dam. This will make the dam unattractive to tourists and residents.

If the project is not completed, it will open a different type of risk. Since 2015 it is technically possible that all the water in the Mokolo dam could be shunted to the power stations of Matimba and Medupi, to Exxaro mines, and to support any further fossil fuel based development. This would result in less water for irrigation, threatening commercial farms, the supply of food that they provide, and jobs on farms. Pressure on water resources will also threaten rural and other diffuse water users. If the MCWAP2 does not proceed, the FGD scrubbers would not be installed at Medupi and sulphur dioxide pollution would continue uncontrolled, as is happening at present.

EMSEZ

The EMSEZ is planned as a 90-year project with an optional extension of 30 years. While it is unclear exactly how and where the EMSEZ plans to source its water, except that it will come from “the Limpopo river”, all possible plans carry long terms risks, mainly to poor rural water users.

The plan to transfer 30 Mm³/a – only enough for the construction phase of the Makhado EMSEZ, but not for its eventual operation requirement of 123 Mm³ - from the Zhovhe dam in the Mzingwani catchment in the dry Matabeleland, across the Limpopo in Zimbabwe, would cut off any possibility for the revival of commercial agro-businesses and threaten subsistence and smallholder farmers dependent on the river and its alluvial aquifers – and any plans they have for expanding their incomes.

Risks to Tuli Karoo aquifer and its population of 123 400 largely rural and predominantly female, and poor, are great. With its relatively large yield, this aquifer in Zimbabwe, Botswana and South Africa is the only realistic source for the amount of water use foreseen in the Makhado EMSEZ. Water security in the area is already affected by climate change, as witnessed in rising temperatures and increasing rainfall variability leading to more droughts and floods. If the EMSEZ relies for its water requirements on this aquifer, it will deplete it, leading to the collapse of thousands of livelihoods, cause long term damage to the aquifer, and put an end to development plans. It will also do considerable damage to diplomatic relations between the four aquifer states (South Africa, Zimbabwe, Botswana and Mozambique) and the emerging but weak governance system of the aquifer (LIMCOM).

If no alternative sources of water are found and the Makhado EMSEZ goes ahead, or if the EMSEZ water requirements are under-estimated, it will exert a very destructive pressure on water resources, which are already at breaking point. This will most likely first affect the diffuse rural water users with their fragile rights, as well as domestic users. It may also affect the irrigation farms and put pressure on food production and farm jobs.

EMSEZ factories can be expected to pollute water sources in the area, both surface and ground water, given the weak state of water quality regulation in South Africa and the experiences with steel making pollution in the Vaal Triangle. An increase in coal mines in the area will lower the regional water table, causing community wells to dry up, a phenomenon already witnessed by rural communities in the area.

What are the chances that the projects will go ahead?

Both projects take place in defiance of climate change. They are part of a politics of ‘late coal’ in South Africa (and the world), a politics of opportunism and tactics aimed at exploiting the last spoils of a sunset industry. A serious implementation of climate change response could see the MCWAP proceed at the minimum scale that is required for pollution control of sulphur dioxide, or Medupi shut down and the MCWAP not proceeding. New coal mines or power stations in the Waterberg are unlikely.

The EMSEZ is preposterous in its defiance of a reasonable climate change mitigation calendar. Its timeline of 90+ years ignores the need to reduce global coal use by 2030 and completely phase it out by 2050. The EMSEZ proposal can anticipate stiff opposition from climate change and other anti-coal activists, a growing reluctance and refusal of financial institutions to invest in coal as well as regulatory opposition from elements in the South African and possibly Chinese government who take climate change mitigation seriously. In addition, its huge coal fired power station of between 3000 and 3 600

MW (the dimensions keep changing) is not planned for in the South African Integrated Resource Plan (IRP). It may face opposition from embattled state electricity producer Eskom.

The EMSEZ appears to enjoy the support of Chinese authorities and strong Chinese state owned corporations as part of a programme to offshore excess Chinese steel producing capacity and carbon emissions.

The declared commercial aim of the EMSEZ is to produce steel for sale to China and Sub Saharan Africa. However, there does not seem enough demand for the steel output of the EMSEZ. South Africa's steel demand is stagnant, Sub Saharan Africa imports two thirds of its modest steel requirements, and China is producing and exporting a surplus of steel as its construction boom has slowed down. It is also questionable whether transport plans (to the Maputo harbour) are feasible, including the possibility that Transnet may oppose them. In other projects, lack of economic viability has led to withdrawal of Chinese government support.

While environmental considerations may not loom large in China's overseas investments, the diplomatic fall-out of a dispute about the shared water catchment of the Limpopo may motivate Chinese state actors to abandon the project. For this reason, it is important to understand – as this report has attempted to do – what the real implications are of the EMSEZ choice of “the Limpopo” as its source of water. There are four governments involved with the Limpopo river, and opposition from any one of them may lead to diplomatic tensions that may scupper the project. As for taking water from the Zhovhe dam, while the current Zimbabwean regime may acquiesce to this, it will create a potent future source of resentment among many Zimbabweans, particularly those directly affected.

While the South African government appears to be in support of the project, there are contradictory signals. There are references to the EMSEZ in official government literature, such as the DTI's Industrial Policy Action Plan (IPAP 2018/19 – 2019/20). The DWS planners' efforts to find extra water for the EMSEZ (or similar developments) date from 2014, and possibly earlier. But there are also contradictory signals indicating that some actors in the national government may be deliberately leaving this project in the hands of the Limpopo provincial government. In December 2019 Environment Minister Barbara Creecy confirmed that the Limpopo Department of Economic Development, Environment and Tourism (LEDET) is indeed the regulatory authority looking after the EMSEZ project, and that the national DEFF cannot intervene. This response is a surprising hands-off attitude, which may signal that the national department is keeping its distance from a disaster about to happen.

The National Water and Sanitation Master Plan (2018) explicitly identifies water for mining and industry as a priority. However, it also notes a serious deterioration in water ecosystems, expresses concern about the deterioration of water quality in the country, as well as the deterioration of water monitoring systems. It identifies the potential to further exploit groundwater resources, but cautions that this water is very widely distributed across the country and its potential availability offers particular opportunities for small towns, villages, mines, and individual users to meet their water

requirement for domestic use, irrigation and stock watering. It is therefore unlikely that groundwater would be made available on large scale to an industrial development like the EMSEZ.

On the ground, a number of civil society groups are strenuously opposing the plans, against the background of a long and reasonably successful history of resistance to the expansion of the coal industry in the area.

Longer term issues

The report also identifies four issues that need attention. They are:

- The invisibility of “diffuse” water users and their fragile rights in water allocation research and planning. These are rural water users who form the majority in the areas studied in this report, who are in general poor, consisting of a majority of women who face daily challenges in providing food and ensuring health for their families;
- The urgent need for an ecological understanding specific to South African sand aquifer rivers that would effectively influence policy making and water allocation and allow for the implementation of ecological flows in these rivers – that are currently absent;
- The need to strengthen citizens participation in water governance both in South African catchments and in international, shared river catchments such as the Limpopo;
- The need for South African activists to understand the growing influence of China in Africa, and with it the need for engaging with Chinese approaches to the environment. China is already a world leader and in the future will become more so.

ACRONYMS

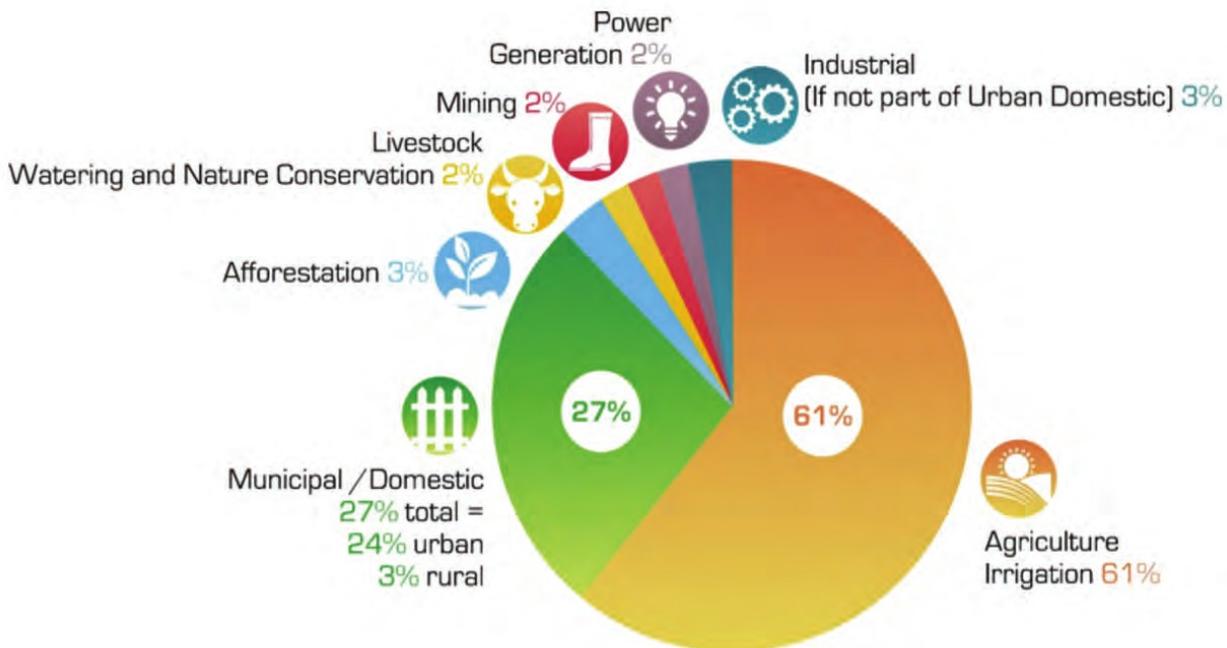
CoAL	Coal of Africa Limited
CPA	Community Property Association
DEIR	Draft Environmental Impact Report
DTI	Department of Trade and Industry
DEA	Department of Environmental Affairs
DWS	Department of Water and Sanitation
EMSEZ	Electro Metallurgical Special Economic Zone
EWR	Ecological Water Requirements
FDI	Foreign Direct Investment
FGD	Flue Gas Desulphurisation
IAP	Invasive Alien Plants
IBT	Inter Basin Transfer
ICT	Information and Communications Technology
IPAP	Industrial Policy Action Plan
IPP	Independent Power Producer
LEDA	Limpopo Economic Development Agency
LEDET	Department of Economic Development, Environment and Tourism
LIMCOM	Limpopo River Commission
LNWMA	Limpopo North Water Management Area
MCWAP	Mokolo Crocodile West Augmentation Project
Mm ³	Million cubic metres
MMSEZ	Musina-Makhado Special Economic Zone
MoU	Memorandum of Understanding
Mtpa	Million tons per annum
MW	Megawatt
NCP	North China Plain
NEMA	National Environmental Management Act
PAIA	Promotion of Access to Information Act
PES	Present Ecological State
SEZ	Special Economic Zone
SIP	Strategic Industrial Project

SOLVE	Save our Limpopo Valley Environment
VMRSF	Vhembe Mineral Resources Stakeholders Forum
WMA	Water Management Area

From millimetres to millions of cubic metres of water per year

Rainfall is measured in millimetres per year (mm/a). National water planning in South Africa is expressed in millions of cubic meters per year (Mm³/a). A cubic meter contains 1000 litres. A million cubic meters per year (Mm³/a) thus equals a billion litres per year.

South Africa has an average annual rainfall of 465 mm (half the world average), producing a total annual runoff of approximately 49 000 million m³/a. But surface water available to water users - the current reliable yield of surface water at an acceptable assurance of supply (based on an average because South Africa's rainfall is very variable between years) - is much less at approximately 10 200 Mm³/a nationally. The combined storage capacity of large dams is in the order of 31 000 Mm³. The total nationally accessible groundwater potential is about 4 500 Mm³/a of which between 2 000 and 3 000 Mm³/a is currently being used.



How we use our water resources in South Africa

Information and diagram from DWS Master Plan (DWS 2018).

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Chapter 1: Issues

Introduction and overview

This report deals with the water aspects of two infrastructure plans for fossil fuel development in the water scarce area of the Limpopo North catchment of South Africa: the Mokolo Crocodile West Augmentation Project (MCWAP) (see figure 10), and the proposed Electro Metallurgical Special Economic Zone (EMSEZ) between Makhado and Musina – shown in the artist’s impression in figure 1. Both are mega projects, both contain power stations, contain or imply expansion of coal mining, both propose inter basin water transfers, and both can be seen as water grabs. Both hold huge risks for other users, particularly the majority of residents of the Limpopo river catchment in South Africa, Botswana, Zimbabwe and Mozambique whose water rights can be described as “fragile”, as well as for the environment. But they also differ: the MCWAP is the result, and completion phase, of a mega project constellation emanating from apartheid South Africa’s growing international isolation in the late 1970s and made possible by the 1980s Lesotho Highlands Inter Basin Transfer scheme. On the other hand, the EMSEZ is a proposed – and in many ways uncertain – mega project constellation in the context of post-apartheid South Africa and political conditions in its Limpopo province, against the background of the growing international influence of the People’s Republic of China, with serious implications for the international Limpopo river.

This report specifically looks at the risks these schemes hold for competing water users in the Limpopo area. It uses the concept of risk as the product of (1) the scale of the possible impacts and (2) the likelihood of these mega projects going ahead (or in the case of the MCWAP, the completion of the next phase). This report deals, in the main, with the first aspect, although it returns to the likelihood issue in chapter 4, below. The report aims to

- provide reliable and up-to-date information for all interested stakeholders, particularly social and gender justice activists, to support public debate and democratic engagement with relevant authorities regarding water security and access in Limpopo province in the face of increasing demand;
- explore the status of on-going and proposed infrastructure projects and associated processes relevant to water supply and demand into the medium term, especially demand associated with fossil fuel production and use,
- inform community-based education and advocacy regarding proposed industrial developments, as well as engagement with the new Plan released by the Minister of Water and Sanitation¹.

¹ This paragraph is taken from the FES Terms of Reference for the project.

Water risks need to be understood in terms of the “slippery effects of water grabs” (Franco et al 2013). Because water moves in a cycle, there are many interactions between (1) different hydrological components such as rainfall, rivers, dams and groundwater – especially the alluvial aquifers typical of the “sand rivers” in the area; (2) the different ways in which water is used; (3) challenges of information and regulation (e.g. historical water uses, and uncertainties both seasonal and in whether users actually take up – or exceed – their allocations) and (4) scale issues, for example the large number of “diffuse water users”, a description of millions of small scale water users whose water use is allowed but not secured by formal permits. This results in weak rights (Van Koppen and Schreiner 2018), with the aggregate volumes of such use not appearing in reconciliation calculations (see chapter 2). Add to that (5) water quality – or water pollution – issues as a result of and industrial production and power generation specifically, making water unusable or dangerous especially for neighbours of these projects.

The report also draws attention to four crucial issues:

- the invisibility of “diffuse” water users and their fragile rights in water allocation research and planning. These are rural water users who form the majority in the areas studied in this report, who are in general poor and consist of a majority of women, who face daily challenges in providing food and ensuring health for their families;
- the urgent need for an ecological understanding specific to South African sand aquifer rivers to effectively influence policy making and water allocation and allow for the implementation of ecological flows in these rivers – that are currently absent;
- the need to strengthen citizens participation in water governance both in South African catchments and in international, shared river catchments such as the Limpopo;
- the need for South African activists to understand the growing influence of China in Africa, and with it the need for engaging with Chinese approaches to the environment. China is already a world leader and in the future will become more so.
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Chapter 1 as it continues below, introduces and explores a number of issues that are raised by considering these two mega projects. The term “mega project” is used as shorthand for the concept of “mega project constellations”. In both cases, we are actually dealing with a constellation of coal and other mining, coal fired power stations, major water supply infrastructure, transport infrastructure, new town development (see Hallows and Munnik 2018) as well as, in the case of the EMSEZ, the mining and processing of other minerals. The chapter also introduces the concept of water grabs, current and historical, inter basin transfers, and aspects of China’s growing interventions in Africa.

Chapter 2 provides an overview of the international Limpopo basin, and then specifically considers the water supply and demand situation in the Limpopo North. It notes the disadvantaged position of two important categories of water users: (1) the majority of residents in the area who have fragile water rights not clearly and decisively acknowledged in water allocations, and (2) the ecological water

requirements of sand aquifer rivers that characterise the area which are neither properly understood or operationalized.

