EXPLORING SOUTH AFRICAN

IRRIGATION HISTORY

SANCID

WATER RESEARCH COMMISSION

SP 165/24

Obtainable from:
Water Research Commission
Private Bag X03
Gezina
0031

www.wrc.org.za

Disclaimer
The Water Research Commission (WRC) has approved this book for publication. Approval does not signify that the contents necessarily reflect the views and policies of the WRC, nor does mention of trade names or commercial products constitute endorsement or recommendation for use.

Production editor: Lani van Vuuren
Design and layout: Anja van der Merwe

SP 165/24
ISBN 9978-0-6392-0535-9

Printed in the Republic of South Africa
© Water Research Commission

CONTENTS

CHAPTER 1: HOES, SPADES AND FURROWS: WATER MANAGEMENT BEFORE 1860 7

CHAPTER 2: PRIVATE AND STATE IRRIGATION 1870-1916 31

CHAPTER 3: GREAT EXPECTATIONS, HARD TIMES (1912 – 1932) 59

CHAPTER 4: FROM FACILITATION TO INTERVENTION: THE STATE AND IRRIGATION (1935-1956) 89

CHAPTER 5: SOUTH AFRICA REACHES IRRIGATION MATURITY (1960-90) 115

CHAPTER 6: BETTERMENT AND A BETTER FUTURE? AFRICAN IRRIGATION (1950-1994) 145

CHAPTER 7: IRRIGATED AGRICULTURE IN POST-DEMOCRATIC SOUTH AFRICA 171

CHAPTER 8: FUTURE IRRIGATION DEVELOPMENT: APPLYING THE WATER-ENERGY-FOOD (WEF) NEXUS AS A CROSS-SECTORAL STRATEGY FOR IRRIGATION DEVELOPMENT IN SOUTH AFRICA 207

CHAPTER 9: SANCID – THREE DECADES OF COMMITMENT TO SOUTH AFRICA'S IRRIGATED AGRICULTURE 219

PREFACE

South Africa has a robust and productive agricultural sector and is regarded as a net food exporter. The country lists among the top five countries in Africa regarding land area under irrigation, the other countries being Egypt, Morocco, Madagascar and Sudan. Of the estimated 1.3 million hectares under irrigation, about 50 000 ha are smallholder irrigation schemes. Irrigated agriculture, while being the largest single user of surface and groundwater in South Africa (it has been reported that the sector uses 62%) contributes more than 30% of the gross value of the country's crop production.

The need for irrigation is necessitated by the country's semi-arid nature. South Africa receives only about 450 mm of precipitation a year – well under the world average of 860 mm a year. South Africa falls among the 30 driest countries in the world. The country's economy is threatened by high extreme climatic events, high variability and change. The distribution of rain varies widely across the country, generally reducing from east to west, with 65% of the country receiving less than 500 mm a year. The total runoff of all South Africa's rivers (approximately 49 million m^3/annum) is about equal to the Zambezi River to the north of the country.

It is due to these climatic constraints that South Africa has focused on irrigation as a means of increasing food and fibre production. In many irrigation schemes large storage reservoirs have had to be constructed in addition to irrigation canals to stabilise supply in times of need. These dams typically store two to three times the mean annual flow of the rivers in which they are constructed. The country's 320 largest dams, many of which were partly or wholly constructed for irrigation purposes, together store at least 66% of the country's mean annual runoff.

The country cannot boast an ancient irrigation history such as Syria, Egypt, Iran and Turkey, yet irrigated agriculture forms an important part of the country's agricultural sector. The combination of influences varying from traditional African to European, combined with the country's unique agricultural challenges makes for an interesting history.

The South African National Committee on Irrigation & Drainage (SANCID) with support from the Water Research Commission, created a platform to provide an account of South Africa's irrigation history, including the history of its own origin, some years ago. It was seen as especially pertinent to include the history of irrigation among smallholder farming communities which has hitherto been much neglected.

The result is a detailed chronicle of how the irrigation sector developed in South Africa from initial private initiatives to the cooperative flood diversion schemes of the nineteenth century and the large, sophisticated public storage schemes which took shape after unionisation in the early 1900s. The book ends with a glimpse of the current and future challenges faced by both commercial and smallholder irrigation farmers in the country.

It can be argued that the South African irrigation sector is entering a new era in which challenges such as extreme climatic events, high climate variability and change, as well as increasing water scarcity are at the forefront. The intensity and the frequency of droughts, floods, fire, disease and pests outbreaks are some of the multi-stresses affecting the agriculture sector. These challenges can only be overcome through nexus thinking, circularity and transformative approaches, technological innovation, the implementation of climate adaptation and mitigation strategies and a return to 'climate smart crops' – such as previously neglected and underutilised crops which are currently experiencing a welcome revival.

We thank each and every individual who participated in this project and, without whom, this publication would not have been possible. It is hoped that the lessons learnt from South Africa's past will go well to create a water secure future for the country's irrigators.


01

CHAPTER 1

HOES, SPADES AND FURROWS: WATER MANAGEMENT BEFORE 1860

Deborah Lavin and Lani van Vuuren

This chapter describes agrarian and water management practices in precolonial and early colonial southern Africa and the forces that came to curtail extensive agriculture. It examines the gradual adoption of, or resistance to, intensifying agricultural techniques such as irrigation on both sides of the expanding frontier of trading, trekking and settlement, and describes the contributions of individual farmers and private interests in developing irrigation before more formal official interventions by the state.

PRECOLONIAL WATER MANAGEMENT

Modern South Africa has a richly explored Stone Age heritage; archaeologists are now bringing its farming Iron Ages into clearer focus[1]. Farming has generally been identified with the appearance of iron implements – the hoe supplementing the sharpened hardwood stick with which hunter-gatherers dug for roots. We now have evidence that cattle were important centuries earlier than was previously thought, even in Lowveld areas hitherto deemed unsuitable for cattle at an early date. The result is a picture of extended agro-pastoralism as early as about AD 900 – a version of more or less settled village life, combining grain cultivation, cattle herding and metal working, supplemented with hunting and foraging for wild foods.

When there was little or no pressure on land, herding societies coexisted with and gradually absorbed hunter-gatherers on grassland savannah[2]. The climate suited the cultivation of sorghum and two varieties of millet; in the summer rainfall area, with 500 mm of water per annum these grains would mature in 70 or 50 days respectively, allowing more than one crop in a season. A settled existence, and perhaps multi-cropping, tended to exhaust land with light topsoils (though cultivation in floodplains was refreshed by periodic flooding). Herders needed to keep moving to find fresh grazing, and they cultivated according to need or opportunity so that the lands were relieved by periods of fallow before the cultivators returned to favoured sites. From about AD 1300 there was

'Rain is a stranger who has his own home'

(Tshwana proverb)

general though uneven expansion throughout the summer rainfall area into sites with access to iron ore and hardwood for smelting furnaces. Settlement and storage indicate that time was devoted to the labour and effort of sustaining life; rock art may indicate the assertion of claims to territory.

South Africa does not have dramatic visible evidence of ancient furrows, terraces and field systems of the kind and scale to be found at Engaruka in Northern Tanzania and, to the north-east, Marakwet and the irrigation systems of Kilimandjaro (some of which are still in use). Mapungubwe, the first South African kingdom sited at the confluence of the Limpopo and Shashe rivers, seems to have needed no such water management. Its heyday was comparatively short, from 1220-90, though whether it was brought down by drier or colder, wetter conditions is debated[3]. Further north, Great Zimbabwe proved to be an excellent successor location for agro-pastoralism and in the Nyanga highlands there is tantalising evidence of large-scale settlement and terracing, 5 000 km^2 in extent. A recent authority has, however, concluded. '[The people of Nyanga] may have brought water into fields, but there is no definite sign of irrigation'[4] . These furrows seem to have been constructed in about AD 1500 to conserve soil and slow the runoff of water, and in some cases for drainage or to carry water into drained household pits. Both Engaruka and Nyanga survive as monuments only, having been abandoned at least two centuries ago perhaps because over-specialisation made them vulnerable to change.

[1] Early Iron Age AD200-900; Middle Iron Age 900-1300; Late Iron Age 1300-1840. See T.N. Huffman, ***Handbook to the Iron Age: the archaeology of pre-colonial farming societies in Southern Africa*** (Scottsville: University of KwaZulu-Natal (UKZN) Press, 2007). Professor Huffman emphasises that the three phases constitute 'a cultural continuum'. See too T. Maggs, 'Pastoral settlements on the Riet River', ***South African Archaeological Bulletin***, 26, 101/102 (1971), 37-63.

[2] P. Mitchell, ***The Archaeology of Southern Africa*** (Cambridge: Cambridge University Press, 2002)

[3] Huffman, ***Handbook to the Iron Age***.

[4] Mitchell, ***The archaeology of Southern Africa***; J.E.G. Sutton, 'Irrigation and soil conservation in African agricultural history', ***Journal of African History,*** 25, 1 (1989), 25-41.

MAPUNGUBWE – THE ANCIENT STATE

WagnerMK/123RF

View from the top of Mapungubwe hill. At the height of occupation, the area supported up to 5 000 people.

Located near the confluence of the Limpopo and Shashe rivers on the border of South Africa, Botswana and Zimbabwe, the Mapungubwe cultural site was, at the height of occupation between AD 1220 and 1290, the region's largest state society[5]. The main economic activity of the state was trade in gold, ivory and animal skins with Swahili on the Eastern African coast. To support the estimated population of 3 000 to 5 000 people that lived in the area an estimated 900 000 kg of grain an annum would have been required. Crop production was thus an important activity, and sorghum, a variety of millets, beans and peas are thought to have been the main crops to have been cultivated although trade for additional grain has not been ruled out[6]. No evidence of irrigation has been found in the area, although it is thought that floodplain agriculture could have been practiced where rising of receding floodwaters are used to provide water for crop cultivation. The area was abandoned around AD 1300 as a result of unfavourable climatic conditions.

In the present study, irrigation has been broadly defined to include not merely formal canals and furrows, but also basin flooding and smaller-scale systems of management used by farmers in applying water to crops. These methods ranged from planting in riverbeds and natural floodland to the diversion of streams through channels dug with hoes and, at its simplest, the application of water by pot or bucket filled from river or groundwater. Visible traces in the landscape tend to survive in marginal areas but are lost in favourable areas that have been worked over long periods of time. This helps to explain the scattered evidence of early water management in the area of South Africa: accounts of 'ancient' furrows apparently diverting water over a distance of more than four miles at Tshipise in Venda[7], and of old furrows re-opened for more modern use on the Nzhelele River, terraces in the Lydenburg region, indications of permanent Early Iron Age sites close to water on riverbanks, at confluences or on fertile alluvial fans in the eastern Lowveld. Here, millet and sorghum were cultivated and stored in stone pits sometimes lined with clay and cow-dung and sunk into dagga floors raised on stone supports[8]. There are traces of stone-built villages along the escarpment, and in the warmer and wetter terrain south-east of the Drakensberg, a country of fertile river valleys divided by steeply wooded hills, with evidence of small groups of round houses (homesteads) arranged in a circle enclosing a livestock pen (the famous Central Cattle Pattern apparently deriving from East Africa) and grouped into chiefdoms. One of the more dramatic Later Iron Age finds has been the system of water-controlling dykes in the natural caverns of Lepalong in the Potchefstroom area dated AD 1800 when the Bakwena took refuge during the highveld conflicts involving the Tswana.

handmadepictures/123RF

The ruins of Great Zimbabwe.

Documented examples of continuity over time are rare and therefore especially interesting. One such is the eyewitness account by Tudor G. Trevor, Inspector of Mines in the Transvaal and Secretary of Mines in Rhodesia from 1894 to 1928, of terraces being made and temporarily cultivated at Mathlapetsi, south of Polokwane, when valley fields became waterlogged[9]. A striking example from the drier north-west was first described by the Rev. John Campbell in 1820, recording what might be called an African version of the Archimedes Screw to lift water:

'We found a well nineteen feet deep…dug through a chalk rock, one man was standing in the water at the bottom of the well, another stood on the almost perpendicular sides, about six feet above him, his feet resting in holes cut out of the rock, and about six feet above him stood a third man. Looking down into the well, the three men almost appeared as if standing on each other's shoulders. The lowest man filled a large wooden dish with water which he handed to the man above him, and he to the other, who emptied it into a little pool near the mouth of the well, to which the oxen had access, after which the dish was returned to the man at the bottom. The quickness with which it went up and down was surprising, perhaps three times in a minute…They thus employed great part of the day…[10]'

The same procedure was described at Moses Fontein twenty years later by James Backhouse, and again after a century by Sir Charles Rey in 1931[11].

It may be invidious to attempt to draw too firm a line between 'indigenous' knowledge (i.e., surviving practices built up and adapted locally over extended generations[12]) and acquired transformative innovations such as the use of the plough, or more formalised methods of irrigation. Anthropologists have argued that in any case these introductions are not simply adopted or rejected, but often subtly adapted over time as 'African societies inserted new ideas and techniques of water management into social relations, residential patterns, tenurial arrangements, timetables and rituals of their own'[13]. A recent South African study has identified these as 'indigenised' practices[14]. Few truly indigenous pre-settler cultivation techniques in South Africa have been identified, the oldest being ***Galesha umhlaba*** – loosening the soil crust by light hoeing or tilling to increase the infiltration rate of scarce water and the water retention capacity of the soil. This is a seasonal practice to prepare land for cultivation, an African conservation technique; dislodging stones from prospective arable land had a similar effect. The study describes various forms of harvesting and diverting rainwater and of management of the ecological cycle, for example, by letting valleys lie fallow to soak up rain before resuming grazing and cultivation. It also cites wetland cultivation at Suikerbosfontein and floodplain cultivation in the Phongolo. Such examples may suggest that the latter emphasis on pastoralism had led

[5] J. Carruthers, 'Mapungubwe: an historical and contemporary analysis of a World Heritage cultural landscape, ***Koedoe***, 49, 1(2006), 1-13.
[6] M. Murimbuka, Sacred powers and rituals of transformation: an ethnoarchaeological study of rainmaking rituals and agricultural productivity during the evolution of the Mapunguwe state, AD 1000 to AD 1300 (PhD thesis, University of Johannesburg, 2006)
[7] H.A. Stayt, ***The BaVenda*** (London: Oxford University Press, 1931) citing reminiscences of Col. Piet Moller.
[8] M. de Wit, 'A history of deep time' in ***Mpumalanga: history and heritage***, ed P. Delius (Scottsville: UKZN Press, 2007)
[9] T.G. Trevor, 'Some observations on the relics of pre-European culture in Rhodesia and South Africa'. ***Journal of the Royal Anthropological Society***, 60 (1930), 389-99. He remarked particularly on terracing visible from the train between Waterval Onder and Elandshoek.
[10] J. Campbell, ***Travels in South Africa,*** 2 vols (London: F. Westley, 1822)
[11] J. Backhouse, A narrative of a visit to Mauritius and South Africa (London: Hamilton, Adams, 1844); N. Parsons and M. Crowder, ***Monarch of all I survey: Bechuanaland Diaries 1929-37 by Sir Charles Rey*** (Gaborone: The Botswana Society, 1988)
[12] J. Denison and L. Wotshela, Indigenous water harvesting and conservation practices: historical context, cases and implications (Pretoria: Water Research Commission (WRC), 2009, WRC Report No. TT 392/09).
[13] J. Comaroff and J.L. Comaroff. ***Of revelation and revolution. Christianity, colonialism and consciousness in South Africa Volume 2*** (Chicago: Chicago University Press, 1991)
[14] R. Elphick and H. Giliomee (eds), ***The shaping of South African Society 1652-1820*** (Cape Town: Longman, 1979)

to the comparative neglect of precolonial agrarian activity; 'specifically irrigation farming'[15]. Traditional agriculture used irrigation in combination with other extensive strategies, integrating wetland and dryland. Once people chose or were forced to turn to more settled livelihoods their options were limited. 'They might expand the area of agrarian activity, diversify by growing higher yielding crops, crop the existing area more often, work harder, or adopt more intensive systems'[16]. It has also been suggested that the low protein/carbohydrate content of southern African cereals and the long growing time for endemic nut- and fruit-bearing trees, as well as the limitations of indigenous animals for domesticated tasks of traction and transport constituted 'an ecological ceiling to socio-economic intensification'[17]. Irrigation has sometimes been seen as the highest form of intensification, implying stability and expertise, involving cooperation and organisation and significantly expanding the cultivating year and achieving high yields. But once an economy became dependent on hunting or trading cattle, the time spent on cultivation could be seen as an expensive distraction[18].

Women were the traditional cultivators, but they too devoted only limited time and labour to cultivation. In her detailed analysis of the thornveld society of the Thlaping, Nancy Jacobs argued that intensification was deferred for rational reasons because it required greater work:

…Extensive production is not an underdeveloped land use retarded by rudimentary technology. Rather the rudimentary technology and reliance on ecological processes are its strengths, allowing people to get food with lower effort and risk. In Kuruman, [this]…provided good reason to hesitate about intensification… until conditions in the twentieth century undercut extensive production and made it nearly impossible to intensify[19]*.'*

The Thlaping had chosen 'a level of intensification appropriate to the population size', cultivating here and there to make up any shortfall when pastoralism and foraging were insufficient. Access to water was not a priority in their choice of settlement sites until the first traders, raiders, travellers and missionaries arrived from the Cape

[15] J. Tempelhoff, 'Historical perspectives on pre-colonial irrigation in Southern Africa'. ***African Historical Review***, 40, 1, (2008), 121-160.

[16] I.S. Farington, 'The wet, the dry and the steep: archaeological imperatives and the study of agricultural intensification', in ***Prehistoric intensive agriculture in the tropics, parts 1 and 2***, ed I.S. Farington (Oxford, British Archaeological Reports, 1985)

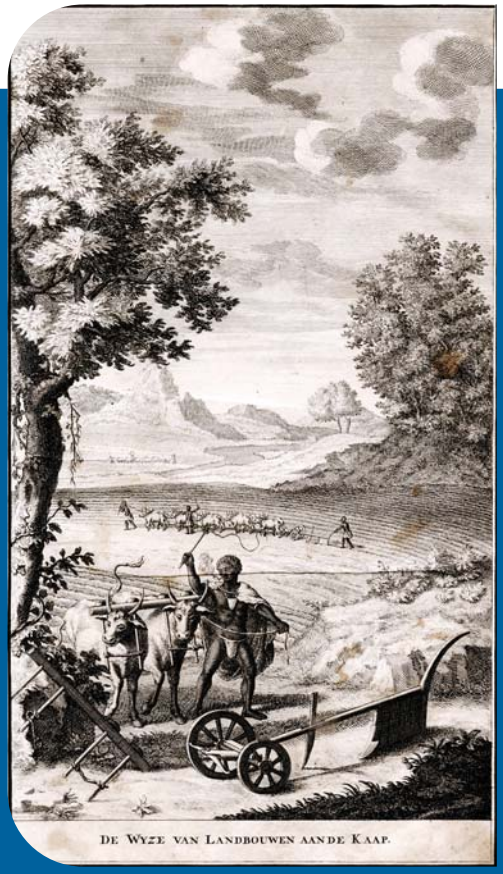
[17] Mitchell, ***The archaeology of Southern Africa***.

[18] M.C. Legassick, ***The politics of a South African frontier. The Griqua, the Sotho-Tswana, and the missionaries 1780-1840*** (Basel Switzerland: Basler Afrika Bibliographien, 2010)

[19] N.J. Jacobs, ***Environment, power and injustice*** (Cambridge: Cambridge University Press, 2003)

MOVING FRONTIERS

The Northern and Eastern directions of white expansion from the Cape Colony were distinctively different from each other. Once intensive grain cultivation had failed in the first decades of the Dutch East India Company's rule after 1652, the tight restrictions on stock farming, hunting and dispersal into the interior were gradually relaxed and the original free grazing licenses developed into leased farms. The first incomers moving northward up the west coast had reached the Olifants River by the 1860s; by 1712 the ***trekboers*** (nomadic pastoralists descended of European descent) had arrived and within twenty years the length of the river had been colonised. Transport difficulties and the uncertainties of the Cape market meant that arable lands were often left uncultivated or used only occasionally for grazing cattle in the dry winter seasons. The ***trekboer*** pastoralists farmed cheaply and extensively, sustaining the momentum of expansion by their preference for enormous farms with unrestricted access to grazing and water and with no recognition of the residual grazing or water rights of the Khoi communities they comprehensively dispossessed. Some prudent farmers took precautions, as did the Griqua Dirk Boukes (Beukes) who accumulated large herds and cultivated considerable amounts of land while choosing to live in a temporary hut on the fringes of the Colony lest he be displaced 'by some boor obtaining a grant of it from the Government, and thus reaps the fruit of all their improvements and industry'[20]. Many of the early northern pioneers were San, Khoi, Korana (or Griqua) and Nama, retreating before the advance of groups of competing white farmers who appropriated their land and water but adopted transhumance living in portable reed and matting houses, travelling with their possessions contained in a wagon and cultivating any damp ground until they met conditions that suited permanent settlement.



NLSA

A depiction of farming at the Cape in 1727.

[20] V. Forbes (ed), ***Travels and adventures in Southern Africa by George Thompson,*** 2 vols (Cape Town: Van Riebeeck Society, 1969)

In 1751 the first loan farm was registered along the Orange River. North of the Kamiesberg was the land of trekveld, hunting, cattle trading and raiding; according to the ***veldkornets*** (term formerly used in South Africa for either a local government official or a military officer) in 1826 there were scarcely ten settled residences in the whole region. Individuals formalised temporary grazing into permanent farms and some people accumulated many such, but this was not an environment in which powerful chiefdoms or settled communities emerged. Cattle-keeping and trading, and the prestige attached to the accumulation of stock rather than agricultural produce, promoted the formation of the states and chiefdoms featured in the earliest accounts of European contact. The increasing size of the political centres changed the circumstances in which ordinary farmers had little incentive to produce crop surpluses[21]. There had already been significant disruptions among the smaller groups dealing with traders and displaced by trekboer, settler and missionary expansion, the enlargement of the Cape Colony eastwards and armed raids of Kora and Griqua for cattle, food and labour.

In contrast to the thornveld, pans and subterranean water of the Kuruman region, the Eastern Cape west of the Kei River is relatively favourable, with an annual rainfall of 800: 1200 mm, watered by great rivers and streams. But the rivers shrink in mid-summer and flood in winter; the area is scourged by droughts, locusts, the north-westerly bergwind, and hail. There is excellent grazing in the coastal strip and deep soils in the Amatola basin. Elsewhere, the soils are poor and erode easily. There were no large concentrations of populations such as at Dithakong; the Xhosa dispersed, each chiefdom or sub-chiefdom having its own river or tributary and needing both winter and summer grazing together with wild hunting and collecting ground which the chiefs were expected to provide for the wellbeing of the people[22].

The first colonial settlers came in numbers to the eastern frontier only in the 1770s. They settled in the upper Fish River valley and in Graaff Reinet, where rain was sufficient for extensive agriculture but where in 1795 Barrow counted only 'about a dozen mud houses covered with thatch' in the town made the seat of eastern government. Some forty years later the erfholders relied on their gardens for produce to such an extent that James Backhouse in 1839 feared the ***leiwater*** (household irrigation) channels were giving off vapours he described as 'miasmata'[23]. William Beinart has contrasted the arable farmers of the Western Cape who depended on imported crop strains and slave workers with the trekboers of the interior whose pastoral diaspora was informed by Khoi hunting strategies, methods of locating water and grazing and kraaling[24]. The inland pioneers in the arable area also adopted local water uses such as ***saaidams*** (basins) and evolved intermediate technologies for building dam walls of earth and stones. As early as 1777, William Paterson described flood recession cultivation on a farm called Goede Hoop, said to be at the source of the (eastern) Olifants River; this method was still in use north of the Cougha Mountains in the 1960s[25].

Pressures such as competition for land and drought eventually ended extensive farming by African societies on the southern highveld from about 1750.[26]

[21] Huffman, ***Handbook to the Iron Age***.

[22] J. Peires, ***The House of Phalo: a history of the Xhosa people in the days of their independence*** (California: University of California Press, 1982). See also R. Derricourt, 'Settlement in the Transkei and Ciskei before the Mfecane' in ***Beyond the Cape frontier. Studies in the history of the Transkei and Ciskei***, eds C. Saunders and R. Derricourt (London: Longman, 1974)

[23] Backhouse, ***A narrative of a visit to Mauritius and South Africa.***

[24] W. Beinart, ***The rise of conservation in South Africa: settlers, livestock and the environment 1770-1950*** (Oxford: Oxford University Press, 2003)

[25] V.S. Forbes, ***Pioneer travellers of South Africa*** (Cape Town, A. A. Balkema, 1965)

[26] C. Hamilton, ***The Mfecane aftermath: reconstructive debates in southern African history*** (Johannesburg: Witwatersrand University Press, 1995); see too N. Etherington, ***The great treks: the transformation of Southern Africa 1815-54*** (Harlow: Longman, 2001)

The second half of the eighteenth century experienced unusually high rainfall. More specialised production of millet, greater competition between chiefdoms for arable land and grazing (as well as access to elephant herds for the ivory trade) and the gradual spread of maize introduced by the Portuguese at Delagoa Bay (perhaps as early as 1635), accounted for a marked increase in populations. New areas were brought under cultivation. Maize was a labour-saving crop with three times the yield of millet or sorghum although it required more water[27]. Its spread was uneven, however. It appeared in the Thabazimbi area 100 to 150 years earlier than in KwaZulu-Natal, while the Tswana people chose to use their limited sources of water to achieve increased yields from the traditional cereal crops rather than maize.

It has been argued that drought in the early years of the nineteenth century was a more significant factor than the Zulu kingdom in both the ***Mfecane*** (the period of heightened military conflict and migration associated with state formation and expansion in Southern Africa) and the northwards movement of the Voortrekkers. The years 1800-03, 1812 and 1816-18 were all dry years, as were 1835-37. Competition for scarce resources formed the context for the intermittent disruptions and shifting alliances of the chiefly followings in the ***Mfecane***. Traditionally, agro-pastoral societies mitigated food scarcity and survived by dispersing, scattering their herds and cultivating in small patches. But as room to manoeuvre became limited, pastoralism no longer gave food security: supplementary cultivation became essential[28]. Displaced peoples were confronted with new factors: slave raiding from Mozambique, growing demands for wage labour from white farmers south of the Orange River, armed raiding bands of ***Feticani*** to the north, as well as contact and conflict on the Eastern Cape frontier. Food scarcity prompted more intensive cultivation of arable land, the need for agricultural labour (including women) and for good well-watered land – hence the migrations culminating in the battle of Dithakong in 1823 and conflicts over access to riverine lands on the Phongola River. These were the years when missionary settlements held out refuge and settled life as an alternative to nomadic starvation.

Missionary irrigation

The unregulated refugee frontier operated on both sides of the Cape Colony's northern boundary, defined as late as 1798 and administered from remote Stellenbosch or Tulbagh; the Cape government, ever in financial crisis, was unable to establish effective authority. When pioneer missionaries inspired by the European evangelical revival were drawn there after 1799, their arrival was at first welcomed by beleaguered frontier communities variously seeking order, protection and help 'to become as rich and happy as their neighbours'[29] while the government hoped the missionaries would act as agents of settlement and order. The one significant social unit was the Griqua proto-state lasting from 1800 to 1840 as a defence against, and sometimes a base for, the constant raids and reprisals and occasional resistance and rebellion[30]. It was planned by the state's missionary progenitors to be an irrigating socio-economy.

[27] Mitchell, ***The archaeology of Southern Africa***.

[28] E. Boserup, ***The conditions of agricultural growth: the economics of agrarian change under population pressure*** (London: George Allen & Unwin Ltd, 1965)

[29] J.J. Kicherer, 'The Rev. Mr. Kicherer's narrative of his mission to the Hottentots, and Boschemen: With a general account of the South African Mission', ***Transactions of the Missionary Society***, 2, 1 (1804), 1-56.

[30] See Legassick, ***The politics of a South African frontier, and R. Ross, Adam Kok's Griquas: a study in the development of stratification in South Africa*** (Cambridge: Cambridge University Press, 1976)

In Legassick's words, the missionaries soon divined that water was the key to their activities. It supplied the metaphor for their great purpose – as irrigators making the African desert bloom, slaking parched souls – and improved the lives of their converts by enabling Christian habits of settled living and purposeful activity in growing irrigated crops with a tradeable surplus (tobacco was immediately successful). The first station was established near the Sak River, where in 1779 Wikar described ***saaidamme***, observing 'when this river empties itself near into the Great [Orange] River the soil is unparalleled for growing wheat[31]. There Johannes Kicherer and William Edwards dug furrows to grow vegetables, although they found the San hunters, as Kicherer put it, unreliable converts and 'no great admirers of vegetables'. By a stroke of bad luck, the mission was founded in the aftermath of armed revolt and in a cycle of drought when the river ran dry for six years. In 1805, Lichtenstein found the gardens destroyed by cattle and the boundary hedges used for firewood. The missionaries had been persuaded north where potential converts were more receptive: at Klaarwater, a fountain appropriated from the San, a demonstration of irrigated sowing and harvesting on 15 missionary acres encouraged the Griqua to take up land allocations and build permanent houses of stone.

Klaarwater, renamed Griquatown, became the focus for missionary state-making, where the London Missionary Society supported the grand project of a Griqua state which lasted till the mid-century[32]. There was insufficient water to sustain irrigated agriculture for more than a few hundred people, but springs stretching in a line for 50 miles at places like Daniëlskuil and Campbell were taken over or purchased by individual Griqua captains. The fortune of the state, with a population of some 3 000 in 1823, was 'told in water'. In times of drought when the fountains failed, its peoples dispersed to the Harts River or new outstations on the Orange, such as Philippolis (which in its heyday became the centre of a prosperous Griqua political unit based on wool and the leasing and sale of land[33].) Peter Wright of the Society planned to re-establish Griquatown as the economic centre by laying on permanent irrigation from a water course from the Orange River, 70 miles distant. The first two efforts to realise this heroic project failed – water diversions at Hardcastle and Read's Drift; a third initiative after the drought of 1830 was planned to source the canal from the Vaal River some ten miles above the confluence with the Orange. But the levels proved difficult and there was no money for pumps.

As early as 1801 William Somerville, accompanying a trade deputation on a cattle-bartering expedition to the Tswana had noted their (indigenous) practice of stubble-burning after harvesting and of leaving the land fallow for a season – 'if it is not necessary to overflow the sown fields as in the easter part of the British settlement, tough it is the same sort of reddish clay'. Impressed, he concluded that 'the state of agriculture is little if at all inferior to that of their southern neighbours, the Dutch boors, who hardly surpass the Bechuanas excepting in the use of the plough[34]. In the end Peter Wright, too, reluctantly acknowledged that the Tswana methods were often as successful as the innovations he had taught the Griqua:

'The Griquas follow the European method of cultivating the ground which is the most efficient and the most certain, when the means necessary to this mode can be commanded. The

[31] E.E. Mossop, ***The journal of Hendrik Jaco Wikar (1779) and the journals of Jacobus Coetzé Jansz (1766) and Willem van Reenen (1791)*** (Cape Town: Van Riebeeck Society, 1935)
[32] Legassick, ***The politics of a South African frontier.***
[33] Ross, ***Adam Kok's Griquas.***
[34] E. Bradlow and F. Bradlow, ***Willam Somerville's narrative of his journeys to the Eastern Cape frontier and to Lattakoe, 1799-1802*** (Cape Town: Van Riebeeck Society, 1979)

Bechuana on the contrary in the cultivation of their corn (a kind of millet) and watermelons, etc. (things best adapted to the climate) do not irrigate but depend upon the rains. In good seasons they obtain unlimited and abundant crops, but when drought prevails…their labour is in vain[35].'

The Tswana at Dithakong (with marginally better rainfall than Griquatown) did not take easily to missionary innovation and influence. In 1816, James Read had brought ploughs and implements, as well as smiths and carpenters who had built a forge and a water mill; he was kindly received but sent to practice his irrigation on the Kuruman River. An attempt to lead water from the Kuruman Eye to the mission failed when the channel was blocked by the chief's wife as it passed the dryland Tswana gardens, and in Robert Moffat's time the dam was destroyed by the women with picks. Retreating to an independent site away from the Tswana town, in 1824 Moffat and Hamilton built a dam below the Kuruman Eye, irrigating the area later known as Seodin. The missionaries introduced new crops (wheat, maize and tobacco) and methods of cultivation requiring regular water.

Nancy Jacobs, in her fine study of Kuruman, suggests that 'people intensify when conditions force them to'[36]. Between 1827 and 1829 the incidence of bovine botulism, drought and disruptive raids by groups of competing Boer, Khoi and Griqua frontiersmen caused the Thlaping chiefdom to fragment and the Thlaping centres to move south in the 1830s, Chief Mothibi to Dikgatlhong at the confluence of the Harts and Vaal rivers and his brother, Mahura, to Taung. Here they hunted and traded until low rainfall in the 1840s and 1850s induced them to turn again to irrigation, encouraged by their resident missionaries although hampered by the reluctance of the London directors to invest in ploughs and spades[37]. With Mothibi's support, pastor Holloway Helmore embarked on four years of construction of a stone-capped earthen dam stretching 250 metres across the Harts River upstream from Dikgatlhong. This heroic forerunner of the Vaalharts initiative was shortlived as floods caused the river to bypass the dam in 1856.

At arid Kuruman, irrigation was inserted intermittently into an extensive farming system. It was not seen as a means of increasing input and had a limited technical and social impact. White expansion presented alternative and more economic labour opportunities in the wheat fields of the Free State and later the grape harvests on the Lower Orange River. In 1895, the Resident Magistrate at Taung commented:

'If the native be asked why do you not make a well or a dam here by your village … the answer is, "What is the use? As soon as we have done this thing of which you speak, will not the white man come and take it away from us?[38]'

Jacobs commented that the people of Kuruman preferred making rain to channelling water. In conditions of ecological uncertainty water attained symbolic significance and its control was a matter of ritual conducted by chiefs and their rainmakers, often Khoi or San believed to have special powers. Francois le Vaillant, who spent three years (1781-4) travelling at the Cape (but was not always a reliable witness) described the method by which a San guide discovered water 'concealed in the bowels of the earth':

[35] Peter Wright as quoted in Legassick, ***The politics of a South African frontier***.

[36] Jacobs, ***Environment, power and injustice.***

[37] K. Shillington, Irrigation, agriculture and the state: the Harts Valley in historical perspective', in ***Putting a plough to the ground: accumulation and dispossession in rural South Africa 1950-1930***, eds W. Beinart, P. Delius & S. Trapido (Johannesburg: Ravan Press, 1986)

[38] Quoted in Jacobs, ***Environment, power and injustice***.

'He throws himself flat on the ground, takes a distant view and, if the space which he traverses with his eye conceals any subterranean spring, he rises and points with his finger to the spot where it is to be found. The only thing by which he discovers it is that ethereal and subtile exhalation which evaporates from every current of water'[39].

Burchell recorded more prosaic indicators – lines of bushes 'almost as legible as footpaths' growing above subterranean dykes[40]. San rainmakers to Xhosa chiefs were said by J.H. Soga to use rings round the moon and the chirping of tree frogs as rain indicators[41] and to place a hornbill or a chameleon in a riverbed to precipitate rain. Such practices were repugnant to most missionaries, who were trained to prefer technology to folklore. Each side was encountering, and adjusting to, the unfamiliar. When Samuel Broadbent dug himself a garden well the chief of the Rolong-Seleka challenged him, saying that water came from the clouds. But when he succeeded the chief returned with his councillors in full battle dress ('to symbolise the threat to the polity') demanding a second well for his people[42]. Some missionaries too made concessions, inventing special rain rites and services in the hope of displacing the rainmakers.

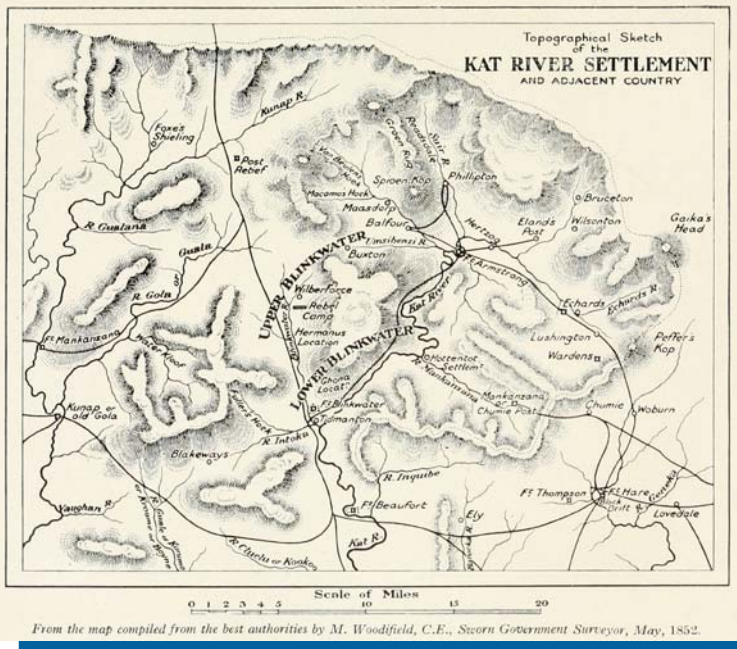
Drought and pressure on the land demonstrated the advantages of water-leading and year-round agriculture. In the Eastern Cape, one Ngqika chief at the Chumie (Tuymie) Mission told William Chalmers that with irrigation he no longer needed a rainmaker as he had rain every day. Here, Chief Tyali gave 40 acres of land for irrigated agriculture, having been persuaded of its possibilities by his chief councillor, Soga, whose son, Festiri, reported that water-leading was gaining ground among people who perceived that 'although the sun was great, those that had water courses had bread to fill their mouths, while their [own] mouths were dry with hunger'[43]. Further encouragement came from the resident adviser to the Ngqika, Captain Charles Stretch, who dammed the river at Block Drift and led water through a ***sloot*** (channel) to land on which he encouraged the chiefs to cultivate after they had seen for themselves that maize, pumpkins and other vegetable crops could be grown by the application of water at the roots without the tops being moistened. His more ambitious project to irrigate 1 000 acres by siphoning water across the Gaga stream in wooden troughs came to nought, though it impressed James Backhouse, a Quaker with a particular interest in hydraulics who raised funds in Britain for Stretch's furrow and a pump for Peter Wright's great canal.

Not all chiefs embraced irrigation. Being constantly moved from their traditional lands by wars and the ever-changing colonial boundary, a number declined roads and water furrows lest acceptance be taken to signify acquiescence in their exile, or in the familiar expectation that they would lose such improvements to acquisitive whites. Black farmers who attempted market-based, accumulation-oriented commercial farming drew institutional support from living on mission stations where they were independent of chiefs and able to produce surpluses and trade in colonial markets.

The establishment of missions among the AmaXhosa probably owed much to their acceptance by marginal groups – the Khoi, the Mfengu and the Gqonas (a people

[39] Quoted in Bradlow and Bradlow, ***Willam Somerville's narrative of his journeys***.
[40] Beinart, ***The rise of conservation in South Africa***.
[41] J.H. Soga, ***The Ama-Xhosa: life and customs*** (Glasgow: Salusbury Books, 1932)
[42] J. Comaroff and J.L. Comaroff. ***Of revelation and revolution***.
[43] Festiri Soga to the Secretaries of the Glasgow Female Association, 11 September 1843, quoted in D. Williams, The missionaries on the Eastern Frontier of the Cape Colony, 1799-1853 (PhD thesis, University of the Witwatersrand, 1959)

with Khoi ancestry who had merged with the Ngqika and whose members flocked to the early stations). The Mfengu, often in settlements on the borders between the colonial system and Xhosa societies, planted, traded and accumulated. Colin Bundy quotes examples of landed Mfengu proprietors buying farms from 500 to 1 500 acres in extent or renting extensively from white landowners and cultivating as much as 50 to 100 acres[44]. In 1816, the missionaries James Read and Joseph Williams were accompanied to the Kat River by the 'enlightened' Gqona leader Jan Tsatsi (Tzatsoe) and a group of Khoi in 1816, choosing a site for a revived Xhosa mission where water could be led out and with plentiful timber and building stone. In the drought, Williams proposed 'the Herculean scheme' of a dam, in the construction of which he



Topographical sketch of the Kat River Settlement and adjacent country[46].

lost a finger by rolling masses of rock from a cliff, while Tzatzoe broke huge basalt boulders with fire and water[45].
In 1829, Andries Stockenström, describing how Ordinance 50 ('the Hottentots' Magna Carta') had been a dead letter, planned a

[44] C. Bundy, ***The rise and fall of the South African peasantry*** (London: James Currey,1979)
[45] Backhouse, ***A narrative of a visit to Mauritius and South Africa.***
[46] G.E. Cory, ***The rise of South Africa: A history of the origin of South African colonisation and its development towards the East from the earliest times to 1857*** (London: Longmans, Green and Co., 1930)

settlement of Khoi and others on the Kat River to give effect to the Ordinance and to strengthen the frontier by establishing the Khoi as a settled and an independent prosperous community producing cash-crops. A year later, according to Justice Menzies, the settlement was a scene of 'the greatest industry', with water courses – one as long as 36 km – leading water from the rivers to cultivated lands. By 1834 there were 2 000 residents and the arable lands were under pressure. But the surveys and issue of title deeds were delayed, while lands were given as rewards to other collaborating groups and the settlement was infiltrated by squatters. The Khoi settlers, unrewarded for their military services and failing to secure government contracts for forage, were reduced to beggary in two frontier wars.