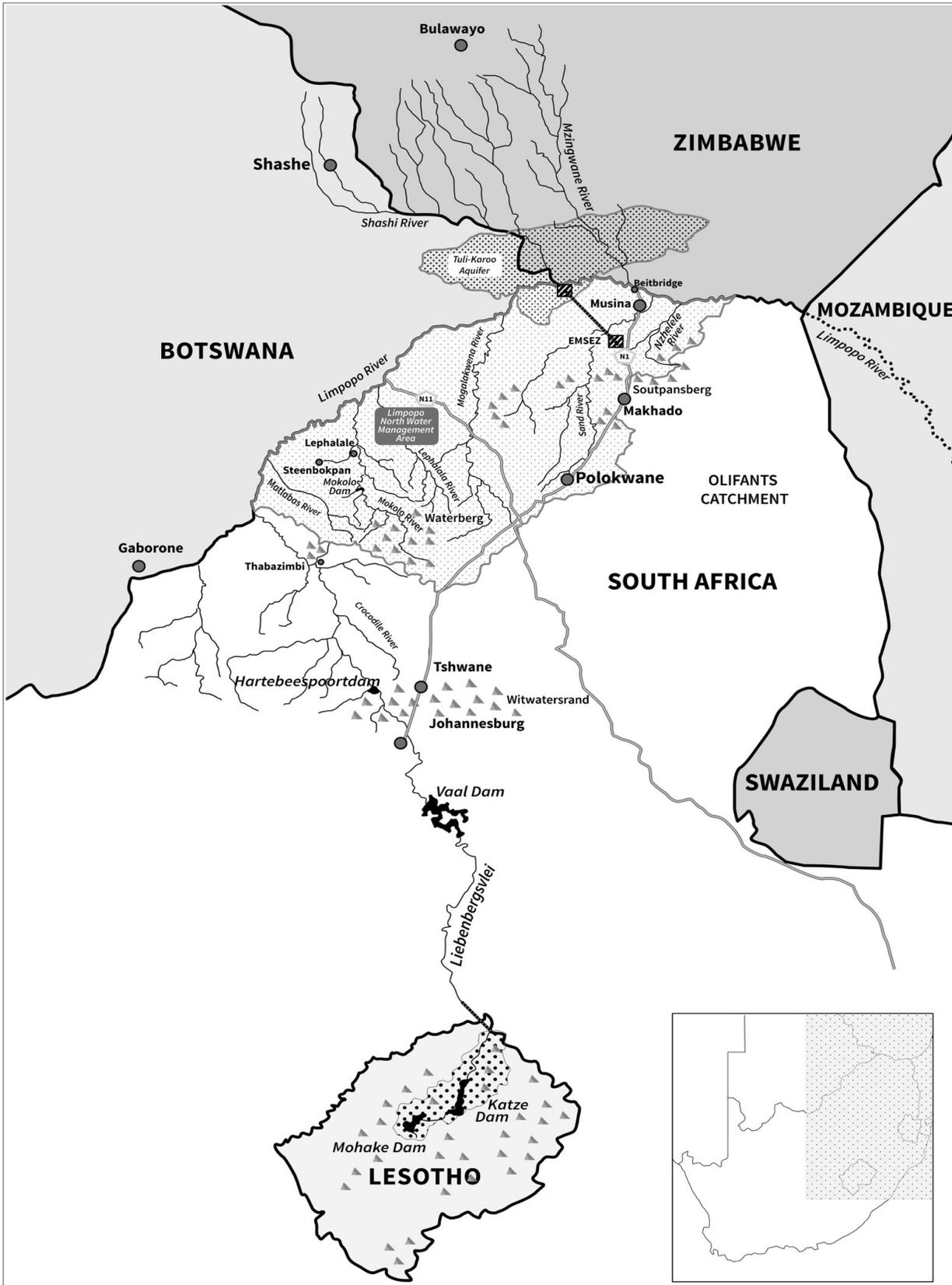


Figure 2 situates the two projects in overview. Drawn by Toni Olivier for this project.

Chapter 3 explores the detailed plans of these two projects, and the implications for other water users, on the Mokolo river in the Waterberg, the Mzingwane river in Zimbabwe and the nearly 2 million mainly rural people associated with the international Tuli Karoo aquifer, the most likely to be the long term victims of the EMSEZ water needs. Chapter 4 summarises risks to other water users, discusses the likelihood of the two projects happening, draws a number of conclusions and suggests further action and research.

This report is an early step in tackling what is a potentially huge field of study. Some of these issues may be new to environmental, social and gender justice activists, other issues may be very familiar but occurring in a new configuration. However, some knowledge of these issues is necessary to engage with the complexity that both these mega projects pose, in a situation where both these complexities and the disbelief that especially the EMSEZ project is a real threat rather than an investors' bubble, have discouraged civil society actors from investing scarce resources in engaging with this issue (see discussion in chapter 4 on likelihood of EMSEZ happening).

Mega Projects

The concept of mega projects is useful to understand the otherwise confusing hype about MCWAP and EMSEZ. Mega projects are characterised by highly aspirational promotion, or “hype”. According to project analyst Brent Flyvbjerg, mega projects create “a fantasy world of underestimated costs, overestimated revenues, overvalued local development effects, and underestimated environmental impacts” (Flyvbjerg 2013: 50).

Mega project promoters, as Flyvbjerg et al observed ten years earlier, “... often avoid and violate established practices of good governance, transparency and participation in political and administrative decision making, either out of ignorance or because they see such practices as counterproductive to getting projects started. Civil society does not have the same say in this arena of public life as it does in others; citizens are typically kept at a substantial distance from megaproject decision making” (Flyvbjerg et al 2003: 5).

Mega-projects succeed in attracting investment and political support, because they create alliances of benefit for politicians, contractors, financiers, trade unions and designers. But megaprojects “...often destabilise habitats, communities and [the] megaprojects themselves...” (2003: 4).

Both projects – the EMZES and the MCWAP (or rather the developments that the MCWAP supports) – can be described as mega-projects. One characteristic that both show is that it is never quite clear how big they are, what their components are, what they cost and when they will be finished. The MCWAP supports Eskom’s Medupi power station near Lephalale, whose cost ballooned from R30 billion in 2005 to R195 billion in 2016, and counting (Hallowes and Munnik 2018). For both the parameters keep changing, regarding who is participating in these projects and what exactly will be built for example

what factories are planned in the EMSEZ, how big the EMSEZ power station is, or the diameter of the MCWAP pipeline. This is because “the project” is often part reality and part speculative bubble, seeking to attract participants and investors on the basis of having secured some platform of rights (see further discussion in chapter 4). Observers and those who challenge these projects often can’t tell exactly what the project is.

They are also mega projects simply because they are big. The EMSEZ involving a variety of steel works, supporting energy generation, mining of coal and minerals, was declared “too big to fail” by Limpopo premier, Stan Mathabatha. The EMSEZ makes mega promises – for locals, 20 800 jobs² - and for Chinese investors the excitement of “building the world’s most competitive energy metallurgical base³”. Mega projects, such as inter basin transfers often promise to overcome natural constraints – in both the projects under discussion water constraints represent a natural barrier they want to overcome. Often this fails, for example in the case of the still controversial⁴ Three Gorges Dam project in China. It is exactly this bigness that makes it impossible for citizens to “comprehend and control” decisions about mega-projects (the phrase is from White 2008).

Inter basin transfers in South Africa

Many are mega projects. By 2013, most of the South African catchments were linked by IBTs, as pointed out by analysts who also noted that “the volume of water transferred in South Africa represents 10% of the total “natural” flow regime of South Africa, and, more significantly, 40% of the total water used.” (Bourblanc and Blanchon, 2013: 2385). The Vaal dam, augmented by water from the Lesotho Highlands, forms the core of a system operated by the Rand Water Board that provides water to more than 12 million people, and businesses, crossing several catchment boundaries. The proposed MCWAP would be an extension of this system. South Africa already has more than 30 IBTs. A 1999 WRC research report mentions a list of IBTs in South Africa that includes the Usutu-Vaal River, Grootdraai Dam, Usutu River, Komati River, Slang River, Tugela-Vaal, Caledon-Modder Scheme, Lesotho Highlands and its further phases Matsoku and Malibatso, Mhlatuze River, Orange River, Riviersonderend-Berg-Eerste River, Mooi (Tugela)-Mgeni; Palmiet to Steenbras, Mzimkulu-Mkomaas-Illovo, Marite to Sand River, and proposals involving the Zambezi, Berg, Olifants and Breede rivers. The authors noted that “The benefits and costs of IBTs are rapidly being subjected to critical appraisal, particularly from communities living within the donor catchments.” (Snaddon et al, 1999: iv). Some regions are completely dependent on IBTs, for example Cape Town, which is supported by the Western Cape Water Supply System, which also provides water for farmers in an area with winter rainfall, but a summer agricultural growth season. South African catchment systems are extensively “replumbed” (Pearce, 1992), in the country that is the 30th least water endowed in the world.

² HK Mining Exchange 2014.

³ EMSEZ operator Ning Yat Hoi in the China Reform Daily of 15 May 2019.

⁴ <https://www.power-technology.com/features/featuredangerous-waters-the-worlds-most-controversial-hydropower-dam-projects-4290847/>



Figure 3: Inter Basin Transfers in South Africa mapped against the 19 (previous) Water Management Areas in South Africa. Map from Pollard and Du Toit, 2008.

The Vaal system in particular is extensively replumbed (see Figure 4).

The Lesotho Highlands project is the best known IBT, conceived in the 1960s, based on a treaty signed in 1986 between apartheid South Africa and Lesotho, and constructed in phases: the Katse Dam completed in 1998; the Mohale Dam completed in 2002; and the Polihali dam planned for completion in the mid-2020s, but delayed by a previous water minister, Nomvula Mokonyane⁵. The Lesotho Highlands is a water source area with annual rainfall of more than 1000 mm, which is high for the southern part of Southern Africa. It delivers 900 Mm³/year of water via the Vaal river and Vaal Dam, which is taken up by Rand Water in providing water to industry, mines and 12 million people mostly in Gauteng. The Lesotho government earns R780 million from selling the water, 5 % of its non-tax revenue, which is largely distributed to a government elite. The scheme has impacted negatively on 15 000 people in Lesotho. The scheme generates 180 MW of hydroelectric power (Rousselot 2015). The Polihali Dam will add another 465 Mm³ to the water supply to South Africa.

⁵ Her rule as water minister is discussed in a recent report on corruption in the water sector, see Muller 2020.

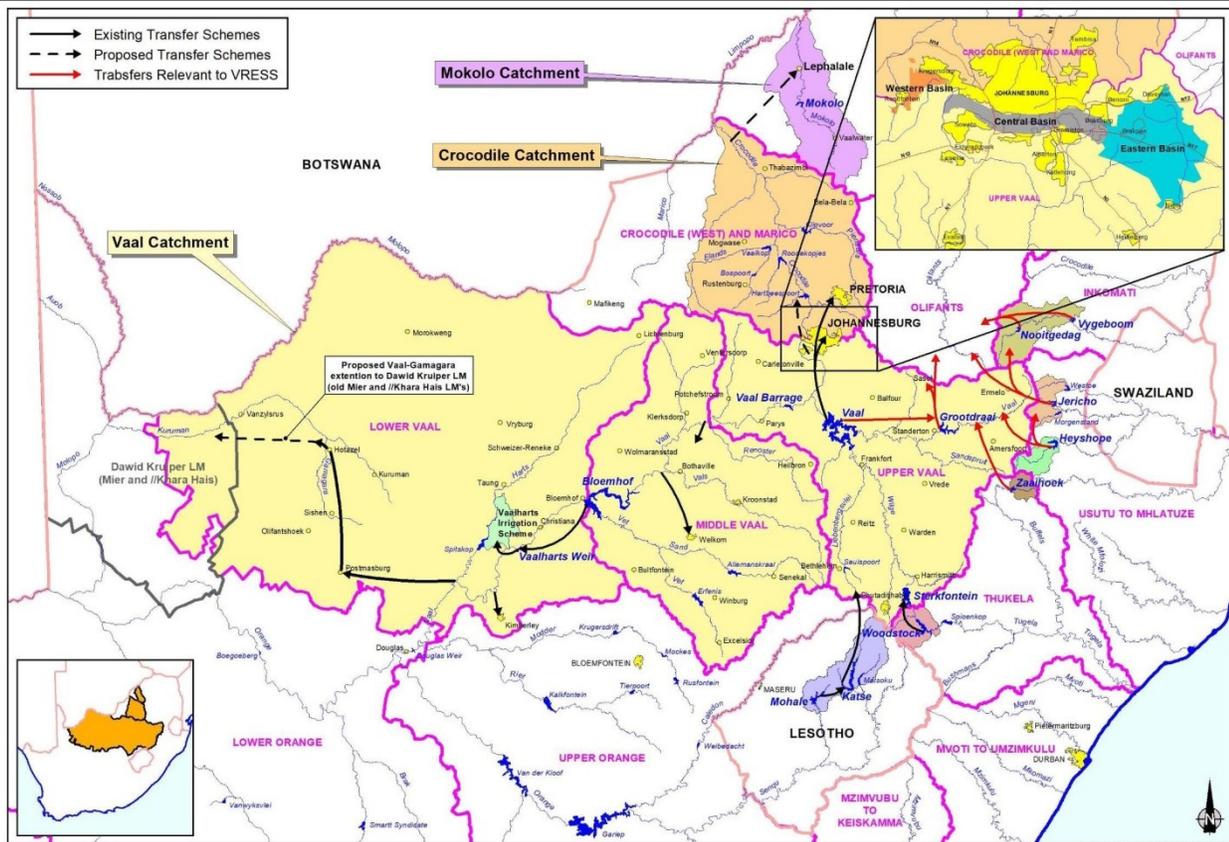


Figure 4. Inter basin transfers relevant to the Vaal catchment. (Accessed on internet credited to FSE (<https://www.fse.org.za/index.php/item/606-summary-of-water-related-challenges-in-south-africa-2018>))

In the Sand River catchment, the part of the Limpopo North catchment where the EMSEZ is proposed, currently both the capital city Polokwane and Makhado itself are radically dependent on transfers from six dams in the Olifants catchment. This is an indication of an already water scarce catchment, but also may explain the ease with which planners and politicians embrace the idea of IBTs (see figure 9).

However, the social and ecological effects of IBTs have started to make themselves known. Snaddon et al (1999) reported on a host of ecological and social problems that arise from IBTs, include those that result from the mixing of biota in waters of different origin (leading to extinction of native species). Spreading of weeds that colonise water bodies, such as the water hyacinth spreading from the Hartebeestpoortdam via the Crocodile river into the Limpopo, can clog up water works, affect water quality and lead to lost tourism opportunities (Rinaudo and Barraque, 2015). Inter basin transfers are also inherently unfair to people living in the “water donating” catchments who, more often than not, are not consulted on these mega project decisions, or not compensated fairly.

Water grabs and water conflicts

Inter basin transfers reallocate water on a permanent basis. From a social justice perspective, such appropriation can be better understood under the broader category of water grabs. Water grabs can be defined as “a process in which powerful actors are able to take control of, or reallocate to their own benefit, water resources used by local communities or which feed aquatic ecosystems on which their livelihoods are based” (Franco et al, 2013: 1653). While water grabs are often large scale, it is important to look not only at volumes of water (and money), but also at water needs in space and time. This is done below, for the case of “diffuse water users”, whose small water consumption does not appear in most official accounts, but for whom water re-allocation in the system may make the difference between life and death (Schreiner et al 2017).

It is worth remembering though that Inter Basin Transfers are only one form of appropriation. In general, water grabbing has the effect of exclusion of previous water users from the now enclosed water, but it could also manifest as “adverse incorporation” (Franco et al 2013): while communities may continue to use water, it may be reduced in flow, or polluted. Seasonal regimes may change and shallow wells from a sand river aquifer on which small scale farmers depend, may dry up after dams are built. In South Africa, with its colonial and apartheid history, water grabs can also close off opportunities for access to future water users.

Historic land and water grabs in the Makhado area

Land and water grabs are often intertwined. There are many land claims in the Makhado area, the result of the takeover of land by white settlers in the late 19th and early 20th century, including after 1913 (Bergh 1998). Since 1913 was chosen as the cut-off point for land redistribution claims under land reform legislation in the post-apartheid South Africa (Aliber et al, 2013), there are many land claims in the area. These dynamics are important in the EMSEZ case. A successful land claim group – the Mulambwane Community Property Association – now find themselves now in control of land and leasing it out, also planning to establish themselves as part of EMSEZ and provide it with food from nearby farming (Interview, Makhado, Feb 2020).

During field work⁶ we met with the Mudimeli and Mulambwane communities. The Mulambwane community has established a Community Property Association (CPA) consisting of some 600 households and have been granted a number of farms – a large number rumoured to be a 100 farms. They now own the land on which the EMSEZ is supposed to be built. They also own some farms that are being leased to “a Saudi prince” who has built a very exclusive lodge in the area. The spokespeople from the newly elected CPA leadership, which is in a tense relationship with the previous leadership, are anticipating that their community will be getting some of the 20 800 jobs promised in the EMSEZ, as well as taking part in the development of a new EMSEZ town. They also anticipate growing food

⁶ In February 2020, together with Mashile Phalane, Further fieldwork was interrupted by the COVID-19 lockdown.

supplies for the new town on their other land claim farms. Asked whether they did not perhaps anticipate pollution from the steel factories that may interfere with their farming, they answered that “the Environmental Impact Assessment, expected in June 2020, will take care of that and protect us”.

Not so trusting in their approach is the Vhembe Mineral Resources Stakeholders Forum (VMRSF), a group that includes local farmers, wildlife tourism operators, and traditional authority groups. The group has significant overlaps with the Vhembe Biosphere Reserve, an internationally recognised mixed land use conservation area. The VMRSF strategy seems to be to limit coal mining in the area, in particular the plans of CoAL – Coal of Africa – which was embroiled in controversy for plans, and actual mining, in the Vele colliery near the historical site of Mapungubwe (the first African city in SA and a national heritage site), and now involved in planning four coal mines intended to supply the EMSEZ. VMRSF have entangled CoAL, now called MC Mining, in a number of appeals about mining and water use licences. The Save our Limpopo Valley Environment (SOLVE) are also very active in watching and resisting the proposed EMSEZ development, as are other civil society organisations. This report does not however pursue these dynamics further.

A focus group⁷ of men and women of the Mudimeli tribal authority, who “share” the Mutamba river near the proposed EMSEZ with MC Mining’s Makhado Colliery, was revealing. Women in the village reported that since the bulk sampling by the Makhado Colliery, two of the village wells had dried up. They now buy in water from private borehole owners. This makes all their daily tasks: cleaning, cooking, taking care of children and growing their own food, much more difficult and expensive. They are apprehensive about the development of the coal mines around them.

Chinese development in Africa

Chinese foreign direct investment in Africa is characterised by a long term approach (a perspective over several decades), which is in sharp contrast to the short term (5 years) profit making approach of Western extractive companies, argues Chin Kwang Lee (2014) on the basis of ethnographic research on the Zambian copper belt, comparing the Chinese company, China Nonferrous-metal Mining Company, to its Indian (Vedanta) and Swiss (Glencore) counterparts. The aim is to establish long term, stable sources of strategic minerals such as copper, coal, iron, vanadium, chrome and manganese, which are in short supply in China. This involves patient work in establishing control over mining the minerals, some local beneficiation to make export easy, as well as the establishment of safe export routes, include ports and sea routes (Executive Research 2009). In the Zambian example, the Chinese companies paid wages a third less than their competitors, but provided a stable working environment insulated from commodity price fluctuations and consequent lay-offs (Lee 2014).