Floods in 1848 destroyed the dams and furrows. 'Wrongs, oppressions and iron despotisms' drove them into rebellion in 1853, after which the erven of rebels were confiscated and given to whites issued with title deeds by 1855. At its most extensive, before the rebellion, there were 5 000 inhabitants. Robert Ross has identified the traces of 60 dams and 100 km of furrows controlled by sluices, collecting and distributing water draining from 2 000 ha of irrigated land – 25% of the valley. Only one of the original furrows had functioned continuously, but the Kat River Settlement has a notable place in the history of irrigation[47].

Missionary irrigation elicited extraordinary feats of engineering. Frederick Kayser's water furrow at Knapp's Hope took two years to build, one section alone, cutting through basalt rock, taking seven months to complete. Perhaps the most remarkable – now a National Monument – was the tunnel at Hankey, 228 m long and built through a cliff by John Philip's missionary son, William, a trained surveyor, working in 1843 with a Khoi workforce using picks, shovels and wheelbarrows to lead water out of the Gamtoos River. (He is said to have conceived the idea of the tunnel after seeing the 'window' in the hill between Backhousehoek and Vensterhoek). With only a sextant, his measurements were so exact that 'the galleries ran into another in a right line, and the floors were also nearly on the same level at point of meeting, the waterside being four or five inches higher than the other'. William Philip wrote a joyful description of the spontaneous midnight celebrations, 'with hallooing and yelling, bells ringing, fires blazing and children beating tin ***skottels*** (bowls) when the message came, "The tunnel is through!"[48]'

[47] Robert Ross in a seminar at St Antony's College, Oxford, in 2003; T. Kirk, 'The Cape economy and the Kat River Settlement', in ***Economy and society in pre-industrial South Africa***, eds S. Marks and A. Atmore (London: Longman, 1980)
[48] W.M. Macmillan, ***Complex South Africa: an economic footnote to history*** (London: Faber & Faber, 1930)

Gamtoos Irrigation Board

Entrance to the 228 m-long Hankey tunnel.

In the mid-nineteenth century the London Missionary Society met financial difficulties and withdrew on terms devised by Stockenström and spelled out in the Missionary Institutions Act of 1873 – that each Khoi settler should have firm title to a smallholding, and that 'for the betterment of the Hottentots' the settlements should be mixed in race. But in the end the complexities of credit and land transfers meant that ownership of erven and liability for quit-rents and maintenance duties at the Kat River Settlement had become 'chaotic'. An attempt to restore individual title and subdivision submerged the tenants in more debt; within twenty years, the nineteen or more villages, which survived from the old days of the plantation, were reduced to about three. Most of the others had become white farms in a predominantly European-owned district, still known as 'Stockenström'. A similar fate befell Hankey which in 1926 was said to be 'visibly ruined by poverty, neglect and incompetent control'. By then the majority of the agricultural holdings were owned by Europeans[49]. Kokstad, last official refuge of the Griquas where 2 000 people trekked from Philippolis across the Drakensberg in an epic move in 1860/61, became in very few years a centre of regular wheat production on quit-rent farms. The polity lost its independence in 1874 and with it the interdict imposed by Adam Kok II against the sale of land, which was soon bought up by white farmers and merchants[50].

Irrigation policy at the Cape: law and landholding

The movement for the promotion of irrigation as a policy originated in the Cape Colony. Under the Dutch East India Company (before 1806) early grazing licenses evolved into a 'loan place' system of tenure whereby a grazing farm of 3 000 morgen was held by renewable lease on payment of a modest annual rent. This was in practice a secure but legally undifferentiated system: farm boundaries were undefined, no title deeds were issued and the land was not heritable. Naturally, the usefulness of the land depended upon its

[49] Macmillan, ***Complex South Africa***.
[50] Ross, ***Adam Kok's Griquas***.

access to water. This was determined in accordance with two principles familiar in Dutch law (originating in Rome more than a millennium earlier in wholly different circumstances). First, 'public' water (which in Rome had signified general use but which in the Cape was claimed as company/state property) was distinguished from 'private' water – streams, wells, and springs – which were deemed to belong to the owner on whose land the water happened to arise. The private, unregulated hydrological windfalls were celebrated in the historic farm names containing words such as ***-spring***, ***-fontein***, and ***-put***, just as water had been a dominant feature of Khoi placenames[51]. Second, the state regulated access to public water (the owner of land abutting a public river did not, therefore, have automatic riparian rights of abstraction and use). Disputes over water were mediated and resolved administratively on the spot by Landdrosts and Heemraden who were conversant with local conditions but had no legal or engineering training.

On the basis of patchy records, it appears that certain conventions were established in these local agreements – that in periods of low flow public waters were shared by upper and lower owners, and that domestic use should have priority over irrigation. Water might be divided according to 'turns' of a certain number of hours' duration, or more randomly such as flow 'regulated through a sluice adjusted to the fifth hole' or defined as so many 'inches of water'[52].

Britain's temporary occupation of the Cape during the Napoleonic Wars was made permanent in 1812. In 1813, Governor Cradock offered the alternative of changing the largely undefined loan-place system of land tenure for legally secure quit-rents of a maximum area of 3 000 morgen with boundary surveys and title deeds and variable annual payments according to the circumstances and size of the farm. As Andrew Geddes Bain pointed out, little improvement was to be expected from a farmer owning 30 or 40 000 acres. Subdivision was essential for improvement[53]. Subdivision on inheritance had been ruled out for loan places, although secret subdivisions did take place[54]. The changed tenure was optional and, in any case, took the Surveyor's department decades to effect, but title included water rights, encouraging water-leading and the intensified production of fruit and vegetable crops for the Cape Town and local markets.

Roman Dutch law ceased to be administered in the Netherlands at the end of the eighteenth century. In 1827, the British colonial administration promulgated a Charter of Justice at the Cape to institute an independent Supreme Court headed by a Chief Justice; local Resident Magistrates and Civil Commissioners replaced the Landdrosts and Heemraden. A Registrar of Deeds recorded landed property. Though heavily influenced by English precedent, with the Privy Council in London as the final court of appeal the founding Charter directed that the old law be preserved. But as Andries Stockenström saw it:

'Now we have a Civil Commissioner to receive our money for Government and for Land Surveyors, a Magistrate to punish us, a Clerk of the Peace to prosecute us, and get us in the ***Tronk*** *[prison],*

[51] G.S Nienaber and P.E. Raper, ***Toponymica Hottentotica*** (Pretoria: Raad vir Geesteswetenskaplike Navorsing, 1977)
[52] A.D. Lewis, ***Water law: its development in the Union of South Africa*** (Cape Town and Johannesburg: Juta & Co, 1932)
[53] M.H. Bain and A. Geddes, ***The journals of Andrew Geddes Bain – Trader, solider, road engineer and geologist*** (Cape Town: Van Riebeeck Society, 1949)
[54] P.J. van der Merwe (translated by R. B. Beck), ***The migrant farmer in the history of the Cape Colony 1657 – 1842*** (Athens: Ohio University Press, 1995)

but no Heemraden to tell us whether things are right or wrong …'[55]

Confusion at local level was compounded at the centre, where the uncertainties of the new system were increased by what a later authority called 'the slipshod legislative methods' by which modifications and changes were made and English legal practice introduced[56]. Private ownership of land (including all accompanying rights) was formally registered on the English model, encouraging farmers to invest in improvements such as dams and irrigation. On the other hand, the law of water rights was based on the Roman law concept of state control. The tension between the two characterised the legal aspect of irrigation for the next 150 years[57].

The interesting question is – who modernised, who rejected change, and why? There are countless examples of innovating individuals. Missionary reminiscences record ambitious African irrigators: Tyali's councillor Soga became famous in the narratives of the time as the first African to irrigate on his own account, making his own furrow with a view to profit, employing waged labourers to whom he sold produce and supplying vegetables to the colonial garrison at Fort Cox[58]. In 1820, Campbell encountered Seretse, who had been at Dithakong and Griquatown and possessed two houses, one traditional, the other 'having taken the plan from the missionaries'. Campbell likened Seretse to Peter the Great in his fascination with innovation: 'he observed every thing which we did that was all new to him with the eye of a hawk'. In opposition to local Thlaping custom, Seretse irrigated Indian corn and tobacco[59]. Household gardens displayed a great variety of produce as trekboers travelled with stocks of seed and experimented with cultivation in new conditions[60].

In the first years of the century, Henry Lichtenstein's friend and host, Jacob Adrian Louw, farmed Lokenburg, unique in its district for having both fertile soil and enough water to make permanent irrigation possible. Transport difficulties prevented Louw from growing corn for the Cape Town market 60 miles away, but for his own interest he successfully experimented with rice growing[61]. Remarkable initiatives in the early management of water are recorded. The story of Gawie-se-Water is a pioneering example of an inter-basin transfer[62]. On 23 April 1815, farmers in the Wagenmakersvallei (modern Wellington) petitioned Lord Charles Somerset for permission to excavate a tunnel to bring water from the Wit River (a tributary of the Bree River) to the Krom River (which flows into the Berg River). Permission was granted, but the money ran out. Thomas Bain, working with his father in Bain's Kloof in 1846, devised an economical plan to divert the Wit through a road tunnel into the Wellington valley. In 1849, the Krom farmers renewed their request, but though Bain tendered for the work they opted to do it more cheaply themselves:

Gawie Retief began the construction, which was eventually completed in 1860 for three times the price of Bain's original quotation. A similar heroic transfer was achieved some years later from the Breede at Mitchell's Pass, across the Tulbagh basin into the Klein Berg River, we are told 'by the energy of one man'. In

[55] C.W. Hutton (ed), ***The autobiography of the late Sir Andries Stockenström***, 2 vols (Cape of Good Hope: Juta, 1964)
[56] E.F. Watermeyer, 'The Roman Dutch law in South Africa', in ***Cambridge history of the British empire vol 8: South Africa, Rhodesia and the High Commission Territories***, eds E.A. Benians, E.A. Walker and N. Mansergh (London: Cambridge University Press, 1963)
[57] C.G. Hall, ***The origin and development of water rights in South Africa*** (Oxford: Oxford University Press, 1939)
[58] Backhouse, ***A narrative of a visit to Mauritius and South Africa***.
[59] Campbell, ***Travels in South Africa***.
[60] Beinart, ***The rise of conservation in South Africa***.
[61] H. Lichtenstein, ***Travels in Southern Africa, 2 vols*** (Cape Town: Van Riebeeck Society, 1928-1930)
[62] Paarl Post, 29 August 2003. See too M.H. Lister (ed), ***The journals of Andrew Geddes Bain*** (Cape Town: Van Riebeeck Society, 1949)

1886, Thomas Bain, describing this feat, proposed an extension to Robertson where rich land still lay uncultivated[63].

Dam building enabled farmers to store water, at first from fountains but by the 1840s enterprising Karoo farmers were using the revenue from wool sales to build most costly and labour-intensive dams of earth and stone to store rainwater and runoff. Several of these dams are historic, having been built and added to continuously for more than a hundred years. One such was built near Graaff Reinet on the plains of Camdeboo. Interestingly, only when Gerrit Coetzee, a trekboer's son, had obtained full title to the farm Galgenbosch (later Cranemere) did he begin improvements in 1843, building a wall five or six feet high where natural pools of water lay, to accumulate water for his stock. His successor, John Bolleurs, ran a stud farm and used an ox-hide sledge to enlarge the dam to hold water sufficient for two years if no rain fall ('an immense dam resembling a small lake'[64]). Bolleurs irrigated a garden and 'hundreds of acres' of arable land growing fodder, as well as 'supplying his neighbours for three miles below with water for their flocks'[65].

At Tulbagh, on his farm Nooitgedacht, a railway engineer-turned-farmer called Bennet, working on the Wellington line, built a notable dam with a capacity of 25 million gallons, designed 'with a backbone, so to speak, of well-puddled clay, about 4 feet thick, running lengthwise through the centre of the embankment like a wall' instead of an exposed clay lining which would crack in the sun. The cost – under £1000 – impressed the ***Eastern Province Herald***: 'Oh! inhabitants of Graaff-Reinet, and ye dwellers in Somerset … take my advice and find out something of Mr Bennet's works …'[66]. Another energetic improver was J.C. Molteno (in 1874 the Cape's first elected Premier, famously fierce and known as 'the Lion of Beaufort') who accumulated 100 000 acres at Nelspoort on the Salt River. Here he worked with single-minded intensity at excavating water furrows and installing irrigation works and other modern agricultural developments. Establishing irrigation was to be one of his objectives in office. Though his plan was doomed to failure, his son caught the enthusiasm and was to be a founder of the Pioneer Fruit Growing Company on Nooitgedacht in 1892, forerunner of the Rhodes Fruit Farms.

The introduction of a new Cape constitution was an elected Legislative Assembly in 1854 (evolving into self-government in 1872) gave a boost to progressive ideas of agricultural improvement and railway extension. The members doubled in number over the years: in each House of Assembly to 1908 at least one-third were farmers, and the combined numbers of farmers and landowners never fell below 70% of the total. English-speaking predominated until the 1880s. Throughout the period predominantly local men were elected even in the outlying constituencies, while local party organisations and farmers' associations emphasised local concerns and ambitions[67]. Irrigation was an issue as early as 1856[68] and in 1861 the editor of the ***Cradock News*** was, perhaps prematurely, talking up 'the advantage of getting 14 percent per annum … by purchasing shares in the 'Cradock Union' and other banks … the benefits arising from agricultural societies

[63] J. C. Brown, ***The water supply of South Africa and facilities for the storage of it*** (Edinburgh: Oliver and Boyd, 1877)
[64] J. Noble, ***Descriptive handbook of the Cape Colony: its condition and resources*** (Cape Town: Juta, 1875)
[65] Return from Civil Commissioner W.M. Maskew (Somerset), 16 May 1862, to the Colonial Secretary's Circular 16 on the subject of irrigation, 7 May 1862, G54/62. See too E. Palmer, ***The plains of Camdeboo*** (South Africa: Penguin Random House, 2012)
[66] Brown, ***The water supply of South Africa***.
[67] J.L. McCracken, ***The Cape Parliament 1854-1910*** (Oxford, P. Clarendon, 1967)
[68] Proceedings of the Cape Assembly 47, 23 May 1856.

– planting trees – making dams, buying Cawood's American pumps,' etc[69].

The years 1860-70 was a decade of recession, drought and agricultural slump, when the public finances of the Cape were badly hit by a collapse of wine exports and falling wool prices, while the proliferating banking institutions that had confidently launched agricultural credit schemes a few years earlier, stiffened their terms if they survived at all. Public expenditure regularly exceeded revenue. After reading a contemporary study of irrigation in India, Governor Sir George Grey and Cape Colonial Secretary Rawson W. Rawson[70] had been considering irrigation as a means of generating agricultural self-sufficiency when the public purse was reduced by currency inflation to near penury. The comprehensive two-volumes by Captain R. Baird Smith included a description of village-based irrigation in Mairwara ('one of the wildest districts in Central India') which was transformed 'from a state little removed from utter barbarism to one of promising and progressive civilisation'. The author emphasised that state involvement was indispensable[71].

Rawson's Colonial Office was evidently contemplating 'a work of serious magnitude' in 1858 when it proposed that water from the Berg River might be used for irrigation along its banks or even led to Saldanha Bay 'by pipe or open channel'[72]. A project on this scale would need to be underwritten by the state, while schemes too big for individual farmers might be encouraged into reality by the assisted formation of cooperative irrigation associations. The Legislative Assembly refused to vote for increased taxes but demanded facilities for expanding production and trade, launching enquiries into the irrigation potential of the Berg and also the (western Cape) Olifants rivers, as well as the possibilities of inland navigation.

In his ensuing report Engineer Philip Fletcher described the impoverished community of the Lower Olifants River (Western Cape) as working 'feverishly' to plant in the alluvial soil after a flood, while leaving upwards of 8 700 acres of 'some of the richest soil in the world lying at present for two-thirds of the year utterly unoccupied, waste and worthless'. The people of the lower river rejected improvements lest they attract taxation, ***vreemde menschen*** ('strangers') and trouble – justifiable apprehensions. Fletcher, who had read Rawson's copy of Baird's volumes, interpreted what he saw in the light of the Indian experience: 'Our migratory population in the interior – both trekboers and aborigines – are steadily and rapidly … subsiding into a state of ignorance which, if unchecked, must soon verge painfully close to barbarism', and urged 'the immediate commencement of the system of irrigation or other analogous improvements'[73].

The Irrigation Circular and the Select Committee of 1862

At the opening of the 1862 session of the Cape Parliament, Governor Sir Philip Wodehouse spoke of the benefits which would 'in all probability' accrue to landed proprietors if the government were to facilitate irrigation. Rawson circulated the Civil Commissioners for information about irrigation plans in their areas, about practicable works ('as by damming of

[69] As quoted in Beinart, ***The rise of conservation in South Africa***.
[70] A remarkably able man who had been Gladstone's private secretary and was a statistician of international repute who organised the Cape's first census.
[71] R. Baird Smith, ***Italian irrigation 1818-1861*** (Oxford: W. Blackwood & Sons, 1855)
[72] CPP CO4102/23, 29 June 1858.
[73] C.E. Fletcher, Reports of surveys of the Olifants River, 1859, G29/60.

rivers, by diverting or raising water from such sources, by the construction of dams, by the collection of periodical supplies of water or by sinking wells') and whether the proprietors would welcome a law providing for government advances of money for such works on reasonable terms, to be repaid over 'convenient periods'[74].

The Civil Commissioners, familiar with periodic droughts and uncertain rains, generally welcomed the initiative though few had any significant plans to report citing expense, lack of professional advice, and shortage of labour. Many described small farm dams for stock from which gardens and maize lands might be watered but too small to support irrigation on any scale. One enclosed a vehement broadside against obstructionist banks: 'In "the age of banking" it is a notorious fact that the object of all these institutions, without a solitary exception, is antagonistic to the higher and nobler one of developing the resources of the country', since no bank would lend for longer than 4 months, and then at rates between 9-12%. If Parliament would help with advances, the 1862 session would be ranked 'among the most useful that has ever been held in the history of the Colony'[75]. Commissioner le Brun of Robertson lamented that precious water from William Nels River ran to waste for half the year, while in the dry season it gave rise to trouble and costly litigation as a result of which the water was lost to Robertson. He had hoped to launch a cooperative scheme to build a large reservoir of a size and strength beyond the reach of individual farmers, but had failed for lack of technical advice. The farmers who seemed most ready to respond positively were generally defined as 'principal leading men'; others were written off as 'apathetic', 'interested only in subsistence'. The reluctant farmers of Namaqualand were said to prefer 'to increase the size of their properties, rather than to improve what they already possess' – that in an area described by A.G. Bain as of top agricultural potential, with sixty- or seventy-fold returns on cereals in favourable seasons. Conservative farmers would rather build their own dams than complicate their lives with loans, markets and professional advice. Only the Peddie Commissioner mentioned helping the Mfengu farmers; at the Kat River (Elands Post) there was said to be no need of capital – voluntary labour and local contributions had already completed a plan to lead from the Elands River to supplement the original dams and water erven. The Commissioner did not envisage further development.

The returns varied according to the energy and commitment of each Commissioner. Mossel Bay emphasised the inadequacy of the Commissioner's salary although at the same time the local newspaper was urging the government to form a hydraulic corps to search for water, find wells and build reservoirs. The return from Oudtshoorn, too, was entirely negative: no plans for irrigation works had been reported and the Divisional Council was 'unable to say' what would be practicable. Yet the local Assembly Member and press reported that the area 'was wholly supported by irrigation' – albeit in 'a most primitive state, impeded and encumbered by many drawbacks' – and was capable of producing two crops a year.

[74] Circular addressed by the Colonial Secretary to the several Civil Commissioners and their replies thereto, on the subject of irrigation, Circular 16, 7 May 1862, G53/62
[75] Memo by Mr Leonard, enclosed in the return of Commissioner W.M. Maskew (Somerset).

On the strength of the returns, and perhaps because the law was 'in confusion'[76], in 1862 a Select Committee was set up 'to enquire by what means the Government and Legislature can promote a more extensive system of irrigation in this Colony'[77]. The Chairman was Francis William Reitz, who represented the western districts in 1854 and farmed historic Rhenosterfontein on the Breede River. Reitz's scientific approach had been informed by Scottish training and experience of irrigation in Italy; he had published articles on irrigation[78]. The Committee proposed that without irrigation the Colony would not prosper. The government should legislate and give landholders security in leading out water and erecting dams across rivers, with right of passage across private property etc. This should be administered and funded locally, assisted by 'a very moderate sum' from the central Treasury. The government should help landed proprietors to borrow money at the lowest interest on terms that would encourage colonial capitalists and bring European capital into the colony.

The evidence to the Committee is a mine of social and technical irrigation history. The lower owners at Oudtshoorn, fearing that their interests might be damaged by new rights, argued for servitudes of aqueduct over farms above them. On the Hex River, farmer Heatly developed his butter production by flooding his ground to clear the bush and planting a large plot of rich pasture enclosed with wire fencing to keep the cattle out of the cultivated and irrigated lands. Robert Hare at Klapmuts built a dam holding 20 million gallons enabling him to supply Cape Town with strawberries and butter 'and indulge himself occasionally with a cruise in his yacht!'. P.J. de Wet was making a profit of at least £100 a year from his vineyard and garden on the Hex; at Over Hex H.A. du Toit was predicted to make '£2000 income, partly owing to a dam which he lately erected himself, partly to his share of Hex River water'. Where there was a choice, many farmers preferred to lead directly from rivers (the Breede, Smalblader, Hex, Wilge, Norma, Doorn, Wagebooms, Hartebeest), the weir's feeding storage dams.

The press carried seductive items about the easy life of the irrigation farmer: 'Nothing is necessary after the water has receded but to throw wheat or other grain upon the surface and drag a few mimosa trees over it'[79]. But poor irrigation technique meant that water was commonly wasted, as for example on Jan du Toit's river:

'Wherever [the du Toits] can get the water they lead it out, but they have no system of irrigation; none whatever. They could get twice or three times as much done if they went to work in a proper sort of way. They merely turn it out, and it runs over. It runs over a sort of ground neither a valley nor a veld and, after it has gone through that land, you see a beautiful rich crop of clover'[80].

Waterlogging was common. At Worcester, J.C. Brown described an attempt to avoid over-watering the orchards by the sensible practice of siting furrows midway between the rows of trees. Land beside the road to Robertson was submerged and the road itself impassable to pedestrians. The problem of land speculation was also causing concern.

[76] J.C. de Wet, 'A hundred years of water law in South Africa', ***Acta Juridica***, 31 (1959), 31-35.
[77] SCI C3-1862.
[78] F.W. Reitz, 'Irrigation', ***Cape Monthly Magazine***, Jan-June 1857 and Jan-June 1861,136, 223, 296.
[79] South African Commercial Advertiser as quoted in Brown, ***The water supply of South Africa***.
[80] Evidence to Select Committee Q 408.

At Oudtshoorn, land which in the 1860s could be brought for £20 a morgen fetched £150 ten years later. Land became a form of storable wealth for men like the Malmesbury farmer who constructed several dams and then sold the remaining large portion of his farm 'as he can now farm on a large scale on the remainder as he could on the whole'[81]. The rising value of irrigated land resulted in ever more acrimonious disputes between upper and lower landowners, and the Select Committee showed concern about the implications for the supply to lower owners when upper owners abstracted water (as in the case of the Klein Berg River). Included in its recommendations was the need for legislation dealing with existing water rights and new permissions to abstract; the appointment of streams should be conducted by bodies with knowledge of local conditions[82].

In his evidence to the Select Committee, Molteno had said, 'You cannot move a step without legislation', anticipating no difficulty in framing a Bill to settle equitably the respective rights of proprietors to common streams; nor did he see a problem with the rights of lower owners when above them the floodwater of the river was dammed, 'because this is water that would otherwise never be made use of …'[83]. The opposite view came from T.B. Bayley, author of a topical article on the subject, who considered the difficulties of legislating 'almost insuperable', recalling the famous Eerste River case when 'club law prevailed: each night the lower owners who were deprived of water ordered their slaves to destroy the dams made above them, 'and so before morning the stream was again flowing to the sea'[84]. The irrigators of Oudtshoorn who had evolved their own system of arbitration protested vigorously at the threat to the interests lower owners from unknown new rights granted above them, rejecting the Committee's proposed local regulation by Divisional Councils.

J.C. Brown had prepared an exhaustive Memoir for the Committee covering, he believed, every aspect of the extension of irrigation, the difficulties involved and the government measures required to give effect to it[85]. But the Committee's recommendations for legislation, surveys and grants were not followed up, though Chambers of Commerce and agricultural societies in Port Elizabeth, Uitenhage and Mossel Bay and other irrigation enthusiasts, or '***collaborateurs***' (as Brown called them) campaigned for action. Bills were unsuccessfully introduced in 1861, 1863 and 1866. An anonymous pamphlet entitled 'Notes on irrigation' was privately printed in 1867 by a frustrated ***collaborateur*** 'induced by a sense of duty to the public' to collect data in an attempt to get 'the people of South Africa to awaken from their slumber'[86]. In that year Molteno failed to resuscitate a bill originating from public pressure in Aliwal North to allow a right of aqueduct over another's land. John X. Merriman, Commissioner of Crown Lands in Molteno's government, who was to introduce the Irrigation Act of 1877, believed that if Molteno had been able to influence the Dutch land-owning class he would probably have effected a revolution in the economical conditions of South Africa[87]. Not until 1876 were lower owners able to compel upper owners to pass down water, when the Right of Passage of Water Act secured a servitude of aqueduct (expanded in 1882 to allow registration against the title deed).

[81] Evidence to Select Committee Q 335; return from Commissioner John Raynier (Malmesbury), June 1862, in G54/62.
[82] See, for instance, Evidence Q29 to Sir John Molteno.
[83] Evidence to Select Committee Qs 38 and 39.
[84] Bayley letter in Appendix F to SCI1 C3-1862. T.B. Bailey, 'Agricultural theories and agricultural practice', ***Cape Monthly Magazine***, June 1862.
[85] Brown said that a summary of the memoir was appended to the Report of the Colonial Botanist for 1866. This does not appear in the printed version (G1-1866) and could not be found in the Archives.
[86] Anon, Notes on irrigation, 1867, National Library, Cape Town.
[87] Quoted in P.A. Molteno, ***The life and times of John Charles Molteno*** (London: Smith, Elder & Co, 1900)

Legal title to water rights

The evolution of the law of water rights was advanced less by legislation than by common law, with the principles of English and Dutch common law adapted to South African hydrological conditions. In 1856 the case of ***Retief vs Louw*** passed unremarked until 1874, though it was later acknowledged to have had 'a profound influence' on the history of water law and irrigation. The case concerned disputed access to water flowing through both an upper and a neighbouring lower farm. The two judges concurred in finding for the defendant, though they drew their conclusions from different legal traditions. Hendrik Cloete J. (trained in Utrecht and Leiden and combining his vigorous advocacy of Roman-Dutch law with a highly informed knowledge of English jurisprudence) applied the Roman-Dutch precept that the flow of a small stream, rising on private land, was privately owned; he said nothing about the rights of others along the stream. Sidney Smith Bell J. looked more widely at the relation of water and land:

'In a country such as this, where the value of land is greatly dependent upon the facilities for obtaining water, there are few questions which can be conceived of greater magnitude or importance to the inhabitants, yet, singular to say, after making enquiry I am not able to discover that any case upon the subject has ever been decided by this Court, or by its predecessors, or that there is any judicial authority upon the subject'[88].

Turning to English, Scottish and American law, he applied the American precept that each riparian owner had a common right to use the water flowing through his land, 'limited by a consideration of the rights of other proprietors'. Riparian rights presupposed a system of apportionment and allocation, but none such existed[89]. Bell J. established a principle of proportionate sharing and reasonable use, distinguishing the various uses of water into a hierarchy of priority: primary (drinking/domestic) use in support of human and animal life, secondary (agricultural/irrigation) use and tertiary (mechanical/industrial) use. This judgement has been said to have produced 'if nothing else, confusion' as to the water law regime applying to the Cape, and the Select Committee of 1862 recommended legislation to secure to landowners' water rights they had obtained by legal title or prescription, and the creation of local bodies to apportion streams to users without such privileges. The legislative approach failed, but in a number of cases referred to the Supreme Court, between 1874 and 1881 Chief Justice de Villiers laid down principles in his judgements which became the accepted basis for irrigation legislation that dominated the law of water rights in South Africa for the next fifty years[90].

[88] Retief v. Louw, Buchanan's Reports (1874).
[89] For a brief time Resident Magistrates succeeded to the old power of Landdrosts and Heemraden regarding the regulation and apportionment of water, but this had been revoked in 1848, after which the Supreme Court seems to have attempted to apportion water, in every case with local assistance (Lewis, ***Water Law***).
[90] Hall, ***The origin and development of water rights in South Africa***.


02

CHAPTER 2

PRIVATE AND STATE IRRIGATION 1870-1916

Deborah Lavin and Lani van Vuuren

Irrigation in the Cape in the later nineteenth century became professionalised, planned and designed by engineers, adjudicated and recorded by lawyers, contributing significantly to the economy through wine and fruit growing and irrigated pasture for livestock. Governments established positions like Colonial Botanist and Colonial Hydraulic Engineer.

More ambitious irrigation construction was encouraged by government loans, organised through Irrigation Districts and elected irrigation boards, regulated through legislation. But cooperative irrigation associations developed slowly, while tight budgets compelled the first Cape Directors of Irrigation to propagate the irrigation idea and investigate future possibilities rather than build state schemes. Larger-scale enterprises still came from private initiative, often funded with mineral capital. By the end of the century the high values of watered land, the opportunities of sizeable markets, and especially the boom in feathers from ostriches fed on irrigated lucerne engendered 'irrigation fever' in the Cape. Encouraged by advice from foreign experts and strengthened by the technocratic approach of the colonial regimes in the northern ex-republics, the Union promised a new era, anticipated in the Irrigation and Land Settlement Acts of 1912, but dashed by the end of the ostrich boom and world war.

The 1862 Select Committee had posed a fundamental question: was the role of the government to construct irrigation works or to aid others to do so? Private small-scale irrigation by individual farmers or mission stations was amplified when wealthy and progressive Karoo farmers began investing the profits of wool or ostrich feathers in more ambitious schemes. Runoff was channelled into large farm dams, water collected and led through canals sometimes miles in length, pumped from boreholes and/or promised by water diviners claiming to detect reliable underground flows. These families often farmed on a large scale – the Rubidges at Wellwood, the Barbers at Halesowen, the Southeys, the Halses and the Colletts and others[1]. By the mid-1870s drilling boreholes for

water, erecting windmills to pump it into galvanised iron pipes, and erecting wire fences were becoming common. Drills were improvised from sewing machines; petrol, gas suction and even experimental solar pumps were in use.

The improvers, far from rejecting the state, looked to it to support the next stage of development – dams and irrigation works of national significance as engines of progress. Advocates of state funding, such as F.W. Reitz and Reenan J. van Reenan, often did so on the basis of experience of irrigation in other countries – America, Italy, India.

HYDRAULIC ENGINEERING, IRRIGATION BOARDS AND LOAN FINANCE

The first indication of government commitment to irrigation came with Molteno's appointment in 1875 of John Gamble as Colonial Hydraulic Engineer under Public Works Commissioner John X. Merriman. Representing dry Namaqualand in the Assembly, and later as Prime Minister himself and the owner of a famous Cape wine farm, Merriman took a personal interest in irrigation and directly influenced the course of the Cape's irrigation history.

Gamble was primarily a municipal engineer, but once he had satisfied himself of the potential for well organised irrigation, he identified two essentials: cooperation among the farmers and 'the patient scientific study of all the conditions which ... can alone secure success', a professional approach contrasting with the individual and generally technologically uncomplicated initiatives that most farmers had hitherto undertaken for themselves, or that were to be seen in the watered ***erven*** (plots) of town smallholders. His early reconnaissance reports from 1876-7 cited irrigation practice throughout the world[2]. He had arrived at the Cape assuming that water belonged to the state and that on the analogy of railways irrigation could be developed by powers of expropriation. Instead, he found a tangle of water rights and discovered that irrigation was being developed by private energies rather than state initiative. Gamble advised that water rights should always be attached to the ownership of land and all developers should own the land on which their works were placed. His strong conviction, however, was that state investment in hydraulic works would return a benefit to the nation as a whole from increased land values that would follow. In the short term, returns could be obtained from leasing out works on Crown Land or by lending them to an irrigation association at interest[3].

The earliest scheme for which the Cape government had some responsibility was Brandvlei on the Zak (Sak) River near Calvinia in 1876 where the government built a dam and works for a newly established village laid out with building lots and water, with sowing plots let to 40 poor families in the nearby settlements of Klippekraal and Nelskop. The owners of water ***erven*** were not able to exercise their rights to water from the dam owing to the illegal abstractions by owners and informal settlers along the canal above the dam. The villagers displayed 'much jealousy and ill feeling', refusing to make good the furrows and banks trampled by their carts and cattle and showing no inclination to manage the supply or collect rates.

[1] Beinart, ***The rise of conservation in South Africa***; L. van Sittert, 'Holding the line: the rural enclosure movement in the Cape Colony 1865-1910', ***Journal of African History***, 43, 1 (2002), 95-118; S. Archer, 'Technology and ecology in the Karoo: a century of windmills, wire and changing farming practices', ***Journal of Southern African Studies***, 26, 4 (2000), 675-696.

[2] CPP. A21-1876, Report on the Lower Orange, Bushmanland and the Achterveld by John G. Gamble, Hydraulic Engineer, 27 May 1876; G10-1877, Report of the Hydraulic Engineer on completion of a tour to the Northern Border and Port Elizabeth, 27 February 1877; A26-1877, Report on the Division of Oudtshoorn by John G. Gamble, 6 August 1877. See too G43-1878, Report of the Hydraulic Engineer for the year 1877.

[3] As Gamble had foreseen, after a slow start irrigation in the Cape was to prove a good investment at state expense: huge profits were being realised from watered land. At Van Wyk's Vlei land bought at £1 per morgen was selling at £100 for a ten-morgen block. At New Bethesda in the Graaff-Reinet district a farm bought for £3000 in 1878 was valued at £50 000; on the Breede the gains were still more spectacular. ***Saaidamme*** on the Brak River (now reconstructed on engineering lines by A.D. Lewis) were bringing in returns of 20%.

The first wholly government work was the controversial Van Wyk's Vlei storage scheme, eagerly backed by the local Assembly Members but opposed by the Divisional Council on financial grounds and by local farmers who reported ***brak*** (saline) soils. The dam was completed in 1883 for £18 000, justified on the ground that it would take 5 000 farm dams to store the same amount of water. Gamble thought the site generally promising but had no technical staff to undertake 'patient scientific study'. Instead, he complained that he was thrown back on 'some Government surveyor who may happen to be in the neighbourhood, and who, though well up in his own line, is frequently not well versed in levelling, or in the preliminary researches necessary for hydraulic works'[4]. The dam did not fill, poor drainage accelerated the ***brak*** and the only revenue recovered was from the sale of pure salt from a hole at the back of the embankment[5].

Gamble applied the lesson of Van Wyk's Vlei on the Zak River in January 1885, refusing a dam in favour of weirs and ***saaidamme.*** In the Calvinia area, the intermittently flooding Zak River did not flow in a known and defined channel but varied in breadth from yards to miles over flat deep silt ground. Afrikaner farmers reaped remarkable wheat harvests in flood recession basins reminiscent of irrigation along the Nile, over farms as large as 4 700 morgen. The Magistrate, Andrew Bain, invested in a farm there, his son Donald later managing the prolific Zak River Estates, 100 000 morgen in extent. In refusing to dam the Zak, Gamble was accused of attempting to influence the forthcoming election when he warned that if Le Roex (pro-dam candidate for Fraserburg) were to be elected the project would not be forwarded for parliamentary consideration. The candidate for Calvinia and the lower owners opposed the dam fearing the ruin of their own ***saaidamme*** if the salts were not regularly flushed out of the soil[6]. This episode illustrated the pressures exerted by conflicting interests – the Brandvlei settlers, squatters with temporary sowing leases, the would-be upper irrigators of Fraserburg hoping for storage, and the lower owners depending on flood. Gamble's judgement was endorsed by a later Director of Irrigation at the Cape, W.G. Gordon, and further vindicated in an article by a farmer from Carnarvon published in 1914 arguing that the disasters at Van Wyk's Vlei would have been averted if ***saaidamme*** had been used in preference to the dam and that the advantages of ploughing 'behind' receding water slowed the drying of the soil and enabled a longer ploughing season for the farmer who did not have the capital to invest in a steam tractor or many draught animals[7].

Gamble pressed for legislation, while recognising from Italian experience that it was likely to be a matter of trial and error generating conflicting interests. The year 1875 was a drought year. The first Right of Passage of Water Act was passed in 1876, giving an individual owner the right to lead water across the land of an upper proprietor, thus enabling a farmer to lead from beyond his own property. Gamble encouraged Merriman to expect that once right of passage was established, associations of proprietors would begin to form, each with elected representatives and a properly trained engineer, 'the value of water being in truth so great that every man becomes more or less a police officer'[8]. Associations of irrigators with elected management committees would

[4] Quoted in C.O. Linscott, 'A short history of irrigation development in South Africa', ***South African Irrigation Magazine***, 3 (1924), 5-56.
[5] As late as 1919 satisfaction was expressed that 'only 100 bags of salt were collected this year'. (Report of Department of Lands for 1919, UG 45-20)
[6] The Calvinia proprietors had consistently opposed irrigation works since the time of the Civil Commissioners' survey of 1862.
[7] Report by the Director of Irrigation of his tour through the North-west Districts, June/July 1904, CCP 1/2/1/128; L.G. Green, ***Karoo*** (Johannesburg, Howard Timmins, 1955)***;*** C. J. van Zyl, 'Irrigation by zaaidam', ***Agricultural Journal***, 7, 4 (1914), 493-5; Beinart, ***The rise of conservation in South Africa***. Successful modern ***saaidams*** are described in Denison and Wotshela, Indigenous water harvesting and conservation.
[8] G10-1877.

develop projects with the aid of professional expertise and government loans, and would want a stake in managing the result – in effect, as Irrigation Boards.

The following year Merriman steered through an Irrigation Act (No. 8 of 1877) to encourage irrigation and improve the supply and storage of water. It provided for the formation of Irrigation Districts in which small farmers could pool their resources to invest in dams and water furrows. Any three owners together owning one-tenth of the scheduled land might apply for the proclamation of a District; if two-thirds of the owners agreed to associate, the other third were compelled to join. Elected Irrigation Boards would make by-laws, levy and collect rates, take action against defaulters and devise an irrigation schedule to determine the quantity of water due to each owner. Boards wishing to construct works to supply or store water might apply for government loans at 8%[9] to be repaid over 24 years. If no Board could be formed, an individual proprietor might apply for an advance or a loan. Merriman wrote in 1920,

'I recollect that when I was young and enthusiastic I persuaded Molteno to let me go in for irrigation and I passed a long Act embodying all the main principles that operate today. ... Then came the frontier war – and a spell of the cold shades [a reference to Molteno's dismissal from office in 1878]. My poor Act was laughed at and put on the shelf. It was 20 years later before I got it to work at Robertson and now all the practical work done at the Cape, and it is very considerable, springs out of that Act. The mills of administration grind very slowly but they do sometimes get results[10]'.

In 1879 the government announced that public companies and private individuals might call on the services of the Hydraulic Engineer at the rate of £2 per day, presenting a problem to Gamble who had little or no professional support and failed to get on top of the mounting advisory work.

But despite encouragement the Cape irrigators did not associate as had the Italians. Litigation over water rights was expensive and the Irrigation Act was obscurely worded, imposing costly and complicated procedures on irrigators who were cautious about paying a water rate depending on personal security rather than land. Many farmers preferred to irrigate from private springs rather than face the complications of diversion from public rivers. To encourage the habit of association the Right of Passage Act was extended in 1882 to locations where one weir might serve several farms. In an attempt to establish a viable model for an Irrigation Board the authorities resorted to the sort of 'top-down' project that has seldom found favour with South African irrigators, laying a scheme before the farmers of the Lower Olifants (Klawer).

Surveyor J.A. Balfour, revisiting Fletcher's previous investigation, recommended weirs for ***saaidams*** (basin irrigation) at an estimated cost of £40-50 000, suggesting repayment in kind since the area had barely developed a cash economy[11]. An Irrigation District was proclaimed in a fit of enthusiasm in 1882, later said to have been the result of forced consent after 'all sorts of influences and all sorts of fine promises'[12]. It did not last, and though there was an effort to revive a Board in 1909, organised irrigation in this prime area was resisted until 1917.