Views on the Chinese environmental record are mixed, and complicated by (1) a tendency by Western media to focus on bad Chinese environmental practices, as well as (2) a tendency by the Chinese to censor discussion of environmental issues, for example the banning, after a few showings, of a documentary showing environmental problems that had at first been supported by the environmental

⁷ Undertaken in February 2020

department (Shinn 2016)⁸. As a result, most environmental criticism comes from Chinese living and working outside China (Yeh 2015). Many commentators are watching this issue area as the most likely place for a more democratic, participatory politics to emerge (Wu, 2009).

While Chinese civil society does not make direct inputs into environmental policy, including overseas investment, there is a growing concern about pollution in both civil society and government, where environmental issues have become a priority issue – the result of three decades of very fast and often careless industrial growth (Shinn 2016). Direct experiences of air pollution have played a major role in this development. Shinn also argues that domestic opinions such as the concern about air quality, translate into concerns about how FDI is done, but this remains to be seen. . Lately, “green economy” and “clean coal” discourses have emerged which both criticize environmental pollution and present advances in “green technology”, but it is not clear how real this is in practice (Mohiuddin et al 2014).

While China is credited with a long history of pre-industrial engineering, particularly surface water management (Elvin, 2004), it has also gone through periods of bending nature to its will, notably under chairman Mao (Shapiro 2001, see also Watts 2010). China, a water scarce country, does not have a good track record in its management of aquifers, including the North China Plain aquifer near Beijing, the biggest aquifer in Asia: “The North China Plain (NCP) has one of the most depleted aquifers in the world due to over-pumping to meet the needs of fast economic growth and intensive irrigation” (Liu et al, 2011). The water quality in the aquifer has deteriorated as a result of the depletion (Currell et al, 2012).

Coal in Limpopo and the climate change response timeline

Both the EMSEZ and the Waterberg development requiring the MCWAP violate reasonable expectations of the timeline for phasing out coal in SA and the world, such as that the early 2020s should mark a sharp downturn in fossil fuel burning, and that by 2050 coal burning should be zero. The EMSEZ is negotiating to sign a land lease deal for 90 years – with an optional 30 year extension. This goes 60 to 90 years beyond the 2050 zero objective, making a mockery of climate change policy and presents a new obstacle to a just transition from coal (Halsey et al 2019). The MCWAP is intended to extend the lives of Medupi and Matimba power stations, provide for one or two more coal fired power stations, new coal mines and expansion of the Exxaro Grootgeluk coal mine. The EMSEZ September 2017 powerpoint presentation contains the following ominous “benefit” of EMSEZ: “Transfer China’s excess steel capacity to reduce China’s energy consumption”, which points to the offshoring to South Africa of carbon emissions, pollution from steelmaking and related industries, and high water demand.

⁸ See also the censorship experience of Stellenbosch University Chinese expert Dr Ross Anthony in 2018 at <https://www.universityworldnews.com/post.php?story=20180922152502761>

Chapter 2: Water scarcity in Limpopo

This chapter explains why, in terms of water supply and demand, the International Limpopo is already a “closed catchment”, meaning that all water resources are already fully allocated, and that many water users already do not have adequate access to water. It introduces three Limpopos’ and their water users. (1) The first Limpopo is the international river basin, important because the EMSEZ has expressed an intention to source its water from a Zimbabwean river, the Mzingwane (see also chapter 3). (2) The second area, the Limpopo North WMA, is the main area of discussion in this chapter, based on an analysis of the DWS documents of the Limpopo North WMA Reconciliation Strategy of 2016, which also describe the Mokolo and Sand River sub-catchments. (3) The third is the province of Limpopo, with provincial government the prime mover and deal maker in the EMSEZ, but not the MCWAP. It is one of nine provinces of South Africa, and contains catchments other than the Limpopo North Water Management Area – the Crocodile (West) WMA as well as the Olifants catchment, which is shared with Mpumalanga. The political Limpopo will be discussed further in chapters 3 and 4, which focus in on the dynamics of MCWAP and EMSEZ development.

Limpopo as an international river basin

Around 18 million people were living in the international Limpopo basin by 2011⁹, which covers an area of approximately 408 000 km² and is shared by South Africa, Botswana, Zimbabwe and Mozambique (Midgley et al 2013). Its annual rainfall varies from 200 to 1 500 mm per year, but most of the catchment receives less than 500 mm/year, which generally arrives in a short rainy season (fewer than 50 rainy days) between October and April. The biggest contributor to the Limpopo is the Olifants river in South Africa, while the Mozambican side contributes only 10% to the run-off¹⁰.

Irrigation dominates water use in the catchment, accounting for around 50%. Urban use is 30%, and mining, power generation and rural water use each claim around 6%¹¹ (Midgley et al 2013). The majority of residents in the catchment are poor, small scale or subsistence farmers who grow maize, sorghum, millet, groundnuts and bambara nuts, and run goats and cattle. Rainfed agriculture suffers from unreliable rainfall and droughts. These farmers are also held back by poor soils, lack of access to water and lack of infrastructure, because of “large commercial farms having good access to water and infrastructure, while small holder farmers lack even drinking water” (Ncube et al, 2010: 11). Researchers warn that “while the effects of climate change on the river have not been quantified, it is expected that increased volatility in rainfall will occur, escalating the threat of droughts and flooding. This leaves the rural subsistence farmers, a population already suffering from insufficient water

⁹ These are the figures used in the DWS 2016 reconciliation strategy.

¹⁰ <http://www.fao.org/3/y5744e/y5744e07.htm>

¹¹ Mining water use is not only an issue of volume, but also of pollution impact. In the Upper Olifants, for example, coal mines use 7% of water but are responsible for 70% of pollution.

resources – only two out of every five seasons produce sufficient crop yields – especially vulnerable.” (Midgley et al 2013: 17).

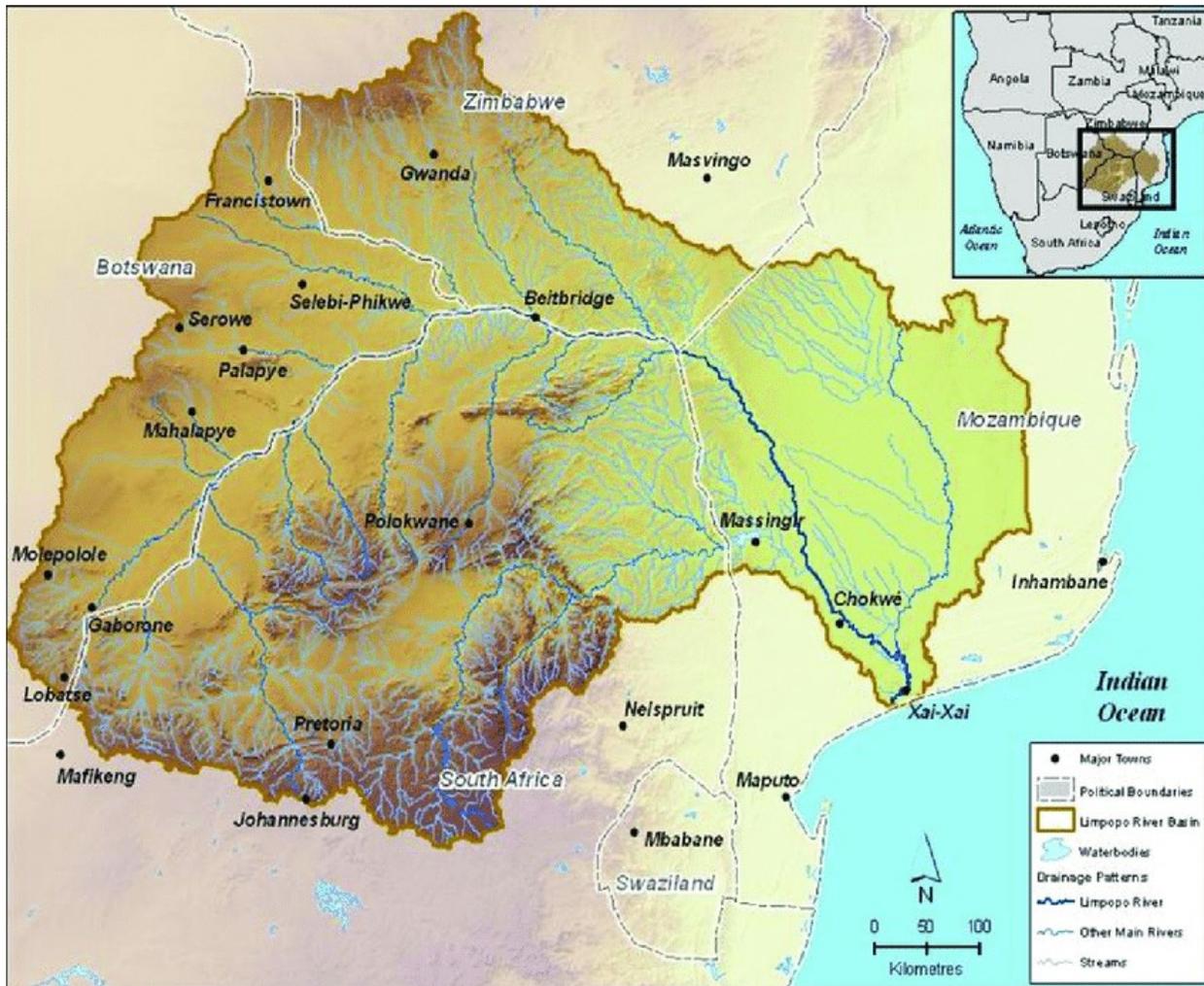


Figure 5: The international Limpopo River Basin, shared by Botswana, South Africa, Zimbabwe and Mozambique (source www.limpopo.riverawarenesskit.org).

All water resources in the International Limpopo catchment “have been allocated to activities already in operation. In reality, South Africa’s water usage alone exceeds the basin’s yield by 800 mm per year” (Midgley et al 2013: 17). This shortfall is made up by water transfers from the Vaal River system, in effect water from the Lesotho Highlands schemes, as pointed out in the section on IBTs above. This means that any new water uses in this basin will require additional water transfers, unless the water can be sourced from more intensive use of groundwater (interview, Jonathan Lautze, February 2020 and chapter 3, below). South Africa has 45% of the surface area of the Limpopo basin (or catchment), but already uses 60% of the total water available. This imbalance is reflected in the governance of water decision making.

While there is an international organisation responsible for basin management, the Limpopo River Commission (LIMCOM, see website¹²) it is generally regarded as having very low enforcement ability. It is dependent on member states, of which South Africa is by far the most influential. Within these states, it is the commercial agricultural lobbies that have so far dominated decision making, although clearly mining and industrial interests are now challenging this. (Midgley et al, 2013). Analysts foresee growing competition and tension between the four Limpopo riparian states and urge strengthening of the LIMCOM structure and capacity (Gomo and Vermeulen 2017, Lautze et al, 2019). It is however doubtful that LIMCOM will be able to play any meaningful role in the EMSEZ water supply decision making, because of its very limited institutional capacity and lack of political influence.

Limpopo North Water Management Area

The Limpopo North WMA (LNWMA) is only one part of the South African section of the international Limpopo Basin. Other important rivers include the Olifants, which is the biggest contributor in volume to the Limpopo river, the Crocodile river, which receives large volumes of water, via Rand Water, from the Lesotho Highlands water scheme and the Marico (Madikwe) river. It is in the LNWMA that both the MCWAP and the EMSEZ are located although they both have implications beyond the LNWMA, which consists of six river catchments, as can be seen in the map (figure 6) above. They are, from west to east, the Matlabas, Mokolo, Lephhalala¹³, Mogalakwena, Sand and Nzhelele-Nwanedzi. The following section will first discuss the LNWMA as a whole, and then focus in on the two relevant sub-catchments, the Mokolo and the Sand River (with its small neighbour, the Nzhelele-Nwanedzi). It is based on the DWS Limpopo North Reconciliation Strategy (LNRS), as well as the LNRS support study on socio-economic perspectives¹⁴

The LNWMA's climate ranges from temperate and semi-arid in the south to extremely arid in the north. Annual rainfall ranges between 300 mm to 700 mm per year, but potential evaporation is far higher. A large part of runoff after rain is soaked up by the sandy soils in much of the area.

The LNWMA includes the towns of Polokwane, Lephhalale, Musina, Louis Trichardt, Mokopane, Mookgophong and Modimolle. With the exception of Lephhalale, all are along the N1 highway (see figure 6). Around 760 rural communities are scattered throughout the area, with concentrations in the former Lebowa, homeland areas. The total population in the catchment was estimated at just under 2 million people, 51% of them living in the Sand River catchment in Polokwane, Makhado and Musina, with 40% of the rural settlements also in the Sand river catchment (DWS 2016). The overall population growth rate has been less than 1%, due to outmigration to seek economic opportunities elsewhere.

¹² http://www.limpopo.riverawarenesskit.org/LIMPOPORAK_COM/EN/GOVERNANCE/WATER_GOVERNANCE_IN_THE_LIMPOPO/LIMCOM.HTM

¹³ The river, where the majority of Lephhalale local municipality residents live, inspired the new name for the town of Ellisras.

¹⁴ Both dating from 2016, but the socio-economic statistics are from 2011.

Growth was expected here, as well as in the Mokolo catchment, as a result of mining, power generation and associated industrial activities. The main economic activities are irrigation and livestock farming. Mining operations are expanding, or expected to expand. The DWS 2016 reconciliation states clearly that “water resources, especially surface water resources, are heavily stressed due to the present levels of development.” It also noted that water quality was deteriorating throughout most of the catchment.



Figure 6: Limpopo North Water Management Area, with six rivers, district municipalities and towns along the N1. (Source: DWS 2016).

The strategy notes that “Groundwater contributes approximately 40% towards the water supply from local resources and is the only dependable water source for the majority of rural domestic users in the study area. Since surface water resources are fully developed, groundwater might be the only possible local water source to augment supply in some areas. However, it should be noted that groundwater resources in the Mogalakwena and Sand catchments have been extensively utilised, and possibly over-exploited by the dominating irrigation sector.” (DWS 2016: 4.8).

Rural dwellers’ and environmental water needs

This section provides some detail on planning for competing water users¹⁵. We start with two categories that are not visible in current DWS planning: environmentally necessary flows (see next

¹⁵ In theory, reconciliation strategies anticipate rather than allocate, but in practice they do shape water supply and demand

section) and the “diffuse water users”, who use water in small quantities, and operate on the margins of the formal permitting system. They are the 740 rural communities living in the area, whose residents make up 64% of a total population of just under 2 million people in 2011¹⁶ (LNRS 2016 socio-economic), thus approximately 1 280 000 people. Like many other rural populations in Southern Africa, women form the majority due to men seeking work elsewhere.

This majority of water users are far less visible to policy and decision makers (see Schreiner et al, 2017) than the big water users: irrigation (which uses two thirds of the catchment’s water); domestic/municipal use; mining, power generation and industry; livestock watering and water used by plantations and alien plants (which both absorb the water before it reaches the streams, known as stream flow reductions). The result is that these are the most fragile water rights or entitlements, and likely to be the first to be impacted, should there be a demand (for example caused by expansion of industry, mining and power generation) that has been under-estimated, or is based on supply plans that do not work. This is an inheritance from colonial policies that systematically removed the customary rights of indigenous people in favour of colonial settlers (Van Koppen and Schreiner 2018).

In the Limpopo North catchment, environmental flow requirements (the amount of water that is necessary for the maintenance of healthy ecosystems) are not yet applied to calculations in the catchment. The authors of the LNWMA reconciliation strategy (DWS 2016) decided not to make provision for Ecological Water Requirements (EWR) based on the arguments that (1) there simply is not enough water in the dams to release the required amounts, and (2) the requirements are not suited to the non-perennial¹⁷, sandy aquifer nature of the rivers. They argue that “Almost all of the major dams within the study area will not be able to meet their current allocations if the desktop Ecological Water Requirements (EWR) are implemented” (DWS 2016:4-5). For example: “Applying the Present Ecological State¹⁸ (PES) scenario in the yield model simulations indicated that the implementation of the EWR on the Mokolo Dam would be significant. Without the EWR the dam has a yield of 38.7 million m³/a, yet with the EWR the yield, depending on the operating rules could be only 3.48 million m³/a.” The same applies to other dams in the catchment, see figure 7 below.

The current requirements (the 2016 DWS reconciliation strategy calls them “desktop requirements”) have been written for perennial rivers (rivers in permanent flow), whereas the LNWMA rivers are mostly sand rivers with intermittent flow on the surface and large aquifers holding the river water. However, there is research suggesting how this could work for the Mokolo river, which has been around for a decade now but not yet taken up in planning (Seaman et al 2013). With these two important exceptions in focus, we can turn to the mainstream water users who do feature in the calculations of water demand from 2011 to 2040 first in tabular form, then in a graph.

¹⁶ According to Stats SA 1 897 664, DWS estimate 1 941 592, the difference due to assumptions about household size.

¹⁷ Non-perennial rivers only flow for part of the year. They have very different ecological requirements from perennial rivers. In addition, much of the water is stored in sandy aquifers.

¹⁸ PES refers to the present ecological status of a river or wetland, namely how much it has been changed in comparison to its original (not impacted) ecological status.

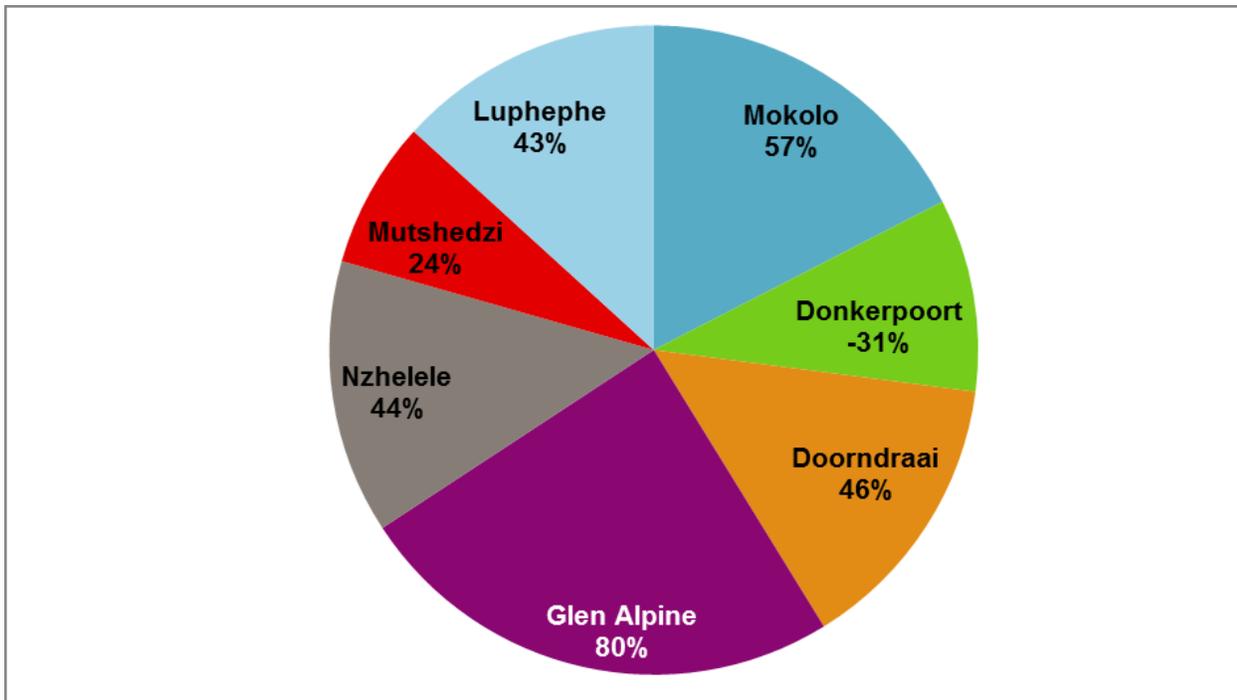


Figure 7: Reduction of yield for Limpopo North dams if environmental flow requirements were to be implemented. (DWS 2016).

Mainstream water demand in Limpopo North

Sector or water user	Water requirements (million m ³ /a)						
	2011	2015	2020	2025	2030	2035	2040
Irrigation	464.8	464.8	464.8	464.8	464.8	464.8	464.8
Domestic	102.1	105.6	109.0	115.8	122.6	128.3	134.0
Mining, industries and power generation	45.0	64.0	111.4	157.9	204.7	237.3	249.1
Livestock	23.4	23.4	23.4	23.4	23.4	23.4	23.4
IAP and commercial forestry	9.1	9.1	9.1	9.1	9.1	9.1	9.1
TOTAL	644.4	666.8	717.7	771.0	824.6	862.9	880.4

Table 1: Overall water demand in Limpopo North WMA, 2011 – 2040 (NLRS 2016).

Irrigation (commercial irrigation, in the green block in figure 8) is by far the biggest current water user, taking 464.8 Mm³, over an area of 666 km², with 72% of the total water use in the LNWMA. Most of the water is sourced from groundwater (57%), with surface water at 43%. Farmers in the Sand River catchment account for almost half at 221.7 Mm³, sourced from groundwater (126.8 Mm³), the main

stem (i.e. international) Limpopo river (43.7 Mm³), aquifers along the Limpopo river (41.3 Mm³), and from rivers and dams (9.9 Mm³). It seems (according to DWS 2016) that around 5% of white commercial irrigation use is “unlawful”. The main products are maize, potatoes, and wheat, while there is also citrus, tobacco and tomatoes. The planning assumption for irrigation users is that this amount will be kept constant. This implies three further assumptions: that (1) irrigation will become more efficient, doing more with less (2) reallocation of irrigation water will involve winners and losers (3) climate change will make no difference to this sector.

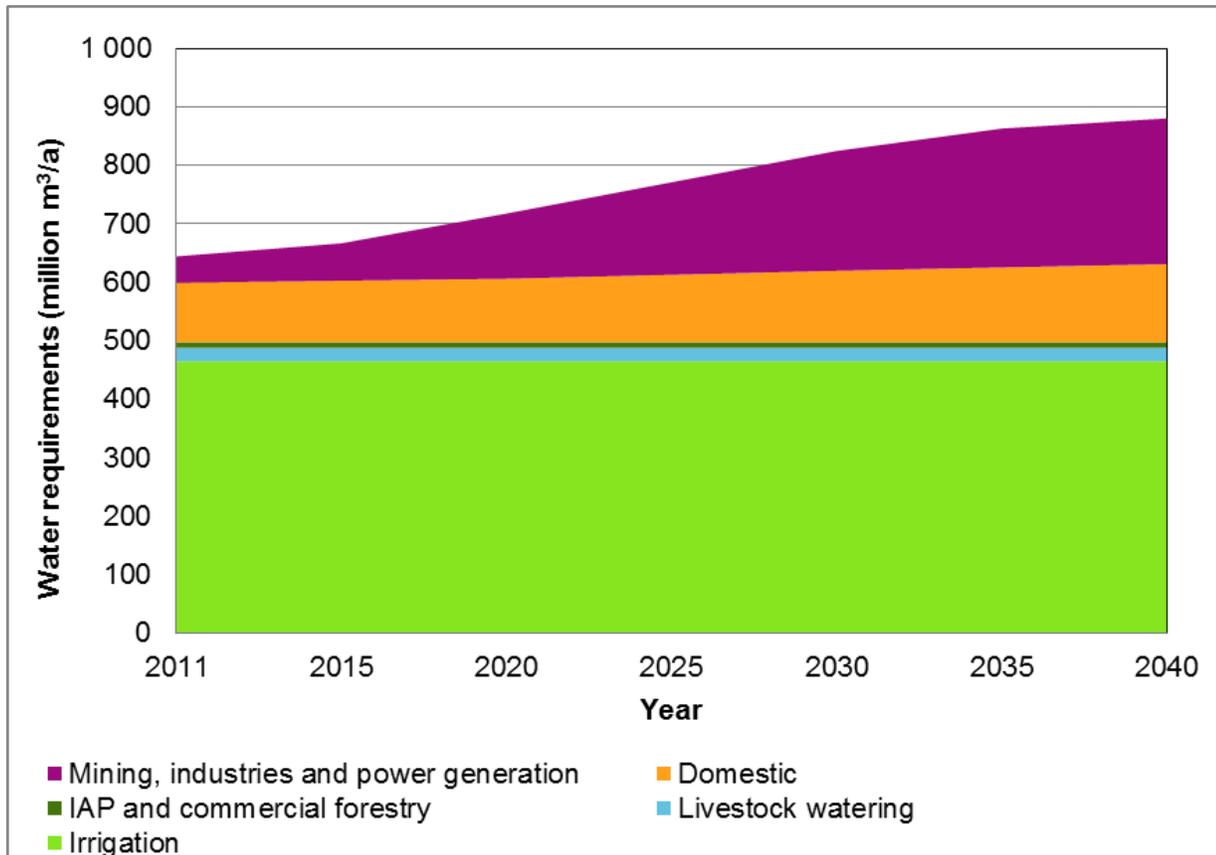


Figure 8: Graphic illustration of water demand in Limpopo North WMA, 2011 – 2040 (NLRS 2016).

There is no doubt that agriculture in the province is a dual system, and that transformation of the irrigation sector has been extremely slow. Approximately 5000 white commercial farmers use 70% of the land, 72% of the water, and provide 17.5% of the working population in the province with jobs. A study undertaken in 2002/3 on Limpopo agriculture (Oni et al nd) quotes a figure of 273 000 smallholder farmers (on pieces of land averaging 1.5 ha) in the former homelands, of which 80% were women. This sector provided work for 25% of the workforce.

However, there is a bigger need for water among black small-holder farmers than officially recognised. Recent research indicates that there is much more informal (that is, self-organised) irrigation in the Limpopo province (mostly in the former Venda area) than indicated in official statistics: 30 000

informal irrigators working up to 80 000 hectares (ha) in the province, compared to official schemes of 20 788 ha (Van Koppen et al, 2017). It does not seem that this growth in irrigation has entered into planners' figures. Another distortion is the underestimation of the percentage of women participating in irrigation farming, as men are generally registered as participants on the assumption that they are the heads of households. On these schemes the main crops were maize, vegetables such as tomato, onion, peas, butternut, dry bean, groundnut, and nuts; and fruit trees including banana, mango and avocado. These products were produced for markets rather than subsistence (Van Koppen et al, 2017).

In the DWS projections, domestic use is expected to grow modestly in line with urbanisation mostly as a result of industrialisation, from 102.1 (in 2011) to 134.0 Mm³ (in 2040). Livestock watering takes small amounts for commercial cattle running, small and subsistence cattle and goat farming, as well as for game farming. Although amounts are relatively small, this is a crucial category in terms of subsistence, small farmers and job creation. The plantations and other stream reducing activities (alien plants using large amounts of water) are not as important in this area as in other catchments.

It is in the category of mining, industries and power generation that large increases in demand are foreseen (see figure 8 above). Some of this is already a reality on the Waterberg coal field, though not to the extent predicted (see chapter 3), and in the platinum mines on the Mogalakwena sub-catchment. These anticipated increases are explored below in more detail for the two relevant sub-catchments of the LNWMA.

The Mokolo River catchment (MCWAP sub-catchment)

This section discusses the Mokolo catchment as the region for which the MCWAP is planned (with some reference to its small neighbouring catchments, the Matlabas and the Lephhalala, as these are part of the same political unit, the Lephhalale local municipality) and the coal mega-projects in this area.

The Mokolo River catchment centres on the water that the Mokolo river and its tributaries collect in the Waterberg over an area of 8 450 km², which has a higher rainfall than surrounding areas (on average 700 mm/year as opposed to 300 mm/year on the plains next to the Limpopo), and an average mean annual run-off (the water from rain that runs over land after the soil has stopped absorbing the water) of 272 Mm³, of which 98 million m³ could be used (see figure 9; DEA 2010). This water is collected in the Mokolo river, both as occasional surface flow, but more importantly, stored in the river sand and riparian alluvial aquifers able to yield an amount similar to what the Mokolo dam is able to hold, about 23 Mm³ per year¹⁹.

¹⁹ These calculations from early DWS planning documents are discussed in more detail in Hallowes and Munnik, 2018.

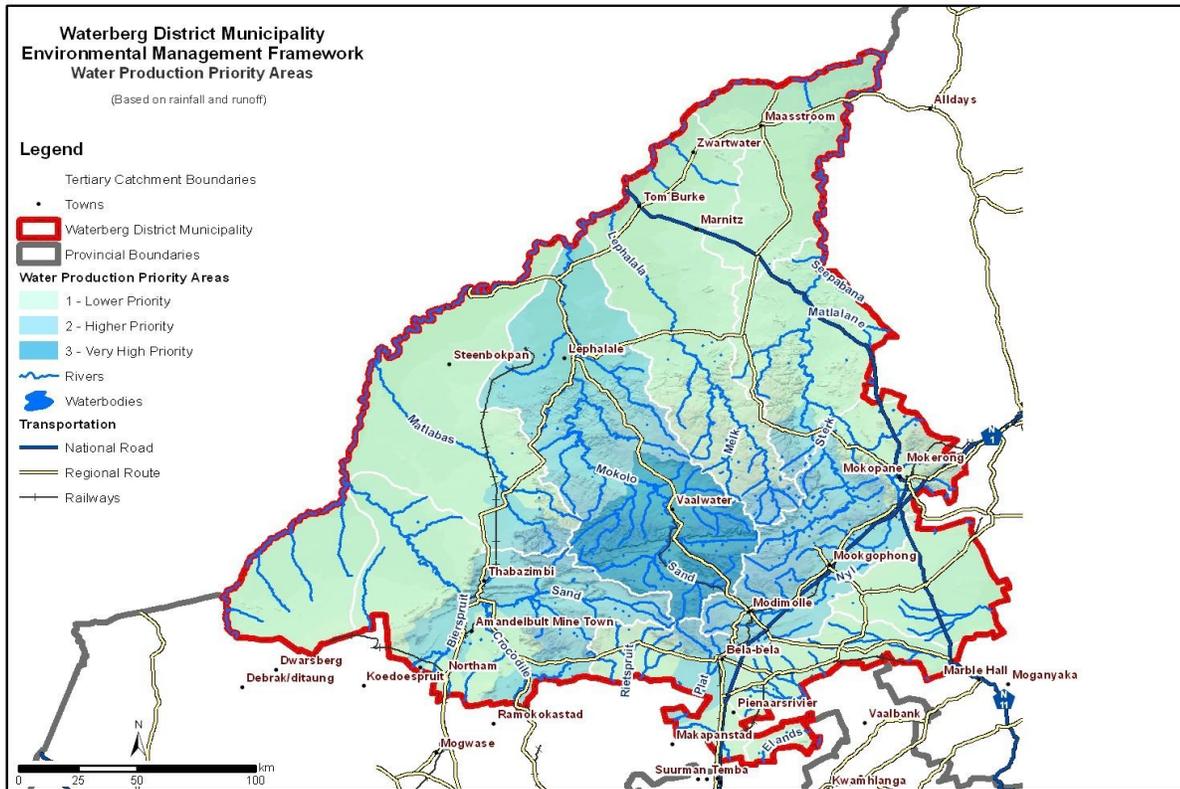


Figure 9: Mokolo river and dam derive their water from high rainfall area in Waterberg mountain (DEA 2010).

The Mokolo dam is the largest dam in the LNWMA. It was planned in the 1970s and completed in 1980. It had three main objectives: to stabilise water for irrigation downstream of the dam; to anticipate water demand for coal mining and coal power generation; and to accommodate urban expansion as a result of the new coal economy. The coal economy itself was driven by Iscor – the steel making parastatal – that was concerned that its international sources of coking coal, necessary to the steel making process, which was in turn important for the South African economy and the military, would be cut off due to growing international isolation resulting from apartheid sanctions. After the dam was built, irrigation from groundwater continued, but the river was increasingly invaded by reeds that reduced the water availability in the sand aquifers.

In order to make its mining plans work, Iscor persuaded another parastatal, Eskom, to build the 4000 MW Matimba power station. This enabled Iscor to mine coking coal and sell the remaining low quality coal to Eskom, a business model that has served to make South African coal exploitation profitable (selling low quality coal to Eskom roughly at cost while earning on exporting high quality coal). Due to water scarcity even then, Matimba was built as a dry-cooled power station to minimise water use. Iscor's mining division was later privatised into what is today Exxaro, the owners of the Grootegeluk coal mine in Lephalale. First Iscor and then Exxaro not only built a company town (Onverwacht) next to the pre-existing, small farmers' town of Ellisras, but also took responsibility for its water supply. A pipeline from the Mokolo dam brought water to the mine, the power station, the town and the new

township, Marapong which was established in the shadow of the Matimba power station. By 2004, the major use of water from the Mokolo dam was still irrigation at 61%, not counting water used for irrigation from small farm dams, weirs and run-off-river abstractions. Grootegeluk mine was using about a third of their allocation, and the power station less than half, leaving room for modest expansion.

Name	Allocation	Actual Water Use	Return flows to river
Vaalwater town	0.0	0.0	0.0
Grootegeluk coal mine	9.9	3.4	0.0
Matimba Power Station	7.3	3.0	0.0
Lephalale & Onverwacht	10.00	3.3	1.0
Marapong		0.5	0.3
Irrigation downstream of dam	10.4	16.0	0.5
TOTAL	28.6	26.2	1.8

Table 2: Summary of major point-source water requirement, allocations and return flows in the Mokolo River System in 2004²⁰ (Mm³/a). DWS 2016.

Like the Matlabas catchment to the West, the Mokolo catchment consists largely of white commercial farms, some of which have been converted to game farms resulting in lower water demand for farming as well as a decrease in farm jobs and farm workers dwelling on farms, who have now moved to local urban areas like Vaalwater. The Lephalala catchment to the East, in particular the area that was the Lebowa homeland, under the tribal authorities of Seleka and Shongwane, houses the majority of the population of the Lephalale local municipality. :

“Irrigation is the major water user in the catchment, accounting for 93% of the water requirement and is supplied mainly from farm dams in the upper reaches, storage weirs in the middle reaches and alluvial aquifers in the lower reaches. A large amount of irrigation (approximately 44%) is supplied by the Limpopo River alluvial aquifer (on the Botswana border).

“Basic domestic and stock water needs of 38 villages are supplied by five local groundwater Schemes (GWSs). In total these schemes consist of more than 120 boreholes.” (DWS 2016: 5-6).

Higher up in the Mokolo catchment the small towns of Vaalwater and Mabaleng, upstream of the Mokolo dam, are supplied from local boreholes, which from time to time run dry, with the result that communities are supplied via water tankers (DWS 2016). The pipeline from the Mokolo dam was upgraded and enlarged in 2011 and has been operational since 2015. It is now able to transfer all of the

²⁰ DWS 2015. Literature Review for Limpopo Water Management Area North Reconciliation Strategy.

water in the Mokolo dam (30 Mm³ against dam capacity of 28.6 Mm³). This pipeline was phase 1a of the MCWAP, discussed in the next chapter. It consolidated the full capture of the Mokolo's resources and points to three enduring tendencies: (1) the capture, through dam building and pipelines, of the water amassed in the Waterberg mountains and sand aquifers (2) the main use of the Mokolo's water is still by far for white-dominated irrigation, and (3) expansion of coal, power generation and industry now drives a search for water sources from outside the Mokolo and more generally outside the South African area of the Limpopo North catchment. This underlines the general situation of water scarcity in the area, the constraints it presents, and the ambition of mega-projects to "overcome" this water scarcity. In addition, removal of sand from the Mokolo sand aquifer has reduced the capacity of the aquifer to store water. According to one calculation, just under 500 000 m³ of sand was removed to build Medupi (Hallowes and Munnik 2018).