[9] 6% interest plus 2% amortisation.
[10] Merriman to (Transkei Magistrate) W. Carmichael, 10 May 1920, quoted in P. Lewsen, ***John X. Merriman: Paradoxical South African statesmen*** (New Haven: Yale University Press, 1982)
[11] Report by J.A. Balfour, 3 August 1882, Cape Archives, PWD 2/76.
[12] Evidence of J.P. Mostert to Irrigation Finance Commission, Second Report, UG 44-25, 89.

NLSA

Ostrich farming on the farm Armoed outside Oudtshoorn, circa 1906. Booming economic sectors, particularly the trade in ostrich feathers, promoted the use of irrigation for the cultivation of lucerne.

Merriman also proposed a pilot scheme at Oudtshoorn, where intensive farming in the river valleys was thriving with irrigated cultivation of lucerne for ostrich rearing. These 'irrigation ***Voortrekkers***' would, he hoped, demonstrate the advantages of cooperation and the essentials of good irrigation as Gamble defined them: 'reliable mechanisms for giving or withholding water; water used to its fullest extent, running shallow in continual motion to aerate both water and plants; good drainage of any excess'.

Gamble described what he found at Oudtshoorn:

'An irrigable field has a furrow running along the highest side of it; when the farmer wishes to irrigate, he blocks up the furrow so that it overflows on the field, or he cuts openings in the side of the furrow for the same purpose. The water then runs down the field as far as it will go. There are seldom if ever any second furrows for catching and redistributing the water, hence after running a certain distance the water collects itself into ruts and channels, and unless great care is taken large spaces of the field are left dry. ... A sod, judiciously dropped in the opening by a sly neighbour deprives the owner of most of his share[13].'

[13] J.G. Gamble, Report on the division of Oudtshoorn, Cape Town Report no. A.26.77.

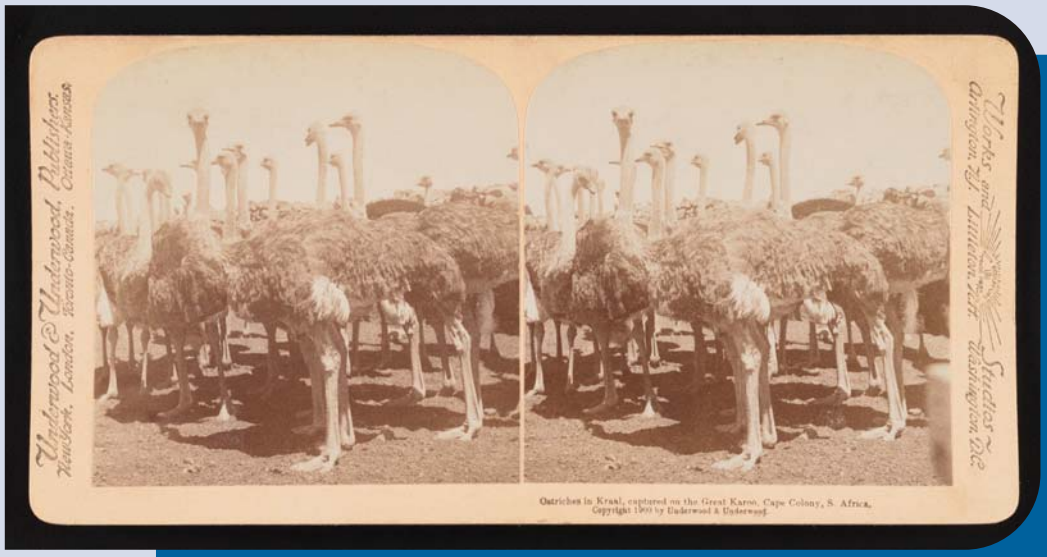
There were no records or surveys; dams were planned without drawings or specifications. Upper owners wasted water, depriving their riparian neighbours below. The area was notorious for water disputes[14] arbitrated according to local conventions by attorneys and auctioneers who tended to oppose an equal allocation of water between upper and lower owners on the ground that it would upset land values. There was no realistic hope of getting the irrigators to combine: riparian farms in the area were commonly in multiple occupancy, the holdings greatly varying in size and generally already mortgaged. Nevertheless, enterprising farmers were already converting their old 21-year leases into quit-rents in anticipation of government loans[15]. In 1883, Gamble proposed a technically competent water court familiar with local conditions to resolve disputes and establish a principle 'of securing the least amount of waste of water and the greatest amount of productive cultivation [16]. His suggestion was not acted on, and when later legislation was effected it was on the basis of common law principles established in the supreme court.

Library of Congress

European fashion, particularly the use of feathers in ladies' millinery prompted the expansion of the South Africa ostrich sector from the eighteenth century.

[14] Often relating to seepage water from irrigated fields ('***brakstraaltjies***'), Reenen van Reenen, 'Development of irrigation in the Union of South Africa', ***South African Journal of Science***, 1925, 178-192.
[15] Gamble to Asst Commissioner of Lands, 20 August 1879, PWD 2/55; Appendix Q; A56-79.
[16] G37-1883.

THE OSTRICH FEATHER INDUSTRY AND THE BOOST FOR IRRIGATION

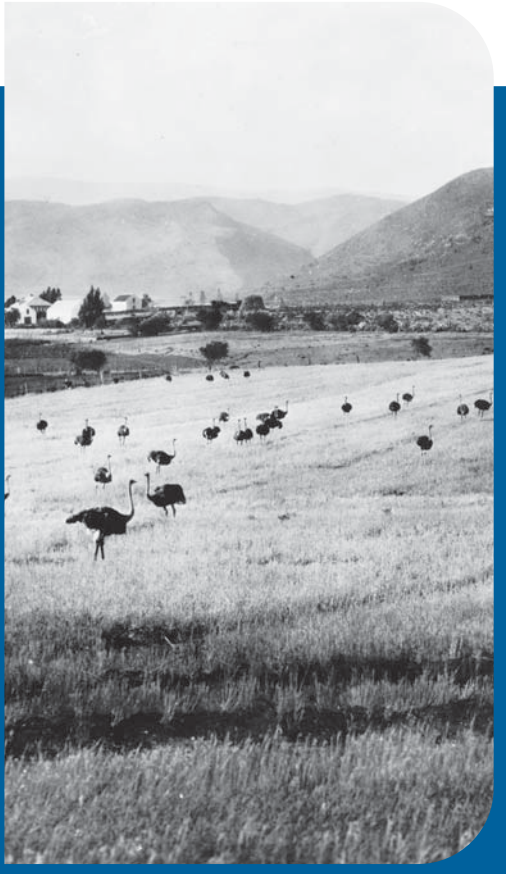


Library of Congress

Paddocked ostriches, 1900.

Ostrich feathers have been used as a fashion statement for thousands of years, but it was in the late eighteenth century that the elaborate dress of the European elite spurred the birth of a new agricultural sector at the southern tip of the African continent. Early on the European feather market was supplied from the plumage of wild birds, and ostriches were nearly hunted into distinction, the Cape Colony introducing a Game Law in 1822 and closed hunting seasons as a result. Dutch settlers starting taming ostriches as early as 1775, but it was only from around 1857 that the domestication of ostriches started to take off[17]. Chicks were hand-reared and adults were kept in large paddocks. Lucerne was introduced to South Africa in the 1870s specifically to feed ostriches[18]. Farmers soon discovered that ostriches fed on lucerne produced the best feathers (birds were plucked every six months or so). This prompted the planting of large lucerne fields fed by small, privately-owned irrigation works, especially in the Karoo and the Eastern Cape, where ostrich farming quickly usurped farming with tobacco, wheat and grapes[19]. The epicentre of the ostrich industry, Oudtshoorn, had an estimated 27 000 birds by 1875. Worth nearly £3-million at its peak in 1912, ostrich feathers became the fourth biggest export from South Africa, after gold, diamonds and wool. The sector crashed at the start of the First World War.

[17] D.J. v.z. Smit, ***Ostrich farming in the Little Karoo*** (Pretoria: Heer Printing & Co, 1963)
[18] J. Burman, ***The Little Karoo*** (Cape Town: Human & Rossouw, 1981)
[19] Report of the Director of Irrigation for the year ending 31 December 1907 (Cape of Good Hope: Cape Times, 1908)



Library of Congress

Ostriches roaming a lucerne field in the Cape Colony, 1910. Once it was discovered that lucerne-fed ostriches produced better feathers, irrigated lucerne fields were created on ostrich farms for the birds to graze on.

Even an enthusiast for scientific irrigation such as the Port Elizabeth businessman James Kirkwood who was prepared to follow the Act and Gamble's advice to the letter, failed to create an Irrigation Board. Kirkwood bought and irrigated one of the original four farms granted on the Sunday's River, subsequently seizing the chance to consolidate a mosaic of small farms abandoned by owners dazzled by visions of Kimberley diamonds. The area was ideal for irrigation: deep alluvial soil growing maize plants 17 feet high, with grazing and timber and the prospect of rail transport to the markets of Port Elizabeth and Graaff-Reinet. Kirkwood formed the Sundays River Land and Irrigation Co. in 1883 'to bring about by co-operation that which individual effort has hitherto failed to achieve in this Colony, i.e. application of irrigation to an extensive area, whereby the land will be so raised in character as to attract both capital and labour'. The economic climate was adverse and no shares were taken up. Kirkwood died in 1889 a bankrupted and disappointed man, though later celebrated as 'the father of Land Companies and private irrigation settlement'[20]. His ideas were to be vindicated later in the Cape Sundays River Settlement Company, but as late as 1924 mining finance and banking developments were insufficient to sustain the enormous initial costs and the Union government bought out the Company for £100 000.

[20] Quoted from the Company Prospectus in J.M. Meiring, ***Sunday's River Valley: its history and settlement*** (Cape Town: A.A. Balkema, 1959)

IRRIGATION PROSPECTS

From 1878 Gamble undertook reconnaissance journeys for works if and when the state had the funds and the people to develop them. These included Booysens Poort near Graaff-Reinet, the lower Sunday's River, the confluence of the Vaal and the Harts rivers at 14 Streams, and an irrigation settlement at Douglas on the confluence of the Vaal and the Orange. The possibility of developing the lower Orange River, and even bringing water from the Orange into the Colony through natural tunnels, had been talked of since at least the 1850s. By 1882 Gamble was assessing another courageous transfer, from the Upper Orange at Aliwal North across the Bamboesberg into the Fish River, as well as a more modest proposal for a tunnel diversion of the Fish at Cookhouse[21]. Merriman addressed the Assembly proposing a committee to enquire into whether the time was right for the government to implement large irrigation projects, naming especially the Cookhouse tunnel, and the Fourteen streams/ Griqualand West/ Vaal and Harts rivers proposal, to which was added a scheme for irrigation from the Orange River at Prieska. The case for investing in irrigation rather than railways lay in making the Cape more self-sufficient in food production by substituting the import of grains costing £500 000 per annum.

One of the more immediately practicable plans involved a canal and a tunnel to store the waters of the Vaal in reservoirs on the Harts for irrigating the Harts Valley – a project that particularly interested Cecil Rhodes as Member for Barkly West. The full scheme, including the land purchase, was estimated at £230 000; a smaller canal to irrigate 40 000 acres of Crown land in the first instance would cost £130 000, but would involve removing the Thlaping inhabitants. In the years that followed, the informal alienation of land by Cape settlers and Transvaal dissidents accelerated, amplified by reorganised 'locations' and evictions in the Cape's pursuit of irrigation and railway construction and culminating in the transfer of part of British Bechuanaland to the Cape in 1895 and the comprehensive crushing of resistance in the Langeberg the following year. The example of the lands between the Molopo and the Harts was but one case illustrating the accelerating competition for resources. Official and unofficial agents of white expansion – missionaries from many nations, traders, government agents, land-hungry settlers emanating from the coastal colonies and the embryonic inland republics – engineered new relationships with the African polities that had evolved in the ***Mfecane.*** Competition for resources brought increasing levels of land alienation and dispossession, conflicts were generally resolved by the incorporation of the black chiefdoms into white controlled states. In the process, land shortage and legal restriction in densely populated reserves circumscribed the levels of black production and access to land. The chronology of dispossession varied but its intensity was greatest in the well-watered areas identified as colonial irrigation possibilities.

In 1885, exhausted by his journeys and ill health, Gamble applied for leave; he did not return. Irrigation now came under the Chief Inspector of Public Works, who made the advance of irrigation loans a priority in 1866, in which year the position

[21] Gamble to the Commissioner of Public Works, two letters dated 22 March 1882, CPP PWD 2/76, printed in G47-1883. For the Bechuanaland land settlement see K. Shillington, ***The colonisation of the Southern Tswana 1870-1900*** (Braamfontein: Ravan Press, 1985)

of Hydraulic Engineer was discontinued. Thereafter Thomas Bain, as Geological and Irrigation Surveyor took charge, constructing the Verkeerde Vlei Dam in 1889 and authorising the ill-fated Rooiberg Dam at Kenhardt, destroyed by floods in 1900. At his death, Irrigation reverted to Public Works.

Members in the Cape Legislative Assembly were now pressing for development on the Orange and the Vaal rivers, at Kenhardt, Upington and Kakamas (where in 1893 the government made two farms available to the Dutch Reformed Church for an irrigation settlement to relieve poverty). The Cape was not a strong state. Shortage of capital hindered the plans for the Orange and the Vaal. In 1886 and 1889 Rhodes carried motions in the Assembly proposing that the construction of irrigation works in the Harts valley should be funded by government grants of land to individuals or companies interested in doing the work. The same strategy was considered for Prieska, Buchuberg and Upington, until halted by Parliamentary concern that too much state land was being handed over to the detriment of future irrigation development in the Cape.

Lani van Vuuren

The Douglas weir on the lower Vaal River. The original weir structure was built in 1896.

THE APPLIANCE OF SCIENCE TO IRRIGATED PRODUCTION

In 1890, a setback in the gold industry caused the Transvaal to impose duties on Cape goods and fruit, resulting in a temporary recession in the Cape. Rhodes formed a governing coalition with Merriman as Treasurer, responsible also for Lands, Mines, Irrigation and Agriculture. Merriman reported the Treasury to be empty and disorganised, the Agriculture Department in chaos while facing the ruin of the wine farmers by phylloxera, and the banks in the wheat and wine districts failing. Until the 1850s wine had been the Cape government's largest source of income and principal export; thereafter diseases like powdery mildew and phylloxera, and a hostile tax regime encouraged wine farmers to band together and diversify into the export of deciduous fruit. Merriman's strategy was to stimulate fruit and wine production: irrigation would hold the key to economic recovery.

In 1890, Charles F. Juritz was appointed through the Cape Department of Health to promote research into agricultural chemistry for the wine industry: two years later the agricultural chemical laboratory was merged with Bain's Geological and Irrigation Office. In 1893, Juritz initiated the chemical analysis of soils; in 1895 the entomological expertise of C.P. Lounsbury was mobilised against the codlin moth and other pests. These were fortified with Californian experience brought to South Africa by P.J. Cillié ('Piet California') of Wellington and further propagated by H.E.V. Pickstone who persuaded Rhodes to establish demonstration orchards in the Drakenstein Valley.

In 1901, Pickstone's ***Hints on Fruit Growing*** identified sound principles of orchard irrigation (including, that 'the main points to be taken into consideration are the depth of the soil, the character of the soil, the style of the sub-soil and the position of the orchard ... too much water is always more serious than too little ... the manner of our usual irrigation [is made] still more fatal [by] the almost entire absence of drainage in orchards …' In 1906 Juritz published his study of the ***Soils of the Cape Colony,*** taking into account geology and the experience of local farmers as well as chemical composition in his assessment of potential for crop production. He drew attention to two of the most enduring problems of irrigation development – waterlogging ('plentiful and adequate under-drainage must go before plentiful irrigation, otherwise there is bound to be mischief') and ***brak*** ('one of the most striking characteristics of South Africa is the tracts of land quite unfit for ordinary cultures, owing to a large percentage of alkaline salt in the soil')[22].

In 1893 a Select Committee of Parliament faced the fact that, however desirable, the legislation had achieved no practical result; the spirit of joint enterprise for the common good (without which it considered that large scale irrigation would fail) could not be forced. In that year loans were extended to individuals on the same terms as Boards; public bodies and municipalities were already taking advantage of the quicker, simpler and cheaper loan procedures and softer terms of interest available[23]. Most villages and towns had open ***lei*** channels of running water for domestic use and household smallholdings. Town water became contentious in conditions

[22] M. de Villiers, ***Centenary Report of the Agricultural Research Council Institute for Soil, Climate and Water*** (Pretoria: Agricultural Research Council, 2000).
[23] By 1894 £54 000 had been advanced as loans, £43 000 of which was to municipalities and public bodies. Of the £11 000 advanced as private loans, little had been repaid. (Lewis, ***Water law***).

of scarcity, as in Graaff-Reinet where the antagonism between the supporters of a town water scheme against the erf holders protecting their individual rights ended with an appeal to Parliament and the Town Engineer being dumped in the dividing tank[24].

In the next years two remarkable experiments were initiated, one the largest private project yet undertaken in the Cape, the other a model of social rehabilitation by the Dutch Reformed Church that was to influence welfare policy and irrigation settlement for half a century.

The Smartt Syndicate at Britstown: finance and hydrology

The first attempt at a perennial reservoir of serious magnitude in the Cape, made possible by the advent of the mineral era of South African development, was the inspiration of an ebullient Irish doctor. Thomas Smartt planned a vast experiment in scientific stock-farming at Britstown in the dry Karoo, hoping also to advance irrigation there from ***saaidams*** on the Brak River to year-round cultivation through storage and diversion works. In 1893, government irrigation loans were extended to private individuals, but Smartt's project was endangered by shortage of capital until Cecil John Rhodes arranged for De Beers to guarantee a Standard Bank loan of £30 000 to Smartt and offering a counter-guarantee himself[25]. On this basis the Smartt Syndicate was formed. But shortage of hydrological information and engineering expertise continued to be problematic. The Great Houwater Dam was washed away; undaunted, Smartt formulated an irrigation and settlement project ('one of the boldest of its kind ever attempted') starting with a new dam on the Ongers River with a capacity more than fifty times larger than the biggest then existing in the Colony. Designed with the most modern American expertise by Reenen J. van Reenen[26], it was planned to irrigate 20 000 acres. Later the Rhodes Trust was to continue supporting Smartt's dream of creating 'an object lesson and a source of knowledge for all South Africa'. (He used to quote Sir William Willcocks that 'one good example of a perennial reservoir of great magnitude would teach truer lessons of what the Karoo is really worth than another thirty years of information and study – and, to tell the truth, it would cost considerably less.') The experiment did indeed teach lessons in modern agriculture: successful innovations in stock-rearing and management, together with the growth of fodder under irrigation with labour-saving machinery[27].

It also demonstrated the perils of irrigation pioneering: the Smartt Syndicate Dam generated prolonged litigation about water rights and troubles with water supply. The dam cost £284 000, and stood almost empty for a year after its completion in 1916 with a capacity of 84 000 acre feet; ten years later it had silted up and contained only 16 800 acre feet for irrigation. The Ongers River on which it was built was, in effect, a flood channel, washing down silt in the periodic inundations. The scheme for 100 settlers had attracted only 13 by 1925, most by then facing bankruptcy. Britstown was too remote to attract settlers and the enterprise never developed a successful crop or marketing strategy for the Kimberley market. Nevertheless, it won for Smartt the title of 'the father

[24] K. Wyndham Smith, ***From frontier to Midlands: a history of the Graaff-Reinet District 1786-1910*** (Grahamstown: Rhodes University, 1976)
[25] Beinart, ***The rise of conservation in South Africa***.
[26] Beinart, ***The rise of conservation in South Africa***.
[27] Mugglestone (General Manager) to F. Hirschorn (Chairman), giving a short history of the Smartt Syndicate, 23 May 1936. (National Library Cape MSB 473, 3(20).

of irrigation in South Africa' and the positions of Cape Minister of Lands and Public Works (1904-8) and later Union Minister of Agriculture.

The Kakamas Labour Colony: settlement

For many years the only irrigation settlement scheme achieving positive results was Kakamas on the Orange River below Upington. Its originators, the Revs C. Schröder and B.J.P. Marchand, had attended a Dutch Reformed Church conference on poor whites held at Stellenbosch in February 1893. Schröder, an ex-missionary to the Koranna, had taken a leading part in constructing the Upington canal which he famously protected from floods by planting quince hedges. He established the Kakamas Colony to alleviate the impoverishment of nomadic farmers in the North-west Cape after the drought and rinderpest of 1896-7. Having identified a natural intake from the Orange River at De Neus, against the advice of the Cape's Public Works Department in 1897 he built the South Furrow with unskilled labour and 18 draught donkeys to serve the two farms presented to the Colony by Parliament.

Schröder was captured in the South African War, but his friend Marchand continued the work, using an irrigation loan of £15 000 in 1908 to buy farms on the North bank. Schröder's assistant, J.J. Lutz – originally a trader with no engineering training but widely acknowledged as an irrigation engineering hero – built the North Furrow to irrigate 2 000 morgen (according to F.E. Kanthack 'the most difficult piece of work ever attempted in the Cape Colony'[28]). Lutz built simply, with an eye to efficiency, cutting through soft ground by bringing the full force of the canal through a small furrow, using bent corrugated iron instead of stone or brick for the arches of culverts and delivering water to the islands through improvised syphons of corrugated steel pipes. He built contour furrows of drystone walls to save blasting or deviations, using dry packing of lime and gravel to seal the furrows and allowing the silt to accumulate as an effective lining. His methods were ridiculed at first, but later commended – and emulated – by the best engineers of the department. Clearing was somehow achieved in 'a chaos of sandhills, sluits and dense thickets' and the land levelled cheaply by water action or ***spoeling.*** Each colonist dug his own furrow and cleared his land, at first receiving no support although the labour might take three years to achieve. Later colonists were given £12 credit at the Colony shop but also had to live on the advance, which hardly enabled the purchase of a pick and spade. The community was expanded by poor white day labourers. A fall of 22 feet in the left bank was used for a sophisticated power station and a sizeable mill built by Swiss engineers in 1912 to support a variety of industries, with an industrial school planned but delayed from lack of funds[29].

Kakamas was proclaimed a Labour Colony in terms of a Cape Act of 1909. In 1910, a community of 380 families of mixed races settled there, each allotted 6 morgen which remained the property of the church. The scheme drew golden opinions for turning out skilled men trained in intensive farming and water-leading with a future as smallholders or tenants. But the

[28] F.E. Kanthack, Report on Kakamas Labour Colony for period ending 30th of September, 1911. UG8-12, Appendix C.
[29] B.P.J. Marchand, 'Labour Colony irrigation settlements', Annex I to the Report of the First Irrigation Congress, CPP G39-1909; T. Hopwood, 'Kakamas Irrigation Settlement', ***SA Irrigation Magazine***, 1, 5 (1922), 239-243.

erfholders petitioned against the harsh administration of the rules and regulations and especially against the insecurity of being refused title to the plots they had themselves created and improved, without which they could not raise loans. They requested the government to take over the Colony and apply the terms of the Land Settlement Act of 1912. A Commission of Enquiry in 1919 reported that officers of the Colony and even the members of the Labour Colonies Commission had been farming on their own account, that the Superintendent had exercised political bias and that the books were in a chaotic state. A new regime was instituted on business lines, with the plots designed for the cultivation of high value lucerne and fruit rather than mealies and wheat; in time a nursery and expert agricultural advice were introduced[30]. In time a progressive system of education, widely adopted as a model, and railway links to markets were achieved. The scheme's achievements were to be cited by the Carnegie Commission on the Poor White Question in 1932[31].

Lani van Vuuren

One of the historic water wheels at Kakamas.

[30] Union of South Africa, Preliminary report of the Kakamas Commission of Enquiry, UG55-1919. The most stringent criticism of church control came from the Chairman, A.M. Conroy, who favoured granting title to diligent erfholders and their representation on the controlling Board as an education in citizenship. In 1945, Conroy, as Minister of Irrigation, himself instituted a fourth Enquiry which established these reforms (UG14-1945).

[31] J.F.W. Grosskopf, R.W. Wilcocks, E.G. Malherbe, W.A. Murray & J.R. Albertyn. ***The poor white problem in South Africa. Report of the Carnegie Commission*** (Stellenbosch, Pro-ecclesia drukkery, 1932).

Lani van Vuuren

A closeup of one of the famous Kakamas water wheels.

THE STRENGTHENING SUPPORT OF THE STATE FOR IRRIGATION

Water rights and the apportionment of water

Until 1848 water cases were heard locally – under the East India Company by ***Landdrosts*** (magistrates) and ***Heemraden*** (councils), then by British-appointed magistrates. Thereafter, water cases went to the Supreme Court[32]. The essential rationalisation of water case law was undertaken by Henry de Villiers, the young Cape-born and English-trained Chief Justice appointed in 1874. The result was said to have been neither Roman nor Roman-Dutch nor English but 'de Villiers's law'[33]. The common law of water rights developed around the problem of access to and use of a scarce resource. Definition was essential, given the uneven hydrology of Cape rivers and the different sources and forms of surface water, in each of which an owner might have a different entitlement. In successive judgements, De Villiers clarified 'public' and

[32] Lewis (***Water Law***, 1933) describes ***Nel v. du Toit*** (1876) (whether a water turn should end at the top or bottom end of a common furrow) as 'a glorious scrap with 30 on each side, ending in the Supreme Court'.
[33] E.A. Walker, ***Lord de Villiers and his Times*** (London: Oxford University Press, 1925)

'private', 'perennial' and 'intermittent' streams and the rights and limits attaching to each[34]. De Villiers emphasised the principle of the reasonable use of a common right to use water. Other judgements established that riparian rights were inherent in land ownership and could not be separated from that land; that 'reasonable allotment' and use of water in a public stream should be proportional; that water for drinking should take precedence over irrigation; that underground water was private property; that perennial streams capable of being applied to the common use of riparian proprietors were public streams; and that rights could be acquired prescriptively, by long use[35]. The effect on a river defined in Roman-Dutch law as 'public', (i.e., with a strong sustained flow) was to give monopoly user rights to the riparian owners of land riparian to it so that it has been said that by the end of the nineteenth century 'the very expression "public river" had become a misnomer'[36].

The elaboration of the riparian system was to cast a long shadow over water law and the irrigation history of South Africa. An alternative to the riparian system of proportional shares and reasonable use would have been the Californian doctrine of 'prior appropriation' (deriving from hydrological mining by water jet) whereby the chronological first owner to develop a stream had the right to divert and use the flow without limit as long as the water was put to beneficial use; later users were granted rights subject to the prior right. A.D. Lewis, Director of Irrigation in South Africa from 1920-1946, argued that priority in time had been a factor in the earliest Cape administrative arbitrations by ***Landdrosts*** and ***Heemraden*** and that J. Bell, turning to international legal authorities, had failed to consult the latest edition of the key work on the subject, with incalculable effects on South African common law regarding water[37].

By 1891 the agricultural census recorded 146 000 morgen under irrigation and 617 boreholes in the Cape, with 60% of the land irrigated from springs or streams. A series of Select Committees were appointed in an attempt to legislate on the right to use water. In 1896, it was reported that only 17 loans had been advanced to private individuals and only one Irrigation Board (the Breede) was firmly established. The slow start was explained in terms of the uncertainty of water rights, especially private water rights, the question of whether long use established a prescriptive right to water, and the rights to the use of flood waters. One solution, it was suggested, would be that all flood waters should be regarded as state property, to be allocated by local boards to satisfy the just rights of proprietors and encourage soil development to the fullest extent. The Committee's recommendation of easier terms on loans for Irrigation Boards was put into effect[38]; the question of rights to flood waters was left unaddressed.

The most powerful advocate of state action came from William Hammond Hall, the first State Engineer of California, who visited the Cape by invitation in 1896-8. This 'irascible visionary', with experience of both riparian rights and prior appropriation in the Sacramento valley, advised that state-built irrigation works should be preceded by research into catchment areas, soils and river flows though he advocated state regulation and strategic direction:

[34] ***Vermaak v. Palmer*** (1876 Buchanan 25), ***Van Heerden v. Wiese*** (1879 Buchanan A.C. 5).
[35] Hall, ***The origin and development of water rights in South Africa***.
[36] J.C. de Wet quoted in J.R.L. Milton, 'The History of Water Law 1652-1912', in Submissions to the Department of Water Affairs and Forestry by the Land and Agriculture Policy Centre Water Law Legal Grouping (1995)
[37] Lewis, ***Water law***; R. Bate and R. Tren, ***The cost of free water: The global problem of water misallocation and the case of South Africa*** (South Africa, Free Market Foundation, 2002). The book in question was the latest (5th) edition of J.K. Angell's ***Treatise on Water Law.***
[38] Act 24 of 1897 reduced the security demanded; loan interest was reduced to 3 1/2% to be repaid over 40 years.

'In my opinion the solution to the irrigation problem is in the solution of the water rights difficulties, and the solution of the water rights troubles is only to be accomplished by a government of streams and water on the part of the state'[39].

In 1898 a colossal and complex Bill was drafted in the light of Hall's advice on the law of water rights, but as Merriman put it, 'it filled up the Gazette and then passed like a phantom out of sight'[40].

Merriman introduced the landmark Act 40 of 1899, based on Gamble's advice. In an attempt to resolve disputes effectively and cheaply it provided for a Water Court where flow needed to be apportioned or rights settled. The Court would consist of the magistrate with two local farmers as assessors. A.D. Lewis later dismissed the Act as merely made by 'scissors and paste-pot from the judgements of the Supreme Court'. It did, however, lead to the promulgation of regulations approved by Parliament and the Judges codifying the precepts of common law to guide the Water Court, including the meaning of 'reasonable use of a public stream'. (The war of 1899 intervened, and the Regulations were approved only in W.L. Gordon's time)[41].

The Cape Departments of Agriculture and Irrigation were reorganised as part of an economic strategy to develop agriculture to replace lost receipts in a post-war diamond slump when the Cape was feared to be facing national bankruptcy. Their efforts were complemented by an irrigation windfall. After 1906 the booming international fashion trade in ostrich feathers stimulated a surge of interest in irrigated lucerne on which ostrich farming depended. On the strength of feathers, fortunes were made and the irrigating dynasties of Oudtshoorn built extravagantly eclectic and asymmetric sandstone 'feather palaces'. Irrigation in the Cape took off.

The use and apportionment of floodwater

Thus far, water rights had generally been defined in relation to abstraction rather than any precise allocation. Heavily silted flood waters presented a problem in both respects. Too much water was as bad as too little, overwhelming diversion weirs, sweeping away small earth dams and breaching even substantial structures like the Rooiberg Dam at Kenhardt (hastily built as a relief work and destroyed in a welter of recrimination between the government engineer and the contractor)[42]. In the Midlands irrigation was as important for livestock farming and the production of pasture and fodder especially after the extraordinarily successful introduction of lucerne in the 1860s[43]. John C. Brown, in his study of the Cape's climate, saw floodwater as 'carrying destruction and devastation with it in its course when it might have been to a great extent retained to clothe the fields with verdure and flowers and fruit'. He believed that alternating cycles of droughts and floods could be minimised over time by correct management and proper use, with irrigation projects and dams preventing water from 'escaping by gravitation or evaporation'. The Karoo farmers managed this by planting Mexican aloe to stabilise soil, reinforce water channels and serve as fodder in the dry times; they also turned flood water on to their veld, though this practice was frowned on by

[39] Beinart, ***The rise of conservation in South Africa***; J. Crawford and J. Herrick, 'Intelligent Engineering: William Hammond Hall and the State Engineering Department', ***Sacramento Historical Journal,*** 6 (2006). 1-4.
[40] Lewis, ***Water law***.
[41] Hall, ***The origin and development of water rights in South Africa***.
[42] CPP Select Committee, A19-1903. The Dam was breached in 1900. (Beinart, ***The rise of conservation in South Africa***)
[43] F.E. Kanthack recorded that lucerne responded to irrigation in the Cape 'to a degree hardly credible'. (Report of the Director of Irrigation 1907, G34-08).

experts and led to a famously influential lawsuit. William Southey regenerated his grazing veld by flooding it from a weir in the Great Brak River. The silt prevented the return of the excess into the river, to the point where his brother Charles, farming below him, sued him in 1905 for holding up the flow rather than using it beneficially and passing on the rest. William's claim that his flooding strengthened fountains lower down was not upheld: the case demonstrated the prevailing uncertainty about the rights to water in intermittent streams as well as deficient hydrological knowledge about runoff, seepage and percolation. The case involved two prominent lawyers, Henry Juta and William Schreiner, and stimulated furious debate. The storage of flood water was under active consideration and becoming legally contentious[44].

In 1905, Gordon and Thomas Smartt (now Minister of Lands and Public Works on the strength of the Syndicate) drew up a Bill designed to clarify and consolidate existing case law and end the trend towards expensive lawsuits over the use of flood water. Its contested passage illustrates the passions that could be aroused by water rights, especially in the largest irrigation areas, namely Oudtshoorn, Worcester and Robertson. The Bill proposed restrictions on the hitherto unlimited use of flood water, provoking outrage from Oudtshoorn, where Edwin Edmeades, President of the Oudtshoorn Farmers' Association, demanded the exemption of proprietors on the Olifants and Grobbelaar rivers on the ground that they were being robbed of their right of sole usage. It brought to a head, old resentments of practical farmers against technocrats and the intrusive bureaucracy of Irrigation Boards and water bailiffs, let alone the recording of riparian rights and the use of permits by unelected River Boards. Only the winelands of Worcester and the Breede Valley supported the measure, where irrigation had enabled the reconstruction of phylloxera-stricken vineyards and the diversification to lucerne and fruit[45]. Irrigation took off quickly after 1906: 4 Irrigation Districts in 1908; 16 in 1911 (mostly due to 'unprecendented activity' in the Robertson and Worcester areas with the recovery of the market for wines and brandy).

Gordon's chosen successor as Cape Director of Irrigation in 1907 was Francis Edgar Kanthack, Assistant Engineer in the Punjabi branch of the Indian Irrigation Department, who ended the era of fixed term appointments by resigning his Indian position and controlling irrigation at the Cape, and then the united South Africa, until 1920 when he resigned to take up private practice in the field of industrial water. Kanthack maintained that the 1906 Act had unintentionally discouraged the essential storage of flood water by making Government loans and advances over £500 conditional on official surveys: most farmers were choosing to avoid red tape by applying for smaller sums. Nevertheless, by 1911, when the ostrich feather boom was at its height, almost 282 000 morgen was recorded as under irrigation, a rising percentage irrigated with flood water from dams. There were 30 Districts in 1912, many launched in the hope of spectacular returns from ostrich feathers. (Kanthack's warning that it would be safer to base valuations on potatoes than feathers was proved when the ostrich industry collapsed in 1913.)

In 1910, Kanthack was appointed as the first Union Director of Irrigation. The storage question, essential to the future of

[44] See also the cases Southey vs Schoombie (1881) and Struben vs Collett (1899). (Lewis, ***Water law.***)
[45] K. Brown, Progressivism, agriculture and conservation in the Cape Colony c. 1902-1908 (PhD thesis, University of Oxford, 2002)

irrigation given South Africa's uneven hydrology, was addressed in his Union-wide Irrigation and Conservation of Waters Act, 8 of 1912 in which Cape and Transvaal experience were the dominant influences.

NLSA

An unnamed dam in the Loxton area.

IRRIGATION IN THE TRANSVAAL

Land speculation and accumulation had reshaped Transvaal rural society in the later 19th century as Afrikaner notables, missionary societies and land exploration companies claimed land and multiplied their (often ill-defined) holdings. Land was used as a currency in lieu of official salaries or in return for burger service (as in the Mapoch's gronden near Middelburg). White land accumulation did not necessarily mean black dispossession: absentee ownership and the inability of the state to enforce effective restrictions on black land purchase meant that large numbers of Africans occupied, cultivated and grazed nominally white lands, sometimes paying high rentals for irrigated land. They also bought land, especially in the Rustenburg area – 387,730 acres (about 157 ha) was recorded in 1904[46]. The scramble for land and the production of food for the goldfields had the effect of impoverishing small-scale Boer farmers; rural white poverty was perceived as problematic in the 1890s when Kruger bought land in the Zoutpansberg for poor whites[47]. In 1894, the ZAR formalised a water law (Law 11) permitting diversion weirs and furrows, including the principle of the reasonable exercise of water rights, the return of excess water to the stream, and customary written agreements between owners. Provision was made for the arbitration of disputes, with recourse to the law courts only with the agreement of both parties. Priority of position was assumed and, as long as upper owners used water reasonably, their liability for damage to lower owners was restricted to narrowly defined instances. In practice, this meant that irrigation opportunities by diversion near the sources of perennial streams were fully utilised, leaving the lower reaches dry in the winters.

General Ben Viljoen considered that Kruger's government had neglected irrigation. In 1895, A. Snethlage, Consul-General for Holland and technical adviser to the ZAR, wrote a memorandum on irrigation practice in the Cape Colony quoting Gamble and advising the ZAR to appoint an agricultural engineer and two supervisors[48]. At the same time, a report recommended subsidised drills to bore for cooperating groups of farmers. The Volksraad debated at length in April 1898 the pros and cons of damming the main rivers, the establishment of irrigation settlements and the alleviation of white poverty by subsidising progressive landlords to employ white irrigating tenants and enabling them to buy pumps at cost. General Hendrik Schoeman constructed a small masonry dam from which to lead water on his farm Hartebeestpoort with government money, and in 1899 promised President Kruger that he would set aside land for a small irrigation settlement for poor whites. The only government works begun before the war of 1899, however, were an earth dam at Wolmaransstad (later found to be faulty) and a similar work to irrigate the town lands of Schweitzer Reineke. In 1899, works undertaken on a tributary of the Harts River near German South West Africa were halted when war was declared.

By 1899, the Cape was looking for ways of developing irrigation on the Orange and the Vaal. Ingenious means of funding water works were proposed: a joint venture with

[46] C. Bundy, ***The rise and fall of the South African peasantry.***
[47] A. Atmore & S. Marks (eds), ***Economy and society in pre-industrial South Africa*** (London, Longman, 1980). See too J. Krikler, ***Revolution from Above, Rebellion from Below: the agrarian Transvaal at the turn of the century*** (Oxford Scholarship Online, 1993)
[48] ZAR 175, Memorandum '***Vrugtbaarmaking van den Grond door Bevloeing of Irrigatie'.***

the Orange Free State for a joint irrigation project near Aliwal North on the Cape/Free State boundary. The question of transboundary riverine rights was opened with the Transvaal government when the township of Mafeking in the Northern Cape complained of water starvation from the Molopo because of excessive leading on the part of upper proprietors in the Transvaal[49]. The correspondence between Merriman and Smuts on the question opened their immensely significant exchange of letters that was later to clear the political way to a united South Africa in 1910.

Milner addressed the water question in 1901 by inviting Sir William Willcocks, who had proposed and built the Aswan low Dam in Egypt, to travel and report on irrigation prospects throughout the sub-continent in 1901. Willcocks found 'immense agricultural wealth which is today buried many thousands of feet below impenetrable strata of unwise and unsuitable legislation'[50]. State irrigation projects should be the nucleus of agricultural settlements; 'all the poor whites in South Africa might be settled for many generations' on three canals from the Orange River at Prieska, Kenhardt and Upington. The Cape had developed its perennial springs but wasted its rivers and had no dedicated irrigation department. Upstream farms had weirs and canals while the lower farmers 'get only brak infiltration of water turned two or three times through the soil, or extraordinary floods.' Willcocks produced a telling hydrological case for uniting the four colonies and states of South Africa: to produce one pound in value agriculture needed on average 30 000 cubic feet of water; for the mines the figure was 40 000 cubic feet. But mineral wealth was finite; 'irrigation, and irrigation alone, can secure permanent wealth to any part of the South African continent.' He drafted a water bill explicitly vesting in the Crown the right to the use of all water at any time. All exclusive interests or rights previously granted or acquired were cancelled, to be replaced by discretionary licenses granted by a Commission[51]. The draft was not used; it was a measure well ahead of its time, fully realised only in 1998.

As a result of Willcocks's observations, two irrigation experts were temporarily seconded from the Indian Irrigation Service: W.L. Strange as Director of Irrigation in the Transvaal in 1903 and W.B. Gordon to the Cape. Eager to develop, Strange found there was little scope in the Transvaal where the perennial streams were fully utilised and he encountered what he called 'the passive opposition of the riparian community' suspicious that hydrographic surveys would mean loss of rights and the nationalisation of water. C.D. Braine of the Agriculture Department was sent to conduct 47 damage limitation meetings throughout the Transvaal (receiving 46 votes of confidence: only Lydenburg refused.) Strange recommended an Irrigation Commission of the Inter-Colonial Council (Transvaal and Orange River Colony) to report on the state of the law regarding flood storage, the best way to safeguard private rights and encourage private enterprise in irrigation, and how the government might best utilise unutilised assets – subterranean water, storm water and undeveloped rivers – for irrigating lands 'whether riparian or non-riparian'[52].