The Sand River catchment (EMSEZ sub-catchment)

The Sand River catchment is where the EMSEZ is planned, together with a northern portion of the SEZ not discussed in this report, the logistics (and possibly agricultural processing) hub at Musina. The catchment houses about a million people, more than half (51%) of the population and 40% of the rural settlements of the LNWMA (DWS 2016). A large part of the former Lebowa bantustan is in the catchment, making the issue of diffuse water users dependent on small quantities of water particularly important. ²¹Polokwane is the capital of the Limpopo province, by far the biggest settlement with an estimated population of more than 700 000, of which 39% rural and 61% urban. It is also the centre of political decision making. Other important urban centres are Makhado and Musina.

The Sand is the driest catchment in the Limpopo North WMA with very limited surface water resources. However, it has exceptional groundwater reserves which have been fully and possibly over-exploited, mostly by irrigation. One estimation puts the exploitation of groundwater at 155% of the calculated available yield, which is clearly not sustainable (DWS 2016: 4-12). The water requirements in the Sand River catchment are large compared to the rest of the WMA, with irrigation again being the largest water user, followed by domestic use in view of the large number of people residing in the catchment, including in-migration into the Polokwane area. Among the big industrial users in Polokwane are the South African Breweries (SAB) and an Anglo Platinum smelter. Coal mines include the Vele Coal Mine and plans for a number of Coal of Africa mines near Makhado. The 2016 figures do not reflect the EMSEZ water requirements (as envisaged in the "Final" Scoping Report) of 123 Mm³/ year when the steel factories etc. would be in operation (see next chapter).

²¹ The Polokwane local municipality includes large rural areas.

Sand River Catchment	Water requirements (million m³/a)			
Sector/type	2010	2020	2030	2040
Irrigation	221.6	221.6	221.6	221.6
Domestic	55.8	60.7	69.4	77.8
Mining, industrial & power generation	10.6	29.8	54.8	60.2
Livestock	4.4	4.4	4.4	4.4
IAP & commercial forestry	1.2	1.2	1.2	1.2
Total Sand water requirements	293.6	317.7	351.4	365.2

Table 3: Water use in the Sand River catchment, from DWS 2016.

The catchment uses far more water than it has available. The shortfall in urban requirements are met through transfers from other WMAs. Polokwane receives transfers from the Dap Naude, Ebenezer dams located in the Luvuvhu and Letaba catchments, and the Olifantspoort weir in the Olifants River Catchment. Louis Trichardt (Makhado) is currently supplied by transfers from Albasini Dam, to be replaced in future by Nandoni Dam, both in the Luvuvhu and Letaba WMA.

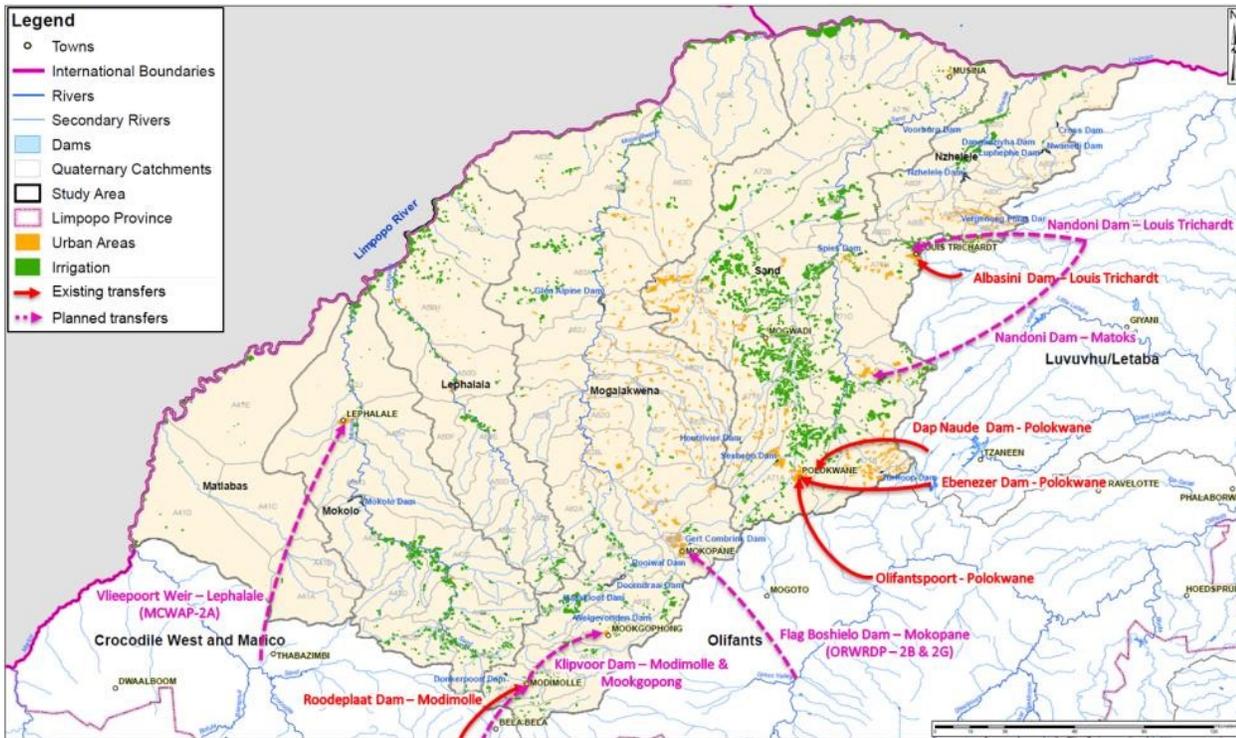


Figure 10: Polokwane, Makhado and other towns in the Sand River catchment already depend on extensive inter basin transfers.

The Nzhelele River and Nwanedzi River catchment

The Nzhelele River catchment is a small catchment dominated by irrigation which is supplied by the Mutshedzi Dam, farm dams, run-of-river in the upper reaches of the catchment, and the Nzhelele Dam (the second largest in the WMA) in the lower reaches of the catchment. Groundwater is also extensively used. Much of this irrigation is managed by emerging farmers. There is also a significant amount of afforestation in the high rainfall regions on the slopes of the Soutpansberg Mountains, which reduces the runoff.

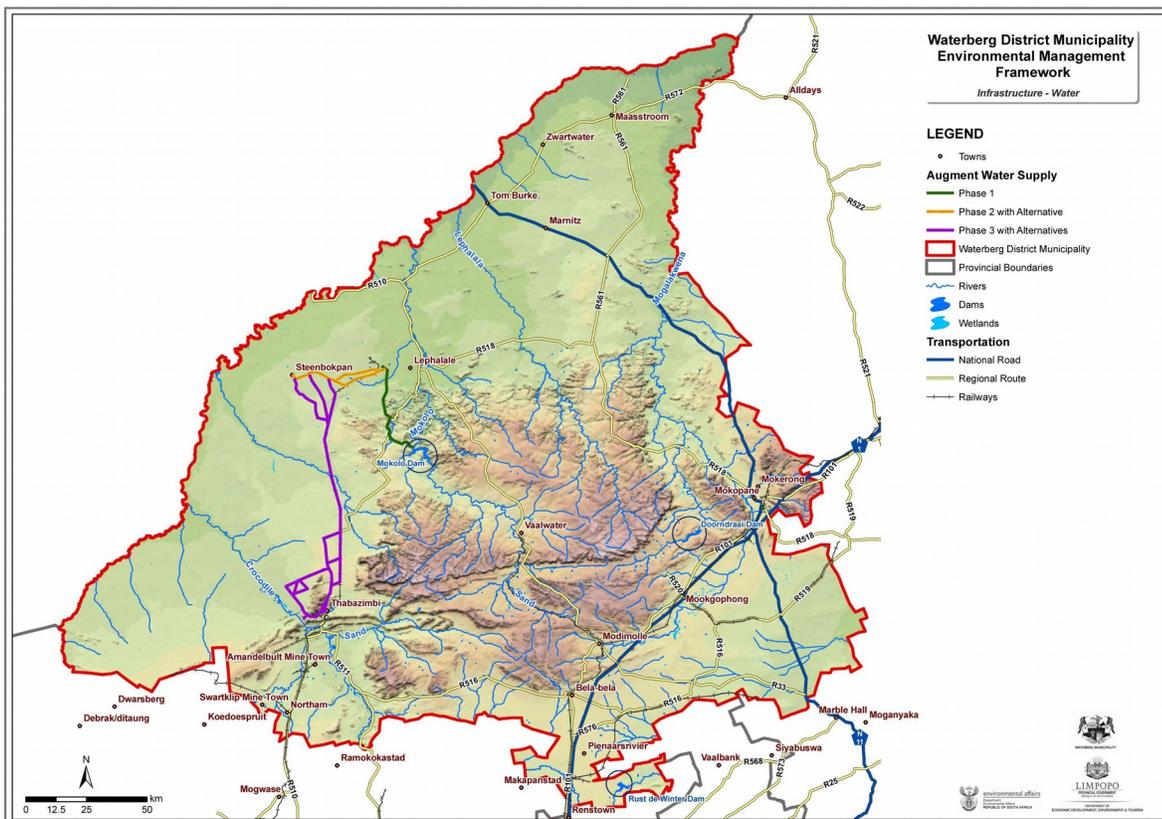
The Nwanedzi River catchment is another small catchment in the north-eastern corner of the WMA characterised by large areas under irrigation (relative to the size of the catchment). The water resources of the area are provided by a few small dams (Nwanedzi and Luphephe twin dams and Cross Dam) and run-of-river abstractions. The catchment is in deficit. This is due to over-allocation or over-development by the irrigation sector. Major planned developments in the Nzhelele and Nwanedi River catchments include CoAL's Makhado and Generaal coal mining projects north of the Soutpansberg. According to DWS planners in 2016, the Makhado Project was already at Feasibility stage and would possibly be supplied from the Nzhelele Dam Irrigation Scheme through water trading with the irrigation sector – pending the approval of the Water Use Licence. The Mutasshi/Musina Corridor Bulk Water Supply Feasibility Study includes these developments and mentions the possibility of expanding

irrigation in the Nzhelele Valley area should additional water become available. This development is opposed by Olifants residents.

These detailed descriptions of the two catchments illustrate that both are under extreme pressure of water scarcity. The MCWAP and EMSEZ projects and the water risks they pose are discussed in chapter 3.

Chapter 3: Two mega projects with mega water demands

This report focuses on the water demands of two mega-project constellations. The Mokolo Crocodile Water Augmentation Project (MCWAP) is planned to bring more water for a project that was started by the apartheid government in the 1970s to secure a South African supply of coking coal, to exploit the Waterberg coalfield for electricity and, as an afterthought, to secure water for scrubbers in the Medupi power station to reduce air pollution as a result of a contractual obligation to the World Bank in the Medupi loan agreement. The water transfer is thus a follow-on as well as a precondition for coal-based development.



Figure

11. This map shows the MCWAP proposed pipeline from Thabazimbi to Lephale (MCWAP2) as well as the pipeline from the Mokolo Dam (MCWAP1, already completed). Source: DEA 2010 MCWAP – the shrinking pipeline

The drivers of the proposed MCWAP can be found in the growth of coal fired electricity generation and mining in the region. While the building of the Mokolo dam and the first pipeline was (more than) sufficient for Matimba and the Grootegeluk coal mine, a need for more water arose when the decision was taken in 2006 to build a further Eskom power station, Medupi. Construction started in 2007. In 2008, DWS commissioned the first MCWAP feasibility study, which was completed in 2010. It planned to augment the supply from Mokolo Dam for the interim period until a transfer pipeline from the Crocodile River could be implemented, in order to provide water to the power stations, the

Grootegeluk mine and the town of Lephalale, including the township of Marapong. Construction was started in 2011, and the 46 km pipeline, parallel to the 1980 pipeline, has been operational since June 2015. It is able to take 30 Mm³/a from the Mokolo Dam – that is, just more than the Mokolo Dam’s 28.6 Mm³ annual yield. This shows how the first phase of coal mining and power generation development created the infrastructure to capture all the water of the Mokolo dam.

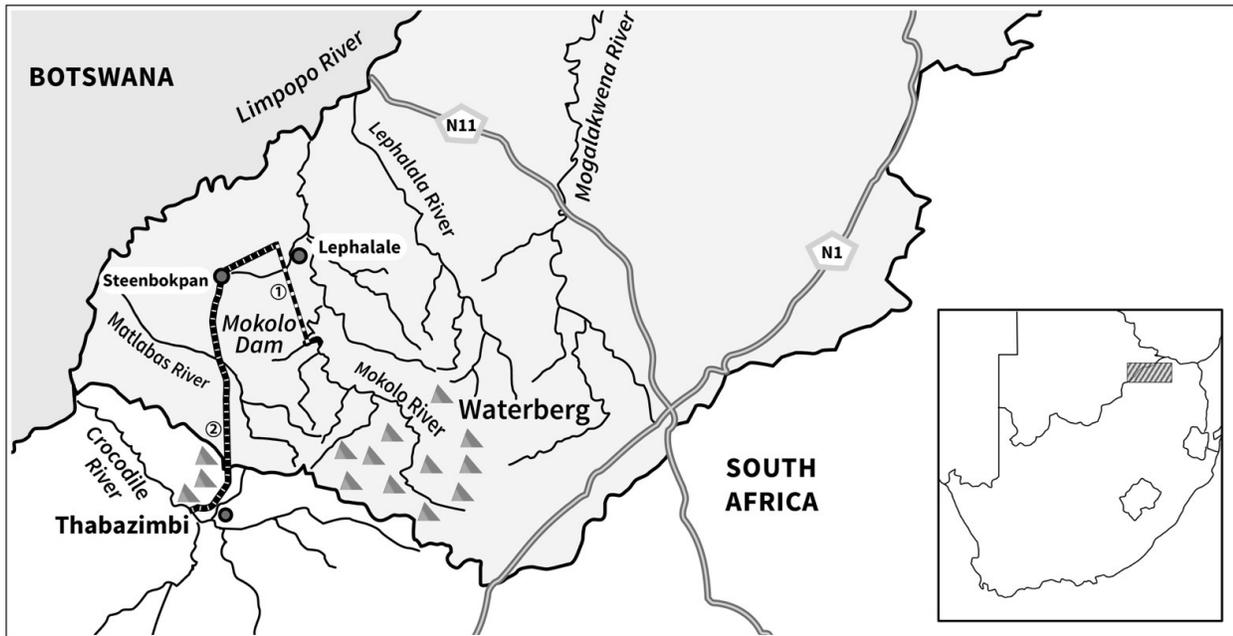


Figure 12: MCWAP plans from Thabazimbi to Lephalale. Map by Toni Oivier for this report.

A second driver goes back to a decision by the World Bank to provide a loan for the building of Medupi – at the time strenuously opposed by environmental justice activists (see Hallowes and Munnik 2018). The World Bank agreement included a condition that, 6 years after start-up, Eskom should install Flue Gas Desulphurisation (FGDs) - sulphur dioxide scrubbers - on the power station. The water required for the FGDs is around 7 Mm³/year, which is additional to use for coal washing at the Grootegeluk mine. According to research by an Eskom environmental manager, Tyrone Singleton:

Estimates indicate that Medupi’s long-term steady state water demand will be approximately 6 Mm³/a without FGD being installed... (while) estimates of the water requirements for 6 wet FGD plants (i.e. on all 6 Medupi units) with 90% removal efficiency and no water efficiency initiatives range from 6.5 to 7.2 Mm³/a. Estimates of the water requirement for a FGD system on 3 units range from 3.2 to 3.9 Mm³/annum ... The addition of coal washing at the mine to supply Medupi with coal increases the total industrial demand associated with Medupi to approximately 18.7 Mm³/a. Currently, only 5 Mm³/a of water is available and it is predicted that this allocation will be exceeded with the commissioning of Medupi’s third unit in 2012. [2010: 81]

Singleton's arguments show the effect of coal mining and coal fired power lock-in: once Eskom had committed to another power station, it was inevitable that water demand would rise. The six year "pollution holiday" the World Bank effectively granted to Eskom, ensured that new water demand would manifest at the end of that period. Eskom also locked in a specific, water-intensive scrubber technology into the architectural design of its Medupi power station.

A third driver was Strategic Industrial Project (SIP) 1, part of the South African government's National Infrastructure Plan of 2012²², to "unlock the northern mineral belt with the Waterberg as the catalyst". In this plan, which consolidated a number of pre-existing initiatives, the Waterberg coalfield was projected as an alternative to the almost exhausted central coal basin in Mpumalanga. In true mega project style, the dreams were big. Eskom planned two more power stations, the size of Medupi, close to the small town of Steenbokpan (see figure 12). Sasol planned another Secunda, to be called Mafutha ("fat one"), an 80 000 barrel a day coal-to-liquid fuel plant, which would build its own new town also at Steenbokpan. Eight new coal fired power stations were planned, linked to new coal mines, of which only Thabametsi survived the bidding process for independent power producers. Also on the list were a Vedanta power station (for wheeling electricity to its copper mining in Zambia), an Anglo American mine to supply them with coal, the Temo mine and Namane power station, the Boikarabelo mine near the Limpopo river, the Sekoko mine and two mines more or less within Lephalale town: Jindal and Groothoek, the Masimong Coal and Power Project, Anglo American's Coal Bed Methane pilot project (with Waterberg coal that is too deep to mine but which they could burn underground to produce methane-rich gas). These various initiatives bought out a total of 57 farms in the area – and leaned heavily on farmers in the local hunting economy who did not want to sell to them. Sasol cleared a large area of vegetation, dug a sample pit, ruined the road between Steenbokpan and Lephalale transporting the samples to its laboratories, and then cancelled its plans for Mafutha. Thabametsi got stuck as it faced serious challenges in court from environmentalists, including for ignoring climate change considerations in its plans. Other plans have waned too (see Hallowes and Munnik 2018 for more detail).

The shrinking mega project dreams were reflected in the shrinking plans for the MCWAP. The height of ambition is shown in the 2009 MCWAP Scenario 9. It envisaged the maximum development of a new boom in Lephalale, including Eskom's Coal 3 and 4, Sasol's Mafutha and a number of Independent Power Producers (IPPs). It put water demand for the year 2030 at more than seven times the yield of the Mokolo Dam.²³

²² See the Presidential Infrastructure Coordinating Commission Summary of The South African National Infrastructure Plan at https://www.gov.za/sites/default/files/PICC_Final.pdf

²³ See MCWAP Final EIA Phase 1. [http://www.dwa.gov.za/Projects/MCWAP/Documents/FinalEIAphase1Appendices/EIA%20Report%20\(Final\)%20-%20MCWAP%20Phase%201%20Sept2010.pdf](http://www.dwa.gov.za/Projects/MCWAP/Documents/FinalEIAphase1Appendices/EIA%20Report%20(Final)%20-%20MCWAP%20Phase%201%20Sept2010.pdf)

Year	2009	2010	2011	2012	2013	2014	2015	2020	2025	2030
Eskom	4.3	4.3	4.9	6.8	9.3	10.9	14.3	50.9	77.6	77.6
IPP's	-	0.4	0.9	0.9	1.5	4.4	13.2	15.6	15.6	15.6
Coal Mining (power)	-	-	1.1	2.7	4.4	5.3	6.8	14.1	20.0	20
Exxaro Projects	3.0	3.2	3.7	4.7	6.6	9.2	10.8	16.9	16.2	19.2
Sasol (Mafutha 1)	-	-	0.4	6.1	6.6	9.9	25.2	43.5	43.5	44.0
Municipality	5.6	5.9	7.7	10.4	12.0	13.6	14.5	20.4	21.2	21.6
Total	12.9	13.8	18.7	31.7	40.4	53.4	84.8	161.4	194.1	198.0
Irrigation + Mokolo River	10.4	10.4	10.4	10.4	10.4	10.4	10.4	10.4	10.4	10.4
Total + Irrigation	23.3	24.2	29.1	42.1	50.8	63.8	95.2	171.8	204.5	208.4

Table 4: MCWAP volumes at the height of ambition. (Source: Nema Consulting Final EIA Report for MCWAP Phase 1. [2015e].)

Now, just more than a decade later, what remains is a plan to build a pipeline that can provide 75 Mm³, which will be added to the 29.4 Mm³ of MCWAP1 pipeline from the Mokolo dam²⁴. The pipeline capacity has shrunk to almost half of its ambition and the project has been disciplined by the SA Treasury requirement that the TCTA only accommodates customers who will actually put down the money. There are three of these: Eskom, Exxaro and the DWS (which is paying for a modest growth in additional domestic water for the Lephalale municipality).

A close look at this third driver contains more warnings for all involved in and potentially affected by the EMSEZ: mega project plans can be drastically overstated, big corporate players can change their minds overnight, and they can cause local damage and then abandon their plans.

MCWAP as an inter-basin transfer

A host of other concerns remain about MCWAP. The MCWAP plan consists of adding a pipeline of about 100 km from Vlieepoort outside Thabazimbi, to bring a complex, artificial river to Lephalale's coalfield (see figure 13). The ultimate origin of the water is the Lesotho Highlands Project, discussed in chapter 1. An extension to this project (the Polihali Dam) is behind schedule, and Eskom has warned in its 2018 report (Eskom 2018) that this may affect the MCWAP and its plans for FGDs.

The Lesotho water flows into the Vaal river and dam, where it is abstracted and treated by Rand Water to supply its 12 million people and industrial customers in Gauteng and some surrounding areas. To achieve this, Rand Water pumps the water 70 km uphill, where a proportion crosses the continental divide (where water to the South goes into the Orange river system and ultimately the Atlantic Ocean,

²⁴ Interview Richard Holden, March 2020.

and water to the north goes to the Indian Ocean via the Limpopo). After passing through industries or the bellies of people in Tshwane, Midrand, and other urban areas, past a number of informal settlements and through nine waste-water works, the water ends up in the troubled Hartebeespoort dam. The dam is not able to cope with the effluent. It has become a case study for run-away eutrophication - the over-concentration of nutrients leading to oxygen depletion and ecological shocks that undermine species diversity in aquatic systems. Eutrophication is a general problem in South Africa's inland waters: 75% by volume are eutrophic by international standards. Hart and Mathew (2018) argue that various expensive programmes to deal with the dam's eutrophication have all failed because the root causes are not addressed through effective management of nutrient releases in the catchment. Meanwhile, the dam is overrun by the alien weed water hyacinth, which has found its way into the Limpopo via the Crocodile river, which receives outlet water from the dam and runs into the Limpopo upstream of the Matlabas and Mokolo rivers.

MCWAP Phase 2 is a plan to transfer 75 Mm³/a (at current plans) of this water from the Hartebeespoort dam to the Lephalale coalfield, via the Crocodile River (on which the Hartebeespoort dam is situated) and via a pipeline to be built from Vlieepoort, carrying water across the Matlabas River to Lephalale. TCTA planner Richard Holden argues that this water would in any case flow via the Crocodile to the Limpopo.

However, an appendix to the 2018 MCWAP Draft Environmental Impact Report (DEIR)²⁵ reveals that, with the regular withdrawal of 'surplus effluent', the Hartebeespoort Dam would have a shrinking shoreline in winter as water levels drop by up to 6 m to reveal mud plains of up to 800 ha, leaving the boats of the dam side residents high and dry. In addition, in September 2018, both Earthlife Africa and groundWork urged the DEA to refuse the MCWAP's environmental authorisation, because

- the need and desirability of the project has not been established;
- the DEIR did not adequately assess the impacts of the project on rivers, wetlands and ecosystems or account for the reserve as required by the National Water Act of 1998;
- the DEIR failed to adequately assess the climate change impacts of the project;
- it failed to properly assess cumulative impacts of the project;
- it failed to assess the indirect and socio-economic impacts of proceeding with MCWAP2A; and
- it failed to accurately consider alternatives to the project, including the no-go option, or to follow the precautionary principle as required by the National Environmental Management Act (NEMA) of 1998.

²⁵ See MCWAP 2a Draft EIA, Hartbeespoort Dam specialist page 296, plus Appendix 18. [https://www.nemai.co.za/documents/MCWAP/MCWAP-2A/dEIA/10580-20180920-MCWAP-2A%20WTI%20EIA%20Report%20\(Draft\).pdf](https://www.nemai.co.za/documents/MCWAP/MCWAP-2A/dEIA/10580-20180920-MCWAP-2A%20WTI%20EIA%20Report%20(Draft).pdf)

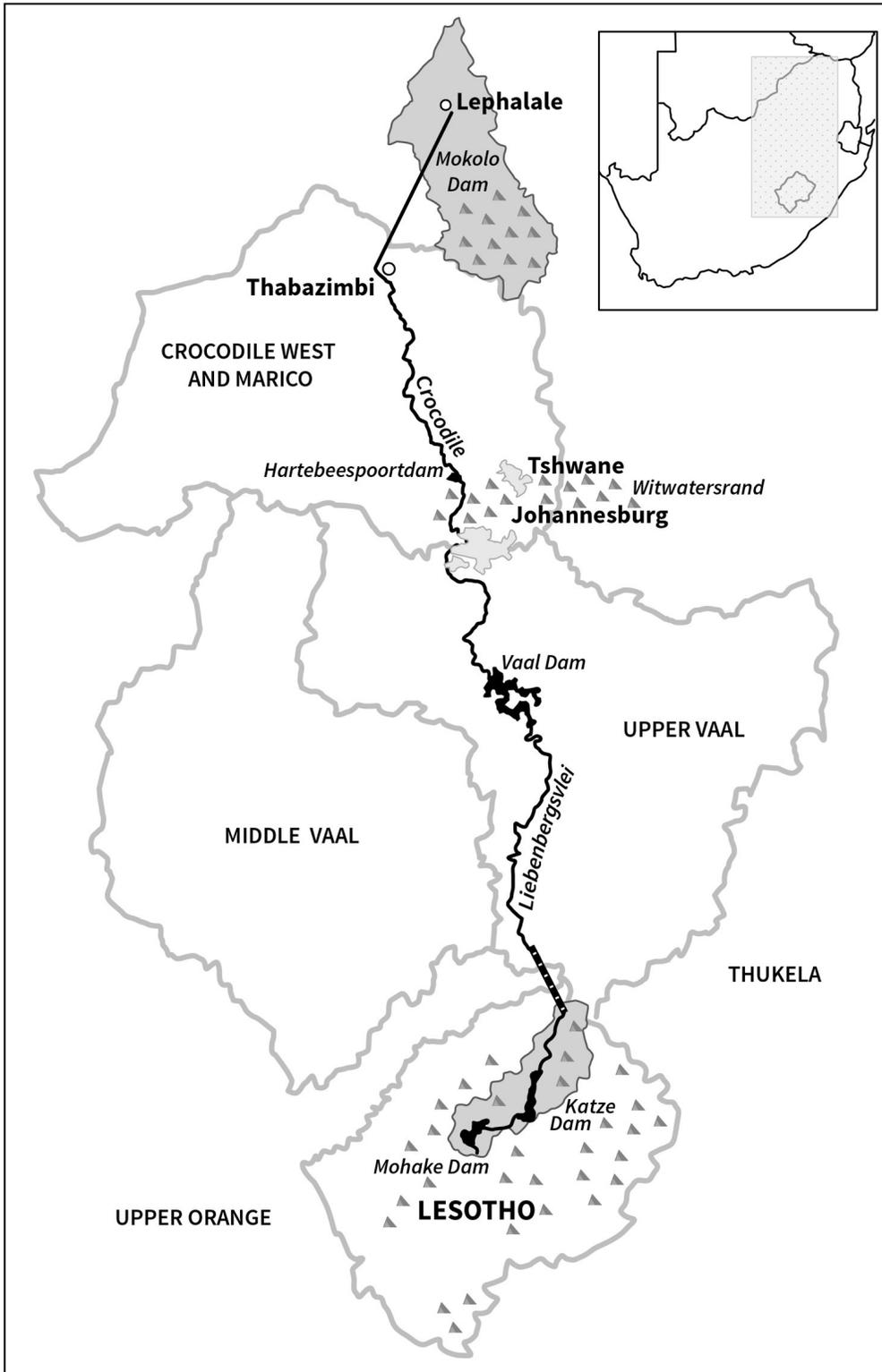


Figure 13: “The artificial river”, the MCWAP will bring water from the Lesotho Highlands all the way to Lephale. Map by Toni Olivier for this project.

The organisations argue that the DEIR has not adequately assessed the project's impacts on the hydrology from abstraction from the Crocodile River, the scouring and ecological contamination that spills from the pipeline could cause to the ephemeral Matlabas River, and the ecological results of transferring this water into the Mokolo catchment – including water quality, sediment regime, transfer of biota. The Hartebeespoort Dam is in a poor state with frequent blooms of algae and water hyacinth giving rise to the concern that these species will be transferred into the recipient catchments. The Crocodile River is also in a poor condition, as reflected in the 2005 River Health Report, which points out that only the hardiest fish species survive (see Hallowes and Munnik 2018).

The MCWAP thus represents a worst case scenario in terms of the ecological aspects of IBTs: dirty urban water from a chronically eutrophied dam, flowing down the Crocodile river that has been hammered not only by Hartebeespoort dam releases of dirty water, but also iron, platinum, gold, chrome, manganese and diamond mining, intensive farming and industry, brought into an area that can ill afford this contamination.

The world's most competitive energy metallurgical SEZ?

The Energy Metallurgical Special Economic Zone (EMSEZ), part of the bigger Musina-Makhado SEZ (MMSEZ)²⁶, is still in a planning stage. It is perhaps best described in the words²⁷ of Mr.Ning Yat Hoi, Chairman of South African Energy Metallurgical Base (Pty) Ltd (of whom more in chapter 4):

The South African Energy Metallurgical Special Economic Zone is a national-level energy metallurgical special economic zone approved by the South African government in accordance with South African SEZ Act... The SEZ is located in Musina-Makhado, Limpopo, South Africa. It covers an area of 60 square kilometers and is adjacent to Zimbabwe, Mozambique and Botswana.

There will be built in the SEZ a 20 Mtpa coal washing plant, a 3300Mw coal-fired power plant, a 3 Mtpa coke plant and a 390Mw waste heat power plant, a 3 Mtpa high-carbon ferrochrome plant, and a 1 Mtpa ferromanganese plant, a 500,000 tpa of silicon manganese plant, a 3 Mtpa stainless steel plant, a 1 Mtpa high vanadium steel plant, a 1 Mtpa high manganese steel plant and a 5 Mtpa metallurgical lime plant , a 1.2 Mtpa titanium dioxide plant and a 150,000 tpa vanadium pentoxide plant.

²⁶ The MMSEZ contains plans for agricultural processing plants, a coal to liquids facility as well as the coal fired power station and steel factories (see Reboredo 2020).

²⁷ Explanation taken for “Build the World’s Most Competitive Energy Metallurgical Base”, an interview with Mr Mr.Ning Yat Hoi by Lei Mao Sheng, China Reform Daily 2019-05-15.

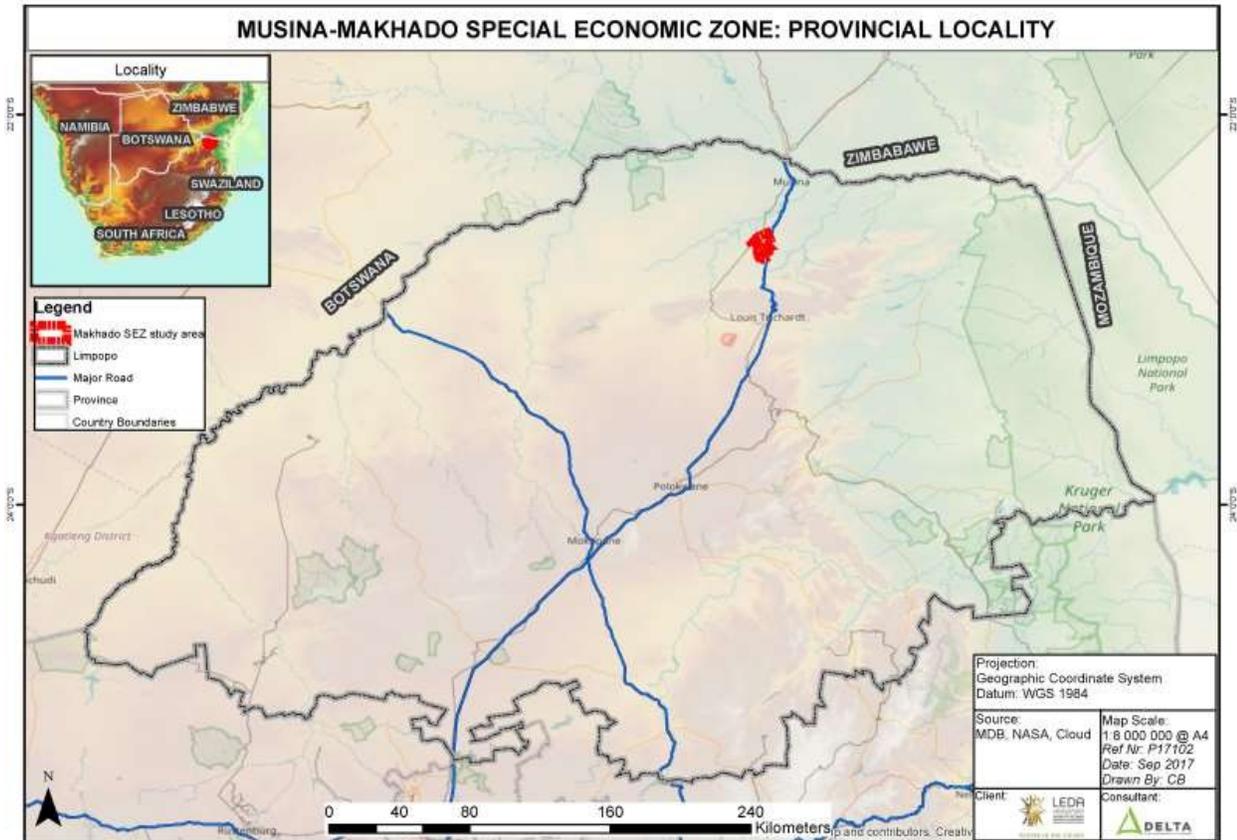


Figure 14: Location of EMSEZ in Limpopo province. Source: EMSEZ final scoping report 2019

The SEZ will also include:

... a mine resource supply centre to provide metallurgical furnace materials (and) inputs for the SEZ project factories. The SEZ will integrate the advantages of energy metallurgy and form a coordinated process energy metallurgical production process from Coking Coal Mine, to Coal Washing Plant, to Coking Plant, to Power Plant, to Ferroalloy Plant, to Iron-making Plant, to Steel-making Plant, and give full play to the advantages of hot-delivery of blast furnace molten iron and ferroalloy hot metal for whole steel processing process... which would improve smelting recovery rate and reduce metallurgical energy consumption. The SEZ operator, South African Energy Metallurgical Base (Pty) Ltd. will provide project investors with a secure and competitive resource supply and ancillary services... Our goal is to build the world's most competitive energy metallurgical SEZ.

In addition, the EMSEZ is also planned to include a town, if not a city consisting of:

an integrated service center (staff quarters, apartments, hotels, shopping malls, hospitals, schools, etc.) and an integrated logistics service center for highways, railways and shipping services with supporting government administrative service centers (such as business administration, customs and taxation functions).