The Commission pronounced that 'nationalisation of the

[49] Merriman to Smuts, 'confidential', 28 February 1899, in Selections from the Smuts papers June 1866 – May 1902 volume I, edited by W.K. Hancock and J. van der Poel, (Cambridge, Cambridge University Press, 1966). A weir had been constructed at the 'eye' of the Molopo in 1898, but investigation after continuing complaints from the Cape side found no illegal diversion by 1910.
[50] W. Willcocks, ***Report on Irrigation in South Africa*** (Johannesburg, 1901).
[51] W. Willcocks's draft is reproduced ***in extenso*** in Lewis, ***Water law***, Appendix 17.
[52] Strange to the Commissioner of Lands, confidential 27 June 1906, CAD BES 313/92.

waters' would retard irrigation for years. It divided the two colonies into hydrographic districts, not based on historic magisterial districts (as in the Cape) but on catchments, each with a Water Board to define and register rights, arbitrate if necessary and control use – a forerunner in concept of the Catchment Management Association. Boring was added later, as the Transvaal's subterranean fractured dolomitic structure was found to be a poor foundation for man-made reservoirs while acting as a natural reservoir supplying many of the perennial rivers. Uncontrolled pumping would run down the aquifers and ruin riparian farms. The Commission recommended a gradual approach to disperse the effect of irrigation, starting with medium-sized works constructed by a combination of private individuals and government aid. In time, however, there would be large works on the Vaal. In the meantime, the Irrigation Department should cooperate informally with the farmers[53]. Strange's approach was later criticised by Kanthack as having concentrated too exclusively on 'the preparation of elaborate and very expensive projects [on the Vaal], all of which were premature'[54].

His successor, F.A. Hurley concentrated on supporting the farmers with a series of bulletins on the design and construction of small reservoirs and small canals, giving details of the alignment of contour canals, siphons and distribution, and advice on minimising silt deposit and water loss[55]. Hurley drafted the Transvaal Water Act 27 of 1908, modelled on the Cape law of 1906 but, as he claimed, a considerable advance with some provisions 'little short of revolutionary' (such as the limit of 10 hp of water-generated power in order to keep the field clear for hydro-electric power for industry)[56]. The Act was passed by the Het Volk government of Louis Botha with surprising ease, attributed by Hurley to 'the progressive spirit which is animating the Transvaal farmer'. It is also clear that both Smuts and Botha supported a policy of agricultural expansion, not least for the relief of white poverty. Smuts wrote to Merriman:

'A million sterling now judiciously spent on small irrigation works all over the country will not only solve some of our pressing problems but lead to a new era in agricultural development and production in future. But we haven't the money'[57].

Applications for assistance with small storage projects built up gradually; by contrast, boring was so popular that it was one of the few areas to avoid cuts in the retrenchment year of 1907-8. Hurley's report for 1909 mentioned a survey of a large project at Hartebeestpoort, previously considered in 1902 as a source of water for Pretoria and Johannesburg, but now identified as a prime site for a future dam across the Crocodile River commanding 30 000 irrigable acres. Five River Boards were in process of formation with the aim of solving questions relating to the storage of surplus water without recourse to the courts. The trend towards replacing pastoral with more intensive agricultural farming for a market (especially after the rinderpest outbreak of 1896) was boosted by a programme of relief for white farmers, tipping the scales decisively against innovating independent African farmers and increasing the demand for farm labour. Despite Smuts's observations, subsidies and grants, credit facilities and tax and transport

[53] Final report of the Inter-Colonial Irrigation Commission, November 1907.
[54] F.E. Kanthack, 'Irrigation in South Africa', ***The South African Geographical Journal***, 5, 1 (1922), 13-24.
[55] Annual Report of the Transvaal Department of Agriculture, 1903-4.
[56] Report of the Chief Engineer of Irrigation, 1906-1908, TG 42-09.
[57] Smuts to Merriman 10 April 1907, in Selections from the Smuts papers Volume 2 June 1902 -May 1910, edited by W.K. Hancock and J. van der Poel (Cambridge, Cambridge University Press, 2007)

reliefs prompted F.B. Smith to comment in 1908 that more money per head of (white) rural population had been spent on (white) farmers in South Africa than in any country in the world.

The Transvaal Water Act was passed in momentous circumstances: the Closer Union of the four self-governing states of South Africa had already been agreed in principle and a National Convention, chaired by the veteran Sir Henry de Villiers, was in the process of convening to negotiate the form it should take and the machinery to bring it into being.

THE 1909 IRRIGATION CONGRESS AT ROBERTSON: THE SOUTH AFRICAN IRRIGATION ASSOCIATION

In recognition of the growing importance of irrigation as a national question that the first Irrigation Congress met at Robertson in May 1909, a week after the final session of the National Convention. It was not political in origin but the outcome of a random suggestion by A.G.H. Teubes of the Breede River Irrigation Board. Delegates from Farmers' Associations and Irrigation Boards in all states gathered at Robertson, their rail fares subsidised; the inaugural address was given by Merriman as Prime Minister of the Cape, personally associated with irrigation in Robertson. In the euphoria the Congress established the first pan-South African body – the Permanent Irrigators Association, for mutual help and guidance. Pioneer Sir Thomas Smartt eulogised irrigation as the way to build up the future Union. Papers were read on irrigation legislation and the state of the common law, on irrigation development in the Cape (by Kanthack) and the Transvaal (by Hurley), on the history of the Breede scheme and the potential of labour colonies and irrigation settlements in the light of Kakamas. Technical subjects such as the relation of water to soils and the management of ***brak*** were covered by scientists[58].

In May 1910, the month of the inauguration of the Union, a second Congress was held at Potchefstroom, site of the historic Potchefstroom canal, a burger settlement scheme and the Transvaal's first Agricultural College. The South African Irrigation Association's motto was 'Conserve water, save the soil', its two objects the promotion of irrigation development and the preservation, conservation and supply of water. In the prevailing spirit of simplicity, there was to be open voting by simple majority at meetings. The occasion was attended by several leading politicians, including Botha, Sauer and Smartt and was used unofficially as an opportunity to canvass the claims of Botha over Merriman to be the Premier of the first Union government. Despite Merriman's standing as an advocate of irrigation, one Congress member reported that 'it soon became clear that heaven and earth would be moved not to have Merriman as a leader or Premier...'[59]

THE UNION DEPARTMENT OF IRRIGATION

Kanthack had been given a ten-year contract by the Cape government in 1908. On leave, he was working on an amendment to the 1906 Irrigation Act when he was

[58] Proceedings of the Irrigation Congress, Robertson 18 May 1909 (National Library, Cape Town).
[59] P. Rabie to Merriman, 5 June 1910 quoted in L.M. Thompson, ***The Unification of South Africa 1902-1910*** (Oxford University Press, 1960).

approached in 1909 to take the position of Director of Irrigation for the Union. His diary thereafter indicates how he worked with Hurley to draft a new Irrigation Act for the country as a whole, working round the various provincial irrigation arrangements. His appointment, with Hurley as Assistant Director, took effect from September 1910. Earlier that year, Kanthack travelled throughout the Union, covering 13 000 miles by train and 1 300 in a cart drawn by 4 mules. His 4-cylinder Napier car, which was said to cover 50 miles in two and three-quarter hours, was much troubled by punctures in the veld and managed fewer than 500 miles. He inspected schemes, labour colonies and settlements, wells and boreholes, pans and dams, 'eyes' and ***wondergate,*** sometimes interviewing Prime Ministers, and occasionally sharing rooms with commercial travellers in dubious hotels [60]. On 1 September he was in Pretoria discussing an irrigation act, conferring on a Union-wide boring policy and identifying potential large irrigation schemes. In the first week of October, he wrote a memorandum for a £10 million irrigation programme together with a land settlement scheme. Acts were passed on both in 1912.

Kanthack's first task was to undertake the reorganisation and establishment of his department, which from early 1911 was an independent entity, linked to Abram Fischer's Department of Lands. The general administration and professional control of all irrigation matters in the Union were now vested in the Director; all irrigation loans were administered in the one department, effecting significant efficiency gains. The country was sectioned into nine circles as the basic units of operation, run by Circle Engineers – T.E. Scaife, R.W. Newman, A.D. Lewis, C.D.H. Braine, I.J.P. Kleyn, M.R. Collins, E.A. Rogers, R.J. Birt and H.G. Holt. They, with their assistants, engaged with the practical irrigators, explaining loans and advising farmers, Boards and Water Courts and sometimes undertaking special investigations. Other sections (funded by annual vote) covered general reconnaissance and hydrographic survey, a meterological branch from 1911, and the construction and operation of government works (funded by borrowing). Recruitment was 'almost impossible': a chronic shortage of experienced engineers in the country drove Kanthack to incur criticism by poaching civil engineers in private practice on municipal work. He kept his regular ('and perhaps pensionable') establishment small, stable and professional, building up and retaining key staff in a close-knit core group and working with temporary surveyors. He insisted on the Transvaal practice of guaranteeing his engineers security and stability rather than the Cape's terms making the profession 'the refuge of the destitute'. This shrewd management tactic ensured that irrigation was developed by a loyal group of professionals, motivated by the general optimism engendered by the Union.

THE IRRIGATION AND CONSERVATION OF WATERS ACT

The stated purpose of Kanthack's Act 8 of 1912 was to utilise as much flood water as possible. The difficulty was to produce a single measure to fit the diversity of water conditions across the country and the various forms of irrigation used as

[60] This account is based on the diaries of F.E. Kanthack in the University Archive of the University of the Witwatersrand, Johannesburg.

well as differing provincial practices and the jungle of water rights that had evolved. At Union in May 1910 there were 15 Irrigation and River Boards in the Cape; by December 1911 ten more co-operative schemes had been stimulated into 'unprecedented activity', encouraged by the Department's enthusiasm and the lure of ostrich fortunes. Kanthack believed that Irrigation Districts and the facilities for borrowing money had advanced irrigation in the Cape, and that the best schemes grew from professional advice[61]. Reconnaissance surveys generated applications for large cooperative schemes like the Breede Valley which had led directly to the Robertson project. The Cape system had been 'an unqualified success': since 1906 there had been no losses from irrigation loans and there were no outstanding sums to be paid – a contrast to the Transvaal, where the 1908 Act had proved unworkable, and Natal, where Act 26 of 1891 introducing irrigation loans produced no practical result. On the other hand, the Transvaal experience suggested the importance of boring on Crown lands: no farms should be offered for sale until water had been found.

In March 1911 the Irrigation Bill was introduced as one of the first bills in the new Parliament; irrigation was assumed to be relatively uncontroversial. As Minister of Lands Fischer had received many complaints about the ambiguity and obscurity of the Act of 1906. Kanthack was determined to keep the new Act simple, describing its aims in his annual report for 1912: to preserve the rights of riparian owners; to distribute water in a 'public' stream equitably [62]; and to conserve and use that portion of the flow that had hitherto run to waste (now defined as 'surplus' water). The Act greatly extended the definition of public water to the point where nearly all rivers (including those previously designated as intermittent) now became public, with consequences for riparian rights. In defining the various categories of use of water irrigation was explicitly privileged.

Two principles were emphasised. (1) The distinction of normal and surplus flow in public streams. Normal flow was water that could be directly abstracted from a public river for irrigation by diversion or pumping and to which all riparians had the right of 'reasonable use'. All other water in a public stream was 'surplus' to which the Act now allowed riparians freedom of use for irrigation or household purposes by diversion and by storage. (2) Protection. If people had the opportunity and the enterprise to build storage works for surplus water, they were to be protected from subsequent works above them. Kanthack explained that this principle had been under consideration before and that the Act 'merely provided the machinery' giving effect to earlier ideas[63]. By the terms of the protection provisions (Sections 15 and 16 of the Act) a riparian could protect his existing or proposed works using surplus water by applying to the Water Court to notify his intention and call for anyone proposing to construct similar works in the next five years to declare them, on payment of a surety to discourage spurious claims. The Court would then determine the size of the works and share the water proportionately between them; thereafter, no other works would be permitted. In effect, instead of flowing to the sea the surplus water would be divided between all those

[61] Report of the Director of Irrigation to 31 December 1911, UG 39-12.
[62] Now defined as 'visibly flowing for the greater part of the year, partly deriving from springs, seepage, melting snows, steady drainage from swamps, in known defined channels and sufficient for common use ***for irrigation*** without the aid of storage"The 1906 Act had referred to the general common use of all riparian proprietors.
[63] As for example at Brandvlei where the works of the Zak River Estates Co. had taken water from the earlier state works below; the state had twice taken the Company to court to assure the future of the Nelskop and Brandvlei settlements and establish a basis for ***saaidam*** irrigation operations throughout the country.

wishing and entitled to store it, after the future intentions of all riparian owners with respect to storage had been declared.

While imposing central control the Act acknowledged the diversity of South African water conditions by including elements from each of the pre-Union states: restricted access to proclaimed areas of subterranean dolomitic water (as in the Transvaal Act); 22 Water Court Districts drawn on hydrographic lines (from Orange Free State practice); the Cape model of Irrigation Districts with elected Boards with power to purchase, construct and maintain irrigation and drainage works, ensure equitable distribution, levy rates on irrigable land and borrow on the security of the rates.

Kanthack consulted widely on the Bill. The Irrigation Association meeting in Bloemfontein in November 1911 discussed the definition of normal flow and went through the Bill clause by clause with suggestions and amendments, deploring its 'utterly miserable' translation and suggesting the use of household Afrikaans expressions for the technicalities rather than obscure Dutch terms 'unknown in the country'. The Transvaal Agricultural Union complained that some riparian rights were breached by the statutory powers of the Rand Water Board and the Pretoria Municipality[64]. The right of passage of water was introduced to the Orange Free State for the first time by the Act; Kanthack was careful to explain to the Editor of the Bloemfontein ***Friend*** that riparian ownership gave the rights of reasonable use only to public streams 'and the Free State riparian owner has no more right of property in the water than has his brother riparian owners in the Cape or Transvaal.'[65] The Administrator of the Cape, Sir Frederic de Waal, complained that in some respects the Bill would 'have the effect of abrogating the legitimate functions of the Provincial Government'. Kanthack drafted a lengthy reply:[66]

'So far as the general Water Law of any country is concerned, a Municipality is merely a user of water of a public stream to which the land owned by the Municipality is riparian, and as such has no more rights and privileges under any ordinary circumstances than any other riparian owner. ... You appear to overlook the fact that the Union Irrigation Department is intended to be the highest authority available in the State on matters regarding all problems connected with hydraulic engineering and that ... Provincial Governments should certainly be in a position, when necessary, to have the benefit of a highly specialised technical department attached to the central Government.'

(In the Act, municipal water was classed as a provincial responsibility.)

Carl Jeppe, an experienced Water Court judge, commended the Act for adding status to Water Courts while making them more accessible, less costly and (theoretically) less formal. It established permanent water court districts, appointed permanent water court judges and (as Gamble had originally recommended) stipulated that one of two assessors on the Court should be an engineer. The Courts would now deal with many administrative functions, including the protection of catchment areas and the control of surplus water. They would undertake site visits and employ local inspectors at different seasons, sitting with technical and local assessors. This, it was thought, would bring long-wanted certainty to riparian owners. Prior to the Act, the upper riparians took what water they could, leaving the lower owners to take the remainder, with practically no remedy since the statutes were unsatisfactory and the status of the Water Courts inferior. Now, according to Jeppe, each riparian owner could apply for an exact determination of the water due to him – a laborious process, especially in rivers without constant flow[67].

[64] Kanthack replied, with the Minister's endorsement, that since the premise of the Bill was that existing rights should not be prejudiced, it would be 'quite out of place, even if it were desirable' to curtail the vested interests of the Rand Water Board and the Pretoria Municipality. Kanthack to the Secretary, Transvaal Agricultural Union, 28 February 1912. ***loc.cit.***

[65] Kanthack's draft of the letter sent unofficially by Fischer to the Editor of ***The Friend***, 13 November 1911, ***loc.cit***.

[66] See de Waal to Abram Fischer, Minister of Lands 3 November 1911 (objecting to Sections 2,3,6,21,25,43,77,78,126 and 131 of the Draft Irrigation Bill) and, in reply, Minister of Lands to the Administrator, Cape Province, 10 November 1911, CDA BES 1391, file 3148 Vol. I.

The application of the Irrigation Act to the Transkei

An interesting aspect concerned the Act's applicability to the Transkei, which had been annexed piecemeal to the Cape in the 1870s and administered under a Chief Magistrate by a distinctive version of local councils, committees and boards. Letters exchanged in 1911 suggest that Kanthack intended his new Act to apply universally:[68]

'It has appeared to me obvious for a long time past that so far as water rights are concerned there can be no justification for excluding the provisions of the Consolidated Irrigation Act from the Native Territories.'

J.W. Sauer, Minister for Native Affairs, referred the Draft Act to Walter Stanford, the Chief Magistrate. Kanthack thought primarily in terms of water rights; Stanford's first instinct was good governance. He inclined to the negative, considering that 'it may be a quarter of a century before irrigation here becomes general' while making exceptions for districts where African-owned farms were 'so intermixed with European areas that the Irrigation Act could not well apply to one and not the other'[69]. He was careful, however, to reserve the communal rights to all unsurveyed and untitled land and the rights of dwellers on the Commonage to use water flowing there. He warned that if Water Courts and other Boards were constituted, 'traders would with rare exceptions be the only qualified persons under the Bill' and that their interference in controlling water or rates would be keenly resented. It was agreed that only certain Sections of the Act[70] should operate in the territories, with others to be extended by later proclamation as necessary.

The Act in operation

In the Union beyond the Cape irrigation loans began in 1913. In that year, 3 Irrigation Boards were started; there were 5 in 1917-18 and 26 by 1922-3. By then the Cape had 72.

The events surrounding World War I presented a 'remarkable and extraordinarily trying' period for the department. Hertzog split from the government on the war issue, some Afrikaners in areas of severe rural poverty (including the vicinity of the relief settlements at Koppies and Kakamas) rebelled, and Kanthack joined Botha and Smuts campaigning in the German colonies of South-West and East Africa. Irrigation development came to a halt and detailed survey work stopped, though general reconnaissance continued. In the Cape three years of drought from 1914-16, followed by floods in 1917, caused irrigation havoc.

In 1916 the government resumed an active irrigation policy: drought and flood had prompted urgent demands in the Cape for water conservation; the rebellion was probably responsible for the priority given by the Ministry of Lands to development of Crown lands in the lower Orange River Valley. The Irrigation Act of 1912 was amended to define the powers of the Water Court and to simplify the protection procedures to encourage conservation. Kanthack was concerned that storage projects would imply large loans to Irrigation Boards, already borrowing extensively under easier terms because of the drought, and as early as 1915 finding difficulty in making the repayments. By 1917-18 the departmental report observed 'there is something exceedingly haphazard about this method of financing a great scheme of progressive development'[71]. The next decades justified the doubts, making irrigation finance a central question and perpetuating the debate about the role of the state.

[67] Jeppe to Theron, confidential, 18 December 1913, CDA BES 1391 file 3148.
[68] Edward Dower to the Minister of Native Affairs, 10 October 1911, and Kanthack to the Acting Secretary for Native Affairs, 10 March 1911.
[69] Such as Elliot, Maclear, Matatiele, Mount Currie and Umzimkulu (Walter Stanford to the Secretary for Native Affairs, 26 September 1911)
[70] Sections 1,2,4,7 and 9.
[71] Report of the Director of Irrigation, 1 April 1913 to 31 March 1917 (UG 19-18); see too Report on various irrigation projects, UG 29-17.


03

CHAPTER 3

GREAT EXPECTATIONS, HARD TIMES (1912 – 1932)

Deborah Lavin and Lani van Vuuren

The unification of South Africa in 1910 brought together the Cape and Natal colonies and the Transvaal and Orange Free State republics. The Irrigation and Land Settlement Acts of 1912 made provision for essential water storage to stabilise rainfall and river flows and utilise the national water resources. Storage extended irrigation into the summer rainfall regions to supplement seasonal water shortages and enabled the production of new crops – wheat, cotton, and fruits. Storage also implied irrigation settlement. Such development accelerated the dispossession of African rural communities. Improved post-war markets for staple crops encouraged the belief that Irrigation Boards would produce enough to bear the redemption and interest costs. But the technical difficulties and construction costs were unexpectedly high and the returns disappointing; irrigators were unable to pay mortgages and water rates. The state eased its terms, but an Irrigation Finance Commission reported in 1925 that less than half the area of irrigated land was cultivated, settled or under active development. A permanent Irrigation Commission was appointed to redress the problems of each Board and to coordinate the variety of departments and disciplines involved. Incrementally, through dealing with the individual Boards, the State institutionalised expertise in technical advice, marketing and training irrigation settlers. In the crisis of rural survival precipitated by depression and drought after 1929 long-planned State irrigation schemes were hastily built and settled to mitigate White unemployment and impoverishment.

The Union Irrigation Department under the leadership of F.E. Kanthack and A.H. Hurley combined the Cape pattern of development through Irrigation Boards, with the Transvaal emphasis on detailed reconnaissance and the collection of hydrological data in anticipation of major storage projects like Hartbeespoort, Christiana and Loskop. In 1911, a Senate Select Committee investigated closer settlement, reporting that most of the unalienated Crown (State) land was either arid, mountainous or malarial.

It recommended an annual vote to acquire land for settlement, increasing the white rural population and promoting agricultural productivity[1]. The Land Settlement Act allocated a million pounds to be spent equally on dry and irrigation schemes for settlers carrying out beneficial occupation and improvements, with regional Land Boards conducting the purchase and division of land.

State irrigation settlements had held out the prospect of solutions to a range of political and social problems. Generations of politicians used them to reward war veterans (from the Mapoch's Gronden by the Zuid-Afrikaansche Republiek (ZAR) after the defeat of the Pedi, to the Middelburg Settlement after 1902 and Vaalharts and Loskop in 1945). They were seen as an answer to poverty and a means of re-establishing the landless (more than 1000 Transvaal families after the Peace of Vereeniging in 1902 in the Burgher Land Settlements of Potchefstroom and Standerton); after 1908 Koppies was built by the Orangia Unie and Douglas by the Cape government in 1909. In 1903, Milner had introduced a new element with the purchase of 11 farms from the Thabina Farmers Association on the Letaba and Magoebas rivers for the Tzaneen Settlement, to settle and train selected men in semi-tropical agriculture as an energising nucleus of agricultural pioneers to develop the country. The two tendencies – remedial and progressive – presented a choice to the Botha government in 1913-14, whether to develop Hartbeespoort or Loskop. Loskop had been reconnoitred by the Transvaal Irrigation Department in 1904 but considered too expensive to develop. In 1913, the Beaumont Commission was persuaded to zone the area for white farming as the future 'granary of the Transvaal'. Hartbeespoort had been proposed to Kruger as a poor white settlement scheme by General Schoeman who built the original dam. A version of this programme was chosen by Smuts as a way of returning the white urban poor of the Reef to the land[2].

In March 1914 the Legislative Assembly passed a special Act authorising the construction of the Hartbeespoort Dam; in the same year it voted for a survey of all the main rivers of the country. This tide of opinion for which Kanthack had worked coincided with the turbulent events of South Africa's entry into World War I and the subsequent rebellion in the poorest parts of the country. During the war Kanthack and many of his staff were occupied in prospecting and providing water for Botha's South-West African campaign. The Department's Hydrographic Section was retrenched in 1916 – the year in which loans recommenced and the Union government reiterated its commitment to irrigation expansion.

HARTBEESPOORT

A project of 15 000 morgen, much larger than Schoeman's original, was planned for Hartbeespoort. Both land and settlement were problematic and disrupted by the war. Part of the area earmarked for the irrigation settlement belonged to the Hermannsberg Mission where a number of Bakwena owners, wishing to be independent of the Mission, agreed to give up farms to the government in exchange for a larger area of Crown land 'at least equal in quality'. This would require special authorisation under the 1913 Land Act[3]. The

[1] Select Committee on Public Accounts, SC6 1910-11.
[2] R. Morrell, ***White but poor: Essays on the history of poor whites in Southern Africa 1880 – 1940*** (Pretoria: University of South Africa, 1992)
[3] H. Cochet, W. Anseeuw, S. Fréguin-Gresh, ***South Africa's agrarian question*** (Cape Town, HSRC Press, 2015)

Hartbeespoort Act was designed in part to accelerate the development by removing the need for multiple applications to the water court for land and rights, and also to validate an agreement with Chiefs Mamogale and Mogale of the Bakwena and Bapo for an exchange of 14 683 morgen of irrigable land for 16 152 morgen of Crown land[4].

Obtaining land for State schemes was often difficult. Many farms were subdivided and held in multiple ownership: in the case of Hartbeespoort negotiations between the Land Board, the Department of Lands and the Superintendent of Native Affairs dragged on for years[5]. The price of land went up when the government was known to be in the market.

It was said that private riparian owners used the disruption of war in 1914 to claim a greater share of the normal flow of the Crocodile River, and Kanthack accused non-riparian owners of undertaking improvements 'with feverish haste' to increase the value of their properties in anticipation of profitable sales[6]. In 1919 the government decided to employ only white labour, allocating temporary plots to the workers on the land earmarked for the reservoir basin and giving them time to work their plots in the hope that they would progress from 'mere labourers' to 'useful agriculturalists'. The workers disliked the conditions and left for Johannesburg in droves; the scheme was completed by black labour to whom no plots were offered.

Hartbeespoort Dam was constructed between 1921 and 1925. The construction site employed up to 3 500 labourers.

[4] CAD LDE 857 17976/19, LDE 865 17976/36 and /43. The farms concerned were Mamagalieskraal, Krokodilskraal, Losperfontein, Wolvekraal and Kareespoort East and West.
[5] Report of the Director of Irrigation 1913-17 UG 19-1918; Report on various irrigation projects provided for in loan estimates for the year ending 31 March 1918, UG 29-1918. See too CAD LDE 867 17976/43 and Hartebeestpoort Land Board Minutes, CAD LDE 857 17976/19 iii.
[6] For example, the farm Sanddrift, offered to the Transvaal government for £6500 in 1909, was offered again in 1923 for £25 000 on one day and £29 332 sixteen days later when the decision to extend the government canal had been announced.

Felix Lipov/123RF

The Hartbeespoort Dam wall sports an unusual feature, namely a miniature Arc de Triomphe. There are two inscriptions on the arch. The inscription on the eastern side reads Dedi in deserto aquas, flumina in invio *which means 'I give waters in the wilderness and rivers in the desert (Isaiah 43:20). The inscription on the western side reads* Sine aqua arida ac misera agri cultura *which means 'Without water it is arid and miserable in agriculture.'*

Ava Peattie/123RF

The Hartbeespoort Dam wall was raised in 1964 through the addition of ten 2,74 m radial crest sluices on the spillway.

From 1916, settlement at Hartbeespoort was controlled by the Department of Lands, with one-third of the area reserved for indigents. The land was ready ploughed, cleared and levelled before the settlers arrived, and an experimental station was established to guide the probationers and study the soil and climatic conditions. The ensuing problems derived from strains within the 'Pact' government, an uneasy coalition of the rural-based National Party and the more urban Labour Party after 1924[7]. On the left bank of the Crocodile River the newly created Department of Labour transformed the Losperfontein Closer Settlement into a training farm, introducing highly centralised and state-directed settlement for reform and rehabilitation, with an intrusive regime aimed at reforming their attitudes and behaviour. Discipline was strict: there was no freedom of movement; liquor was banned; an ***oproep*** (call up) system instituted compulsory labour. Objectors were met with increased surveillance and removal.

The Lands Department disputed the Labour Department practice of 'drawing [indigents] from the rural environment and [placing] them under artificial village conditions, regardless of the enormous difficulties which beset land settlement on intensive lines'. Their preferred model was Vyfhoek (Potchefstroom), where the original indigent settlers had been weeded out, to be succeeded by applicants with a little capital and whose modern ideas promoted improvement more effectively by example than did official advice and exhortation. In 1927, Graham Cross, Under-Secretary for Lands, disputed a proposal from the Department of Labour which he said amounted to 'a request to be allowed to train so-called poor whites with a view to their being placed on closer settlements'. The Smuts government had discontinued the purchase of land for such settlements; the Closer Settlement Account had written off £347 000 to date, the most difficult being the irrigation settlements owing to insufficient knowledge of the duty of water. Irrigation engineers with no knowledge of crops, soil or climate tended to over-estimate the possibilities of supply; lessees wasted what water there was. By contrast, the approach of Lands (endorsed by Minister Grobler) was to assist deserving ***bywoners*** (a poor tenant farmer) and the sons of small farmers to acquire land for themselves[8]:

'This department, owing to having insufficient funds, is only able to meet the needs of about one-third of such applicants. I submit that it would be a grave injustice to this class of citizen to compel this department to devote a large proportion of its activities to finding land for the relief work section of the population.'

In 1930, the Lands Department took over the Labour Department's Hartbeespoort enterprise, establishing self-sustaining family units on plots of 8.5 ha, planted, fenced, with a house and sheds designed to enable the probationer to earn, and the government to obtain, a return in the shortest possible time, the produce divided 60:40 between settler and state. A certificated probationer might choose to stay on the holding on which he had been trained. It was, however, discovered in 1930 that hail, waterlogged ground and low tobacco prices meant that lessees were unable to meet their liabilities unless the value of holdings was written down.

[7] T.P. Clynick, Afrikaner political mobilisation in the Western Transvaal: popular consciousness and the state, 1920-30 (D Phil thesis, Queen's University, 1996). See too A.S. du Plessis, Die Hartebeestpoort dam scheme, 1914-52 (MA thesis, Rand Afrikaans University, 1989).
[8] Graham Cross to P.G. Grobler, 8 October 1927; Memo to Members of the Cabinet by the Minister of Lands, 18 October 1927, CAD GG 943 17/1127.

In 1931, Losperfontein was transferred to the Agriculture Department as a training institution for learner settlers under the Division of Economics and Marketing. But the prolonged drought caused the dam to fail, necessitating relief measures throughout the scheme.

Settlement might take the form of inland colonisation or the encouragement of immigrants, in which South Africa had a disappointing record compared with other dominions. The Smartt Syndicate had planned for 100 British settlers; by 1921 only 13 had taken up residence and were on the verge of starvation; by 1930 they had been replaced by Afrikaner farmers. At the Sunday's River, Sir Percy Fitzpatrick had attempted to break the cycle where 'the small settler cannot, by himself, get hold of a small area and the large landowner will not break up his farm because he has not the funds necessary for development'[9]. He proposed an innovative but volatile funding combination for the scheme – small shareholder settlers and large corporations as bond and debenture holders, with the heavy initial costs of land preparation to be funded by cash from land sales and debenture capital. When the Standard Bank refused further credit in 1917 the whole enterprise depended on settler recruitment. Fitzpatrick found the attitude of the Smuts government ambivalent on this subject, 'expressed by four or five different departments or Ministers, no one having a common purpose or a common principle'. Having failed to recruit South Africans through the mining companies and the unions, Fitzpatrick turned to post-war Britain, spending a year in London attempting to recruit British ex-service men and women in the face of adverse publicity generated by high land prices and the misleading optimism of companies like Schlesinger's African Realty Trust. Kanthack intervened officially to improve the image of South African settlement[10].

BLACK IRRIGATION LAND

Where black land lay in the path of white irrigation settlement, Hartbeespoort set a precedent for the negotiated removal of black communities to what was said to be equivalent land elsewhere. On the Olifants and the lower reaches of the Doorn and Hol rivers in the Western Cape, Kanthack planned (on the basis of very uncertain data) a scheme that he thought would be too expensive for poor whites but suitable for closer settlement by an Irrigation Board. He judged an existing Dutch Reformed Church mission at Ebenezer (today known as Ebenhaeser) and a 'Hottentot Native Reserve' as 'quite unfit to become partners in a high-class scheme of this kind'[11]. A District was proclaimed in 1911 (including the mission and Reserve) for a loan of £155 000 for works to irrigate 6 615 morgen. In 1913-14 more detailed surveys revealed that the most valuable land had been omitted from the original scheme. The government purchased a large area at the lower end for a settlement involving a changed distribution system, estimated to cost £505 000 to irrigate 14 174 morgen. Ebenezer and the Reserve were now excluded from the Irrigation District; in return the Board agreed to levy a fixed annual sum from its members. The agreement was embodied in Acts of Parliament in 1917 and 1925 (relating to the Ebenezer exchange).

[9] FitzPatrick to Sir A. Hennessy, strictly private and confidential, 25 November 1913. FitzPatrick Papers A/LC III.
[10] See the files in CAD LDE 20593 (III) Box 1082 for copious correspondence on this topic.
[11] F.E. Kanthack, Report on the proposed irrigation project in Clanwilliam and Van Rhynsdorp Districts, 1909, CPP G52-1909.

EBENHAESER LAND RESTITUTION

Lani van Vuuren

The 140 000 m³ Ebenhaeser balancing dam, which was completed in 2003, to stabilise water supply to the area. The canal system is managed by the Lower Olifants Water User Association.

Located about 20 km from Doring Bay on the West Coast of South Africa, Ebenhaeser, a predominantly Khoe Khoe community, grew from an indigenous settlement into a mission colony in the mid-1800s run by the Rhenish Mission Society[12]. In 1890, governance of the mission was transferred to the Dutch Reformed Church. The community historically relied heavily on the Olifants River, with fishing and flood irrigation being the predominant economic activities.

In 1926, a land exchange agreement was finalised between the Dutch Reformed Church at Ebenhaeser and the Union government to make way for the Olifants River Government Water Works, which included the construction of the Clanwilliam Dam. Ebenhaeser was to benefit from water supplied by the new scheme initially only for irrigation but later also for domestic purposes. The community was effectively moved south-west of the original station, losing a great deal of fertile soil and river water access in the process[13]. The displacement of the Ebenhaeser community effectively placed them at the tail-end of the Olifants River irrigation scheme, and throughout the years supply to the community has been subject to extreme variation as a result of evaporation and leaks from the open canals, leading to conflict between the community and the canal operators, which after 1994 became the Lower Olifants Water User Association[14].

825 media/123RF

The Clanwilliam Dam was completed as a concrete gravity dam in 1935. The dam was raised to its current height of 43 m in 1964.

In 2020, a settlement agreement was finally reached in the Ebenhaeser community's land restitution application dating back to 1996. The community originally claimed a total of 23 700 ha, including some 677.4 ha agricultural properties, which was later removed during the mediation process. As reported by J. Yeld for Groundup, "the agreement confirmed the restitution of most of the land lost by the Ebenhauser community in 1926 and included substantial government funding to help the community manage the restored farms"[15]. A total of 1 720 community members have benefited from the agreement.

[12] I. Brink, Resilience and adaptability of rural communities. A case study of Ebenhaeser (MA thesis, University of the Free State, 2014).
[13] Brink, Resilience and adaptability.
[14] W.J. de Lange & N. Faysse, 'Accommodating historic disadvantaged individuals in water resource management: A case study in the Lower Olifants Water User Association', ***Elsenburg Journal***, 3 (2005), 7-12.
[15] J. Yeld, 'Ebenhaeser community's claim finally settled in mediated negotiations during lockdown', Groundup, https://www.groundup.org.za/article/almost-century-later-land-claimants-get-thousands-hectares-farm-land-back-and-big-vineyards/. Last accessed on 39 June 2022.

There were accusations of insufficient water and inadequate furrows, and counter-accusations of non-payment of rates, until the construction of the Clanwilliam Dam, 1932-35.

Such examples showed that black irrigators would not be allowed to stand in the way of white irrigation interests. Dispossession sometimes took the form of relocation, but there were many variables. On the Transvaal Highveld, rinderpest and anthrax caused a shift from cattle farming to arable production. Here, dislodged African cultivators were often drawn into free labour tenancies by farmers unable to pay cash wages[16]. The 1913 Land Act provided for additional land to be identified for inclusion in the Reserves. In 1918, the Stubbs Committee of the Beaumont Commission[17] reported relatively few potential areas of closer settlement under irrigation in the Transvaal[18]. The Committee arrived at what it called the 'unfortunate but unavoidable' conclusion that land capable of comprehensive irrigation schemes should generally be included in the non-native area, claiming that 'such opportunities as are left to [black people] are sufficient to afford them reasonable scope for many years to come'. Yet the evidence to Stubbs showed black land purchasers clubbing together to outbid whites for farms; successful black irrigators farming commercially; and the perennial complaint that black farmers who had developed their land for irrigation were evicted by whites[19]. The Magistrate and Native Commissioner at Lydenburg described irrigation in Sekhukhuneland 'carried out in small pockets in the kloofs and along the rivers wherever it is possible to irrigate' and valued Aapiesdoringdraai, belonging to Chief Manok, as high as £13-£15 a morgen. Daniel Liebenberg (later the Controller of Settlements) observed that 'there are many white people who could find something to learn in water-leading from some of the natives in the Rustenberg District'[20].

THE SCRAMBLE FOR TEN BOSCH

The complex competition for good, watered land is illustrated by the case of the farm Ten Bosch 234 in the Transvaal lowveld, favourably situated close to a strong river and the Witwatersrand/Mozambique railway in an area controlled from the mid-nineteenth century by the Ngomane people. Malaria and cattle disease postponed the colonisation of this area. It was scheduled for black occupation by both Beaumont and Stubbs, but its position and potential appealed to many different interests. In 1926, the State reversed the scheduling in order to exchange the land for 300 000 acres owned by the Transvaal Consolidated Land Company in the Kruger Park. A scramble for Ten Bosch ensued. The company wanted a white settlement, with the Ngomane paying rent and tenancy fees in the meantime; the Department of Lands to develop towards its quota of close social settlement; a mining company for a labour reserve; the Lowveld Farmers Association for private white irrigation; an engineering entrepreneur for a large-scale commercial irrigation scheme; the Department of Native Affairs to remove the administrative anomaly of a 'black spot' in a white area. In 1944, the Native Trust bought the land, then sold it to the Department of Lands for white settlement. The Ngomane, subjected to ever-changing terms and associated labour obligations, were able to resist their complete removal until 1954, the victims of a process described as the 'extra-legal conquest of the countryside'[21].

[16] R. Morrell, 'Competition and Cooperation in Middelburg, 1900-1930' in ***Putting a plough to the ground: Accumulation and Dispossession in rural South Africa 1850-1930,*** eds W. Beinart, P. Delius and S. Trapido, (Ravan Press, 1986). See too S. Trapido, 'Landlord and tenant in a colonial economy, the Transvaal 1880–1910', ***Journal of Southern African Studies***, 5, 1 (1978), 26-58.

[17] South African Natives Land Committee, Eastern Transvaal Natives Law Committee and Minutes of Evidence UG 31-1918 and 32-1918.

[18] Mpefu's Location and the Olifants River, the Steelpoort River and Zebediela.

[19] See too Evidence pp. 20-21 of evictions from Beaumont, Schoonoordt, Eerste Geluk and Nooitverwacht as well as Boomplaats.

[20] Evidence, p. 124.

[21] C. Mather, 'Forced removal and the struggle for land and labour in South Africa: the Ngomane of Tenbosch, 1926-54', ***Journal of Historical Geography*** 21, 2 (1995), 169-183.

NATIONAL VERSUS LOCAL IRRIGATION DEVELOPMENT

By 1919 an improved market for staple crops released a pent-up irrigation rush: applications from Boards and private owners to the value of four million pounds had been received by the department[22]. In 1920, Deneys Reitz, Minister of Lands and irrigation enthusiast, chaired the Select Committee on Irrigation Projects posing the question: should a really large scheme be developed on either the Orange or the Vaal? According to Alfred Dale Lewis (Director of the Department of Irrigation between 1921 and 1941) there was only one possibility for large-scale storage on the Orange; on the Vaal two were mentioned – Parys and Christiana. The soils of the Vaal were generally poor; if Parys were chosen the water would be diverted to better, though non-riparian, land in the Renoster Valley. Van der Kloof would cost twice as much as Parys and might prove too expensive, in which case Christiana would be needed for supplementary storage. Kanthack's evidence balanced the national perspective of irrigation development with the need to reward local initiative, while at the same time ensuring that 'the eventual settler who gets on the land is not overburdened with high capital cost'. Kanthack judged the Fish River as the best option in commercial terms, though from a national point of view he thought it would be more important to invest in the Transvaal at Loskop. As Director, his policy had been to spread experience of irrigation as widely as possible by small Irrigation Board schemes until really large-scale storage became practicable: in 1920 he predicted this would take another ten years[23].

THE DROUGHT COMMISSION (1920-23)

The recurrent droughts of this period prompted concern about climate change[24]. Public imagination was stirred by theories such as Prof Ernest Schwartz's 'Kalahari Scheme' to alter the climate by recreating the Kalahari lakes with dams on the Kunene and the Zambezi rivers, transferring the water to the Molopo and Orange so that 'everyone in South Africa, whether he wants it or no, will receive additional rain ... and all his difficulties from drought, famine and pestilence disappear'[25]. Others, like Prof W.M. Macmillan, were sceptical: even with conservation the drought had made much of the Karoo irrigation useless. 'It is hard to see how as the first plank in a national policy we can hope to set out on a large scale to change the nature of the illimitable veld'. He argued that attention should first be given to areas with rainfall capable of supporting a reasonably dense population, such as the Cape coastal belt and parts of the Transvaal[26].

A specialist Drought Commission was chaired by H.S. du Toit who took an informed interest in the propagation of water conservation techniques he had seen on American dryland farms. The Commission reported in 1923 that South Africa was not drying up; nor was it possible 'to turn the whole of the Union into a flourishing garden by irrigation'. Run-off into the rivers was diminished by veld mismanagement causing evaporation and river silting. The essential was not to accelerate irrigation development but to preserve the catchments[27]. Indignant reaction came from ***The South African Irrigation Magazine***, produced from the Department

[22] Report of the Permanent Irrigation Commission for 1928-9, UG 28-1920.
[23] Reports on various irrigation projects provided for in loan estimates for the year ending 31 March 1918, UG 29-1917, and Appendix: Orange River Islands Project. See too Kanthack's evidence to the Select Committee on Irrigation Projects, 1920, SC15-20.
[24] Beinart, ***The rise of conservation in South Africa***. See too the Senate Select Committee (1911 and articles in the ***South African Agricultural Journal*** (1914) vol 7, 5 and the ***South African Journal of Science*** vols 15 (1915), 20 (1920) and 23 (1926).
[25] E.H.L. Schwarz, ***The Kalahari or Thirstland redemption*** (Cape Town: T.M. Miller, 1920)
[26] W.M. Macmillan, ***The South African agrarian problem and its historical development*** (Johannesburg: Witwatersrand Council of Education, 1919)
[27] Final Report of the Drought Investigation Commission, UG 49-1923.

by C.O. Linscott from 1921-24 to inform and give a voice to the irrigating community when the annual Congresses of the Irrigation Association were interrupted by the First Word War. The magazine accused the Drought Commission of downplaying the role of irrigation and belittling the Department's keynote activity of providing water storage and protecting catchments. The slogan, it suggested, should rather have been 'DAM, DAM, DAM AND THEN SOME MORE DAMS'[28].

PRIVATE AND SELF-HELP INITIATIVES

The Olifants River Valley (Transvaal)

Before the twentieth century the area of the present Loskop and Arabie/Flag Boshielo Dams was malarial and subject to rinderpest, owned mostly by mineral companies or absentees and farmed by African tenants and sharecroppers. The potential of the valley for irrigated farming and the site of the Loskop Dam had been identified in surveys by Frank Hurley's Transvaal Irrigation Department in 1905-07, but although its importance as a centre of future commercial farming was acknowledged by Kanthack in 1920, at that time it lacked a railway link and was thought to be too underpopulated to justify development by the State as yet, although private initiatives were encouraged.

In 1917, two Greek settlers, Messrs Darras and Patrajohn, constructed and irrigated from a dam on the farm Rooikraal, increasing their annual wheat yield from 500 to 8000 bags. Downstream of the Loskop site Messrs Meissner and Beukes built their own diversion weir and canals in 1924 with engineering advice from the Irrigation Department; imported steam-driven pumps were not uncommon. In 1918, Karel Schoeman began farming his father-in-law's farm Ramshoring, launching an irrigation dynasty. Hitherto used for winter grazing, Ramshoring was now irrigated from the Olifants River with an imported ram pump and worked by ***bywoner*** labour. Schoeman would trek his wheat for three days by ox-wagon for sale to Godrich's mill in Bronkhorstspruit, taking whatever price he was offered. Until such time as the Loskop Dam could be constructed, smaller schemes diverting normal flow without storage were encouraged, such as W.J. Grobler's small loan to extend his irrigation scheme on the farm Welverdiend. A committee of private farmers who started the Haakdoorndraai project were given an allocation of 29.9% of normal flow of the Olifants by the Water Court in an award shared with the Middleburg Irrigation Scheme. Later, on the strength of a Land Bank loan of £34 000, the Hereford Scheme was proclaimed in 1928; the founding members themselves dug 52 km of furrow, still in use today. A decision on the construction of the Loskop Dam was postponed while the progress of these private irrigators was assessed.

WILLOWMORE (CAPE)

Serious poverty coexisting with progressive farming in the Karoo district of Willowmore in 1918 was recorded by Prof Macmillan whose fieldwork studies of white and black rural poverty before 1930 were used in the compilation of the Carnegie Commission Report (1932)[29]. Macmillan was introduced by John X. Merriman to the remarkable Ockert Almero ('Ockie') Oosthuizen,[30] successful farmer and irrigation

[28] ***South African Irrigation Magazine,*** 3, 3 (1924). The magazine was written and produced in the Irrigation Department which made no other official reference to the Drought Commission's Report.
[29] My gratitude to Hugh Macmillan for providing me with material on Willowmore from his father's and his own research.
[30] Oosthuizen (1859-1943) was successively a member of the Cape Parliament, the Union Convention, the Legislative Assembly and the Senate until his death in 1943, moving across the political spectrum from the Afrikaner Bond to the South African Party and D.F. Malan's National Party.

enthusiast (at his death in 1943 owning some 86 000 ha) who had been a Cape Colony delegate to an international conference on irrigation in New Mexico in 1908. In 1918, Willowmore's average annual rainfall over 10 years had been eight inches (about 203 mm); Oosthuizen cultivated between 170-260 ha lucerne as supplementary fodder along a six mile furrow fed from a large farm dam, employing some 30 people on white labourer wages as well as piece-workers to build and scrape dams. Families such as the Oosthuizens, the Stegmans and others built up irrigating dynasties there over generations. In the better-watered Baviaans Kloof east of Willowmore Macmillan met Petrus Strydom (father of later President J.G. Strydom) a prominent farmer with 200 irrigated ha on a farm of 2570 ha). Macmillan interviewed ***bywoners*** in the area, noting the consistent movement of the landless white population from Willowmore to Johannesburg and observing extreme examples of both legal subdivision and 'undivided shares' of farms where large numbers of kin clustered on unviable fractions of land[32]. The Dutch Reformed Church minister at Willowmore was J.R. Albertyn who conducted surveys of his congregation, showing more than 18% to be in a state of poverty. Albertyn later co-authored the sociological volume of the Carnegie Report including a study of the 'discouraging' history of Federal irrigation settlements in the USA and an admiring analysis of the principles and methods of Kakamas[32].

Lani van Vuuren

The Neusberg weir, constructed on the Orange River near Kanoneiland.

[31] Macmillan, ***The South African agrarian problem.***
[32] J.R. Albertyn and M.E. Rothman, ***Cargenie Commission of Investigation on the Poor White Question in South Africa*** (Pro Ecclesia: Stellenbosch, 1932)

THE LOWER ORANGE: KANONEILAND AND VIOOLSDRIFT

In desperate times some communities took matters into their own hands. After bad floods in 1925 six refugee island farmers calling themselves the ***Verspieders*** (Scouts) investigated conditions on the group of 10 islands that together made up Kanoneiland, finding 2533 ha of excellent alluvial soil. In 1928, 22 farmers formed their own irrigation settlement there. Improvising a willow raft propelled by swimmers, they established a pontoon to ferry their mule carts to the island and, helped by J.J. ('Japie') Lutz made a canal. The first 32 farmers on Kanoneiland were given grazing rights by the Upington Magistrate, but when 20 others followed the Minister of Lands, Piet Grobler, gave orders that they should be evacuated. The Member for Gordonia, J.H. Conradie, intervened on their behalf and when Grobler saw the conditions for himself he promised them the land. The pioneers improvised a dam out of steel cable with trees, branches, reeds and straw to fill Lutz's head canal. Rejecting Conradie's offer of £200, they borrowed £150 to buy concrete for a permanent dam wall (constructed behind a great but precarious earthwork) and a syphon built by Lutz under the southern channel. An elected management committee of 7 formally drew up ***The Regulations of Canon Island***[33].

KIMBERLEY AND THE VAAL

This area was badly hit by drought and a damaging downturn in the diamond industry. In 1923, a deputation met Smartt to lobby for irrigation on the Vaal, even offering to sell riparian land to the government for settlement at an assured £3 per morgen[34]. A Vaal River Irrigation Committee was formed and a second deputation representing municipalities, divisional councils, farmers and diggers met Pact Ministers Jansen (Lands) and Kemp (Agriculture) before the election of 1929. Reiterating their promise of more than 150 000 ha, to be added to the 40 000 ha of government-owned land, in their desperation the Committee were prepared to accept any scheme for growing fodder in the area, if necessary, by using groundwater augmented with water stored in the dry pans characteristic of the area. 'You are the sons of farmers and will show us sympathy,'[35] they told the Ministers. Kemp was impressed by the land offer and emphasised the need for thorough investigation but was frank about his own experience of deputations: 'When a scheme is proposed it is put forward as a land of Canaan, but when it is completed it is a different story and once people have to pay they ask for it to be written off'[36]. The Ministers would await the verdict of the Irrigation Commission.

In 1926 the Olifants River (Cape) Scheme was accepted as a Government Irrigation work together with Hartbeespoort and Kanoneiland on the Lower Orange.

IRRIGATION BOARDS: STOP-GO DEVELOPMENT

Between 1912 and 1935 the number of Boards rose from 15 to 128, mainly in the Cape. This new phase of irrigation construction had to surmount the after-effects of war – shortages of materials, the speculative boom in land – as well

[33] A.A.J. van Niekerk, ***Kanoneiland 1928-78*** (Kanoneiland: Kanoneiland Feeskomitee, 1978); M. de Beer, ***Keimoes en omgewing: 'n kultuurhistorieseverkenning*** (Keimoes Munisipaliteit: Keimoes, 1992).
[34] CAD K121 Box 54 File 137, 'Deputation to Smartt', 26 February 1923, ffs 26-45; 'Opsomming van 'n onderhoud met die Vaalrivier Besproeings Komitee insake die Kromellenboogbesproeings skema' [1929], ffs 219-227; 'Aantekeninge oor die Drie Nasionale Skemas [Van der Kloof, Vaal Rhenoster, Vaal Harts/Kromellenboog] by Van Reenen (24 June 1929) and P.E. Beyers (21 June 1929) ffs 179-193.
[35] '***Julle is boereseuns en sal ons as boere simpatie bewys***'.
[36] '***Waar daar 'n skema voorgelê word, dit voorgestel as 'n land van Kanaan, maar sodra die skema klaar uitgevoer is dan verander die posisie en dan word afskrywing gevra as die mense moet betaal***'.

as a downturn in agricultural prices and high construction and labour costs. The inability of Boards of farmers to repay interest and redemption charges prompted an ongoing debate about irrigation finance, the appropriate level of relief to irrigation boards and the recruitment of settlers for the new schemes. Irrigation development for the next twenty years was spasmodic.

BON ACCORD, 1918

By 1919 five Irrigation Boards had formed in the northern Provinces. One of the earliest was Bon Accord, established in 1918 by owners of diversion schemes on the Apies River near Pretoria to build an earth dam to store surplus water at an estimated cost of £64 233[37]. Its history illustrates many common early difficulties. The dam was begun under an inexperienced Board largely on the initiative of one substantial landowner who later sold out. A loan was granted; the Board chose to build the largest dam possible on the prospect of a good market supplying Pretoria's expanding cement and iron industries[38]. Some farmers, alarmed at the growing expense of the scheme, tried to reconsider but abandoned their protest on discovering that they would have to travel to Cape Town at their own expense to give evidence to the Select Committee. The Irrigation Department relied on local assurances of water supply and soil quality, much of which was later found to be very poor gravel. Yet the water estimate was insufficient ('we had not the haziest idea of the volume of water in 20 inches per morgen per annum'[39]), and when the scheduled area was curtailed the soil became waterlogged: it was said the people of Hammanskraal reaped good harvests from the seepage[40].

The cure was expensive drainage ('we never expected anything of that kind'). A belated application for protection of the supply for irrigation conflicted with the primary needs of users lower down – black town workers and Winterveld farmers – and proved extremely expensive. Even the favourable market proved elusive in the face of competition from growers at Hartbeespoort. After the scheme was approved the land was sold at enhanced values to absentee solicitors and companies in Johannesburg who threatened to take the Board to court over the high rates. The cost of the scheme rose to £75 000 and eventually £114, 080, of which £93 000 was written off by the state in 1928.

LAKE MENTZ (DARLINGTON DAM), SUNDAY'S RIVER, 1917

Lake Mentz illustrates difficulties encountered even by sophisticated Boards with access to the best available professional advice. The Cape Sunday's River Settlement Company founded by FitzPatrick in 1913 joined with three other companies to form the Sundays River Irrigation Board to construct and manage a storage scheme that was to be second only in size to Hartbeespoort and named after Col Mentz, Botha's Minister of Lands and Irrigation. Construction materials were unobtainable in wartime. Inadequate surveys and incomplete scientific data made the estimates largely guesswork, rushed through Parliament and amended three times. Delayed by litigation over land, the dam was finally completed in 1922 at a cost of £560 000 (the original loan had been for £250 000). Reitz considered that the Sundays River Valley had more difficulties and complications than

[37] Third and final report of the Irrigation Finance Commission, UG 15-1926.
[38] Select Committee on Public Accounts SC15/1920.
[39] Select Committee on Public Accounts SC1/1928.
[40] Select Committee on Public Accounts, SC1/1928.
[41] House of Assembly Debates (1925) vol 3, col. 98.

any other irrigable area in South Africa[41]. The Company went into voluntary liquidation and was bought out by the Smuts government for £100 000 in 1924 (endorsed by the incoming Pact government.)

The dam was served by only one good flood before the onset of a series of disastrous drought years lasting until 1928. By then it had lost nearly 40% of its capacity from silting and little more than half the water released was reaching field edge. Yet the Sunday's River experiment, benefiting from FitzPatrick's public profile and political connections, drew public attention to unresolved irrigation issues – capital loans, settler recruitment and terms, the scheduling of non-riparian land – at a time when the State was feeling its way. FitzPatrick was an innovator, always at the forefront of the latest craze. He developed links with the Californian citrus industry in 1920, and later brought to South Africa A.D. Shamel's technique of citrus bud selection as well as the latest tractors, orchard trucks, wagons and citrus grading plant. He introduced the first Stebler-Parker packing plant in the Southern Hemisphere, and played a leading part in 1922 in initiating the Citrus Exchange (later Board) for export packing, refrigeration and

SanParks

Darlington Dam, on the Sunday's River, boasts two spillways with control gates – the main spillway and an auxiliary spillway. Near the left abutment is the river outlet system with a number of release valves.

[42] J.M. Meiring, ***Sunday's River Valley, its history and settlement*** (A.A. Balkema: Cape Town,1959); D. Lavin, 'Irrigation development in South Africa: the Smartt Syndicate and the Cape Sunday's River Settlement Co' in ***African water histories: transdisciplinary discourses,*** ed J.W.N. Tempelhoff, (North-West University: Vanderbijlpark, 2005).

marketing, as well as linking Sunday's River to the expertise of the soil and plant biologists at the University of Pretoria, one of the first Boards to do so. The scheme was to become the centre of a world-class citrus export trade[42].

PRINS RIVER AND BLYDE IRRIGATION BOARDS

Cape Boards could be crippled by undertaking inappropriate storage enterprises. The first rockfill dam was constructed at Prince Albert but was frequently dry. It was common for early Board schemes to economise on outlets and drainage: here, because the outlet controls were accessible only when the dam was dry, water in the full dam was several times emptied needlessly[43]. Farmers with large scheduled areas were unable to maintain their repayment instalments so that the works were not maintained. At the Blyde scheme in the Somerset East/Pearston area the lands were prepared without beds or retaining walls. A soil surveyor from the Government Chemical Laboratories reported: 'The waste of water must have been appalling. I have never seen such a picture of desolation as this scheme afforded. Nowhere was there a green blade to be seen on the irrigated lands. I was told there had been no water available for about 2 years'[44].

COOPERATION AND DISCORD: THE GREAT FISH RIVER AND KAMANASSIE IRRIGATION BOARDS

Boards were joint enterprises engaged more or less equally in cooperative action and the management of conflict. The irrigators of the Great Fish River in the Eastern Cape moved from individual farm diversion schemes to cooperative Boards after 1911. With 10 diversions commanding 25 700 ha belonging to 149 owners along 140 miles of river the upper and lower owners agreed to sink their differences and form the Great Fish River Board to secure the construction of the Grassridge and Tarka (later Lake Arthur) Dams – 'monuments to cooperation', the Irrigation Finance Commission later called them[45]. It was said in the Fish River Valley that 'men are demoralised by wine, women and song; our farmers become intoxicated at the mere thought of water'[46]. Yet in its first 12 years Lake Arthur lost 52% of its capacity from silt; by 1929 the price of lucerne had fallen. Debts of a million pounds were written off by the government, but the Cradock banks and land companies shut off individual credit. In 1931, a deputation from the Fish River appealed to the Minister, E.G. Jansen, and the scheme's crisis was an election issue in 1933. Deneys Reitz, Jansen's successor, rewarded the valley with a write-off of two million pounds. Yet by 1937 there was still insufficient water. Lake Arthur was raised again in 1937 and in the following 8 years lost a further 30% of its new capacity. The problems would continue until the Orange-Fish-Sundays tunnel was completed in 1975.

By contrast, the irrigators of the Kamanassie River at Oudtshoorn were notoriously disputatious when they petitioned for storage in 1916[47]. They had a long tradition of irrigating by flood on an informal basis according to local conventions and refused to apply to the Water Court to regulate their water rights, thereby complicating the planning of the proposed works. The Board's demands for a reservoir with canals, first estimated at £360 000, rose to £450 000 in 1918, and then £814 000. Neither C.J. Langenhoven (advocate,

[43] A.D. Lewis memorandum, 'Write-offs proposed by the Irrigation Commission for Bellair, Prins River and Stoltz River', SAD K121 Box 3 214-216.
[44] CAD Irrigation Commission Archive K121 Box 4 file 3.
[45] Second Report of the Irrigation Finance Commission, UG 44-25.
[46] Van Reenen, 'Development of irrigation'.
[47] Second Report of the Irrigation Finance Commission, UG 44-1925, and Kanthack reports in UG 29-1917 and UG 28-1920.

poet and later Senator) acting for the Board, nor Kanthack could devise a rating formula to satisfy the farmers, who appeared to agree on one thing only: a contribution from the taxpayer of £350 000. A Select Committee later concluded that the ratepayers had behaved unreasonably, the Board was unrepresentative, and that any financial relief to Kamanassie would have to be conditional on proper rating arrangements, a new Board and agreement on water rights and distribution.

CP Nel Museum

On the construction site of the Kamanassie Dam. Due to the inaccessibility of plant and equipment after the First World War (1914-1919), mostly second-hand machinery was used.

DIAGNOSIS AND REMEDY

In his first annual report as Director of Irrigation in 1921 A.D. Lewis identified structural defects in irrigation development common to all new irrigation enterprises:[48]

- costs of irrigation works exceeding estimates (owing to unforeseen construction difficulties and lack of proper control over expenditure since Boards appointed their own engineers and accountants)
- a tendency to overestimate the irrigable area (from a lack of hydrographic data and the failure to secure a definite water right in advance – 'money well spent as insurance')
- the difficulty of collecting early repayments (because Irrigation Boards were reluctant to sue members who could not pay and the Finance Ministry had neither the staff nor the organisation to collect the money – which in any case would be contrary to the principle of local responsibility that was the essence of the Board system).

The post-war Irrigation Department had not yet developed its own agricultural, soil or geological expertise; there were doubts as to the capacity of Boards of farmers as developers lacking business background or experience of intensive agriculture and prone to speculating in land. South African irrigation developed piecemeal, with the irrigators accepting liabilities for works in the hope and faith that before the day of reckoning arrived 'something would turn up'[49]. The Circle Engineers who were supposed to advise them were expected to cover areas of up to 100 000 square miles, at first without motor transport or staff.

IRRIGATION FINANCE

In 1922, the Irrigation budget was £22 575 in arrears, £18 000 of which was owed by defaulting Boards; no government irrigation settlement was paying its way. After a grace period of two years participants in Board schemes became jointly and severally liable for scheme rates covering operation and maintenance. Given the teething troubles of most flood schemes the grace period was too short[50]. An article appeared in the ***Irrigation Magazine*** on 'The slow rate of development and settlement in irrigation Schemes, and its financial aspects'[51]. Increasingly relief was granted. In 1922, an amended Settlement Act permitted the Minister to grant up to four years' additional relief from loan repayment charges (progressively extended to nine years by 1928) and relief up to 25% was available for minor works.

In 1923, Reitz as Minister of Lands and Irrigation made a fighting speech to the Irrigation Association questioning the principle of national development at private expense and citing the Fish River, where irrigation costs of one and a quarter million pounds fell on 127 landowners with 188 470 ha of land, of which 111 370 was not yet developed but was nevertheless liable for rates. Costs, he argued, should be shared between irrigators and State. In the same year Lewis argued that the Board system should be abolished. Only the state could build and settle large storage schemes and manage the transformations involved:

[48] Report of the Director of Irrigation for 1920-1, UG 12-1922, and the Report for 1921-2, UG 8-1923. See also A.D. Lewis, ***Irrigation in America*** (Government Printer: Pretoria,1915).
[49] Report of the Irrigation Finance Commission, 1947, Addendum D by A.C.V. Baines, UG 40-1948.
[50] In America it was 20 years, in India 12, in New South Wales 38 years.
[51] Anon, 'Slow rate of development and settlement in irrigation Schemes, and its financial aspects', ***South African Irrigation Magazine***, 1, 5 (1922).

'Under a big storage scheme the whole nature of agriculture is changed. Intensive cultivation is required, and where one owner farmed before, 100 farmers may be necessary when the scheme is completed. The business of causing this great change ... is quite beyond the powers of a board of farm owners. ... Investigation, acquiring land, dividing it up, getting suitable settlers, financing and advising them, constructing and maintaining the scheme and collecting rates should be undertaken by the State[52].

His own department needed supplementation. As a sub-department, Irrigation had no fixed place in the Union administration. In the ten years from 1920-30 it came under three Ministers of Lands, two Ministers of Agriculture, the Minister of Justice and the Minister of Native Affairs. In one four-year period alone it survived three changes of Department and five different Ministers. Other institutions were also involved: The Land Bank, railways, Provincial and District Councils and Trade Commissioners, although to all these institutions irrigation was a side-line. Settling irrigation lands involved three Parliamentary votes. Like Kanthack, Lewis argued that storage works could not be adequately funded by discretionary annual Parliamentary votes but needed a dedicated Reservoir Fund based on loan remittances. Lewis campaigned for a central government body to coordinate irrigation planning 'before construction is rushed into by pressure from interested persons.'

THE REPORTS OF THE IRRIGATION FINANCE COMMISSION, 1925-6

In 1924 the Pact government appointed an Irrigation Finance Commission to report on the financial position of irrigation works constructed with state aid, place them on a sound footing to give owners, settlers and ratepayers a reasonable prospect of success, and advise on Lewis's proposed permanent commission to coordinate engineering, settlement, financial and agricultural activities connected with irrigation[53].

The Finance Commission concluded that 'Where a decade ago the land was crying out for water, the land and water are today crying out for settlers.' What mattered was rapid settlement, getting the land into production to make repayment possible. Special difficulties faced irrigators in all countries, particularly the initial non-productive years while the farmers carried development costs several times greater than the cost of the land (clearing and levelling, laying out beds or terraces, constructing furrows and sluices). Pioneer crops would then take a further two years to reach production, fruit would take seven. From 1917 to 1924 the State had spent upwards of £3 million in loans to Irrigation Boards to construct works commanding 197 748 morgen, of which less than half was cultivated. The Commission noted that already the grace period for rates and loan repayments had been extended. But most irrigated holdings of 50 morgen were too big for one individual: Board schemes were not fully productive because they were not fully settled. Only

[52] Report of the Director of Irrigation for 1922/3, UG 2-1924.
[53] First, Second and Third and Final Reports of the Irrigation Finance Commission, UG 29-1925, UG 44-1925, UG 15-1926.

the State could tide over the initial non-productive years and attract a wide range of settlers by offering advances and technical advice to people of limited means, while relaxing unpopular terms of the Land Settlement Act (such as personal occupation of irrigated land and joint and several liability for loans) which deterred absentee landowners and stock farmers with capital from taking up irrigated holdings. As Lewis had hoped, the Commission recommended the establishment of a permanent Irrigation Commission under a Minister of State to investigate defaulting Boards and resolve such problems as the definition of 'surplus land', deferred repayments and differential rating, and 'equitable distribution'.

Such a Commission would also synchronise the skills, professions and departments involved in the whole chain of irrigation development, from the determination of supply to construction, the marketing of produce and the repayment of the loan. Meteorology, hydrology and geology were essential to supply and construction of works; soil physics and horticulture to production. Departments, besides Irrigation, included Agriculture (crop raising, knowledge of plant diseases, extension advice, the survey of soils as well as the application of the new discipline of agricultural economics) and Lands (settlement); the Land Bank (assistance to farmers); the Railway Department (agricultural freights and the transport of produce); Provincial and District Councils (roads) and Trade Commissioners (markets). To all these except the Irrigation Department, irrigation was a sideline – hence the need for coordination. Such a Commission, it was argued, would have the additional advantage of lifting irrigation above party politics, relieving the Minister of political pressure over the siting of dams and financial relief which Reitz had declared to be 'intolerable'[54].

THE PERMANENT IRRIGATION COMMISSION, 1926

The Irrigation Commission was created by statute in 1926 with a miscellaneous and ill-defined brief, including the investigation of new schemes, the water supplies of the country, irrigation settlement, markets for irrigated produce and the progress of the Kakamas Labour Colony. It reported to the Minister who referred the reports to the parliamentary Irrigation Select Committee; any recommendation not approved by the Minister was specifically reported to Parliament[55]. While the Commission was working itself in, further development would be halted.

The first chairman was Reenen Jacob van Reenen, President of the Engineering Section of the South African Association of Science, a veteran of the Smartt Syndicate's Ongers Dam and an engineering graduate of the University of Pennsylvania, who had carried the Irrigation Finance Commission as an official member in the absence of its Chairman, thus linking the two Commissions. His colleagues on the permanent Commission were P.H. Nel (chairman of the Transvaal Agricultural Union and later chairman of the Commission) and P.E. Beyers (appointed Superintendent of Kakamas in 1935). Van Reenen complained of the activity expected of them: amending the 1912 Irrigation Act, reporting on the Department of Irrigation, meeting Ministers, attending

[54] First Report of the Irrigation Finance Commission, UG29-1925.
[55] Act 33-1926. Secretary, Irrigation Finance Commission, to the Private Secretary of the Minister of Justice, 20 May 1925 and A.D. Lewis to the Secretary, Irrigation Finance Commission, 13 July 1925, CAD K121 Box 45 File 84/2 (Irrigation Commission Act). See too, Report of the Select Committee on Public Accounts, SC1-1936.

Parliament, Select Committees and the Irrigation Congresses as well as dealing with land purchase for settlement. In its first five years the Commission also visited and reported on 52 schemes applying for financial relief. Sometimes it met formally to deal with matters referred to it, sometimes in camera to hear evidence, and often in public meetings advertised in Irrigation Districts. In 1925, Van Reenen told the South African Association of Sciences, 'I make bold to say that we in South Africa do not yet know how to irrigate', emphasising the efficient use of water. He concluded that the only hope of paying redemption rates in most schemes lay in intensive cultivation of permanent crops 'which can alone be carried out by the smallholder' and greater attention to the economic use of water now that large storage works had made control easier[56].

The Commission began by getting to know individual irrigators and their methods at first hand, sometimes accompanied on its investigations by committees of farmers and bringing authoritative advice to inexperienced irrigators, often for the first time. It aimed to protect State property from being 'frittered away' through incorrect irrigation practice, and battled to counteract a casual approach to the use of water, finding that '[even] people of high repute ... will, without any sense of shame, divert onto their own property water which should have gone to their neighbours'.

Since Board schedules usually included some inferior soils which degenerated through ***brak*** (salinisation) and seepage the Commission established the principle of preliminary chemical and physical soil surveys as standard practice for new schemes. After a slow start field parties were assembled from the Irrigation Department and the Division of Chemistry to survey and map, analysing soils and groundwater. Farms could now be subdivided on a scientific basis, especially when the Commission extended to each owner the right to obtain the survey results for his farm. Good farming practice could save struggling schemes: the Commission sought repeatedly to engage drought-stricken Karoo sheep farmers in irrigating feed as an aid to stock-farming. It emphasised the importance of fertilisers, especially in the north where the perennial rivers were not silt-bearing, describing the results of continuous unfertilised cropping at Hartbeespoort as a 'pirate farming system'. It preached crop diversity beyond the usual cereals and grains, drawing attention to the higher-value irrigated crops – fruit, sugar, tung or cotton, and sending citrus and cotton experts to visit schemes where failing irrigators were 'in need of enlightenment'. Regular analyses of the prices of eggs, poultry and potatoes were compiled, encouraging irrigators to supplement their incomes by profitable trade in local city markets[57].

INSTITUTIONAL AND TECHNICAL SUPPORT

By 1926 many of the institutional and professional supports that would shape the future development of irrigated agriculture were emerging: soil surveys and soil science in Pretoria, with the Division of Chemistry in the Department of Agriculture expanding as it conducted preliminary soil surveys and studied the composition of water on existing

[56] Anon, 'Slow rate of development'.
[57] This section is based on the voluminous files and annual Reports of the Irrigation Commission, CAD K121.

or prospective irrigation schemes. Storage of water made possible more controlled application, while making new demands of the farmer: the need to use water economically, to experiment with the duty of water (the maximum crop obtained from a unit of water), to study the relation of soil to irrigation.

The annual Reports of the Department of Agriculture were published in a user-friendly bulletin, ***Farming in South Africa.*** In 1925, an Economics and Marketing Division was established by the Department with a sub-division devoted to agricultural cooperation under the direction of A.P. van der Post, the assistant chief of the Division, one of the pioneers of agricultural economics[58]. The Division produced daily market reports and monthly information on 'Crops and Markets', circulating farmers' associations on market conditions and linking them with the cooperative societies. A Demonstration Train took lecturers on agricultural economics all over the country explaining the principles of cooperation, so successfully that within 4 years the number of cooperative societies had expanded from 45 (in 1922) to 294. In 1928-9 van der Post reported the recruitment of 15 economists to the Farm Management and Marketing Section. The Department of Agriculture published a ***Handbook for farmers in South Africa*** and in 1931 took over Losperfontein Training Farm at Hartbeespoort from the Department of Labour to train potential settlers. Another distinguished member of the Division, S.J.J. de Swardt, emphasised expanding railway track and route mileage of road transport services between 1915 and 1930 as factors stimulating commercial production by a new generation of farmers with agricultural knowledge and experience, able to finance production by means of savings or loans on the strength of high prices[59].

Maintaining fruit export was essential. In 1930 the government was budgeting for a deficit, but deciduous tonnage exceeded previous records. Agricultural physicists were sent overseas to study pre-cooling, after which the Union-Castle fleet added larger capacity ships and pre-cooling facilities at Table Bay., with experiments in air distribution and ripening conditions of apples and the exploration of apple juice as a means of utilising cull fruit. Much attention centred on the fruit and wine industries. The Division of Chemistry had 3 survey parties in the field in 1928 and 15 in 1932. The elaboration and investigation of fertilizer requirements (including South African raw rock phosphates) was fundamental to establishing a successful agricultural industry. The action of soil organisms and the deficiency of mineral constituents in the soil demanded investigation. The Pretoria chemical laboratory was classifying soil types, Glen School of Agriculture was elaborating methods to combat soil erosion. The Viticulture section of the Agriculture Department was the investigation of wines for export and advising the sultana growers of Kakmas and Upington. Lye strength experiments were conducted at Karos and 75 grape varieties were tested at Oudtshoorn. To combat over-production, table grapes were grown at the Paarl experimental station[60].

[58] Van der Post was an ex-member of the Agricultural Advisory Board and of the Executive Committees of the South African and Orange Free State Agricultural Unions.
[59] S.J.J. de Swardt, 'Subsistence and commercial farming', ***Agrekon***, 9,2 (1970) 3-8.
[60] St C.O. Sinclair, 'Chemical services for the state: solving many farming problems', ***Farming in South Africa***, 353 (November 1932).

In 1927, the Elsenburg College of Agriculture, constituted in association with the University of Stellenbosch, maintained a 7 morgen settlement plot at Olifants River (Vanrhynsdorp). When the ***akkers*** (beds) growing lucerne and maize were infiltrated by alkali from seepage from the main canal through the shale hillsides, the College was able to call on the head of the Department of Chemistry, the Elsenburg Engineer and the Irrigation Department to collaborate in devising remedial measures 'which should prove of the very greatest significance to the Olifants River Irrigation Settlements'[61]. Elsenburg acquired a second plot for demonstration work with vines and fruit trees. As the drought deepened and world prices fell, research accelerated. In 1930, after the Irrigation Commission's Conference on lucerne, Grootfontein undertook 33 experiments on 660 plots into irrigated lucerne and annuals (including imported potatoes and field bean varieties). The duty of water was a major feature, with tabulated figures indicating the optimum supply for various conditions. Pipes were installed to prevent leakage and produce reliable results. Transpiration was studied to establish rates of water loss by means of plants grown in 145 drums weighed daily. The College also initiated a programme on ***brak*** in commercial fruit growing, training white labour in skills such as fencing, tractor driving etc[62].

THE IRRIGATION SUBSIDY QUESTION

In its Report for 1928-9 the Irrigation Commission stated 'the unpleasant truth' that irrigation was only possible with State subsidy (elsewhere in the world 50% was common), and that settlers should not be responsible for repaying money to more than one government department. As the land needed preparation, so the settlers needed training and help with the marketing of irrigated produce if the State was to achieve a return on the millions of capital already advanced or invested in irrigation. It proposed a dedicated Irrigation Development Fund from irrigation loan remittances with a rationalised loans procedure, orderly marketing and price stabilisation[63].

In 1928, the principle of writing off part or all of the capital or interest was enshrined in law (Act 21-1928). Lewis remarked that irrigators were developing 'a writing-off complex'. With compulsory bilingualism in the civil service, the joke in the Irrigation Department was that just five words would do – ***applikasie*** (application), ***deputasie*** (deputation), ***voorskot*** (advance), ***uitstel*** (deferment) and ***afskryf*** (write-off).

Some years later, the Report of the Settlers' Relief Commission (1934)[64] was critical of the way a capitalisation scheme had been managed in 1925 covering 'drought, flood, tempest, lack of water, locusts, failure of crops, or other adverse farming conditions'. Drought, the Commission observed, is not an abnormal features of South African farming conditions[65]. Extensions of time, revaluation of land and improvements and the other relief measures had undermined the settler's spirit of self-help: capitalisations inflated the purchase prices: after a second capitalisation in 1931 'astonishing' arrears had returned in less than three years although the majority of lessees now paid only rent and interest with no capital redemption[66].

[61] ***Farming in South Africa***, November 1928.
[62] Anon, 'Farming under Karroo conditions: the activities of Grootfontein', ***Farming in South Africa,*** 353, November 1930.
[63] Report of the Irrigation Commission for 1928-1929, UG 11-1930. Chairman Van Reenen, (as President of the South African Association for the Advancement of Science) published 'The development of irrigation in the Union of South Africa', ***South African Journal of Science***, 22 (1929).
[64] Verslag van die Kommissie insake verligting aan setlaars, UG 25-1935.
[65] ***Ibid.***
[66] ***Ibid.***
[67] Report of the Irrigation Finance Commission (1944-6), UG 40-1948.

Between 1910 and 1945, 90.1% of all capital and interest in arrears was written off; only 3.2% was actually paid[67]. Various solutions had been advised and attempted: average individual holdings reduced to manageable proportions; the recruitment of settlers to take up the extra land and get the schemes working fully[68]. A departmental Use of Water Section advised on semi-annual rather than permanent crops; curtailment of scheduled ground at the tail-ends was undertaken to maximise supply to the remainder.

THE IRRIGATION AMENDMENT ACT

Although the 1912 Irrigation Act was expressly designed to promote water storage and beneficial use, the complexities of the law and its restrictions had an inhibiting effect. The Irrigation Commission reported in 1927-8 that its work on visits, projects, and loan applications had been severely disrupted by the preparation of a draft consolidation Bill amending the Irrigation Act, to be discussed at the Association Congress[69]. The need was widely recognised. Tertiary use of water in the public interest was expanding rapidly by local government bodies as well as the railways, the mines and the new power and iron and steel industries, while individual rights were involved in two intensely controversial issues arising from the encouragement to storage in the original Act:[70] protection for large and expensive storage works from later abstractions above them, and the equitable distribution of stored surplus water, involving individual entitlements, the distinctions between various 'categories' of water[71] and the definition of 'normal flow'.

Before protection was introduced in 1916, each upper owner in turn had the right to satisfy his full requirements in surplus (flood) water. Section 15 of the Act of 1912, however, required that if a protection order for storage was sought, each upper owner must within six months declare his own intention to construct any storage work within the next five or ten years, giving sureties of £250 to discourage false declarations, or permanently forfeit the right to use surplus water from the protected stretch of river. (His rights to normal flow would remain unaffected). This meant that a belated protection application by the Sundays River Irrigation Board for Lake Mentz involved declarations from 1 800 upper owners to protect the 343 irrigators below the dam[72]. The upper owners of Graaff Reinet and Middelburg protested vehemently that protection had robbed them of their water rights and complained at the expensive and cumbersome procedures involved in safeguarding them.

By contrast, the lower owners of the Fish River, with works capitalised in millions, supported the principle of protecting large storage works since without it (in their case) hundreds of irrigators would be ruined. If several applications for protection were in operation, the Court would divide the water proportionately between them, with non-declarers excluded from a share[73]. Much ink was spilled on 'proportionate division', a practical impossibility when no accurate means of water measurement existed. The Irrigation Association established a Vigilance Committee, and the matter was raised in Parliament, while debate raged over the pros and cons of protection and big versus small dams.

[68] Second Report of the Irrigation Finance Commission, UG 44-1925.
[69] Report of the Irrigation Commission for 1927-8, UG 7-1929
[70] See, for instance, reports in ***Cape Times*** 7 and 14 June 1923 and ***Midlands News*** 18 August 1923.
[71] For example, an owner's entitlement might relate to any or all of the following: a share of stored water in proportion to his irrigable area, to some unstored water according to his position on the river, and a proportion of normal flow according to the time when he first used the water. There might also be rights to seepage or old furrows which had acquired prescriptive rights over time. (Proceedings of the 7th annual Irrigation Congress, August 1927, Director's memorandum, pp 88-90.)
[72] The Board had been officially advised that a formal application was not necessary. Only when the Van Ryneveld's Pass storage Dam higher up the river was passed for construction was the Mentz supply threatened.
[73] As a result of the judgement in Smartt Syndicate v Richmond Municipality, 1921.

At the suggestion of Sir Thomas Smartt, the Association referred protection to a committee appointed by the Minister. The specialist members of the committee disagreed, Justices Van Zyl and Louwrens declaring that in a case of protection riparian interests should always be the paramount consideration in the interests of the country as a whole (although they proposed concessions allowing upper owners to store water for irrigating small areas)[74]. Carl Jeppe, water Court Judge, and A.D. Lewis submitted a separate report emphasising the object of Act 8 of 1912: to encourage storage to the largest extent possible to make maximum beneficial use of all flood water in the interests of the country as a whole[75]. An Irrigation Reform Association had attracted more than 500 members before an acceptable compromise was proposed by Lewis at the Association's 7th Congress in 1927[76].

A further question was how water rights should be ascertained. This required a clear definition of 'normal flow' since water rights and allocations made by Irrigation Boards were expressed as percentages of normal flow. As the Water Court gained wide discretionary powers in interpreting the law, over time 'normal flow' was said to have become 'a more or less imaginary quantity' (according to Lewis). The planning of new schemes also depended on clarity[77]. Cases became longer and more expensive; promising schemes were held up because of potential rights. A form of words was devised for the proposed Amendment Bill 12 of 1928, covering five-and-a-half pages of print so obscure that Langenhoven commented, 'I must confess that after the most intensive study I have not succeeded in gathering the foggiest notion of what in theory the new test is to be', while Deneys Reitz denounced it as 'a cross between Thomas Carlyle and a chapter on holism'[78]. The draft Bill contained 64 clauses and amended 100 other Acts. After exhaustive examination in Select Committee it was referred for further consultation and, in practice, abandoned. A second version was lost in 1932 because of a general election. A simpler Irrigation Amendment Bill was enacted as Act 46 of 1934, based on Lewis's ideas and the findings of the Select Committee of 1932, with contentious issues minimised (although the parliamentary debate was fierce). Protection was effectively left to Government discretion; proportionate allocation was abandoned as unworkable. All riparian owners now had the right to impound up to 150 million gallons of surplus water or divert to a maximum of 10 cusecs; ministerial permits were required for larger storage; small-capacity diversion works in protection areas needed no permission. What Reitz called 'the riparian fetish' was modified by a simpler process for abstracting water for tertiary (industrial) purposes. All approved schemes would be subsidised. Offsetting this concession, the Bill introduced what Lewis called 'a mild form of expropriation' of lands for settlement purposes falling under the large national schemes. As justification Reitz quoted Kimberley: when the Cape had abandoned the Vaal scheme, farms were given to settlers at 25 shillings per morgen; now, despite promises that there would be no profiteering, some options were priced 500% higher than the most optimistic current valuation[79].