The project grew from the ambitions, as early as 2014, of Mr Ning (apparently an experienced Africa hand) and his associates in the Hong Kong Mining Exchange Company and the Shenzhen Hoi Mor companies, who intended to build a coal fired power station, in close association with Coal of Africa, now MC Mining (Reboredo 2020)²⁸, an Australian company that has long looked to expand coal mining in the Makhado area. A few years later they approached the Limpopo government, which was enthusiastic for fast and big scale industrialisation and in turn persuaded the Department of Trade and Industry to adopt the project, which now appears in the DTI's Industrial Policy Action Plan (IPAP 2018/19 – 2019/20). Bigger Chinese companies – owned by the central government as well as provinces – came on board later, and the project was absorbed into China's International Capacity Cooperation programme, which aims to offshore excess Chinese productive capacity for “steel, railways, construction materials, non-ferrous metals, chemicals, electricity, automotive, information and communications technology (ICT), textiles, engineering machinery and aerospace and marine engineering” (Reboredo 2020: 177). Reboredo describes this project as an example of the willingness, and even opportunism, of the Chinese government and big state owned companies to join in projects that have been developed by small scale private entrepreneurs, even when they are not initiated by the government or its companies.

Beyond MC Mining and Ning's companies, the local proponent of the EMSEZ in South Africa is the Limpopo Economic Development Agency (LEDA), an agency of the Limpopo provincial government. The provincial department that LEDA reports to, the Department of Economic Development, Environment and Tourism (LEDET), is also the decision maker on feasibility and environmental soundness of the project. The Limpopo premier Stan Matabatha expects 20 800 jobs, as mentioned in the pre-feasibility study²⁹ and detailed in the EMSEZ powerpoint. The total investment sum is described in various media pieces to amount to \$10 billion, but it is hard to find evidence, including on the EMSEZ website, of any investments that have already been made. What is available are photographs of company representatives signing memoranda of agreement and understanding. The MoUs refer only to intentions to invest, and project preparations. It may therefore be better to describe the \$10 billion as an investment opportunity. This aspect is pursued further in chapter 4, where we look at the probability of the EMSEZ actually happening. This chapter focuses on the extent of the water risk that an EMSEZ would create for other water users.

The Chinese companies who have signed memoranda of agreement and understanding³⁰ come from different tiers of economic activity in China:

1. At the national level, state-owned companies such as China Civil Engineering Construction Corporation (CCECC), and the China Communications Construction company³¹; Power

²⁸ This section relies on information in the Reboredo 2020 PhD thesis “A ‘Bandung’ View of the World: The Political Economy of Sino-South African Megaprojects”, completed at Trinity College in Dublin. The EMSEZ is one of three case studies. The author did extensive high level interviews in South Africa in early 2018.

²⁹ Pre-feasibility study

³⁰ See EMSEZ website

Construction Corporation of China (Powerchina) the China Metallurgical Group (MCC), China and the China Export Credit Insurance company.

2. Then there are strong companies with a provincial base, who have been prominent in three decades of Chinese economic growth: Guandong (one of first Chinese industrial development provinces) Wealth Environmental Protection Co, a water processing and treatment chemicals company, Shaanxi CEI Investment Holdings, Shanxi Coking Coal group, (Shanxi and Shaanxi are coal producing and heavy industry provinces with severe pollution problems); Guanzho Rising steel group Huadian Hong Kong company limited and Taiyuan Iron and Steel Group Co, Ltd (TISCO), which has a history of heavy pollution in its province, although TISCO now claims “green development” (see Kawabata 2012).
3. There is also a tier of smaller companies, based on individual entrepreneurs, such as Ning’s Hong Kong company which holds the operator’s licence.

This accords with the explanation that the generic term ‘Chinese investment’ also masks a hierarchy of capitals of varying status, resourcefulness and connection to the Beijing government. At the top of this pecking order are the central state owned enterprises and policy banks. Below these are provincial-level state-owned enterprises, private companies of varying sizes and, at the bottom of the heap, entrepreneurial or family firms. (Lee 2014:34).

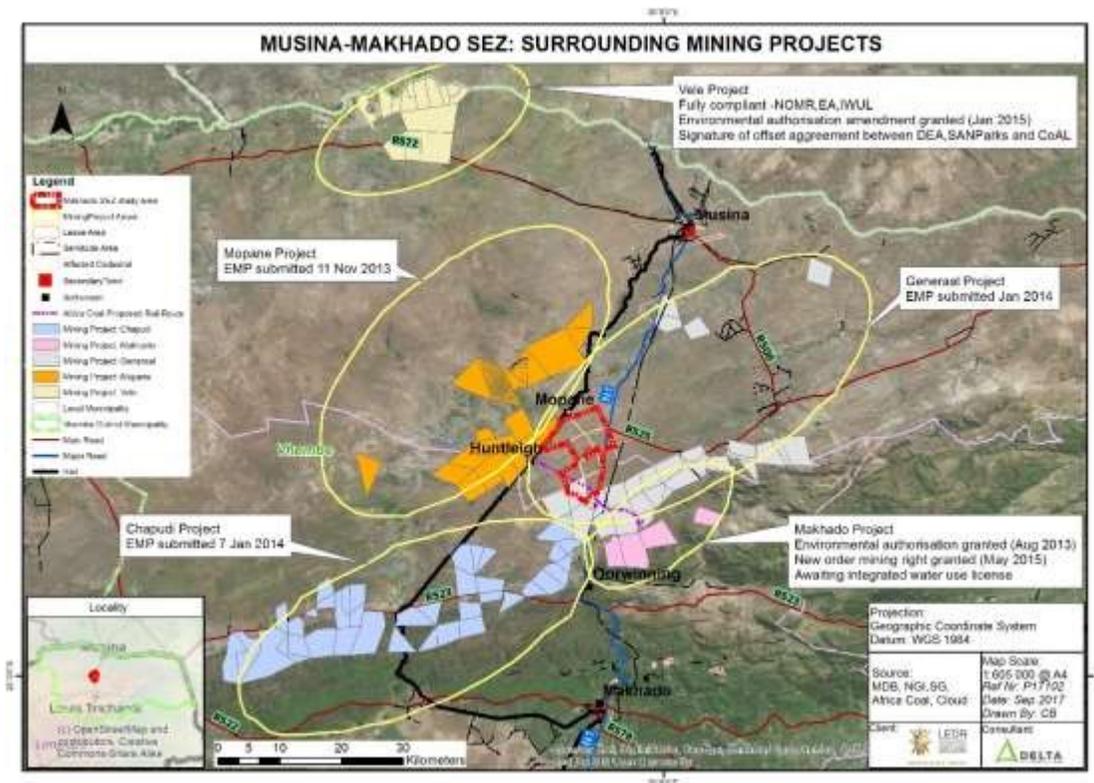


Figure 15: Map of EMSEZ with 4 surrounding coal mines

³¹ This company is mentioned in the Muller 2020 report into water sector corruption for its attempt in forcing the DWS to take loan for the Umzimvubu dam.

Prominent among South African companies interested in the development is Coal of Africa³² (CoAL), now operating as MC Mining, with an interest in four (prospective) coal mines around the EMSEZ, namely Generaal, Chapudi, Mopani and Makhado mines (see figure 15 above).

The EMSEZ’s water demands

The EMSEZ faces a particular challenge in a catchment which is already under water stress. According to the Final Scoping Report of September 2019, the EMSEZ will need 30 Mm³ per annum during a construction phase of 9 years, and then 123 Mm³ to operate an onsite coal fired power station and several iron and steel factories. The EMSEZ September 2017 presentation identifies “the Limpopo River” as the source of water. The only clear plan in currently available documentation is to transfer 30 Mm³/year from Zimbabwe. If this is the case, then the mega project itself is at risk, as EMSEZ board chairperson Rob Tooley (an ANC Limpopo politician and erstwhile treasurer of the province) points out.

The EMSEZ also introduces other water risks, in particular the contamination of surface water (through effluent as well as air pollution) and ground water through waste management, pollution incidents etc, as experienced in the ISCOR – later ArcelorMittal – steel factory in Vanderbijlpark (see Hallowes and Munnik, 2006; Munnik 2012). In addition, the coal mines required to supply EMSEZ would have their own water demands and pollution risks (see Hallowes and Munnik 2016). Other coal mines may also come into play, including an extension of Exxaro’s Tshikondeni coking coal mine, also in the area.

In order to get an idea of water demands, the author combined information from a May 2019 interview by the China Reform Daily and Mr Ning, with a “feasibility report” (of what is intended to be built) developed by the company South African Energy Metallurgical Base. As with the MCWAP and mega projects generally, it is difficult to separate speculative bubble from substantial plan in this case as well.

Table 5: Author’s calculation of possible EMSEZ water demands

MMSEZ plant	Estimated water use	Basis of estimate
20 Mtpa coal washing plant,	At 0.225 m ³ /ton, this could mean 4.5 Mm ³ /a ³³	Grootgeluk coal washing plant ³⁴

³² This company will be familiar to activists for its plans to mine coal next to the Mapungubwe Heritage Site on the Limpopo river.

³³ The figure is from http://www.dti.gov.za/industrial_development/docs/fridge/Guideline_Mining.pdf; 2009:37

³⁴ “Exxaro’s Grootgeluk open-pit mine ... has a beneficiation complex where 8,000 tonnes per hour of run-of-mine coal is upgraded in 10 different plants. -

<https://www.bizcommunity.com/Article/196/646/167962.html>.

DTI (http://www.dti.gov.za/industrial_development/docs/fridge/Guideline_Mining.pdf) mentions an average of 0.225m³/ton.

3300Mw coal-fired power plant	9 million m ³ per annum	Pre-feasibility study, 2014
3 Mtpa coke plant	2.5 M m ³ /a	Pre-feasibility study
390Mw waste heat power plant	No water consumption specified	
3 Mtpa high-carbon ferrochrome plant, ,	6 million m ³ per annum	Pre-feasibility study
1 Mtpa ferromanganese plant	6 million m ³ per Annum	Pre-feasibility study
500,000 tpa of silicon manganese plant	4 million m ³ per Annum	Pre-feasibility study refers to “ferro-silicon” plant
“pig iron plant”	4 million m ³ per annum	Pig iron plant, not in FSR ³⁵
“steel plant”	300 million m ³ per annum,	Steel plant, not in FSR. Question is whether this water-guzzling plant survives in some form?
3 Mtpa stainless steel plant	or 2 million m ³ per annum	Pre-feasibility study – need to compare to AMSA water use
1 Mtpa high vanadium steel plant	No water consumption specified	Not in pre-feasibility
1 Mtpa high manganese steel plant	No water consumption specified	Not in pre-feasibility
5 Mtpa metallurgical lime plant	3 million m ³ per annum	Not in pre-feasibility
1.2 Mtpa titanium dioxide plant	No water consumption specified	Not in pre-feasibility
150,000 tpa vanadium pentoxide plant	No water consumption specified	Not in pre-feasibility

This table accounts for at least 38 million m³, but there are additional projects in the pre-feasibility, among them a “steel plant” that will use a monstrous 300 Mm³/year. It is not clear what the nature and status of this steel plant is. The other unknowns may add an additional 12 Mm³/a, which could push the water use up to 50 Mm³/a. This amount does not include the minimum of 4 coal mines belonging to MC Mining in the area, or Exxaro’s nearby coking mine (Tshikondeni) which may be reopened if the

³⁵ It seems from Ning’s process description that a pig iron plant would be part of the complex.

EMSEZ gets off the ground. It may also be that the project planners do not really know or care how much water they will need.

Mzingwane river and Zhovhe dam

The Limpopo North reconciliation strategy (DWS 2016) reflects early efforts to look for the extra water for coal fired power, mining and industry, since the water resources of the Limpopo North catchment were by then already completely overcommitted. The Sand river catchment –in which the EMSEZ would be located - already imports water from IBTs adding up to 34.16 Mm³/year, to meet water demands in Polokwane, Louis Trichardt (Makhado) Lebowakgomo rural area and Modimolle town.

Early plans, detailed in a 2014 study by Aphane Consulting (not publicly available) investigated the possibility of sourcing water from Zimbabwe. According to DWS 2016, an amount of 30 Mm³/year can be sourced from the Zhovhe dam in the Mzingwane catchment in the dry Matabeleland, Zimbabwe, which was built in 1995. The Mzingwane river flows from just below Bulawayo to Beit Bridge border town on the Limpopo. The plans argue that the water is currently unused. However, it will not be unused if and when the Zimbabwean economy recovers. In 2007, five commercial agro-businesses were using alluvial groundwater abstracted from boreholes in the Mzingwani’s sand river bed and on the banks, and replenished by releases from the Zhovhe dam³⁶. They were producing citrus, wheat and vegetables (Love et al 2007). In the lower regions of the Mzingwane, water releases into the river aquifers hold great potential for rural farmers to improve their livelihoods including producing for markets (Love et al, 2013). The EMSEZ plan to access water from the Zhovhe dam also faces a geological challenge: if the water is released from the Zhovhe dam it will first fill up the extensive sand and alluvial aquifers in the lower reaches of the Mzingwane, and the full amount of water from the Zhovhe dam will not arrive in the Limpopo river, because “no river flows occurs until the channel aquifer is saturated” (Love et al 2007: 2).

Alternative options mooted include: bringing water from Zambia, with a 450 km pipeline dependent on an agreement between seven riparian countries³⁷; an extension of the MCWAP to Makhado, or alternatively counting the MCWAP water that lands in the Limpopo via the Crocodile and abstracting an equivalent amount of water from the Limpopo at Beitbridge³⁸ However, the most likely solution and only one that makes technical sense - although not political or ecological sense – is a water grab aimed at the Tuli aquifer. A presentation shown by EMSEZ promoters simply refers to the water resource for

³⁶ The same mechanism applies to releases from the Mokolo dam to replenish the river’s alluvial or sand aquifers from where irrigation farmers abstract their water. It is an effective method in terms of avoiding evapotranspiration in a hot, dry area.

³⁷ See <https://www.thestandard.co.zw/2019/11/24/matabeleland-zambezi-water-project-remains-mirage/>

³⁸ The MCWAP water will be used in a consumptive way – it will be used up – and not be returned to a water course that reaches the Limpopo Holden interview 2020.

the project as “the Limpopo”, which is odd because the rest of the presentation shows a very detailed appreciation of the geology and mineral resources of South Africa.

The risk of a water grab aimed at the Tuli Karoo aquifer



Figure 16: The Tuli Karoo aquifer with an illustrative pipeline to the EMSEZ. Map by Toni Olivier for this project.

The Zhovhe dam and the Mzingwane river are both located on the Tuli Karoo aquifer, together with other important rivers: the Bubyi, Shashi and Motloutse (the last two in Botswana). It is a huge aquifer spanning a surface area of 12 000 km² Zimbabwe (the largest portion, in Matabeleland), the Tuli block in Botswana and a smaller portion in South Africa. The broader system - the six river catchments that flow over and interact with the aquifer- cover a total of 82,000 km². The total population on the aquifer is estimated at 123 400, while that in the Karoo Tuli system -the rivers feeding the aquifer and gaining water from it- is estimated at 1 834 500 (Lautze et al, 2019). Overall, the population is largely rural and predominantly female, with a poverty rate in the biggest section, Matabeleland South, of 62.8% (Lautze et al 2019.) Water security in the area is already affected by climate change, as witnessed in rising temperatures and increasing rainfall variability leading to more droughts and floods.

The aquifer is an intricate system consisting of a deep sandstone aquifer, as well as shallow aquifers, both in the sandy river beds as well as off-river deposits ,which likely were older river courses. These aquifers consist of “coarse sands with intermittent pebble horizons and clay lenses”, resulting in highly permeable aquifers with high-yielding boreholes (Gomo and Vermeulen, 2017). They argue that the interactions between the main stem Limpopo river, the sand river bed and the riparian aquifers, and the deep aquifer(s) are not well understood and more research is needed, a call echoed by Lautze et al. It is

likely that surface waters recharge groundwater, but that groundwater does not contribute much to surface (river) water flow. Excessive use of surface water may therefore have a negative effect on groundwater.

The Lautze report estimates the total groundwater resource (for the alluvial aquifers associated with current and historic river courses) at 750 million m³ (Lautze et al, 2019:31). The report does not estimate the yield of the deep sandstone aquifer, but does state that it is recharged (receives water) at the edges where the sandstone reaches the surface.

The aquifer hosts 55 boreholes in Zimbabwe, 24 in Botswana and 11 in South Africa. At the edge of the aquifer, Musina town pumps water from it. In terms of land use: 12% of land is cultivated, irrigation 1%, so a sustainable expansion of irrigation may be possible (Lautze et al, 2019). In terms of current water use in the aquifer:

...81.9 percent of (abstracted) water is used in irrigation in the Tuli Karoo Aquifer Area, followed by mining (8.2 percent), environmental flows (5.1 percent) and water supply service including domestic use (3.3 percent), livestock (1.1 percent) and industry (0.4 percent)... Irrigation schemes often do not have enough water to fully satisfy demand... Unabstracted water, e.g. green water in rainfed agriculture, should also be recognized. Rainfed agriculture consumes 27,497 million m³/a of green water, way above the blue water of 173.56 million m³/a consumed in the aquifer area.” (Lautze et al, 2019: 80).

Despite its importance, analysts are not confident that the necessary governance structures – including LIMCOM – are in place to protect it. It may be vulnerable to a water grab. Gomo and Vermeulen (2017:1169) observe that:

Of the groundwater users in the Trans Boundary Aquifer (TBA), rural communities are the most vulnerable. Although the groundwater demands of rural communities are probably the lowest of all water users, their exploration tools and techniques are not very much advanced... wells are mostly hand-dug and hand-pumped.

Threats to the groundwater and thus to these rural communities include over-pumping by other users such as commercial farmers with more powerful pumping technologies, water pollution from fertilisers (e.g. nitrate) and pesticides in return flows from irrigation, and mines that practice dewatering and thus lower the water table (Gomo and Vermeulen, 2017).

The EMSEZ is the worst threat to the Tuli Karoo aquifer. If operators intervene in this system and deplete it, the consequences will be far reaching and close off development possibilities for these communities. The sensitivity of this intervention may explain why the water supply plans for the EMSEZ are so vague.

Chapter 4: Risks and lessons

This chapter concludes the report by exploring the likelihood of the two projects happening, summarising risks to other water users, and drawing some conclusions which suggest further action and research.

How real are the threats?