In his annual Report for 1934-5[80] Lewis drew attention to a 'notable' legislative tendency towards the State ownership

[74] C.T. Krummeck, 'Protection as a "principle" of Irrigation Law', ***S.A. Irrigation Magazine***, 2, 2 (1923).
[75] Anon, 'The Irrigation Committee', ***SA Irrigation Magazine***, 3, 2, June 1924.
[76] Proceedings of 7th annual Irrigation Association Congress, August 1927.
[77] Report for the Director of Irrigation for 1925-6, UG 16-1927,
[78] Assembly Debates 1926-7, 5 March, col. 1706.
[79] Assembly Debates 19 March 1934 col. 1630.
[80] Report for the Director of Irrigation for 1935-6, UG 15-36

of water. The new Irrigation Act introduced the device of ministerial permits and was carefully scheduled to precede discussion of the Vaal Act in Parliament. The Vaal River Development Scheme Act (Act no. 38 of 1934) that followed preserved the rights of existing Vaal River users as well as riparian rights of 1/5 cusec for every mile of river frontage; the remaining rights were again subject to government permit.

'A NEW IRRIGATION ERA'

By 1928 it seemed that the era of constraint was ending. Lewis had addressed the Irrigation Congress at Graaff-Reinet on the irrigation possibilities from the Orange River which he had been studying since his time as Circle Engineer in 1908. He reported that it would be extremely difficult; the Vaal was more promising: the project to irrigate the Harts Valley from the Vaal had been under intermittent consideration since 1866, and the Vaal/Rhenoster (Parys) scheme since 1921. He emphasised the 'extreme importance that the first big scheme to be undertaken should be the very best that we can discover[81].

In 1928-9 the permanent Commission, too, announced that 'the time has now arrived when a general policy of construction should be adopted'. Its own function would be to formulate the farmers' problems and propose solutions, as well as pursuing the questions of catchment protection and the use of water. In the build-up to the election of 1929, Hertzog promised to use diamond revenues to fund a new irrigation policy taking into account the lessons of past experience and the practice of other countries. In response, the Commission compiled a retrospective and comparative review and was asked to propose a programme of works costing two million pounds, although in February 1930 the Pact government was budgeting for a deficit and showing increasing concern over unemployment and poverty. Ruling out the 'big 3' national schemes – VanderKloof, Parys and Vaalharts – on the ground that there were not enough potential irrigators to settle them, the Commission proposed smaller schemes[82].

Lewis anticipated a new era of steady irrigation expansion governed by three considerations:[83]

- the rate at which settlers could be placed on the land (since the expected rush of experienced farmers with capital had not materialised),
- the rate at which new areas could be brought under irrigation without disturbing the produce markets,
- the rate of subsidy for works and settlement granted by Parliament.

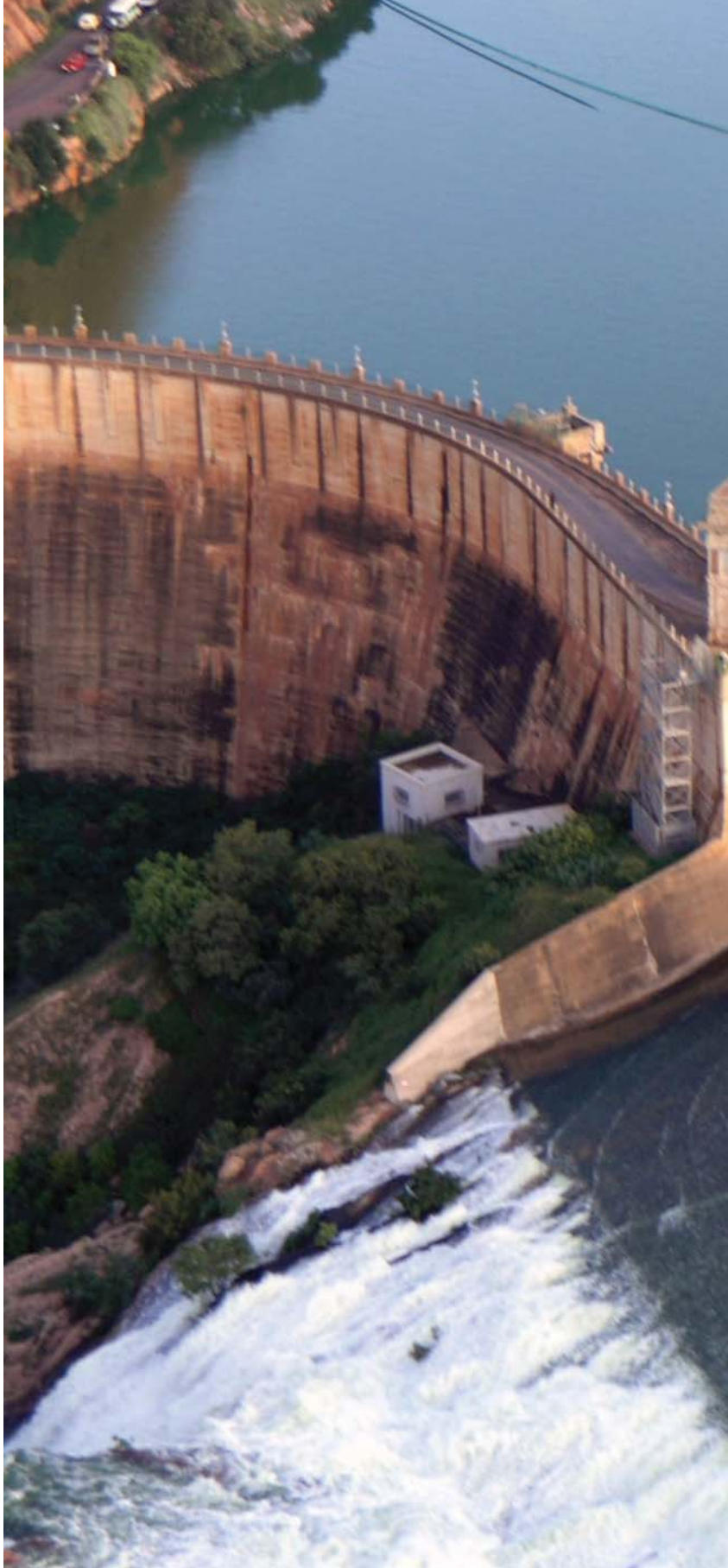
The new start was overtaken by events. In the crisis precipitated by world economic depression, Lewis was instructed to push ahead immediately with emergency irrigation construction[84]. Works previously postponed as premature or cancelled as too expensive were now hastily reconsidered by the Department of Labour as social policies for construction by unemployed whites. These included the Buchuberg Dam (long planned but now started precipitately 'without indication, or preparation or design') and the Oukloof scheme at Prins Albert (repeatedly turned

[81] Report of the Director of Irrigation for 1928-9, Appendix 1, 'Possibilities of irrigation schemes from the Orange River', UG 9-1930.
[82] Marico-Bosveld, Nkwaleni and Overhex. R.J. van Reenen, ***'Aantekeninge oor die drie nasionale skemas;'*** 24 June 1929 and P.E. Beyers, ***'Aantekeninge oor die drie "nasionale" skemas;'*** 21 June 1929, CAD K121 Box 54 file 137.
[83] Report of the Director of Irrigation for 1928-9, UG 9-1930.
[84] Lewis to the Minister, 21 September 1928, CAD K121 Box 53 file 127.
[85] Report of the Director of Irrigation for 1929-30, UG13-1931.

down as uneconomic, but now promoted for immediate commencement)[85]. Procedures were telescoped: the Irrigation Commission was bypassed as schemes involving millions of pounds (such as Loskop) were advanced on the authority of a special sub-committee of the Cabinet convened to deal with a crisis of white poverty and unemployment. Draft legislation on Board subsidies, about some of which the Auditor-General had legal doubts, was put on hold[86].

World economic depression (1929-34) coincided in South Africa with renewed drought: in the water year October 1932 – September 1933 a number of rivers showed the lowest flow yet recorded and the run-off index was 30 (the average was 100). By December there were widespread floods. Agricultural export values in 1932 values fell to 36% of the 1928 figure, from nearly £20 million to £8.5 million, although commodity values were unevenly affected[87]. The government refused to devalue the South African pound by following Britain off the gold standard, with the effect of pricing agricultural exports out of the market which normally took 90% of their produce. Public discontent and currency speculation forced the government off gold and out of office; the South African pound was devalued in December 1932. In February 1933 Hertzog and Smuts formed an uneasy coalition to tackle the crisis. When the USA devalued the dollar in April a windfall increase in the price of gold (from $20.67 to $35 per fine ounce) initiated decades of sustained prosperity in South Africa, though in the continuing drought agriculture took longer to recover than did industry or mining. An Excess Profits Tax on the richer mines allowed for a dramatic rise in state expenditure all round, including major government water storage and irrigation schemes.

[86] Report of Irrigation Commission for 1937-8, UG 9-39, and Select Committee on Public Accounts (SC 1-37).
[87] D. O'Meara, ***Volkskapitalisme: class, capital and ideology in the development of Afrikaner nationalism, 1934-48*** (Cambridge University Press, 1983).




04

CHAPTER 4

FROM FACILITATION TO INTERVENTION: THE STATE AND IRRIGATION (1935-1956)

Deborah Lavin and Lani van Vuuren

From 1935 the Government financed major irrigation schemes requiring high capital investment. Irrigation production faced special problems of production and marketing: the collapse of world farm prices increased legislative and bureaucratic intervention leading to the Marketing Act of 1937. White irrigation development often displaced black communities from favourable land. In the Reserves, irrigation was used to avert famine and, when the black areas were expanded after 1936, to promote more productive agriculture and conservation of natural resources. The Vaal Development Scheme included the two largest State settlements in the country, Vaalharts and Taung, in linked but contrasting white and black schemes. In the war years, new Directors of Irrigation emphasised the advantages of 'extensive irrigation' to improve farmers' livelihoods and introduce irrigation to a large area of land were otherwise it would not be possible. Reconstruction Committees planning the post-war future set two major strategic targets, firstly, the need to prioritise the development, conservation and use of the country's water resources and, secondly, a fully researched plan for the Reserves 'to improve every aspect of human life ... a rehabilitation of life not merely soil.' These were proposed under one regime, implemented under another after 1948. The creation of a National Finance Corporation stimulated the development of a domestic capital market that sustained public investment; a new Water Law greatly extended state control of water resource management through a redesigned Department of Water Affairs.

In February 1935, Reitz announced in Parliament the controversial principle that the cost of irrigation works of national importance should be met by the nation as a whole rather than falling on 'the unfortunate irrigators'. This was a new policy, different in principle from extensions of repayment periods (Act 38 of 1922) or the writing off of debt (Act 21 of 1928). It was further clarified on 5 April 1937 when Finance Minister N.C. Havenga acknowledged that irrigation schemes, by nature 'uneconomic', should be subsidised

according to their productive potential rather than costs. State Water Schemes, hitherto limited in number, were now developed.

The report of A.D. Lewis for 1934-5 announced the largest total expenditure in the history of the department[1]. Loskop, Vaalharts, the Clanwilliam Dam, the Vaalbank (Vaal) Dam, Pongola, Rust-der-Winter, Marico-Bosveld and projects on the Riet and the Vet rivers were all in various stages of planning or completion. Lewis was chairing an Advisory Board to produce the first complete topographical map of the Union, with the aid of air photography, facilitating aerial irrigation surveys and identification of catchments as well as serving the Department of Defence.

ADMINISTRATIVE CONFUSION IN IRRIGATION DEVELOPMENT

The procedures for authorising new schemes were imprecise at the best of times. There was ambiguity over parliamentary approval before costly State works were started and whether the Minister was bound to consult the Commission before agreeing to measures of relief and write-offs[2]. The Auditor-General described confusion between subsidies, loans and relief grants[3].

The respective spheres of the new Cabinet sub-committee, the advisory permanent Commission, the Parliamentary Irrigation Select Committee and the Irrigation Department were not clearly defined or established in practice. The Labour Department lobbied and paid for a number of schemes to relieve unemployment; settlement came under Lands; initiatives came from the Ministers of Agriculture and Finance. The Irrigation Commission completed its second five-year term of office in 1936 and was given a third. Lewis, who had originally proposed it, now considered it to be ineffective, lacking the authority to effect departmental coordination or resist political pressure for schemes to be rushed through prematurely[4]. The Commission complained that the Director did not supply the information necessary. Differences of policy and opinion multiplied[5]. Reports listed remissions of capital and interest granted without reference to the Commission, ministerial write-offs which the Commission had opposed, promised conferences not convened. The Select Committee on Public Accounts for 1935 heard that the Commission had been sidelined when schemes of national importance – Vaalharts, Loskop and Pongola – were commenced, Lewis maintaining that the new Cabinet sub-committee on white unemployment had authorised the schemes and that further authorisation was unnecessary[6].

At the suggestion of the Public Accounts Select Committee, a Round Table Conference was held in December 1936 between Reitz, Lewis and the members of the Irrigation Commission. The Minister gave his assurance that he would make no decision and submit no government scheme to Parliament before a report from the Commission had been received. The Commission advocated a steady programme of construction 'even if it involves heavy subsidies so as to keep the people on the land'. It recorded its considered opinion that the new schemes (Vaalharts, Rust-der-Winter, Loskop, Pongola) would not be settled rapidly and would require very heavy

[1] Report of the Director of Irrigation for 1934-5, UG 15-36.
[2] Evidence before the Select Committee on Public Accounts, 25 January and 8 February 1937, SC1-37, pp. 18-19 and 64ff. Further irregularities in declaring the Egmont Board Scheme to be a Government Work for 1937-8, SC1-39, p. 279. Report of the Irrigation Finance Commission 1947, UG 40-48.
[3] Report of the Select Committee on Public Accounts for 1934-5, UG SC1-1936.
[4] Lewis maintained that the Act setting up the Commission had departed from the terms of the original Bill to which he had contributed.
[5] See, for instance, the subsidy to the Marico-Bosveld scheme in UG 9-32; the case of Rust-der-Winter in UG6-35; the Spekboom scheme (Lydenburg) in UG 4-36, the Commission Report for 1934-5; and Interviews with the Minister, CAD K121 Box 43 file 73. In 1935 P.H. Nel succeeded Van Reenen as Chairman.
[6] Second Report of the Select Committee on Public Accounts, SC1 -36, para 11; also Evidence paras 2896-9 and 3259-88; also Appendix M, statement by P.H. Nel, Chairman of the Irrigation Commission, paras 3242-3.

expenditure; additional schemes ***for settlement purposes*** should not be encouraged before the existing ones were fully developed[7].

The new State schemes illustrate the problems resulting from lack of departmental coordination: authorisation on the basis of inadequate detail; belated changes and additions to designs resulting in continuing uncertainty about the relation between the preliminary soil survey, the area scheduled for irrigation and the water available. Many Government schemes were uneconomic since the rates did not cover operating and maintenance costs and irrigators were not liable for capital or interest repayments or charged for water[8]. White irrigation development, once seen as politically neutral, became increasingly controversial[9].

LOSKOP

The Great Olifants River Basin had long been identified as a good prospect for commercial irrigation. In 1929, the Irrigation Commission recommended that experience with crops on the Hereford scheme should be studied while engineering and soil data and an estimate for the Loskop Dam were assembled[10]. A petition and the personal intervention by the Minister of Finance produced a decision in 1933 to proceed with the scheme as a relief measure, authorised by the Cabinet sub-committee without further reference to the Commission. The Moutse rural community was expelled from land (known as Mmatoti) close to the dam 'without compensation for our loss and pride'[11]. Construction began in 1934 as a white labour project, employing in all some 7 000 workers and generating the town of Groblersdal. The dam filled in 1938, but the workforce was conscripted in 1939 and the canals were completed in 1948 by Italian workmen. The irrigable area originally calculated was extended when the Minister enlarged the plot sizes; the water supply was inadequate from the first[12].

[7] Report of the Irrigation Commission 1936-7, UG 4-38.
[8] Report of the Commission of Enquiry concerning the water laws of the Union, UG 11-1952.
[9] Report of the Irrigation Finance Commission of 1947, UG 40-1948. See, for instance, the debate on the Irrigation Supply Vote, ***Assembly Debates*** vols 24-5 (1935), cols 668-70; also cols 5095 ff. relating to the Beenbreek scheme (1933), Vaalharts (1933-40), Vioolsdrif (1933-5) and Loskop (1933-8). See too A.H.J. Eaton on anomalous subsidies, raised in the budget debate, cols 3757-8 (***Debates*** vol 29 (1937).
[10] Irrigation Commission report for 1929-30, UG 3-31.
[11] N. Stott; K. Sack & L. Greeff, Once there was a community, Southern African Hearings for Communities Affected by Large Dams (Environmental Monitoring Group, Cape Town, 2000)
[12] Report of the Commission of Enquiry concerning the water laws of the Union, UG 11-52. Extra information kindly provided by Mr Dick Engelbrecht, Chairperson of the Loskop Irrigation Board.

Lani van Vuuren

Loskop Dam. The original dam wall was 45 m high, but the wall was raised by 9 m in 1980. The dam feeds the Loskop Irrigation Scheme – today the second-largest Government irrigation scheme in South Africa.

PONGOLAPOORT

The potential of Northern Zululand for plantation crops of sugar and cotton had been identified by R.H. Rouillard, a mining engineer and geologist who, after World War I, formed the Candover Cotton Estates from land hitherto used for winter grazing. The Beaumont Commission recommended the area for black occupation, but Reitz convinced Smuts of its potential for white settlement in 1923. Less than a month later the Land Board had been instructed to prepare 'a comprehensive scheme for opening up Zululand in a big way' for a settlement scheme for ex-servicemen on government farms previously identified as a 'native area'. The Estates were controversially purchased by the government in 1930 for

£64 000 with the active encouragement of E.G. Jansen, local MLA and later Minister of Irrigation. Amid accusations that 'inducements and pressure' had been brought to bear the Pongola diversion scheme went ahead, planned for 150 irrigated holdings[13].

The scheme was cheaply built under an accelerated programme and badly developed as a relief settlement. In 1937, it became a government irrigation area and training establishment, imposing monk-like living conditions on probationers from Agricultural Schools who left it as soon as they could. The scheme did not prosper even when settled by unemployed settler families working their own plots under supervision (to inculcate 'a spirit of independence, responsibility and self-respect'). The scheme was closed in 1941 as uneconomic, with waterlogged soil and leaking canals, most of the remaining settlers opting to transfer to Loskop. Pongola was saved by the wartime demand for essential foodstuffs and resuscitated on improved lines after an Enquiry in 1943 recommended the cultivation of sugarcane. On that assumption in 1947 the Irrigation Commission supported a proposal for a dam at Pongolapoort[14] where construction began in 1963.

Lani van Vuuren

The canal system of the Pongola scheme. Today, sugarcane is the main irrigated crop.

[13] Assembly Debates, 1931-2, Vol. 19 cols 5220 ff. Accusations made by Abrahamson, MLA.
[14] Report of the Irrigation Commission to the Minister of Lands and Irrigation, 23 Sept. 1947, CAD BAO 6932 260/337 (ii).

RIET RIVER[15]

In the difficult years of the early 1930s a well organised and determined Riet River Vigilance Committee sent a deputation to Hertzog (Prime Minister), N.C. Havenga (Minister of Finance) and Reitz (Minister of Lands) to press for reconsideration of a scheme originally proposed in 1922 by Havenga as Member for Fauresmith, now expanded in scale to grow irrigated fodder. New gold discoveries in the Free State strengthened the case for additional water and produce; no fewer than 7 Cabinet Ministers had farms there. Reitz (who had no personal interest) took up the cause with his customary energy; due process was more or less abandoned in Lewis's absence (he was on a visit to Australia). Under political pressure construction of the Kalkfontein Dam began before any decision had been reached on the distribution of the irrigable lands, the crops to be grown or the layout of the water distributaries[16].

The scheme was designed and surveyed for extensive irrigation rather than for settlement, but in September 1939 Senator Conroy, the new Minister of Lands, belatedly decided to include an intensive settlement previously ruled out by the Irrigation Commission and the Land Board[17]. There was confusion over scheduled land; attempts to impose a water quota alternated with periods when irrigators had unlimited supplies, especially during the drive for wartime food production. The scheme became a hybrid scheme serving settlers, private owners and probationary lessees. A social welfare settlement was added with notoriously bad conditions and no facilities[18]. There was never enough water to satisfy the various demands. No fewer than 11 reasons for the shortage of water were advanced in 1950: belated additions to the schedule including a canal to the farms of Messrs Havenga and Strauss, ground allotted to Jacobsdal, provision of water to the Ritchie Irrigation Board, the sub-division of farms and the delayed inclusion of ground originally categorised as non-irrigable[19]. Irrigation Minister Strydom called it 'one of the most tragic things that have ever happened in South Africa in respect of State funds and in respect of settlement and irrigation[20]. By that time settlement plots with houses could not be supplied with water and lay vacant and unirrigated.

THE CRITIQUE OF THE AGRICULTURAL ECONOMISTS

In his Carnegie volume on rural poverty, J.F.W. Grosskopf, head of the Division of Economics and Marketing, identified as 'our biggest mistake' – that ***land settlement*** (inland colonisation) and ***poor relief*** were not kept clearly separated. If the State was to gain a return on the millions of capital advanced or invested for irrigation, settlers would need training and help with marketing irrigated produce[21]. According to the Settlers Relief Commission of 1934, farming was becoming 'more and more complicated and exciting', irrigation in particular requiring 'a very special knowledge of all that is involved'. The lands were expensive to develop and subject to heavy interest and redemption charges. In good years lack of agricultural know-how resulted in overproduction of poor-quality produce, with glutted markets and low prices, while in the disastrous droughts of 1931-3 'people sank to levels hitherto unknown, and debt picked up to such an extent as to make it impossible for settlers ever to be able to overtake their arrears'.

[15] This account is based on the evidence in R.K. Goosen, 'Riet River Irrigation Scheme, Fauresmith: historical technical and general aspects of the scheme', 22 April 1950, CAD BES 169 vol. 60/xviii.
[16] Select Committee on Public Accounts for 1937-8, SC1 - 39 p. 1347 ff.
[17] S.L. Kantor [Administrative Engineer], 23 March 1950, CAD BES 169 60/xvii.
[18] Report by C.R. Nyenes, Asst Controller of Social Welfare Settlements, 29 June 1951, CAD BES 193 60/42.
[19] L.A. Mackenzie, 1 May 1950, 'Rietrivier Besproeiingskema' and Mackenzie to the Administration Engineer [S.L.Kantor], 4 February 1950, CAD BES 169 60/xvii.
[20] Assembly Debates, 24 April 1950, vol 72 col. 4899.
[21] J.F.W. Grosskops, R.W. Wilcocks, E.G. Malherbe; W.A. Murray; J.R. Albertyn, ***The poor white problem in South Africa. Report of the Carnegie Commission*** (5 vols) 1932, Vol. I, J.F.W. Grosskopf, Economic Report: rural impoverishment and rural exodus 232-3. The investigations were conducted by the Dutch Reformed Church and paid for by the Carnegie Foundation.

More than relief and subsidy, settlers needed assistance in resisting drought through extensive irrigation, combining crops and stock farming at a living wage[22].

In his ***Economics of Agriculture*** published in 1937, A.P. van der Post synthesised many of the arguments, proposing authoritatively that successful irrigation settlement should be measured in terms of net income rather than high yields – 'not production ***per se*** but profits per man'[23]. Van der Post reversed the orthodoxy of the Irrigation Finance Commission ten years earlier (that plots were too large); the common plot size of 10 morgen limited earning potential and did not suit South African conditions. Such holdings demanded the most intensive forms of agriculture in areas where there was often insufficient water, poor soil and an undeveloped market. In these circumstances irrigation could only be profitable on larger holdings in combination with dryland farming and grazing.

AGRICULTURAL TRAINING

In 1925, Professor Grosskopf had drawn attention to the problem of how farmers were to produce 'those things for which the market will offer them the most profitable net income' rather than how they were to sell them[24]. At Hartbeespoort after 1931 the Department of Agriculture replaced the old Labour Department methods with a new 'Losperfontein System' to categorise and train settlers, enabling selected trainees to produce large crops of wheat and tobacco on plots of 8-10 ha, marketed by the Department for the credit of each trainee's account. The average wheat yield was double that produced by the average farmer in the area while using 30% less water[25]. The Department proposed that potential irrigators on state schemes should first attend a School of Agriculture and then practice farming on a scheme such as Losperfontein using the intensive methods required for irrigated cultivation or for irrigated fat-lamb production before taking over a State holding. The new schemes at Vaalharts, Loskop and Pongola should set aside land for practical training on Losperfontein lines, producing commodities for export to avoid flooding the domestic market.

After 1935 the Reports of the Director recorded the initiation of a crop census, begun with the idea that increased production of higher-value crops could offset capital expenditure hitherto deemed 'irrecoverable'. In 1936-7 the census revealed a productive irrigable area of about 135 000 ha producing gross returns of four million pounds, half of which came from citrus and vines occupying less than 12% of the area[26].

Farming in South Africa devoted increasing space to the role of the Extension Service – 34 full-time officers stretched thinly over 104 Magisterial Districts by 1939. Their original function was to check poverty by linking farmers to the Department through regular personal contact, farmers' associations and cooperative demonstrations, persuading them to adapt to changed conditions and use sound methods of agriculture. Shortage of staff meant that this educational work became increasingly combined with inspection and regulation, to the detriment of the original intention[27].

[22] Verslag van die Kommissie insake verligting aan setlaars, UG 25-35.
[23] A.P. Van der Post, ***Economic factors in agriculture, South African Agricultural Series Vol XV*** (Gordon and Gotch, 1937)
[24] Van der Post, ***Economic factors in agriculture***.
[25] ***Farming in South Africa,*** December 1936, 600.
[26] Report of the Director of Irrigation for the period 1926-7, UG 3-38.

MARKETS AND THE MARKETING ACT 1937

Van der Post argued that many schemes had no economic justification and were overcapitalised; improvements must be justified in terms of market conditions which in South Africa were 'most unfavourable'. The Settlers Relief Commission warned that problems of the production and marketing of irrigated produce would intensify as new schemes increased the irrigable area: without government investigation and intervention, if irrigators had to depend on their own resources irrigation schemes would fail. In the recession and price fluctuations of the early 1920s the Smuts government had channelled state support to farmers through the Cooperative Societies Act of 1922. But cooperatives did not cope successfully with surplus production, the need for diversity and a better balance between exports and imports[28]. By 1930, statutory control boards with monopoly powers were established for the wine, tobacco and dairy industries, restricting imports and subsidising exports.

The Marketing Act of 1937 established a National Marketing Council on a Dutch model, extending Control Boards to new products[29]. The policy was reactive: Stanley De Swardt of the Economics and Marketing Division had seen, at the height of the Depression, the drought-stricken wastelands in the north-west, and Karoo mohair farmers struggling for survival in an unstable and chaotic market beyond the competence of any amateur cooperative[30]. The Act provided for specialised marketing bodies to ensure efficiency and price stability; it stimulated the intended capital investment and diversification into higher-value tobacco, vegetable and citrus production although fixed prices were more advantageous to the large producers than the small independents. Guarantees against the collapse of markets meant that agriculture was becoming a less risky option: by the 1940s smaller farmers were investing in improvements and mechanisation, boosted by state aid and wartime production subsidies and marketing policies.

VAALHARTS – SOUTH AFRICA'S LARGEST IRRIGATION SCHEME

The Vaalharts scheme, where construction began in 1934, illustrates aspects of the consequences of over-accelerated irrigation development in times of social crisis and some of the practical effects of policies instituted over the next twenty years.

Investigations had been resumed in the early 1920s for the settlement of ex-servicemen. It was not built then, partly for economic reasons and partly because much of the best irrigable land was found to lie within the Taung Reserve[31]. In the delay, new factors emerged. The severe drought drastically curtailed the flow of the Vaal River, causing the Rand Water Board to propose the Vaalbank Dam to store supplies for the Rand; Vaalharts was revived as a prestige project of the incoming Hertzog/Smuts governing coalition. In 1933, the Cabinet sub-committee authorised £20 000 for preliminary works at Loskop and Vaalharts to be undertaken by white labour. Before the two related Irrigation Amendment[32] and Vaal River Development Acts had been fully debated Reitz

[27] Report of the Director of Irrigation for the period 1926-7, UG 3-38.
[28] See the contributions by J.F.W Grosskopf and A.P. van der Post in Report of the Conference of the Economic Society of South Africa, Johannesburg July 1925, 61-70. See too Grosskopf, 'Economic Aspects of Farming', ***Farming in South Africa*** December 1936.
[29] ***Farming in South Africa,*** January – April 1937.
[30] S.J.J. de Swardt, 'Agricultural marketing problems in the 1930s, ***South African Journal of Economics,*** 51 (1983), 1-19; the [P.R.Viljoen] Commission into Co-operation and Agricultural Credit, UG 16 -1934. See too E. Davis, 'Some aspects of the marketing of farm products in South Africa', ***South African Journal of Economics,*** 1, 2 (1933), 167-87; F.J. Van Biljon, State interference in South Africa (P.S. King & Son Litd, 1939)
[31] 'The relation of the natives to such a scheme would have to be seriously considered' (A.D. Lewis, Report of the Director of Irrigation, 1921-2, UG 8-23)
[32] Vaalhartz Irrigation Works. Amendment Act. Rand Water Board, ZA SAB BES 299 90/24 1.

announced the Vaalharts Scheme in Parliament on 3 November 1933, committing the House to spending an initial four million pounds. The Rand Water Board's Vaal Dam at the confluence of the Wilge and Vaal rivers[33] was made the subject of a deal by which the Board would enlarge the dam to store additional water for diversion to Vaalharts by means of a weir 567 km downstream at Fourteen Streams, the dam acting as a regulator increasing minimum flow and controlling floods on the long intervening river reach.

There remained the question of the Taung irrigable land. The case was complicated by the Land Act of 1913 and the terms on which British Bechuanaland had been transferred to the Cape in 1895[34]. In the Depression, mass meetings held by the Kimberley/Vaal lobby insisted that the scheme be started immediately as a white unemployment measure[35].

In 1933, Minister Piet Grobler sent Senator F.C. ('Matabele') Thompson as a secret agent to buy white farms at regular prices in anticipation of an exchange of land on the precedent of Hartbeestpoort. Reitz, Lewis, Thornton (Director of Native Agriculture) and Cross (Secretary for Lands) met Chief Mankuroane and his councillors to discuss a proposal: the southern half of the irrigable area in the Reserve to be incorporated in the Vaalharts scheme, leaving the Bathlaping the northern irrigable 6 425 ha to be supplied with irrigation water free of charge in return for labour in cleaning and maintaining the canals. In addition, 9 166 dryland ha (bought by Thompson) would be added to the Reserve. The ***Johannesburg Sunday Times*** carried the headline '£4,000 000 to Irrigate a Native Reserve?'[36]. Land prices soared. On 13 February 1934, Lewis reported that additional land would be required from Taung to make up for land for roads and depots included in the transfer and to allow for an access strip above the line of the canal. The land exchange was not finalised until 1940[37].

The Vaal River development was justified in Parliament as the outcome of half a century of research, '[placing] us almost in the forefront of dam builders'[38]. The debates canvassed possible alternative uses for the capital – smaller schemes, large schemes, roads. Vaalharts was criticised on grounds of expense, undue haste and inadequate chemical analysis of the soils. The dam (at one million pounds) was widely praised; the irrigation scheme (at two-and-a-half million) was criticised in its agricultural aspect though acknowledged as important for white employment[39]. Some years later an Eastern Cape supporter of the government claimed that 'old members of the SAP [the South Africa Party of Botha and Smuts]' had been told that Vaalharts was a matter of confidence and that if they opposed it the Smuts-Hertzog coalition would dissolve[40].

Lewis's hopes for steady, methodical irrigation development were overtaken by events. In 1935, the soil survey was fast-tracked as an urgent priority[41]. In 1934, construction began concurrently on the Vaal Dam, the Vaalharts weir at Fourteen Streams and the main canal; the full scheme was completed in 1961. The Department of Labour recruited a white labour force of single men aged between 18 and 45. Controls in the settlement were strict and conditions challenging.

[33] A site identified by F.A. Hurley in 1905.
[34] That any change to the law would require the agreement of Britain. By the time of the land deals in Taung the constitutional position had changed entirely, with South Africa's full independence guaranteed by the Statute of Westminster and confirmed by the Status Act of 1934. For the legal position on land see, for example, the correspondence between the Department of Lands and the Government Attorney, October-November 1936, BES 255/90/xi.
[35] Fincham Memoranda, 'Vaal-Hartz Project', 3 May and 15 July 1932, BES 254/90 vi.
[36] ***Sunday Times***, 19 November 1933.
[37] Parliamentary debates 1934, cols.3551 ff.
[38] ***Ibid.***
[39] Assembly Debates, 14 May 1934, pp. 3561, 3570-1.
[40] Parliamentary debates 1937 cols 849 ff.
[41] A. Stead (Division of Chemistry), Vaalharts Survey 3 April 1935 and correspondence, CAD BES 253/90 (iv).

Press reports of a high dropout rate resulted in a visit by the Secretary of the General Poor Relief Commission of the Dutch Reformed Church to report on the spartan conditions for the 1 200 young Afrikaner workers[42]. A year later Olga R. Price, from the Johannesburg ***Star***, described a modern township with good facilities, and even an orchestra, for the benefit of 1 800 unemployed men (including 'former lawyers, accountants, men who had won and lost fortunes, professional boxers and a circus couple')[43]. Politics and politicians were banned from the works after the intervention of several parliamentarians[44].

WRC archives

Vaalharts Weir. From the weir water is diverted into the main canal which flows for 19 km before bifurcating into the West and North canals, which are 21 km and 60 km long respectively.

[42] The Rev. P Du Toit, 'The Vaal-Hartz Scheme' (August 1934).
[43] Olga R. Price, 'Work and Play on the Vaal-Hartz Scheme', ***The Star***, 30 November 1935. See too the assurances of 'very special attention given to welfare and leisure' in the Director's Report of 1934-35, UG 15-36.
[44] See, for example, the correspondence on the Van Wyk case (CAD BES 255/90/xi and xii), taken up by ***Die Vaderland*** (16 December 1936) and ***Die Burger*** (12 Jan 1937).

The first settlers arrived in 1938 as probationers, leasing holdings of 17 to 26 ha. (This was later increased to 30 ha). They had to be under 50 years of age and supposedly possessing operational capital (though this was frequently waived). Preference was given to farmers who had lost their farms – men like P.J. (Piet) de Wit who had lost his ostrich farm in the drought of 1933. He began by planting watermelon pips in 500 paper bags, only to suffer the destruction of the seedlings by wind on the first night after they were pricked out. Later he sowed three sacks of corn, harvesting just two sacks by hand and tying up the sheaves with torn bedsheets[45]. After the first probationers were approved in 1941 as lessees with an option to buy, the scheme was also used for a social welfare settlement and wartime internment.

Vaalharts was to become an important testbed for irrigation development. While the glacial valley had the advantage, unusual in South Africa, that the bulk of the scheme could be laid out in a continuous block some 20 miles long, the flat terrain minimised runoff. From 1947-50, 400 ex-servicemen were placed in the Magogong area. To ensure sufficient supply night storage dams were constructed on all plots. But the unlined canals and sandy soils underlain by limestone made waterlogging a serious problem, while regular irrigation greatly increased the surface run-off. Water management remained exceptionally difficult, given the size of the scheme and the number of abstraction points.

In 1953, the ***Cape Times*** reported that the Kalahari had been transformed; Vaalharts had shown a gross income of a million pounds in each of the past three years. Farming associations had formed, and the farmers had embarked on food processing, with lucerne drying plants (later extended to vegetable dehydration) and canning factories. The Agricultural Coop, begun in 1944, provided extension services and was to play a major role in the processing of agricultural products and the manufacture of implements. By 1955, there were 1 180 families, growing to a peak number in 1970 of 1 400.

IRRIGATION IN 'RESERVE' AREAS

During the Depression large-scale State intervention in agriculture was applied worldwide. The Kassier Committee on the Marketing Act pointed out in 1992 that, uniquely, in South Africa, State intervention was combined with the Land Acts of 1913 and 1936 to favour the interests of white commercial farmers to the exclusion of smallholder black farmers and others. In the long term, the interventionist measures 'in fact resulted in a largely unsustainable commercial and poorly developed subsistence agriculture'[46].

The Department of Native Affairs started its Agricultural Service in 1929, when the Reserves were producing only half their food needs. R.W. Thornton, the first Director of Native Agriculture, immediately initiated an attempt to ensure food security and alleviate poverty by improvements funded from local taxes, with extension services to encourage progressive farmers. There was official interest in the potentialities of irrigation which the Irrigation Commission concluded might be encouraged in the Transkei 'among the more enlightened classes, that is to say, among those Natives who make application for it'[47].

[45] Hans Bornman, ***Vaalharts*** (Vaalharts Halfeeus komitee, 1988)
[46] Republic of South Africa: Report of the Committee of Inquiry into the Marketing Act (Government Printer: Pretoria,1992)
[47] Annual Report of the Irrigation Commission for 1930-31, UG 9-32. See too, the Report of the Native Economic Commission advocating a transition to 'more rational and productive agriculture', UG 22-32.

In 1930, a study by Professor W.M. Macmillan revealed the extent of landlessness and distress in Herschel (Transkei), dismissing ideas that the Reserves could be made to absorb more people and arguing that lack of transport would make it impossible to market the produce or introduce more profitable crops. The Native Development Fund set up in 1925 to distribute a portion of black taxes was inadequate[48]. In 1931, Thornton commissioned the Irrigation Department to enquire into soil erosion in the Herschel District and the possible mitigating effects of irrigation 'at comparatively small cost'[49]. Conditions were unfavourable, but there were daily pleas for 'water – somehow – on the lands'. The Sterkspruit diversion scheme was begun by a pessimistic Irrigation Engineer in 1932. Thornton advised him not to judge by European standards; a few acres under vegetables would produce a lot of food and the Native Agriculture Department would persuade the farmers to grow better crops. When the works were damaged by the first heavy rains in 1933, the landowners and tenants demanded a storage dam, agreeing to pay a water rate of 1/- per acre for maintenance costs[50]. This, however, was deemed invalid because 'in terms of section 15 of Act 41 of 1925, the beneficiaries under an irrigation scheme can hardly be regarded as a community' [51].The Sterkspruit works fell into disrepair and arrears were written off in 1945[52].

In 1934-5, 'Native Development' was voted £100 000 for employment and food-producing schemes. The Irrigation Department surveyed irrigable lands, and with local labour and resources (paid at starvation wages) built furrows and laid out fields to make 'simple yet practicable' small schemes, classified in the annual reports as 'minor works' for the Native Affairs Department[53]. Experiments based on individual and varying forms of group and communal systems were undertaken as pilots.

THE GOMPIES EXPERIMENT (ZEBEDIELA LOCATION)

This originated in an idealistic proposal to spread the benefits of irrigation in an area of scattered settlement with limited water, giving security to families whose heads worked elsewhere. An association of 300 shareholders would pay 10 shillings a share carrying an obligation of 30 days' work on the irrigated lands in summer and in winter and an entitlement to a ***pro rata*** share of the crop (cereals and peas in summer, cereals and beans in winter, with potatoes; tobacco was grown but not marketed)[54]. The scheme was heavy on administration, involving a register of shareholders and time sheets as well as complicated disposals of the crops in varying proportions. Production rates were high, but the scheme proved expensive when it was extended by 100 acres a year,[55] and the original assumption that 1 irrigated acre would produce enough to support food, taxes and clothing for a whole family proved inadequate.

Hard-pressed and well-intentioned officials on the ground, already battling to introduce agricultural improvements, were faced with introducing irrigation in places where residents were reluctant to commit themselves either to labouring on the works or supplying draught animals. The new black schemes, superimposed on land already occupied, did not

[48] W.M. Macmillan, ***Complex South Africa – An economic footnote to history*** (Faber & Faber Limited, 1930)
[49] What follows is sourced from CAD NTS 7949 209/337.
[50] Assistant Native Commissioner Sterkspruit to the Native Commissioner Herschel, 23 January 1934 and 9 January 1935: 'Control and Maintenance of Irrigation Works', NTS 7949 209/337.
[51] The Native Economic Commission had cited this as evidence that the Act was not sufficiently flexible to meet the needs described. Report, para 135.
[52] Note for Ministerial approval, September 1946, NTS 7949 209/337.
[53] Report of the Director of Irrigation for 1933-4, UG 7-35: Linokana and Gopane (Moiloa Native Reserve), Kuruman Native Reserve (3 schemes), Kamastone (Whittlesea). Report of the Director of Irrigation for 1934-5 (UG 15-36): Seliba (Thaba N'chu); Kamastone; Gopane (Moiloa Native Reserve); Maropin, GrootKoning, Botheletsa, Vlakfontetin, Manyeding (Kuruman); Zebediela Location (Potgietersrust); Witzieshoek; Veeplaats and Missionvale (Bethelsdorp).
[54] Collective farming, Northern Areas, CAD BAO 6416 368/327. See too Sibasa, NTS 7947 NA197/337.
[55] In 1939 the scheme cost the Local Council £992.10.0 while providing an income of £355. (CAD NTS 7947 202/337).

provide extra land on which to settle the landless former occupiers who vigorously asserted their own preferential rights[56]. The Grobler scheme at Seliba (Thaba 'Nchu) was built as a distress relief measure in 1933-4. Many irrigators owned their own ground and successfully resisted collective working, let alone the attempted introduction of the Gompies model[57]. Chief Mpefu, when offered the Njelele scheme as a relief measure, suspected (with justification) that this would incur liability for payments in future and would stop the customary use of the lands for winter grazing after harvest[58].

Even where irrigation improvements were eagerly received, the controlling tone of their administration in the name of 'betterment' generated resentment.

IRRIGATION ON MOILOA'S RESERVE, ZEERUST

There was a long tradition of leading water from the Dinokana fountain, acknowledged in 1917 and 1923 by two Native Commissioners; not until 1931 was the area officially recognised as 'ideally suited in every respect for development purposes'[59]. Michael Moiloa, Secretary to the Moiloa Local Council, wrote an impressive Agricultural Plan for the Reserve to improve cattle farming and promote a dairy industry.

The Agricultural Supervisor forwarded Michael's Memorandum to Thornton, describing how Michael's father, a successful irrigation farmer, had introduced a water system and established a small Water Board to control the Maramage furrow for the successful production of mealies and wheat. Rules regulating 'turns' for irrigators had been enforced by local supervisors mediating in minor disputes on each section of the furrow. On payment of five shillings an irrigator could use the water and was obligated to help clean the furrow. The penalty for stealing water was two shillings and sixpence, paid directly to any man catching another stealing; the spade of the miscreant would be forfeit until the fine was paid. Other councils of irrigators had come into existence on the furrows from the Linokana Fountain, each with a foreman to convene meetings and manage the scheme. The supervisor proposed that rather than spending £1 000 on agricultural assistance the Department should advance £2 000 to rehabilitate every part of the old irrigation schemes, with deviating weirs at the various fountains, the money to be repaid over ten years from local tax receipts[60].

In October 1932, schemes were authorised for Linokana and Gopane on condition that local residents supplied transport, fuel and water and paid local taxes. The Gopane Dam was officially opened in December 1934 in honour of the late Chief Jairus; Thornton was presented with a leopard skin. When the Taung land negotiations ran into difficulties the Chief and his councillors were shown the Zeerust scheme as an inducement. For a time, the irrigation farmers of Moiloa received state aid – demonstration plots, advice on irrigation methods, and benefits such as fencing and a citrus packing shed through which commercial farmers like Michael Moiloa could market their crops[61]. But by 1939 the tone changed: residents complained at planting restrictions, the engineers were recommending reorganisation on the lines of Gompies and Grobler/Seliba (i.e., group tenure, reorganisation around new lined channels rather than miniature lands and hand-dug furrows between the Linokana huts). A total of 31 formal rules

[56] With the concomitant inconvenience and disruption. See, for instance, James L. Seloma (Head Kraal, Naboomspruit) to N.A. Department, Pretoria, 2 June 1937, NTS 7947 NA197/337.
[57] CAD NTS 7981 and 7982 /259/337 i and ii. See too C. Murray, ***Black mountain: land, class and power in the Eastern Orange Free State 1880s to 1980s*** (Wits University Press: Johanesburg, 1996)
[58] CAD NTS 7936 174/337.
[59] Report by Asst Engineer Durnell, 'Moiloa Native Reserve', 20 April 1931, CAD NTS 7908 41/337.
[60] Zeerust Magistrate to R.W. Thornton, 20 January 1932, CAD NTS 7908 41/337.
[61] J.H. Drummond, 'Changing patterns of land use and agricultural production in Dinokana Village, Bophuthatswana' (MA thesis, University of the Witwatersrand, 1992).

for the Linokana Water Board were drawn up on lines derived from white schemes by an official frustrated at 'the hopeless and inefficient manner of irrigation as a whole in Linokana Stat, and the governing thereof'. This met with resistance and delaying tactics.

CONTROL OF IRRIGATION SCHEMES IN THE NATIVE AREAS

The 1936 Native Trust and Land Act created the SA Native Trust to acquire and hold additional state- and privately-owned farmland to a maximum of 7.25 million morgen for black occupation 'to advance the interests of natives ... in the agricultural, pastoral and other industries[62]. There were general reports of neglect and mismanagement of irrigation in the Reserves with falling yields, furrows not maintained and schemes underutilised; the remedy was seen as greater departmental control. A White Paper in 1937 stated the need to 'place the soil before anything else';[63] a new reclamation programme was instituted. Diversity became standardised. Lengthy scheme regulations in obscure phrasing were gazetted, laying down the terms on which allotments were held[64]. Reinecke spoke of fostering self-reliance but also 'the necessity of gaining greater control over the plotholders'. The departmental report for 1935-6 announced that collective crop farming would be introduced 'with its attendant advantages of time, labour-saving and efficiency'. Organised groups or associations of heads of families under a leader responsible to a local council or chiefly advisory board would pool their labour, animals and implements 'and undertake all operations ... at the proper time and efficiently in order than optimum crop returns may be obtained'. The system would release '50-75% of the male labour units and 40-50% of the draught animals ... on individual holdings'. The best method (collective or individual) of organising the production of new subsistence and cash crops would be investigated[65]. Early emphasis on cooperation and gradual implementation[66] was replaced by talk of stringent regulations. Collective farming, it was argued, would encourage scientific methods, provide for storage against times of scarcity and facilitate the marketing of surplus produce.

During the war the Smuts government single-mindedly pursued increased food production, with inputs for farmers of all races subsidised at 55% and the mobilisation of labour to achieve bulk purchase contracts placed by the UK government. Irrigation was steadily expanded in the black areas throughout the war years. Fort Cox Agricultural School introduced a group project system training demonstrators and teachers for the locations, replacing previous courses in commercial large-scale fruit and grain farming for skilled workers and foremen[67]. Cultivators on irrigation schemes were said generally to employ better methods and produce a greater diversity of crops than dryland farmers. Wheat, groundnuts, lucerne, citrus and grapes were all successfully produced under irrigation by black farmers, especially in the north[68]. The Reports of the 1940s cited the Rembander Vegetable Garden Scheme in the Sibasa district, the Letaba Bantu Farmers Cooperative with over 1000 members and an 'outstanding' vegetable growing project on the farms York

[62] Native Trust and Land Act, Act No. 18 of 1936.
[63] 'A statement of land policy under the Native Trust and Land Act', Department of Native Affairs, February 1937.
[64] Grobler Irrigation Scheme: Bylaws; Minutes of Seliba Native Reserve Board, 14 May 1937; B.H. Wooler, NC to Chief Native Commissioner 18 May 1937; E.W. Lowe, Chief Native Commissioner Northern Areas to Secretary for Native Affairs, 28 May 1937; Proclamation 173, ***Government Gazette*** 26 August 1938, CAD NTS 7982 259/337/2.
[65] Report of Director of Native Irrigation in Report of Native Affairs Department for 1935-6, UG 41-1937.
[66] Assembly Debates 1936, vol. 27 cols 2951-2.
[67] Report of the Department of Native Agriculture for 1944-5, UG 44-1946.
[68] Report of the Director of Native Agriculture for 1950-1, UG 30-53.

and Tours at Thabina. In the Ciskei, by contrast, much money had been spent on irrigation but there was no example of a productive irrigation scheme in the black areas.[69] In his report for 1944-5 the Director of Native Agriculture commented, 'Each year it becomes more and more obvious that the irrigation schemes in the Native areas are the greatest asset there is.' By 1950 there were 126 irrigation schemes in 'the Native areas of the Union', covering 14 200 morgen of irrigable land.

TAUNG: SOUTH AFRICA'S LARGEST BLACK IRRIGATION SCHEME

Despite its more or less accidental origin great ambitions were invested in this scheme: 'The eyes of the whole of South Africa (white and black) are on the scheme. The onus is on our Department to see that it is a success and under no circumstances can haphazard methods be tolerated'[70]. Native Commissioner, F.H. Ferreira's superiors hoped to proceed by goodwill and cooperation, given the antagonism between the various communities of Thlaping and Gamahedi people living in separate parts of the Reserve, with an additional significant Mfengu presence; it was proposed also to import 'affiliated groupings' to bring all the irrigable ground into production. The irrigation area would be supplied with water from Vaalharts; 400 men would be eligible as 'labourer-probationers' to be taught 'to farm properly but also to live properly'. After 1-4 years on a training scheme the trainees would continue farming either on communal lines or individually[71].

Director of Native Agriculture, T.G.W. Reinecke and his Deputy, H.E. Melle, had decided the trainees should work 'as a collective group' of 20 on 30 irrigated morgen, while the Native Trust would control the use of soil and water and production. Each group would form a Farmers' Association with an executive committee employing permanent irrigation officials to ensure the land was being worked efficiently; the village headmen would maintain tribal traditions[72]. The Thlaping were told this was 'better than what is being done in any other District'. But adverse comment at the expense caused collective working to be dropped and individual occupation substituted. The eight management committees were abandoned as 'cumbersome, unwieldy and unmanageable'. Instead, a new committee would control irrigation in each area. Cattle men were to be transformed into intensive cultivators; the annual exodus to harvest on white farms in the Western Transvaal and Orange Free State could not be disrupted; it would be 'a very delicate matter' to charge a maintenance fee to plotholders expecting to get free water, perhaps endangering the whole scheme[72].

The exchange of land was not finally affected until 1940[73]. The scheme was built between 1939-42, designed for flood irrigation on plots of 1.7 ha cleared, complete and ready to receive water. Planned to take 8 years at an annual rate of 1 000 morgen, by 1944-5 only 1 499 morgen had been brought under irrigation. In the wartime food shortage there was great competition for plots, but the planned model villages were not built as no water had yet been supplied. Plotholders were permitted to work their plots without

[69] Report of the Director of Native Agriculture 1949-50, UG 61-51.
[70] Native Commissioner F.H. Ferreira to Chief Native Commissioner Lowe, 11 November 1936, CAD NTS7971 NA235/337/8.
[71] Director of Native Agriculture (Reinecke) to the Secretary for Native Affairs through the Controller of Native Settlements (Rogers), 5 November 1937, NTS7971, 235/337/8i
[72] Melle and Reinecke, Vaal Hartz Irrigation Scheme, 22 May 1938, CAD NTS 7973/235/337/15.
[73] Digested from the many submissions to the Secretary of Native Affairs during the first 6 months of 1939. See too Vaalharts irrigation scheme (Taung) reports, CAD NTS 7973/235/337/15 for monthly progress reports from Taung.
[74] Proclamation 85/1937; Proclamation 238/1940.

first taking up residence in the adjacent villages, travelling long distances; the irrigable lands were not yet accessible to vehicles. Grievances submitted by the headmen in June 1944 were dismissed by the Native Commissioner as of 'no substance whatever'[75].

The scheme started under great disadvantages, soil depleted by years of constant dryland cropping, and water from the Vaalharts weir, fifty miles away, taking some two days to reach the Taung settlement with losses from evaporation and leakage. Drainage had become a perceived problem: sizeable stretches of concrete furrow were sinking and a substantial drainage furrow had to be constructed at Mokgareng. By September 1946, 646 families were settled on two-morgen plots and 142 morgen was laid out as vegetable gardens for 318 plotholders, though the response had been slow and undeveloped land was put under wheat as part of the national food drive to offset acute local food shortage.
In 1952, only 2 500 morgen had as yet been scheduled at Taung (the Vaalharts scheduled total was 35 463 morgen) and the Minister ruled that Taung must receive water for the full 7 500 morgen originally negotiated[76]. The following year, plans

Lani van Vuuren

The canal system in Taung, present day. In 2009, while the area had a scheduled irrigation area of 6 424 ha, only about half (2 759 ha) was being irrigated. The canal system is being managed by the Vaalharts Water User Association as part of the greater Vaalharts irrigation scheme.

[75] Vaalharts irrigation scheme (Taungs), Native settlement and development, CAD NTS 7971 235/337/8 (ii).
[76] Vaalharts Irrigation Scheme, weekly reports, CAD BES 262/90.
[77] Chief Native Commissioner Potchefstroom, 'Report of Ad Hoc Committee on Taungs Irrigation Scheme', 15 May 1953, CAD NTS 7971 NA235/337/8 (iii), with ms. annotated calculations by G. de Waal showing that of the 7 500 morgen 4076 had been developed with roads, canals, leidams etc., so that only 3 254 morgen was actually irrigable.

Lani van Vuuren

So-called 'Dam 6', which feeds the Taung section of the Vaalharts irrigation scheme.

were made to introduce lucerne to build soil fertility, and to institute one-channel marketing. Elaborate plans were outlined for advice, assistance and training for the black irrigators and in marketing their produce, drawing praise from the Secretary of Native Affairs for the Taung officials (who felt the scheme was 'something of a Cinderella by comparison with Vaalharts'). But many plots were vacant and many plotholders lived away from the scheme in the Taung Location.

IRRIGATION IN WARTIME

From September 1939, A.M. Conroy held the position of Minister of Lands and Irrigation in Smuts's coalition wartime cabinet. A.D. Lewis was appointed Advisory Engineer to Defence, bringing to an end thirty years of irrigation continuity when he retired as Director of Irrigation in 1941. The Engineers of the Department went to war[78]. In Pretoria, the Irrigation Department, successively directed by K.R. Shand and Tom Hopwood, was left short-staffed and short of equipment while

[78] Their distinguished record is described in L.A. Mackenzie, Director of Irrigation to H. Pring (Public Service Enquiry Commission) 31 October 1946, CAD BES 319/100(2).

preparing for an increased post-war construction programme. In August 1942, Conroy announced to a United Party meeting in Germiston (site of a large wartime Army camp) large State irrigation schemes planned for the Caledon and Orange rivers, with settlements specifically for returned soldiers[79]. These would be groundbreaking developments of post-war reconstruction in the new Free State goldfields[80]. The Irrigation Commission was asked on 11 December 1942 to report on a 'Three River Combination Project' (Caledon/Sand/Vet) by the end of January 1943. Before the election in July 1943 Conroy made large promises in Parliament that the Orange River scheme would 'transform [the north-west Cape] into a paradise' as well as saving the irrigators of the Fish and the Sundays. A total of 32 post-war irrigation and water schemes were planned to benefit established farmers (rather than settlers), 'involving no unpopular expropriations [of white land]' and designed on extensive lines to increase carrying capacity and provide against drought. It was announced that all schemes would now be financed by the State with the irrigators playing a fixed water rate of £1 per morgen[81].

THE POLICY OF 'EXTENSIVE' IRRIGATION: THE SAND-VET IRRIGATION SCHEME

In reporting on this scheme Director Hopwood proposed 'a new departure in irrigation policy': extensive irrigation. 'Instead of irrigating the nearest block of suitable soil the canals are extended in order to serve as many farms as possible, allotting from say 10 to 50 morgen per farm ... loaded in favour of the smaller farms ... The result will be ... that the productive and carrying capacity of each farm can be built up to provide against droughts'[82]. Although it would be more expensive than intensive development, Hopwood justified the new approach in terms of benefit to the State as a whole rather than to single owners on Government Schemes who sold, at great profit to themselves, land improved at state expense. His Memorandum sketched the broad outlines of a cost-benefit analysis, as originated in the water sector in America in the 1930s[83].

Two dams (Allemanskraal on the Sand River and Erfenis on the Vet) would be the first phase in potentially 'by far the largest irrigation scheme either constructed or conceived within the history of irrigation in South Africa', on high quality land in the immediate area of the new Free State mines. Eventually, the scheme could be extended to include a diversion dam on the Caledon carrying water in tunnels to augment the other two dams and hugely extend the irrigable area served by the canals. Sand-Vet was designed to serve 17 990 ha with a reserve water allocation for future mining and industrial development. The canals would be lined and the water would be carried by an underground aqueduct; 682 farms would be included, suitable for ex-servicemen and with a number of small permanent social welfare settlements for the aged and unfit.

The Irrigation Commission endorsed with enthusiasm the idea, already adopted in America and Australia, of a system designed to give low irrigation density over a wide area, taking water from high rainfall areas and low soil fertility to distant areas of low rainfall and high fertility[85].

[79] ***Rand Daily Mail*** 20 August 1942. Conroy was referring to the activities of the Ossewa Brandwag.
[80] L.A. MacKenzie, Memorandum on the functions and activities of the Irrigation Department, 6 August 1947, Department of Irrigation, Pretoria; Irrigation Commission, Investigation of irrigation conditions along the Orange River, April 1945, CAD K121/106/595.
[81] Assembly Debates vol 46 (March- April 1943) 60, 90 ff.
[82] T. Hopwood, Outline report on Sand and Vet Rivers scheme, OFS, 24 February 1944, CAD K121 Box 105/578.
[83] Ian Carruthers and Colin Clark, ***The economics of irrigation*** (Liverpool University Press, 1983)
[85] Irrigation Commission Report, 'Preliminary Interim report on the Sand-Vet Irrigation Project', 26 March 1943 and 'Sand-Vet Irrigation Project, 26 March 1943,' with Addendum by G.R. Theron, 10 March 1944, CAD K121 Box 105/578.

DWS

Excavations on the left flank of the Erfenis Dam in 1956.

DWS

The completed Erfenis Dam in 1963.

WARTIME PLANNING FOR THE FUTURE

Supply, streamflow and storage

A Cabinet Committee on Reconstruction was established to identify principles for the future agricultural industry. It concluded that 'irrigation-cum-water conservation policy' should prioritise supply – the replenishing of underground streams, the control of flood water, the maintenance of river streamflow and the storage of surplus water, with water for irrigation distributed as widely as possible among the general farming community. The Committee worked on the assumption that the same general principles should apply to the conservation of black or white farmland; it was anomalous that farmers in the same catchment should be administered and controlled by independent State departments. Agriculture, Irrigation, Lands, Native Affairs, the Land and Agricultural Bank and the Farmers' Assistance Board functioned independently of each other, giving rise to conflicting methods and approaches to the use and conservation of basic agricultural resources[86].

'A NEW ERA IN BANTU HISTORY'

The betterment impetus was projected forward in idealistic terms by Douglas Smit, Secretary of Native Affairs, in a speech to the Ciskei General Council in 1945[87]:

'The Department is planning for a new era in Bantu history – an era when the land will no longer be robbed as in the past, but when it will be built up, made fertile, planted with trees and supplied with water, an era when men's reason is to be employed in the place of blind custom, where such custom stands in the way of a better and fuller life.'

The government's Social and Economic Planning Council, planning a new post-war dispensation saw this as evidence that the Native Affairs Department had evolved into 'a great welfare department'. It proposed a fully researched plan for an agricultural system to improve 'every aspect of human life in the Reserves, not merely more progressive agriculture' but 'a rehabilitation of life, not merely soil'[88]. How these idealistic pronouncements worked out in the post-war world will be examined in Chapter 6.

THE IRRIGATION FINANCE COMMISSION, 1944-6[89]

In 1944 Conroy appointed an Irrigation Finance Commission to investigate the issues raised in the Hopwood Memorandum on Sand-Vet: whether the benefits to the State as a whole resulting from irrigation schemes were commensurate with the amounts expended on them, the expenditure on each Government Water scheme and the total cost of the existing Board schemes with their loans, repayments and write-offs. Land values, speculation and profiteering were included in the brief, together with the relative merits of extensive and intensive irrigation development[90]. The Commission was chaired by Graham Cross (of the Department of Lands) with Hopwood, A.V.C Baines (ex-Chairman of the Irrigation Commission) and H.W. Turpin (Director of Agricultural Engineering and Research). It reported in 1946 in the light of first-hand experience of irrigation in Australia and New Zealand[91].

---

[86] 'The reconstruction of agriculture', Report of the Reconstruction Committee of the Department of Agriculture and Forestry, 1943-4 (S 9278).

[87] J. Yawitch, ***Betterment: the myth of homeland agriculture*** (Johannesburg: SA Institute of Race Relations, 1981)

[88] Ninth Report of the Social and Economic Planning Council: 'The Native Reserves and their place in the economy of South Africa' (UG 32-46). See too the Tenth Report (UG 37-46).

[89] Report of the Irrigation Finance Commission (1947), UG 40-48.

[90] See Memorandum for Cabinet on the Orange Free State Water Resources Development Bill, 1944; also the Report of the Irrigation Commission and Addendum on mineral rights by G.R. Theron; also Irrigation Commission to the Minister of Lands and Irrigation, 13 March 1944 and his reply of the same date. (CAD K121 Box 105/file 578.) Conroy had evidently made up his mind on the point, since before the Irrigation Finance Commission reported he had announced his intention in Parliament to develop extensively to achieve 'the greatest good of the greatest number'. (***Farmer's Weekly*** 20 February 1946.) His Irrigation Amendment Bill of February 1946 proposed Ministerial authority to construct irrigation works for Boards and private persons, while the Department of Lands and Irrigation – in future to be called the Department of Water Affairs – would regulate the flow of public streams. (***Ibid.***)

[91] Chairman: Graham Cross; Members: Tom Hopwood, the newly retired Director of Irrigation (1941-4), A.V.C. Baines and Dr H.W. Turpin, J.W.G. Fincham and W.J.G. van Rensburg. UG 40-1948.

The Commission concluded that irrigation 'more than justifies the expenditure of further large sums upon it'. In the past four years alone excise duty on irrigated produce had exceeded the total amount spent on government works since 1910, together with the sums written off from unredeemed loans to Irrigation Boards in that period. When other factors (income tax, transfer duties) were taken into account for irrigated areas, the position was even more favourable. On irrigation finance the Commission noted that 90% of all capital and interest in arrears had been written off between 1910-45; only three Irrigation Boards had paid off their liabilities. It recommended the abolition of Board powers to borrow money for works, but new schemes costing less than £10 000, if authorised by the Director, might be subsidised up to 50% if the proposers put up the balance. All future irrigation or water schemes costing more than £10 000 should be state schemes.

The Commission recommended nationalisation of surplus water in public streams. Water should be charged – by volume rather than irrigable area, so that a farmer got the water he paid for and was deterred from over-irrigation and waste, while marginal costs would be covered. Meticulous recording of data would be necessary to introduce precision into irrigation accounting. Settlements, if monitored to ensure adequate facilities for settlers including training schemes and experimental stations, would reflect the positive record of American Reclamation Policy 'once the strict canons of private enterprise [are tempered with] social values' [92].

The Commission and its advisers were divided as to the relative merits of intensive and extensive irrigation, intensive development producing dairy produce, vegetables and fruit would deliver maximum yield per unit of water, at the risk of waterlogging and ***brak;*** the extensive system costing more but having a stabilising effect giving each stock farmer his own fodder bank. Both should be considered.

The Report ended with a blunt declaration that the development of water resources was 'a vital necessity – as or more important than the development of roads on which many millions are now being spent.' But unless similar sums were spent on proper utilization of water, full benefit would not be derived from the expenditure. 'Senator Conroy knows this; but the wider public needs to be educated to that view'.

A new Director, and enlarged Department and a new Act

In 1944 L.A. Mackenzie, who had led the irrigation engineers in Europe, succeeded Hopwood. He began by reviewing the 1912 Act from the viewpoint of future development of water resources for decentralised industry. Existing irrigation laws 'practically give a riparian owner a monopolistic right to the use of water in a river.' Water was scarce and much current use 'primitive, wasteful and uneconomical ... It is obvious that our limited water resources will have to be nationalised' [93]. The outline of a new water regime began to emerge on a broad, multi-departmental basis linking irrigation with other water usages in a long term policy, regionally planned, with water from different catchments reallocated between rural, urban and industrial use[94]. A multi-purpose project for the Caledon River with hydro-electric and industrial developments, was

[92] The Commission quoted the report to the US Government in 1929 on the Economics of Irrigation Projects (UG 40-1948 para 106).
[93] Report of the Director of Irrigation [L.A. Mackenzie], 1940-46, UG 55-1947
[94] L.M. Mackenzie memorandum 'Correlated Long-term Public Works Programme', 31 January 1945, sent to the Social and Economic Planning Council. CAD BES 5A vol. I.

referred to the Social and Economic Planning Council which endorsed the idea of multi-disciplinary regional development agencies developing natural resources on the model of the Tennessee Valley Authority[95].

The depleted department was faced with continuous recruitment problems as its trainees were poached by municipalities, industry and commerce. Nevertheless a Research Division was created, developed by the hydraulic engineer Col D.F. Roberts from a makeshift laboratory he had set up on the banks of the Olifants River as Resident Engineer on the Loskop Dam. Research attention was directed towards storage. The years after the war revived memories of the drought crisis of the 1920s. Conroy himself accompanied an expedition in 1945 which reassessed, and again dismissed, the viability of the old Schwartz Kalahari Scheme. The South African Association for the Advancement of Science arranged lectures with titles such as 'Are We Drying Up?' and there were authoritative calls for legally enforceable conservation of river sources and underground water supplies. The Hydrographic Survey Branch proceeded with flow gauging and pollution assessment; reconnaissance was expanded by young trainees from the survey school at Andalucia (Jan Kempdorp). In collaboration with the newly established Natural Resources Development Council the eight Irrigation Circles undertook 200 regional surveys based on catchment areas. A national water resources survey, both surface and subterranean, was supplemented with special studies of the use of water from the Vaal and in the Tugela Basin relating to industrial decentralisation[96].

UPDATING THE IRRIGATION ACT

Conroy had campaigned for the State to develop its water resources as 'the foundation on which all other development in South Africa, also in the industrial field, will have to be built.' He was vilified in Parliament but he persisted: the 1912 Act had at all costs to be updated. The days of the old intensive settlements were over. Future government schemes would be extensive, selling water and 20 morgen of irrigated ground to farmers to spread the benefits of development more widely and promote regional electrical and industrial development[97]. This speech was jeered by some of his own side as 'something like an Eldorado or a tale from the Arabian Nights[89].'

Conroy's interim Irrigation Amendment Act (39-1946) authorised the Irrigation Department (renamed the Department of Water Affairs) to enter riparian land for the purpose of water conservation and river control (following an Irrigation Commission warning that river erosion needed 'a complete co-ordinated plan of attack' with state control over the major rivers of the Union[99].) Water from irrigation works could now be extensively distributed, an 'irrigation work' being redefined as 'a work in connection with the use of water for any purpose.' Critics resisted the Act as a 'dangerous' encroachment on riparian rights and drove a hard bargain, forcing up capital subsidies on works by individual farmers from 25% to 33%, nominally equal to those for Irrigation Boards. Farmers on Government Schemes received 100% capital subsidy. (The Water Commission of 1970 calculated that when written-off loans were taken into account Boards

[95] 'Post-war Reconstruction Projects – Memorandum by Dr Holloway, 15 November 1945; 'Notes by Design Engineer [D.F. Kokot] on the suggestion to apply the methods of the T.V.A. [Tennessee Valley Authority] to the Caledon River', 16 January 1946. (CAD BES 5A vol.I.) See too Kirsten and Van Zyl, 'The economic impact of irrigation agriculture (in a regional context)' ***Development Southern Africa***, 7, 2, (1990)
[96] Report of the Director of Irrigation for 1946-7, UG 28-49.
[97] Conroy, ***Assembly Debates*** 1946 Vol. 55 cols 1526ff.
[98] ***Ibid***. col. 1544.
[99] 'River Erosion', 19 April 1945, CAD K121 596 (Box 106).

in fact enjoyed a capital subsidy of 60.2%, so that private irrigators, though cultivating the largest percentage of the total irrigated area, were still at a considerable disadvantage [100].)

The Minister's approach appealed to the farmers of the Sundays and Great Fish rivers hoping for the diversion of one million acre-feet of water annually from the Orange River[101]. Conroy made the Orange-Fish the theme of his opening address to the 6th Annual Congress of the Cape Midland Area Development Association on 10 January 1947, encouraging regional support[102]. On 18 March 1948, two months before the general election in May, Smuts announced to the farmers in this United Party stronghold the decision to build the supplementary Allemanskraal Dam. He lost the election; they lost the immediate prospect of relief.

THE 1948 WATERSHED

As recommended in the Twelfth Report of the Social and Economic Planning Council (1948) after 1949 Havenga, Minister of Finance in the coalition government of D.F. Malan, expanded South Africa's financial sector to establish a money market. A National Finance Corporation heralded a more comprehensive financial system. According to Charles Feinstein, 'short term liquidity increased, temporarily idle funds were mobilised, financial expertise and capital more readily available, credit extended[103].' Foreign capital participated in the development of the Union's resources. Financial institutions aided the rise of Afrikaner finance capital and fuelled a sustained economic boom after 1963. In 1964 public investment stood at 7.9% of GDP, much of it investment in economic infrastructure – water supplies, electric power, railways and water schemes such as the Orange River Development Project.

Conroy's ministerial successor was also an irrigation enthusiast. J.G. Strydom was a farming lawyer in Nylstroom, as prominent in his local Agricultural Association as in his republican political activities leading the National Party in the Transvaal. He came from a farming background in the Baviaans Kloof in the Cape where irrigation and flood control were ever-present issues. His maiden speech as Member of Parliament for Waterberg in 1929 had advocated a clear irrigation policy and a survey of the country's water resources. Within months of his appointment as Minister of Lands and Irrigation, Strydom had negotiated an increased Irrigation Vote, augmenting the previous government's £10 000 to £373 000 for subsidies;[104] under his leadership Irrigation was promoted to a full government department. The result was a barrage of requests from constituencies for schemes and boring machines, for the Allemanskraal Dam, for the development of the northern Natal rivers, and generally for 'water, water, water', until Strydom pleaded grey hairs and urged the need for a full Parliamentary discussion of general policy[105].

HALL ENQUIRY INTO THE WATER LAWS 1950-3

Strydom appointed the Hall Commission in 1950 to investigate the effect of current water laws on the social

[100] Irrigation Boards cultivated 29% of the irrigated area; private irrigation 40% (1961 figures in UG 34-1970, Report of the Water Commission, Findings III para 27.) In consequence, farmers took to irrigating from soil erosion dams, built and subsidised at 50% under the auspices of the Ministry of Agriculture, rather than the Department of Irrigation's 33%. (CAD BES 1055, file 1067 (iii) 1948.)
[101] D.F. Kokot, 'Notes on the possible improvement in the water supply to irrigators under Grass Ridge Dam', SAD K121/12 Box 7 84ff; 'Raising of Lake Arthur Dam – Great Fish River Scheme, 19 January 1942, SAD K121/12/Box 7 94ff.
[102] From the Caledon and Orange River Regional Development Association (RDA) and the Northern Cape and Adjoining Areas RDA.
[103] C.H. Feinstein, ***An economic history of South Africa*** (Cambridge: Cambridge University Press, 2005)
[104] Assembly Debates 1950 Vol. 70
[105] Assembly Debates 1950 Vol. 70 'South Africa's agricultural production can never supply a really large population. There must be a reasonable and fair division of all available water between these various essential interests.' The Opposition had pressed for a Commission on the Orange River as a preliminary to a planned policy of development prioritising the Orange-Fish scheme. Strydom contrasted the government's expenditure with that of its predecessor, explained the necessarily long timescale of major developments and proposed that priority be given to 'the schemes where the requirements of already established irrigators are greatest' citing schemes such as Modder River, Gamtoos, Oudtshoorn and Pienaar's River (Ohrigstad) since one-tenth of all expenditure on irrigation in the previous 38 years had been spent in the area of the Sundays/-Fish. Assembly Debates Vol. 74 (1951) Bowker col. 2432ff; Vol. 76 (1951) Strydom col. 8627ff.

and economic development of the country, and their consolidation and amendment to utilise water resources 'to the best advantage of the people as a whole[106].' Chaired by Cyril Godfrey Hall J., who had been studying water rights in various capacities since his first position as an articled clerk in Calvinia in 1909, the Commission travelled widely and heard evidence both for State control of the country's water resources and for the preservation of riparian rights. The Report played down any dramatic change: to challenge riparian rights would 'invite antagonism throughout the length and breadth of the country', citing the fierce opposition of the South African Agricultural Union which regarded nationalisation as a step towards communism[107]. Nevertheless, the Enquiry advised 'a far greater measure' of State control over the allocation and use of public water[108]. Citing the defects in the large State Schemes of the later 1930s it criticised the 'extremely haphazard method of planning and adapting the water resources available to the areas of land which could beneficially be irrigated'[109]. There was disagreement over the most appropriate body to exercise control. The majority followed the Director of Irrigation in favouring an official Ministry of Water Development with a technical and administrative advisory body responsible to the Director, capitalising on the Department's accumulated expertise and new research capacity. Existing rights in public water not currently in use should be vested in the State through the Minister 'for the benefit of the whole community'. (This became the controversial and much amended Section 62 of the 1956 Water Act.) Hall himself thought the Department was insular, lacking the outlook and capacity to cope with urban growth and industrial expansion; he proposed a widely cast central body, responsible to the Minister but outside the Department and supplemented by Regional Control Boards, to plan an overall policy for State water as well as controlling sources, catchments and underground water.

THE WATER ACT 54 OF 1956

The enormous Act with 184 clauses grew out of the majority Report of the Hall Commission. Its immediate significance came from its title – a Water rather than an Irrigation Act, establishing a Department of Water Affairs (the renamed Irrigation Department) to respond to the demands of an urbanising and industrial country. It distinguished two forms of water – public (if the water could be used for irrigation on at least two pieces of riparian land) and private (not capable of shared use for irrigation.) The classification of uses was updated: the old 'primary' (domestic) and 'secondary' (irrigation) categories were now combined as 'agricultural' water. 'Tertiary' covered industrial and urban use; daily consumption of more than 60 000 gallons (270 000 L) needed a ministerial permit, granted or abated according to local water availability. The words 'control' and 'in the public interest' occurred frequently in relation to the quantity and quality of public water; the subtext was its beneficial use.

The Act empowered the State to regulate distribution and to control abstraction, use, supply, distribution and quality, effectively extending government control over all public water

[106] Union of SA, Report of the Commission of Enquiry concerning the water laws of the Union, UG 11-52
[107] Union of SA, Report of the Commission of Enquiry concerning the water laws of the Union, UG 11-52 para 93: 'Communism is no more than the nationalisation of all industry and the sources of production, and the nationalisation of any one of these is but a step towards Communism'.
[108] Union of SA, Report of the Commission of Enquiry concerning the water laws of the Union, UG 11-1952
[109] ***Ibid.***

not being used and therefore available for redistribution. Riparian rights were mildly attenuated. Executive power was delegated to the department supplemented by Regional Control Boards to construct and operate water works and record hydrological conditions. Land required for State water works could be expropriated (with compensation) and declared a State Water Control Area; in these areas riparian rights were modified to rights of use. In practice, the Minister would determine the quantity of water available each year, how much was available for irrigation and the basis on which it should be allocated. If not all the water was allocated for irrigation, concessions for urban or industrial use might be granted. (Underground water was similarly controlled). The Minister had discretion over new abstractions having regard to the supply to other users, the location of industry in the light of national decentralisation objectives, and the impact of wastewater in the area. The Act gave statutory recognition to the sole and exclusive use of private water for the first time, disputes being governed by the Water Court which no longer had jurisdiction over public water. Pollution became an offence; agricultural and industrial users and local authorities were required to return used and unused water, duly purified, to public streams.

In Parliament the Bill was taken as a non-party measure. Owing to the illness of the Minister, Paul Sauer, the Bill was put before the House at the end of the Parliamentary Session and not extensively debated – the Minister congratulated the House on 'so successfully curbing the natural desire of every man to speak about water'[110]. It had, however, been scrutinised in great detail by a Select Committee chaired by Hertzog which met 34 times, produced 4 reports and put forward 114 unanimous amendments to the Hall Commission draft. Hertzog maintained that the Bill restored the State as ***dominus fluminis*** (custodian rights) of the stored masses of water which it apportioned, confirming the principles of Roman-Dutch law[111].

The foundations were laid for the expansion of water provision and the modernisation of irrigated agriculture.

[110] Parliamentary Debates vol. 92, 5 June 1956, col. 6901.
[111] Parliamentary Debates loc.cit. col. 6894-5.


05

CHAPTER 5

SOUTH AFRICA REACHES IRRIGATION MATURITY (1960-90)

Deborah Lavin and Lani van Vuuren

In the 1970s Merle Lipton developed the concept of 'two agricultures' in South Africa[1], one labour-intensive, the other capital-intensive, with enormous differentials in inputs and economic incentives but, at least in the 1950s, with narrower differences in outputs and average yields obtained. In summary, she argued that small-scale, low-cost, non-mechanised black smallholder farming was not necessarily old-fashioned or pre-scientific; indeed, intensive farming with family labour had some advantages over capital-intensive large-scale white farming with insufficient labour. Nevertheless, capital allocations, especially for irrigation, had upgraded the land of white farmers whereas black land had deteriorated from overgrazing, incorrect agricultural practices, characterised by low yields and capital starvation with very little spent on black agriculture before 1946[2]. The agricultural farming setups for black farmers in the early 1940s was characterised by low production and productivity, poor access to input and credit and, as a result of these conditions, the majority of black farmers ended up engaging in off farm or non-farm generation activities (more in the next chapter). Marketing and transport were geared to white needs, as were research, education and technical training. This chapter traces how the white irrigation sector, capital-intensive and internationally acknowledged, was transformed in its own terms between 1960 and 1990 and addresses the factors and people making sophisticated irrigation possible and the paths it followed.

[1] M. Lipton, 'White farming: a case history of change in South Africa', ***Journal of Commonwealth and Comparative Politics,*** 22, 1 (1974), 42-61.
[2] Lipton cited Hailey's ***Africa Survey*** (1957) giving a ratio of spending on white: black agriculture (1910-36) as 179:1; using the figures given in the Tomlinson Report and by S. Brand – she calculated a ratio of 13,8:1 in 1953. In 1973 the figure was 1,88:1 if food subsidies were taken into account.

In 1965, irrigation and stock farming together used 70% of available surface water; and according to the Commission of Enquiry into Water Matters, 83% of freshwater intake was used for irrigation. By 1990 the figure was 53.8%, irrigation (on a scheduled area almost double the size) accounting for 52.2%[3]. Irrigation farms were fewer and bigger; irrigation technology moved from the quick-coupling pipes of the 1950s, through sprinkler technology and the era of microjets and drip irrigation for efficiency and control in years when electricity prices doubled, to the more market-driven irrigation monitoring of the 1980s and 1990s. In part this technological evolution reflected a worldwide trend in intensification related to mechanisation and the use of commercial fertilisers. In South Africa's case it was achieved despite, and sometimes in response to, a background of empire and the transfer of power in Africa by colonial countries, the declaration of a Republic, boom and bust economics, high apartheid, social and political turmoil, international isolation and bitter years of drought. Nevertheless, these were the years when a cohesive irrigating community of international quality emerged.

Extraordinary economic growth, funded by investment and gold, gave the state the confidence and ability to undertake mega-projects such as the Orange River and Pongolapoort schemes as well as the on-going programme of multi-purpose dam building and revitalisation of older schemes to place existing development on a sound, and often enlarged basis. Where Lewis had in the accelerated developments of the 1930s complained of 'the hurried way in which things are done', on schemes such as Loskop there had been no serious effort to fix the areas to be irrigated or the land commanded by the works and at Riet River the planning had also been unsatisfactory. The 1956 Water Act widened the availability of loans and subsidies to Boards hitherto ineligible under the 1912 Irrigation Act[4].Throughout the country dams were replaced or raised (some multiple times), distribution systems improved, canals lined or relined, and many kilometres of drainage installed where the introduction of regular water had caused waterlogging. These measures were designed to increase and stabilise water resources, improve the assurance of supply where river flow was irregular, attenuate floods and regulate flows. In 1957-8 there were 10 Government Water Schemes: ten years later there were 50, mostly concentrated in the Transvaal (the area which today comprises Gauteng, Mpumalanga, Limpopo and North West provinces) and the Orange Free State (Free State today)[5]. Dams were increasingly constructed to supply water for coal-fired electricity generation rather than farming. Water was needed to sustain industrial growth – steel, fuel from coal – but 1960-66, 1970-3, 1979-86 were drought years and predicted water scarcity threatened to make the water allocation to agriculture a major political issue. The fact that South Africa's major rivers rise in other countries with which South Africa in these years had varying degrees of coercive and conciliatory relationships, complicated the resource question.