Coal and climate

A factor which counts against both projects is that they take place in defiance of climate change. They are part of a politics of ‘late coal’ in South Africa (and the world), a politics of opportunism and tactics aimed at exploiting the last spoils from a sunset industry. As the dirty tail of a five decade long history of coalfield development, MCWAP hoping for an impossible coal boom in the Waterberg contains a warning of how long the effects of ill-conceived coal-based development last, and of how the impacts, and risks of additional impacts continue to escalate, once such a development path is embarked upon.

How likely is it that the MCWAP pipeline will be completed? None of the proponents of another coal boom – Sasol, new power stations and new coal mines – are putting money on the table for the pipeline, and its support has shrunk to only three institutions: Eskom (to fulfil its World Bank FGD obligations), Exxaro (in the hope of expanding its mining operations, a hope that may also disappear in the near future) and DWS (to support the municipal water supply).

Activists have, since at least 2008, argued that Medupi should not be built, and some argue that the power station is so expensive and riddled with design and construction flaws that it should be shut down even now. There are water security and other environmental risks created by this coal mega project cluster with or without the expansion of the MCWAP, though of different nature and scale and probably more extensive if it is built.

The EMSEZ is preposterous in its defiance of a reasonable climate change mitigation calendar. Its timeline, expressed in a lease of 90 years (plus a further 30 years extension) completely ignores the urgent need to reduce global coal and completely phase it out by 2050. The EMSEZ proposal can anticipate stiff opposition from climate change and other anti-coal activists, a growing refusal by financial institutions to invest in coal, and increasing regulatory hurdles from elements in the South African and Chinese governments who take climate change mitigation seriously.

In addition, its huge coal fired power station of between 3000 and 3 600 MW (the specified capacity keeps changing) is not provided for in the South African Integrated Resource Plan (IRP) for electricity supply. While the plant could be kept separate from the national grid, it may face opposition from embattled state electricity producer Eskom, which is currently the only supplier to heavy industry.

Wild card Ning

The local newspaper Zoutpansberger in February 2019 reported³⁹ that

The chairman of the SEZ operator, South African Energy Metallurgical Base (Pty) Ltd... Mr Ning Yat Hoi... has had his fair share of bad press over the past few years, and in April 2017 he was removed as CEO of the international mining group ASA Resources, following alleged irregularities. Hoi and the company's financial director, Yim Kwan, were accused of transferring "several million dollars" from the accounts of its 85%-owned Freda Rebecca gold mine (FRGM) to entities in China, without full value being received by FRGM. Freda Rebecca is the largest single gold mine in Zimbabwe. Ning dismissed the allegations.

More recently Amabhungane reporter Sam Sole asked two ministers whether they had checked the allegations against Ning. Minister Rob Davies responded that he had not been aware of these at the time of issuing Mr Ning the operator's licence (in September 2017), but subsequently asked Ning about it, presumably after reports that an arrest warrant had been issued for Ning, and a detailed expose of the allegations against Ning and his associates. Davies seemed to have been satisfied by Ning's explanation that the allegations were part of a scam against him⁴⁰. According to Sole, based on documents received by the CER after a Promotion of Access to Information Act (PAIA) request, Ning was appointed without a proper process, and without a proper feasibility study, in an initiative that emerged in the Zuma era⁴¹.

Contradictory signals from central government

There are references to the EMSEZ in official government literature, such as the DTI's Industrial Policy Action Plan (IPAP 2018/19 – 2019/20). DWS planners' efforts to find extra water for the EMSEZ (or similar developments) date from 2014, and possibly earlier. However, a recent interview by the author with DWS planners was abruptly cancelled in the first 10 minutes when the DWS official in charge declared the questions about water sources for the EMSEZ to be "political".

There are also contradictory signals indicating that some actors in the national government may be deliberately leaving this project in the hands of the Limpopo provincial government. In response to a query from the Centre for Environmental Rights, on 5 December 2019 Environment Minister Barbara Creecy confirmed that the Limpopo Department of Economic Development, Environment and Tourism (LEDET) is indeed the regulatory authority looking after the EMSEZ project, and that the national

³⁹ <https://www.zoutpansberger.co.za/articles/news/50592/2019-07-28/towards-the-land-of-smog>

⁴⁰ <https://www.news24.com/SouthAfrica/News/amabhungane-earthcrimes-limpopos-dirty-great-white-elephant-20200407>

⁴¹ <https://amabhungane.org/stories/earthcrimes-limpopos-dirty-white-elephant-part-2-the-dodgy-designation/>

DEA cannot intervene. This response reflects a surprising hands-off attitude, which may signal that the national department is keeping its distance from a disaster about to happen.

National Water & Sanitation Master Plan

The National Water and Sanitation Master Plan (DWS 2018) frankly analyses South Africa's current water crisis: a water deficit of 17% by 2030, unless radical measures are taken, widespread problems in municipalities affecting water services, and a huge investment deficit. It names priorities and outlines a plan of action to 2030. It regards water for mining and industry as a priority: "As the manufacturing sector is the pillar sector required to drive economic growth and social development of the country and rightfully earmarked for future growth in the water demand." (2018: 3 -29) "The development of new mines in water scarce areas requires forward planning to make arrangements for the transfer of water and development of new sources." (2018: 3 -29) and "The economy of the country largely depends on mining and various large industries. Water availability should not be a limiting factor to growth in this sector. Water resources developments should prioritise the availability of water to this sector." (2018: 3 – 40).

It also notes a serious deterioration in water ecosystems, noting that 57% of river ecosystem types are threatened (2018: 8-4), and expresses concern about the deterioration of water quality in the country, as well as the deterioration of monitoring systems. It identifies the potential to further exploit groundwater resources, where it sees an additional potential of accessible groundwater between 1 500 and 2 500 million m³/a. It cautions, however, that this water "is very widely distributed across the country and its potential availability offers particular opportunities for small towns, villages, mines, and individual users to meet their water requirement for domestic use, irrigation and stock watering." (2018:3-44). It is therefore unlikely that groundwater would be made available on large scale to an industrial development like the EMSEZ.

Steel market uncertainties

The primary declared aim of the EMSEZ is to produce steel for sale to China and sub Saharan Africa. However, there does not seem enough demand for the steel output of the EMSEZ. Reboredo reports that South African experts were highly sceptical about the chances of EMSEZ in the market. South Africa's steel demand is stagnant, Sub Saharan Africa imports two thirds of its modest steel requirements, and China is producing a surplus of steel as its construction boom has slowed down (Reboredo 2020). Reboredo also questions whether the transport plans (to the Maputo harbour) are feasible, including the possibility that Transnet may oppose them. The EMSEZ complex could become a clearly uneconomic proposition, not receive investment and not get built. If it proceeds, it will saddle investors, including the South African or Limpopo governments, with extra debt. In other projects, lack of economic viability has led to withdrawal of Chinese government support.

International water risks

While environmental considerations may not loom large in China's overseas investments, the diplomatic fall-out of a dispute about the shared water catchment of the Limpopo may well motivate Chinese state actors to abandon the project. It is important to understand what the real implications are of the EMSEZ choice of "the Limpopo" as its source of water. There are four governments involved with the Limpopo river, and opposition from any one of them may lead to diplomatic tensions that may scupper the project. As for taking water from the Zhovhe dam, while the current Zimbabwean regime may acquiesce to this, it would create a potent future source of resentment among many Zimbabweans, particularly those directly affected.

Strong opposition from civil society

On the ground, a number of groups are strenuously opposing the plans. Foremost amongst them is the citizens group Save Our Limpopo Valley Environment (SOLVE), and the Vhembe Biosphere group. Also involved are the Centre for Environmental Rights, Earthlife Africa, the Bathlabine Foundation and other groups. Some of these groups are part of alliances that have been resisting coal mining plans by Coal of Africa (CoAL), now reinvented as MC Mining, since they established the Vele mine at the Mapungubwe international heritage site.

How serious are the risks?

The MCWAP risks

The MCWAP project is really the tail end of a number of decisions that have already locked in the need for a water supply from outside the Waterberg to its coalfield. As a result there are risks both to completing the project, and not completing the project; a caution to planners and citizens to consider the long term implications of any water supply development. If the project is completed, dirty water would be brought into the Waterberg and eventually contaminate streams including the Mokolo, for example foreign biota carried on pipes, other equipment, workers' clothing etc. There are risks of spills carrying foreign biota including the water hyacinth into the Matlabas during regular cleaning operations, or unexpected spills and breaks.

The availability of water may open the region for further fossil fuel development. It will also decrease the water in the Hartebeestpoortdam, increasing the risk of oxygen depletion events, leading to fish kills and hammering what is left of the aquatic ecosystem in the dam. This will make the dam unattractive to tourists and residents.

If the project is not completed, it will open a different type of risk, in that it is, since 2015, technically possible that all the water in the Mokolo dam can be shunted to the power stations of Matimba and Medupi, to Exxaro mines, and to support any further fossil fuel based development. This would result in less water for irrigation, threatening commercial farms, the supply of food that they provide, and farm jobs. Pressure on water resources will also threaten rural and other diffuse water users.

The FGD scrubbers would not be installed and sulphur dioxide pollution would continue uncontrolled, as it is present. The project may also be abandoned half way, leading not only to a waste of money, but also opportunity costs and money misspent on preparing for it, as well as collateral damage, for example to roads used by heavy trucks which they were not intended for, such as the Steenbokpan road.

EMSEZ risks

Documents supporting the Makhado EMSEZ indicate a 120 year lock-in. This would have serious implications for other water users in both the South African Limpopo North Water Management Area, and the greater Limpopo river basin.

The main water risk in the EMSEZ is to rural water users. The Mudimeli community is already experiencing the effects of initial coal mining – a MC Mining sample pit for the Makhado colliery – which they say has lowered the water table and dried up some of their boreholes. It has forced the already poor population to buy in water for daily tasks, particularly affecting women.

Transferring 30 Mm³/a – only enough for the construction phase of the Makhado EMSEZ, but not for its estimated operation requirement of 123 Mm³ - from the Zhovhe dam in the Mzingwani catchment in the dry Matabeleland of Zimbabwe, would cut off any possibility for the revival of commercial agri-businesses and threaten subsistence water supply and smallholder farmers dependent on the river and its alluvial aquifers.

Risks to Tuli Karoo aquifer and its population of 123 400 largely rural and predominantly female, largely literate and poor, are great. It is the only realistic source for the amount of water foreseen in the Makhado EMSEZ, in an area where water security is already negatively affected by climate change. If the EMSEZ relies on this aquifer for water it will be depleted, leading to the collapse of thousands of livelihoods, long term damage to the aquifer, and an end to local development plans.

This would also damage to diplomatic relations amongst the four aquifer states (South Africa, Zimbabwe, Botswana and Mozambique) and the emerging but weak governance system for the aquifer (LIMCOM). It remains to be seen whether the Chinese government will pressure Zimbabwe to provide water for an industrial complex in South Africa, what may be in such an agreement or what the response of the other aquifer states might be. Would this agreement bypass the SADC protocol of 2000 on shared water resources? Would it displace the weak institution LIMCOM? Would South Africa's national government be party to such a deal and/or allow the Limpopo provincial government to orchestrate such a deal?

If the Makhado EMSEZ goes ahead and no alternative sources of water are found, or if the EMSEZ water requirements are under-estimated, it will exert a very destructive pressure on resources for other water users. This will most likely first affect the diffuse rural water users with their fragile rights, as

well as domestic users. It may also affect the irrigation farms and put pressure on food production and farm jobs. Ironically, it will also undermine the related MMSEZ plans for agricultural beneficiation⁴².



Figure 17: The Mulambwane Community Property Association is the current owner of the land on which EMSEZ is to be built. (Photograph, Victor Munnik).

Given the weak state of water quality regulation in South Africa, the EMSEZ factories can be expected to pollute, both surface and ground water in the area. An increase in coal mines will lower the regional water table, causing community wells to dry up. During construction it is possible that sand will be mined from sand aquifers which are crucial to ground water supply in this area, as happened in the Mokolo case. An operational EMSEZ would bring an end to the conservation status of much of this area in the shape of the internationally recognised Vhembe Biosphere, as well as wildlife tourism in the area. It would impose a coal dynamic on this area, that may well include domestic coal burning with its intense ground level pollution effects (Munnik 2009).

Manoeuvres in anticipation of this development have already led to considerable tension in the Mulambwane community, the land reform beneficiaries who expect to benefit from the Makhado EMSEZ development.

Lessons

From a longer term perspective, four themes stand out:

⁴² Musina-Makhado Special Economic Zone refers to an overall plan that contains agricultural processing plants, a coal to liquids facility as well as the coal fired power station and steel factories (see Reboredo 2020).

- The invisibility of “diffuse” water users and their fragile rights in water allocation research and planning. These are rural water users who form the majority in the areas studied in this report, who are in general poor and consist of a majority of women who face daily challenges in providing food and ensuring health for their families;
- The urgent need for an ecological understanding specific to South African sand aquifer rivers that would effectively influence policy making and water allocation and allow for the implementation of ecological flows in these rivers;
- The need to strengthen citizens participation in water governance both in South African catchments and in international, shared river catchments such as the Limpopo;
- The need for South African activists to understand the growing influence of China in Africa, and with it the need for engaging with Chinese approaches to the environment. China is already a world leader and in the future will become more so.

Strengthening and making visible to planners the rights of invisible rural water users

There is long-standing concern in the water sector regarding poor rural water users and their rights, including in the current DWS Master Plan (2018), but a weak history of transformation. A recent line of research is pointing to how colonial water systems, and democratic post-colonial systems, do not recognise the rights of rural dwellers. The deep historical reason is that colonial water rights systems displaced customary rights, and they remain invisible to current planners (Van Koppen and Schreiner 2018). Planners ignore these water users because they typically use very small amounts that are not noticeable in aggregate planning systems, and because these water rights are difficult to formalise within existing permitting systems. In South Africa formal rights are recognised as general authorised use and schedule one use, while customary use rights are ignored. In conditions of water scarcity such fragile rights are crowded out by more formal rights. This requires urgent reform of official water planning to explicitly recognise that although these amounts of water are small, they literally make the difference between life and death, and they apply to the majority of residents in the country. Water reform is as urgent as land reform.

Understanding sand rivers and planning for their ecological requirements

While the past two decades have seen an upsurge in research on groundwater, there is still much to be understood about these water resources that more and more users are turning to in a water scarce country like South Africa. Both groundwater and alluvial aquifers are important to diffuse rural water users, but under threat from large scale irrigation (in terms of depletion) and mining (dewatering and pollution). In particular, South African planners, as showed in this report, have not been able, or willing, to reserve water for ecological requirements in these rivers, despite some research (Seaman et al, 2013) that has shown what may be needed. There is an urgent need for an ecological understanding specific to South African sand aquifer rivers that would effectively influence policy making and water allocation and allow for the implementation of ecological flows in these rivers. The burden of

accommodating ecological flow requirements should fall on large scale users. The DWS Master Plan shows an appreciation of this:

Groundwater abstracted from river beds, close to streams, and from shallow alluvial aquifers has a very direct influence on river flow and plays an important role in sustaining wetlands and river flows ('base flows') and supporting refuge pools in the dry season. Apart from the human benefits of maintaining river flows in the dry season, refuge pools in seasonal rivers support water dependent animals that would otherwise not survive when the rivers dry up. (2018: 8-10).

In addition, aquifers such as the Tuli Karoo need to be much better understood in terms of recharge, depletion, and the effects of pollution from commercial farming – e.g. irrigation return flows – and mining, including the creation of depletion cones from mine dewatering. Industrial pollution impacts need to be understood before embarking on a dangerous path, for example whether it is true that there is hexavalent chrome in the groundwater of Thubatse.

Strengthen citizens' participation in water governance

The threat that mega projects like the EMSEZ pose to the scarce water resources of the Limpopo area, both in and beyond South Africa, points to the urgent need to strengthen citizens' participation in governance systems such as the catchment management system in South Africa, and LIMCOM for the international Limpopo. The Limpopo Water Management Area currently operates as a proto-CMA (meaning that officials in the Limpopo offices of DWS act as an interim CMA), rather than a fully developed Catchment Management Agency (see Munnik 2019).. Catchment management forums are almost non-existent in the area and in effect, most decisions about water use are still made by white irrigation boards. The DWS Master Plan promises that all 9 CMAs would be established in 2020 (DWS 2018: 9-6). In the meantime, citizens and water users are active in public spaces outside water management institutions.

China in Africa, and China and the environment

The EMSEZ project, whether soon-to-be reality or nightmarish scam, points to the importance for social justice activists to understand the nature of Chinese interest and interventions in South Africa. Due to the specific circumstances surrounding knowledge production about China – both the Chinese tendency to censorship and the Western media response of only focusing on negative aspects – it is important to develop an autonomous (that is, not Chinese sponsored and controlled) understandings and expertise on this topic.

The motivation for Chinese interest in the EMSEZ is to secure long term, stable resources of minerals (iron, coal, steel, manganese, copper, vanadium, chrome etc) that can be extracted and minimally beneficiated for ease of export, as well as an official programme of offshoring excess Chinese industrial capacity. There is a red flag in the EMSEZ presentation which points out, as a "benefit" of the project, that it will enable China to offshore its excess steel capacity and thereby cut (dirty or fossil

fuel) energy consumption, adding it to South Africa's carbon bill, causing local pollution in the Limpopo province, and competing with other steel producers in South Africa. In contrast to Western industrial and mining companies, Chinese investment comes with strong state support and diplomatic/political/security aspects attached. The Chinese interest in Southern African minerals is real. If the EMSEZ does not happen, these interests are likely to find another extractives export hub in Southern Africa.

It is similarly important to understand the Chinese approach to the environment and pollution legacies over the past three decades. This includes a rise in importance of pollution issues in China itself, an interest in ecological modernisation, as well as a strong "clean coal" discourse.

Environmental issues constitute an area with potential for democratic institutions to develop, challenging a pattern in which governments "listen" to the people, but there are no democratic institutions in which politics and policies are contested. This requires frank discussion with Chinese leaders, industrialists and environmental managers about their own approach to the environment as they become a strong presence in Africa.

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