ORANGE RIVER DEVELOPMENT AND PONGOLAPOORT

In 1963, the Government decided to proceed with the largest water scheme as yet undertaken in Africa – the

[3] Anon, 'WRC 25 years 1971-1996', ***SA Water Bulletin***, special edition, (1996), 41.
[4] A.R. Turton, R. Meissner, P.M. Mampane and O. Seremo, A hydropolitical history of South Africa's international river basins, (Pretoria: WRC, 2004 WRC Report No. 1220/1/04). See for example the case of the Douglas Irrigated Areas Board, 175-6.
[5] Report of Secretary for Water Affairs for 1961-2, RP 33-1963. See too 'Notes on some of the more important irrigation and multi-purpose schemes built and /or controlled by the DWA, RSA 1969 (revised); L. van Vuuren, ***In the footsteps of giants – Exploring the history of South Africa's large dams*** (Pretoria: WRC, 2012)

Orange River Project with its great storage dam (the Hendrik Verwoerd/Gariep) and the high diversion scheme at PK le Roux/Vanderkloof with its extensive canal system). Besides the irrigation, industrial and urban implications of the scheme there was a social element in the plan to further improve conditions in the Lower Orange area[6]. Beneath the apparent confidence symbolised by the mega-dams and transfer systems, there were setbacks such as the delayed construction of the Vanderkloof Dam, from which water was to be abstracted and distributed to the northern Karoo and the Riet River Valley. At the time the delay was put down to inflation; an additional eyewitness explanation has suggested that only after the engineers had identified the sites for the Orange River dams and canal routes were soil surveys belatedly undertaken in the areas demarcated as irrigable. The unsatisfactory results caused a major redesign, setting back the Vanderkloof Dam by a year to 1967 and causing the construction to be undertaken in-house by the Construction Division of the Department of Water Affairs[7]. The Pongolapoort development too had been controversial, prioritised over the Orange River by the Natural Resources Development Council in view of a sugar shortage predicted for 1967, but hotly contested by the Eastern Cape irrigators of the Great Fish and the Sundays River. Should government save established schemes in difficulties or promote new ones? Longstanding silting and periodic drought were causing curtailment of irrigated lands and citrus orchards in the Eastern Cape, where some farmers were desperate enough to make impulsive false economies rather than planned efficiencies. Since 1928 they had hoped for supplementary water from the Orange by a transfer plan first imagined in the 1880s and revived by A.D. Lewis[8]. The government bought time in 1961 by purchasing 5 800 ha of the scheduled 18 000 ha in the Fish River Valley, later to be redeveloped as the main element in the revitalised scheme[9]. It also pursued the Pongola project, said to be the only irrigation scheme in the Union able to provide, at reasonable cost, the additional sugar production capacity required[10]. (South Africa may have wanted to preserve its export sugar quota at a time of worldwide over-production.) In 1961, however, when sugar quotas were cut by 25%, Ministers were challenged in Parliament over Pongola. Minister P.K. le Roux gave lame answers proposing, strangely, hollyhock (***stokroos***) as an alternative crop to sugar cane. No adequate official responses were forthcoming to hard questions about crops, markets and processing facilities in this remote area.

Ultimately the Government developed both projects (though in somewhat modified form: the Sak River canal from the Orange was abandoned on the advice of soil scientists and the white settlement below Pongolapoort never materialised.) The two schemes added 360 000 morgen to the total irrigated area of South Africa – an increase of 40% - and made possible a dramatic series of transfers bringing the water of the Orange River to revitalise the Sundays and Great Fish rivers, as well as confirming the long-term future of irrigation on the Riet River, where chronic water shortage was relieved by Orange River water through the Sarel Hayward Canal, completed in 1987[11]. The Pongolapoort Dam, commenced in 1963 and completed ten years later, became a byword for misfortune. The geology

[6] Plans outlined in 1965-6 to improve the Kakamas canals and to expand, upgrade and better irrigation in the Irrigation Districts and Settlements of the Upington Island Scheme were delayed for financial reasons and built in phases from 1989-97. A levy of R10 per morgen on expensive government irrigation works ensured some return on capital over a 30-year period, but the principle of government subsidy was maintained.

[7] G. Laker, 'Orange River Scheme history notes' (2006), compiled during preparation for the development of a strategy for irrigation development in South Africa, and personal communication to the authors.

[8] P.S. van Heerden and G.C.de Kock, 'Ontwikkeling van besproeiing in die Visrivier vallei', ***Karoo Agriculture*** August 1980; G.R. Backeberg, Besproeiingsontwikkeling in die Groot-Visriviervallei, (M.Sc. (Agric) University of Pretoria, 1984).

[9] ***Ibid.***

[10] Union of South Africa, Report on the proposed Pongolapoort-Makatini Flats Government Water Scheme, WP F-60.

[11] An occasion joyfully celebrated with the spit-roasting of 18 sheep, washed down with brandy and canal water.

proved to be challenging; the dam was kept at one-third capacity for the first 13 years as a portion of Swaziland was threatened with inundation if the level rose higher. Downstream communities on the Makatini Flats, traditionally living by flood recession agriculture, fishing and cattle grazing, had their livelihoods, and the ecosystem on which they depend, disrupted by the annual patterns of dam releases. (These have been major preoccupations in the management of the dam ever since).

By 1970 the proportion of South Africa's channelled water supply used for intensive farming was among the highest in the world at 75%,[12] but there was mounting internal dissent at the preferential position of farming in general and irrigation farming in particular. In 1967, subsidies to white farmers had totalled R66.8 million, with the average farmer depending on public funding for 20% of his income: farmers were said to have become '***bywoners*** of the state'[13]. (The majority of black farmers were not reaping these benefits) Commercial farmers received state support in the form of subsidies on the use of capital, state funding of research and extension, and – especially – through the revised Marketing Act 59 of 1968, providing for the institution of marketing schemes for individual products administered by Control Boards on which farmers were guaranteed a majority, covering about 80% of total agricultural production. The Act also provided for levies imposed by the Minister to fund the SAAU[14]. In 1968, K.P. Landman's ***Ontvang die boere die boodskap?*** (***Have the farmers got the message***?) drew attention to ineffective or wrongly directed extension services, the bottleneck in medium term credit granted by the Land Bank and the inadequate performance of Control Boards helping producers of perishable products to engage in higher output growth and well researched and sophisticated international marketing in new fields such as Asia. S.J. du Plessis observed 'a total lack of realistic norms for the utilisation of water ... in the case of irrigation farming'[15]. D.F. Kokot had written a withering account of indirect water subsidies and misallocations favouring irrigation over urban and industrial supply[16]. The ***Handelsinstituut*** (Chamber of Commerce), hungry for labour, criticised the inefficiency of irrigation labour production costs of 40%. A D.Sc (Agric) thesis in the University of Pretoria in 1969 showed that agriculture had been a net recipient of capital since 1910[17].

[12] W. Beinart, ***Twentieth Century South Africa*** (Oxford: Oxford University Press, 2001)
[13] M. Lipton, 'White farming: a case history of change in South Africa', ***Journal of Commonwealth and Comparative Politics,*** 22, 1 (1974), 42-61.
[14] N. Vink, 'South African agriculture in the 1970s', ***South African Journal of Economic History***, 14, 1-2 (1999), 90-113; The Kassier Committee, Report of the Committee of Inquiry into the Marketing Act. (1992)
[15] RSA, Second Report of the Commission of Enquiry into Agriculture, RP 84-70.
[16] D.F. Kokot, (1967) 'Is water the limiting factor in the development of South Africa?', ***Optima,*** 17, 1 (1967), 12-17.
[17] S. Brand, 'The contribution of agriculture to the economic development of South Africa since 1910', (University of Pretoria D.Sc. (Agric) 1969). Cited in M. Lipton, 'White farming: a case history of change in South Africa', ***Journal of Commonwealth and Comparative Politics,*** 22, 1 (1974), 42-61.

dpreezg/123RF

The Vanderkloof main canal. It has a length of 14 km and a capacity of 57 m^3/s.

dpreezg/123RF

With a maximum height of 90.9 m above foundation, a crest length of 909.5 m and a gross storage capacity of 5 950 million m^3, Gariep Dam is the largest dam in South Africa.

dpreezg/123RF

The intake of the Orange-Fish tunnel. At the time of its completion in 1975, the 82.8 km-long tunnel was the world's longest continuous water tunnel.

A National Irrigation Symposium was convened by the Department of Agricultural Technical Services in October 1967 in the shadow of drought. The chairman, S.J. du Plessis, then Acting Secretary of the Department[18] referred back to 'the art of irrigation taught in our childhood days to so many of us alongside the irrigation furrow', before broaching the need for efficient use of water rather than competition as the way to manage the future demand for South Africa's limited water supplies. A pioneering paper presented by J.K. Siertsema of the Department of Agricultural Economics demonstrated the effect of applying economic principles and methods to irrigation farming. The statistics in his tables struck with the force of revelation[19].

[18] J.K. Siertsema, 'The economic of irrigation farming in South Africa', ***Agrekon,*** 7, 2 (1968), 13-18.
[19] ***Ibid.***

The farming community was changing, and irrigation with it. Rising costs knocked out the small man and uneconomic farming units were consolidated into viable propositions. State support, in the form of technical advice and advantageous tax and credit regimes, now favoured efficient large-scale enterprises able to transform agriculture by investment and know-how in niche crops. Two important Commissions, one enquiring into Water Matters and the crises of resource and demand, the other into Agriculture, produced major reports in 1970, inspiring new aspirations and principles in the Department of Water Affairs. New institutions of agricultural, economic and hydrological research helped to transform the quality of planning, testing, experiment and discussion in the field of irrigation.

THE REPORTS OF THE COMMISSION OF ENQUIRY INTO WATER MATTERS AND THE COMMISSION OF ENQUIRY INTO AGRICULTURE, 1970[20]

In 1963 the flow in the Lower Orange River almost ceased, endangering the irrigation development below the Buchuberg Dam along both banks of the Orange. The Vaal supplemented the supply; four years later supplies to the Pretoria-Witwatersrand-Vereeniging heartland were threatened by drought. Water scarcity caused the appointment in 1966 of the Commission of Enquiry into Water Matters, chaired by the distinguished economist Dr Stephan du Toit Viljoen, to assess the available and potential sources of water supply, their development, stabilisation and conservation; devise a water strategy for the future with programmes for research and construction, and a 'broad long-term master plan' for the coordinated development, conservation and control of water resources 'with which may be included a rational allocation of the available water among the various users'. This would include preparing master plans for the areas best suited to irrigation farming, stock breeding and afforestation[21]. The Commission reported in 1970, but the issues it raised were still taxing the water authorities years later, and it came to be regarded as 'virtually the alpha and omega of water affairs in South Africa[22]'. The report's findings and recommendations were reproduced, with detailed progress reports and comments, in the monumental ***Management of the Water Resources of South Africa*** published by Water Affairs in 1986 which became the departmental bible[23]. (It should be noted that the Department of Native Affairs [under a variety of euphemistic names] was responsible for water in the black areas.) The work that followed the Report had an immense effect on irrigation, including the emergence of a close irrigation community within the constrictions of apartheid. The Report suggested that as things stood, all potentially usable water would be committed by the year 2000[24]:'The question is therefore is not how the drought problem can be solved but rather how we can make the best use of the various water resources at our disposal.'

From the first paragraphs agriculture was dislodged from its privileged position. The Commission followed Dr Kokot and

[20] RSA, Report of the Commission of Enquiry into Water Matters, RP 34-70; Second Report of the Commission of Enquiry into Agriculture, RP 84-70. See too DWA, ***Management of the water resources of South Africa*** (Pretoria: Department of Water Affairs, 1986.)
[21] In the event, the Agriculture Commission surveyed these – see RP 84-70 section 6.3.4.
[22] House of Assembly Debates, W.L. van der Merwe (Member for Meyerton) 18-22 June 1984, col. 9548.
[23] DWA, ***Management of the water resources of South Africa*** (Pretoria: Department of Water Affairs, 1986).
[24] South Africa's economic recession after 1975 relieved the pressure on water usage.

others in arguing that water was 'not the prerogative of a group or class'; its supply had to be balanced across the whole range of national demand[25]. In 1965, 83.5% of freshwater intake was used for irrigation, therefore no valid case could be made 'either on economic or strategic grounds' for large-scale additional water or land for the irrigation sector. The familiar 'pressure exerted by influential groups' for construction and allocation should be resisted, (though supplementary water for some valuable export crops might be modestly increased – sugar, deciduous and dried fruits, canning, citrus and vine products constituting 9% of the total value of exports[26].)
In future, increased irrigation production must result from intensification rather than expansion; improved techniques might realistically be expected to achieve a 25% efficiency saving of irrigation water per unit of yield[27].Both Water and Agriculture Commissions commented on the Pongolapoort and Orange River schemes in terms of the challenges they presented. Potentially there was a danger of a surge in production; meanwhile, the shortage of knowledgeable farmers to take up the new irrigated land made it imperative to protect valuable irrigation soils from sale for other uses. The Agriculture Report regarded the Makatini Flats as 'probably one of the last great irrigation schemes in the country' and urged caution in committing the area to sugar, already overproduced. The Water Report conceded that the Orange River project would revive confidence in the Republic and give assurance of supply to the intensive irrigation developments on the Lower Orange, but warned that the prestige projects might stimulate an already overheated economy and that the provisional allocation of water on the Orange River appeared to be heavily biased towards irrigation rather than urban and industrial use[28].

[25] Kokot, 'Is water the limiting factor'. Dr Kokot was the retired Chief Design Engineer of the Department of Irrigation.
[26] Finding 4 and Recommendation 7 (iii); RP 34-70 Part III Policy Issues.
[27] Recommendation 6 (i) (a-e), 'Allocation of water to various sectors of the economy: Irrigation'; Finding 26.
[28] The White Paper of 1962 (WP X-62) had allocated only 90 000 morgen-feet a year for urban and industrial use (later corrected to 400 000 morgen-feet); this implied that up to 1 200 000 mf. would be used for irrigation.

Cedric Nunn / African Pictures

Cotton picking on the Makhatini Flats in 1993. Cotton, which is a water thirsty crop, became established following the establishment of the Pongolapoort Dam in the area.

Looking for solutions to the 'unavoidably explosive results of galloping water demands', the Water Commission made recommendations for improved development of the county's water resources, increased efficiency in the use of water, and the creation of new sources of supply, summarised here as they affected irrigation.

The Commission also addressed the role of the Department of Water Affairs, made the centre of planning, management and control of water after the Water Act of 1956. With the largest development budget and a reputation for unilateral action, the Department had no adequate accountancy section or procedures but in an era of inflation had continued

to value schemes at historic costs, distorting the planning of replacements and additional works. With resource development and allocation now its primary purpose, it would have to exercise efficient financial control and 'as a matter of urgency' set up a cost accounting section, adapting its systems to allow for the scarcity of water, providing accurate unit costs and demonstrating the economic case for each proposed new publicly funded scheme in a White Paper covering the merits of competing schemes and the implications of recovering capital outlay[29]. It should now be integrated into the country's economic planning at the highest level and resource development coordinated across departments.

Irrigation had been officially subsidised since 1935. The Commission found that the differential subsidies on capital costs introduced in 1946 to private, Board and Government schemes produced inexplicable anomalies disproportionately favouring state schemes, especially in the Government Water Control Areas proclaimed after 1956. The basis of these calculations was frequently inaccurate – costs underestimated, profitability inadequately analysed – with loans and unpaid running costs often written off as Boards continued to set unrealistically low rates not allowing for regular maintenance, necessitating loans for later repairs and upgrades. The Commission therefore recommended that a realistic water tariff be charged to all users of water from state works,[30] to cover at least operational costs. Negligible charges encouraged wasteful use of water, and hidden subsidies led to inflated market prices for irrigated land. Irrigators on State schemes were liable only according to the enhanced value of their scheduled land, with financial assistance as far as possible rendered through State financing institutions. New schemes should cover their full running costs plus a percentage of interest and redemption costs; existing State schemes should be treated more leniently, with rates raised gradually 'in so far as is consistent with socio-economic conditions' (by which the Commission meant not social rehabilitation but regional economic growth.)

But realistic pricing, let alone cost recovery, was highly controversial. The redoubtable S.P. le Roux in a personal Addendum to the Report argued for the preservation and extension of irrigated farming as 'the cultural, spiritual and stabilising influence of a healthy farmer-element in the national organism.' Reduced water quotas and increased tariffs would, he feared, upset the stability 'so essential in farming'; irrigation subsidies should be 'axiomatic[31]'. He need not have worried: the recommendation was not immediately implemented[32]. In 1975, a White Paper to Parliament proposing the Sterkspruit Dam on the Crocodile River quoted a tariff for farmers five times lower than the urban/industrial tariff and fifteen times lower than the cost of supply[33]. This was justified by a conventional formula that 'in accordance with the accepted policy of subsidisation of irrigation schemes ... it is not the intention that irrigators pay the full costs of R123.66 per ha per annum'. In 1976, annual charges on water from State schemes were raised by a fixed percentage each year exceeding the rate of inflation; organised agriculture protested so vigorously that an enquiry was launched in 1984.

[29] In the event, the departmental budget allowed for the employment of only one cost accountant, and the objectives were rarely achieved as cutbacks extended construction periods in phases, increasing overheads. (***Management***, Comment, 1.58)
[30] Defined as 'reflecting the scarcity value of the relevant factors in the national economy' i.e. water and irrigable land.
[31] Addendum by the Hon. S.P. le Roux, RP 34-70,162.
[32] R. Bate and R. Tren, ***The cost of free water: The global problem of water misallocation and the case of South Africa*** (South Africa: Free Market Foundation, 2002)
[33] DWA, Report on the proposed Crocodile River (Eastern Transvaal) Government Water Work (Sterkspruit Dam), WP T-75.

This revealed that as yet no scheme had covered its operating costs still less any appreciable percentage of interest and redemption costs[34]. The differential tariff between old and new schemes was then discontinued as impracticable, although the agricultural tariff, lower than that charged to industry, was retained 'because of the vast difference in kind between the ... sectors' and the tendency of farmers to economise by underutilising water rather than optimising production. Subsidies survived.

To keep costs down, control of State irrigation schemes was increasingly devolved to producer Irrigation Boards. The ***Management*** volume stated in 1986, 'if the full costs of ... basic human needs or agriculture cannot be afforded by users, operating deficits should be recovered for as long as necessary by means of published, regularly reviewed, subsidies ...' From 1986 tariffs were determined independently for each scheme and differential tariffs levied within a scheme on criteria of cost and ability to pay[35].

The Water Report included a blueprint for new irrigation scheme planning by 'all interested organisations' – soil surveys to be the basis for the design of layout and distribution, and the agricultural suitability of a scheme to be the first consideration, taking account of all aspects from crop production to social conditions. Allocations and rates should be based on an economic irrigation unit to be calculated in each case by the Division of Economics and Marketing so as to give efficient farmers a reasonable livelihood.

The irrigation sector, allocated the lion's share of the water, was required to make the biggest efficiency savings by the improvement of irrigation techniques. The first target was to reduce high evaporation rates and losses from leaking distributaries and poor irrigation management. Simple measures, such as the lining of canals and night storage dams would save water; sophisticated variable draft management was already in use on dams for irrigation schemes, minimising evaporation loss by reducing storage in dams during drought after assessment of the demands and the degree of assurance with which they must be met. Irrigation not involving trees was accorded a relatively low degree of assurance (100% of quota for 70% of the time; 70% of the quota for 30% of the time.) A whole chapter of the report was devoted to saving water, listing 13 basic factors to be taken into account for irrigation efficiency. Irrigation, it maintained, stabilised and enhanced agricultural production, and the additional revenue derived must compensate for the expenditure entailed.

New sources of water presented difficulties. Not much emphasis was placed on so-called 'unconventional sources' such as water harvesting and desalination, but a high priority was given to catchment management to optimise runoff, and a survey of Subterranean Water Control Areas. Future water transfers would be a possible solution, with linked catchments and the conveyance of water over long distances. In this case the Commission had been advised by a powerful critic of 'the water-scarcity psychosis', making a vigorous case for cooperative water development schemes rather than emergency dolomitic water abstractions.

[34] Department of Environment Affairs, White Paper on the policy on water tariffs and other related matters, WP N-84.
[35] ***Ibid,*** Backeberg, Die politieke ekonomie van besproeiingsbeleid.

Prof D.C. Midgley[36] argued that only 40% of the country's exploitable resource was in use, 'of which three-quarters goes to irrigation[37]'. He advocated inter-basin water trading – 'we must grasp the nettle of promoting international cooperation for highly attractive mutual advantages' – and a large-scale water transfer scheme for the Pretoria-Witwatersrand-Vereeniging area as 'a lucrative substitute for trading in unskilled labour'. A year later, the ***Management*** volume confirmed that merely providing assured water delivery would necessitate new sources of supply, while the demand implicit in the riparian rights system, with its guarantee of simultaneous optimal advantage to all owners, compelled international negotiations with frontline states as well as inter-catchment transfers. Linked river systems proved their worth in the drought of 1978[38] and the extraordinary circumstances of 1983, when the flow of the Vaal had been reversed in a mere six months to supply the Grootdraai Dam near Standerton and then the SASOL power stations and the petro-chemical complex of the coalfields[39]. extended in great state-constructed projects linking the Tugela-Vaal, the Orange-Fish, Usutu-Vaal, with the Lesotho Highlands project in prospect. The Department's first Joint Permanent Technical Committee was established in 1983 to cooperate with Botswana, Mozambique and Zimbabwe, the first of a number of joint basin committees later elaborated and extended by the Transitional Government of the early 1990s.

Lani van Vuuren

The lower Olifants River was one of the irrigated areas which saw 'betterment' from the 1960s (such as the lining of canals with concrete) in an effort to increase water efficiencies in South African agriculture[40].

[36] Midgley had created the Hydrological Research Unit at the University of the Witwatersrand, responsible for the monumental ***Surface water resources of Southern Africa*** (6 vols, 1981).
[37] D.C. Midgley, 'Towards a rational water policy for South Africa'. ***Optima***, 33 (1985), 50-60.
[38] When the Central and Upper Vaal had been linked to the Mooi and Mgeni river systems.
[39] Van Vuuren, ***In the footsteps***.
[40] L. van Vuuren, 'Water use efficiency – Irrigators take the lead in Lower Olifants', ***the Water Wheel***, 10, 2 (2011), 14-17.

It fell to the Department of Water Affairs to implement the Water Report. Veterans of the department in the 1970s and '1980s recall as 'golden years' the term of office of Minister S.P. (Fanie) Botha, in tandem with the outstanding civil engineer J.P. Kriel as Secretary ('it was a token of the respect in which he was held that he was almost never referred to as anything but 'Mr Kriel' or 'the Sec'[41].') A senior engineer, returning as an Assistant Chief Engineer to the busy Construction Division of the Department, remembered 'Oom Faan' for his personal qualities – 'He was an intelligent man, with an attractive, strong personality; but undoubtedly his greatest asset in binding his department to him was his memory. ... He could meet an engineer, foreman or ganger, once and unerringly place the man, recall his name and job, in totally different circumstances months or years later[42].' In 1968-9 the department was taking on extraordinary volumes of construction work, employing 20 000 people but 50% short of its quota of engineers[43]. The department was producing 20 White Papers a year for new and revitalised schemes.

Some existing Cape Irrigation Boards were given security and assurance by better flood control (Gamtoos Valley, Beervlei), but new multipurpose water storage for mining, industry and domestic demand was now said to take precedence over storage for irrigation and was mostly located in the Transvaal and Orange Free State[44]. Exploiting the unique prerogative of his department, vigorously defended since 1912, to recruit 'Section 3' construction employees, Botha's legendary achievement was to persuade the Cabinet to allow him to recruit and train 30 junior engineers and technicians a year on bursaries at Stellenbosch and Pretoria universities. Known as 'Botha's babies' and although initially paid very little, this new cohort was to transform engineering capacity in the department for a generation.

The department was concerned not only with construction but increasingly with the management of water in the national interest, ensuring the availability of water and its equitable sharing. Its ***Management of the Water Resources of the Republic of South Africa***, published in 1986, introduced the concept of Fundamental Principles of best joint utilisation, and an iterative National Water Management Strategy based on an active partnership with all groups of users enabling the department to react rapidly in meeting legitimate demands and anticipate developments ahead of needs[45]. Catchment Management Associations and Committees were already familiar, one of the earliest being the Eastern Cape Buffalo Catchment Association, founded in 1946 under the presidency of D.L. Smit MP, collecting funds for catchment protection and aiming to coordinate and integrate development in every portion of the area for every section of the community[46]. The ***Management*** volume showed the department working on cost-benefit analyses and environmental impact statements[47] and formulating 15 objectives to promote efficiency of agricultural water use[48]. It expressed the need for 'sophisticated, scientific and objective' criteria to determine the comparative value obtained per unit of water from each of its various uses, expressed either as contributions to gross national or geographic product, or to taxation and foreign exchange, or to multiplier effects in the economy[49].

[41] As Secretary, J.P. Kriel was effectively the successor to the Director of Irrigation in the Department of Water Affairs. (Peter Ross, ***One dam thing after another,*** ms copy, 150. Our gratitude to Prof Rodney Davenport.)
[42] ***Ibid,*** 150-1.
[43] Van Vuuren, ***In the footsteps***. In 1970, his first year back, Peter Ross was responsible for the Kat River Dam, the Doorn River Dam and the Gubu Dam in the Border area, with the Jozini Dam at Pongola, Koppies Dam in the Free State, and six Transvaal dams – Badplaas, Da Gama, Buffelskloof, the Blyde River Dam, the Vaalkop Dam and the Tzaneen Dam.
[44] Although according to an ex-department engineer, in practice irrigation was frequently given priority over municipal use in rural areas (information from personal interview).
[45] DWA, ***Management of the water resources of South Africa.***
[46] Buffalo Catchment Association, ***Man and his environment. A study relating to the Buffalo river basin.*** (Buffalo Catchment Association, 1950). The Association made a submission to the Hall Commission in 1950 that since Africans were unable to purchase land freely, if they were removed from land to protect water sources they should be given alternative land on which to settle, and that 'the White man, to protect the country's water sources, must be prepared ... to give up some of his land to the natives presently on those sources.'The Border Village Management and Local Boards Association dissociated itself from this submission. CAD K122 100/4/144 and 147. See too 'Upper Buffalo Development Scheme and removal of natives', NTS 8059 529/337
[47] DWA, ***Management of the water resources of South Africa.***
[48] ***Ibid***.
[49] ***Ibid***.

Between 1970-84 there was an annual decline in real terms of 8.8% in expenditure on new government water works. Expenditure on irrigation in these years declined to about one-tenth of its 1970 value in real terms, while more or less constant on industrial and municipal schemes, with concomitant reallocation of staffing between the Construction Division and those engaged in control functions[50].

The Second Report of the Agriculture Commission, then chaired by Dr M.D. Marais, described the 'growing pains' experienced by farmers in the previous decades as the economy expanded and more complex processes were introduced: 'the whole farming structure has been placed on a much higher level'[51]. It endorsed the Water Report's emphasis on the selection and training of irrigators and more purposeful use of irrigation to supplement rainfed farming while emphasising the necessity of conserving water and irrigable arable land by adapted intensification practices rather than expansion. Rather than ubiquitous 'irregular and especially excessive irrigation', it advocated soft loans for sprinkler and spray equipment saving 20-30% of water used. Both the Water and Agriculture Reports advised a greater role for the Department of Agricultural Technical Services in planning, researching and introducing new techniques (especially effective water measuring devices) and in extension services in improved management e.g. in the efficient use of labour. Above all, 'meticulous planning' was 'imperatively necessary' for the Orange River Project and the 'exceptionally valuable' Makatini. Since irrigation was particularly labour-intensive, the layout of new lands would have to take into account the planning and adaptation of labour and mechanical equipment, and as yet data on water requirements for crops was inadequate.

The coming challenge to agriculture was assessed by J.A. Groenewald, distinguished Agricultural Economist, after the downturn in the economy in 1970[52]:

'Through higher productivity, agriculture will have to exert a bigger export effort, it will have to supply industry efficiently and cheaply [with] raw materials, it will have to be able to supply sufficient amounts of food to the population at reasonable prices and last but not least, it will have to cede labour sources to other economic sectors[53].'

Prof Vink has argued that despite the apparent success of white commercial farming in the 1970s the situation could not be sustained; state intervention in agriculture 'played a particularly strong role in the impoverishment of the South African economy.' The goal of food self-sufficiency and increased maize and wheat production resulted in the misallocation of capital and depressed growth in, for example, the fruit export industries 'where the state allowed a marketing regime that militated against higher output growth.' A 41% rise in the value of farm output during the 1970s derived from prices rather than growth in physical output: only in the case of horticulture did production grow in terms of both value and volume[54].

[50] DWA, ***Management of the water resources of South Africa.***
[51] RSA, Second Report of the Commission of Enquiry into Agriculture, RP 84-70.
[52] J.A. Groenewald, 'The state of South African agriculture – A diagnosis, ***Agrekon***, 10, 1 (1971), 12-26.
[53] ***Ibid***.
[54] N. Vink, 'South African agriculture in the 1970s', ***South African Journal of Economic History***, 14, 1-2 (1999) 90-113.

FARMER INITIATIVE

The Agriculture Commission had remarked on the increasing demands made of the irrigation farmer: high capital investment, specialised knowledge and management ingenuity. Examples of innovation and ingenuity abound. To take one example: in the Loskop Valley Gert Schoombie's parents had taken an active part in building and supporting the work force on the original dam, completed in 1938, when the (private) Hereford Irrigation District was incorporated into the Loskop Government Irrigation Area. The dam supported three Irrigation Boards as well as municipalities; by 1971 25 000 ha was under irrigation. Gert Schoombie himself spent a lifetime on the Hereford Board in the area, from the time when the Loskop distribution system was not adequate to deliver even half the quantity of water awarded by the Water Court, through a R17 million expansion scheme and a major change from tobacco to permanent crops – citrus, nectarines and table grapes. The grapes proved a breakthrough crop after an ecological study by the Roodeplaat Research Station helped the farmers counter hail with hail netting (developed in consultation with the University of Pretoria) and plastic covering against summer rains. With these aids, the Loskop area had a five to six-week advantage in overseas marketing of table grapes. The Schoeman family built the first ventilated grape packhouse, together with a hostel to house the group of local unmarried ladies who did the packing[55]. Flood irrigation prevailed until 1973, when Schoombie, as chairman of the South African Tobacco Farmers (OTK) travelled to Israel, France and the USA to investigate new technology. He returned having seen drip and micro systems operating in Israel and having bought 25 American-made centre-pivots for OTK (he is said to have invented the Afrikaans word ***spilpunt***); difficulties with the supply of electricity were overcome. Electronic irrigation meant the economical use of water – in the case of citrus falling from 120 litres per tree per day to 60 litres. Even with this saving, the capacity of Loskop was now inadequate; after a complex negotiation with the Minister the dam was raised by nine metres (1974-80).

[55] Information from Messrs Kalie Schoeman and Gert Schoombie, to whom much thanks.

Lani van Vuuren

Loskop Dam in 2018. Today, the dam serves a total scheduled area of 16 135 ha through a canal system of 295 km[56].

KNOWLEDGE, RESEARCH AND TECHNOLOGY

In the 1970s the emphasis in irrigation development switched from the 'horizontal' (more schemes) to the 'vertical' (more research, training and sophisticated farming practices.) In 1972, Minister Botha opened the new building at Roodeplaat housing the Hydrological Research Institute of South Africa with seven research sections[57], the creation and inspiration of its remarkable first Director, Joan S. Whitmore[58]. Botha also introduced Act 34 of 1971 setting up an autonomous Water Research Commission to advance, prioritise and fund water research and the application of the findings, as suggested in the Water Report. The 8-member Commission got off to a prestigious start under the chairmanship of J.P. Kriel and with the immensely distinguished water reclamation expert

[56] DWA, Loskop Irrigation Board Water Management Plan, http://watermeter.org.za/wp-content/uploads/2019/09/Loskop_WMP_Final.pdf, accessed 25 July 2023.
[57] Hydrometeorology, surface water hydrology, groundwater hydrology, water quality, catchment management, hydrological techniques, multi-disciplinary research.
[58] She had initiated and directed the Agroclimatological Research Unit from 1946 to 1958 before moving to Roodeplaat. In 1988 she initiated the International Convention on Women, Leadership and Development in Pretoria and in 1999 the International Conference on Drought Management. In 2003 she was awarded, posthumously, the Women in Water Award for Research.

Dr G.J. ('Gerrie') Stander, as CEO[59]. Dedicated to research across the hydrological cycle, it has been said that within a few decades the Commission had 'transformed a situation in which knowledge and research were rudimentary and incapable of adequately supporting water management in a water-stressed country to one in which available knowledge and technology is equal to the best internationally[60].' The Commission's role in irrigation development began with a national tour by its Irrigation Study Group out of which developed the first Master Plan for Irrigation Research, devised through a series of workshops led by Dr George Green to identify needs in the agronomy, soils, engineering, and economic and social aspects of irrigation. In funding research projects from the wider community rather than exclusively among its own staff, the Commission has played an important role in creating the multi-disciplinary irrigation community and holistic approach.

The 1970 Commission Reports and the environmental and economic challenges of the late 1970s raised the stakes for farmers. The 1967 Irrigation Symposium had drawn attention to the broad range of professions and disciplines involved in irrigation practice and planning – farmers, farming companies, engineers, equipment designers, soil specialists, agricultural economists, research organisations, and engineering consultancies such as Murray, Badenhorst and Biesenbach, and Ninham Shand[61]. It had also drawn attention to the lack of systematic guidance available to farmers, or cooperation across the board to solve their longstanding problems – salinisation and waterlogging, etc.

FARMER SUPPORT

One of the first institutions to support irrigation farmers was the South African Irrigation Institute (SABI, its Afrikaans acronym). The old Irrigation Association had atrophied, after which there was no society to inform irrigators and if necessary, lobby on their behalf. Into the breach stepped the SABI, formed in October 1976 by engineering alumni of technical courses instituted by the Department of Agricultural Technical Services and Water Affairs bringing together soil scientists and agricultural engineers[62]. The Institute aimed to 'promote the science and practice of irrigation engineering and the advancement of the profession', and began with 110 founder members. A year later it had formed branches throughout the country and in 1978 held its first National Congress (with the theme 'Irrigation for all'). With its criteria established, the Institute took the pioneering step of working to buck South Africa's isolation by gaining international acceptance. SABI, as a private institution, may have been seen beyond South Africa as an acceptable proxy for official state initiatives. The moving spirit in this was WRC Deputy Executive Director D.S. van der Merwe, who from 1978 onwards attended congresses of the International Commission on Irrigation and Drainage (ICID) (founded in 1950). He was the founding Chairman of the South African National Committee on Irrigation & Drainage (SANCID), working towards the goal of ICID membership; from 1984 SABI liaised with the ICID with a view to membership, achieved in 1992.

[59] Dr Stander was the first Director of the National Institute of Water Research at the CSIR. In 1976 he was honoured by the International Association of Water Pollution Research, of which he had been a longstanding President, with such words as 'dedicated' and 'courageous', 'responsible and responsive'. A tribute to his exceptionally productive professional career included 'wastewater treatment technology, reclamation of the water component of wastewater, development of a universally respected water resources research organisation, mobilisation and preparation of scientific manpower of the highest calibre, and accomplishment of an effective programme of international sharing of new knowledge in the water fields ....'

[60] Anon, Water Research Commission – Celebrating 40 years of research excellence, ***The Water Wheel***, Supplement to 10, 5 (2011), 6-7.

[61] The Symposium had included papers addressing all these aspects, after which the equipment companies had formed the Sprinkler Irrigation Association.

[62] What follows is based on F. Reinders, ***Agricultural Engineering, Silverton, 1961-2001,*** unpublished and F. Reinders and Heloise de Beer, ***SABI, 25 Years*** (2001). By then membership stood at 400.

In 1991, the Institute became fully multidisciplinary, extending its membership to companies, trade organisations, designers, manufacturers and suppliers. High professional standards were maintained, in the case of design by proof of competence in the institute's own national examination. The activities of the branches covered an enormous range: farm visits (250 members came to discuss irrigated citrus on Hendrik Schoeman's farm Moosrivier); sources of advice on topics such as irrigation during droughts (and even the irrigation of turf on the Sun City golf course); field days to evaluate the latest satellite tracking possibilities for checking production or the computerised control of micro-irrigation systems. Branches participated in university and technikon courses[63]. The Western Cape set up a study group to produce technical criteria for Water Affairs subsidies; Oranje helped to plan the design directives for the upgraded Riet River Scheme and developed several computer programmes. The Eastern Cape Branch initiated comparative studies of irrigation in Spain, the USA and Israel. In 1996 under the Presidency of Frikkie Koegelenberg a new SABI was created by consensus to formalise the expansion of the institute's membership and interests and uphold professionalism and the influence of the irrigation industry.

The need for intellectual and professional cooperation across disciplines was duplicated in the administrative structure where aspects of irrigation policy evolved in various divisions of the Department of Agriculture (Technical Services, Economics and Marketing, Agricultural Credit) as well as the Departments of Lands and Water Affairs. In the years of its existence the Permanent Irrigation Commission had not solved this conundrum. From 1968-74 an Interdepartmental Committee for Irrigation Development and Planning (IKBOB) had not worked well and was replaced in 1975 by separate interdepartmental committees dealing respectively with irrigation and drainage. Only in 1982 was a workable Liaison Committee between Agriculture and Water Affairs established (the LWSK).

In 1987, J.A. Groenewald published a fighting article in ***Agrekon*** entitled 'The involvement of the agricultural economist with agricultural policy – or should he withdraw himself from this mess?'[64] To mark the 21st year of the Directorate of Production Economics in 1988 Dr Gerhard Backeberg, specialist in irrigation economics and ex-Assistant Director of Research in the Department of Agriculture and Water Supply, described the increasing importance after 1984 of agricultural economics in agricultural research, advice and project management to achieve more economically efficient use of resources. In contrast to 'withdrawal', he showed how the collaboration of the agro-economist across disciplines was helping the policy maker and the farmer to determine the economic and financial viability of irrigation development. In relation to the irrigation economy, in particular, Backeberg identified subjects needing the economists' attention: market-directed production, the use of appropriate technology, cost recovery of capital investment and the replanning and rehabilitation of irrigation schemes in the national interest[65].

[63] The first university course on irrigation was offered at University of the Free State in 1981.
[64] Paper read at the Transvaal Group of the Agroeconomics Society of South Africa, 16 April 1986, reprinted in ***Agrekon*** 26, 2 (1987), 15-19. See too C. Keevy, 'The role of the agricultural economist in agricultural advisory services', ***Agrekon***, 25, 2 (1986) 21-25.
[65] G.R. Backeberg, (1988), Assistant-Director of the Directorate of Agriculture Economics, 'Terug- en toekomsblik oor werksaamhede in die Afdeling Makrohulpbron-ekonomie', unpublished.

Table 5.1 Funds expended by the Department of Water Affairs from 1970/71 to 1984/85 (in R million)[66]

Financial year	Actual expenditure	
	Total	Works
1970/71	108,1	79,3
1971/72	117,4	80,9
1972/73	138,8	109,2
1973/74	128,1	98,0
1974/75	133,0	97,0
1975/76	146,0	106,5
1976/77	162,5	115,6
1977/78	154,1	104,8
1978/79	164,8	102,0
1979/80	186,4	112,0
1980/81	205,6	126,1
1981/82	238,4	139,0
1982/83	261,7	141,7
1983/84	297,7	162,8
1984/85	311,5	143,0

RECESSION AND A NEW CONSTITUTION

By 1975 the South African economy was in deep recession and a phase of drought years (1970-3, 1979-86).

Double-digit inflation and import substitution distorted prices; apartheid policies gave rise to heavy state controls and expensively inefficient institutional duplication (at its peak, 14 departments of agriculture and similar proliferation of market controls.) Forced removals and homeland consolidation generated uncertainty over property rights. The oil crisis, successive regional crises and internal black activism, first by the Soweto youth in 1976 then more generally, led to the articulation of a 'total national strategy' and President P.W. Botha's injunction to 'adapt or die'. For a time, all capital works were stopped while the implications of the riots were studied. The National Party and its supporting institutions had become deeply divided, illustrated by the divergence between the exporting (and irrigating) wine, fruit and sugar farmers – twelve of Botha's Cabinet Ministers were wine farmers – and the northern maize producers, particularly badly hit by the recession in the internal market, who backed more conservative leaders.

A period of tentative social and economic concessions culminated in 1983 in a last-ditch constitutional power-sharing arrangement of an executive President and three separate parliamentary assemblies for Indian, 'Coloured' people of mixed race and whites (each relating to supposedly discreet 'Own Affairs' matters) with a joint President's Council. In 1984, an austerity budget was announced in every department except 'security'; the Defence budget rose from 2.4% of GDP to 4.6%, the Agriculture budget was cut from 1.5% to 0.6%. A state of emergency followed in 1986 as the popular struggle for full political and economic participation gathered force.

[66] DWA. *Management of the water resources of the RSA.*

The Tricameral constitution involved further upheaval and duplication among the departments. As with roads, health and education each 'Own Affairs' administration included a Department of Agriculture and Water Supply; Water Affairs remained a national department controlling resource development and finance. In the 'White Own Affairs' sphere 'Agricultural Water Supply' included irrigation boards, irrigation in general and borehole drilling – some 70% of the total water diverted for use – handled in the new Chief Directorate Agricultural Engineering and Water Supply housed at Silverton, with Charles Crosby as Chief Director from 1986 to 1989[67]. Crosby was well informed and inclined, both by temperament and experience, to informality, lively discussion across disciplines and participatory management with a low profile. His career encompassed both private and public sector aspects of agricultural engineering, taking in field crop research and rural development along the way.

IRRIGATION MOVES FROM THE DEPARTMENT OF WATER AFFAIRS TO AGRICULTURAL ENGINEERING

Agricultural Engineering (Ag Eng), under J.J. Bruwer, assisted by Crosby, had developed its own campus at Silverton, encouraging regular interaction with the farming community as the first port of call. Here from 1987 irrigation, the Cinderella that did not fit easily into a system of linear departments, had a collegial home of its own, backed by high-calibre research and housed in the distinctive prefabricated village (still in use today) which the inhabitants liked to say demonstrated accessibility and practical action rather than bureaucratic isolation. The new Chief Directorate brought together Agricultural Mechanisation, Soil Conservation and Drilling, as well as Irrigation Engineering under the Directorship of Frans Hugo. It also included the Research Institute for Soil and Irrigation, a development from the old Division of Chemistry and now specialising also in agro-meteorology and the modelling of drought, as well as pedology and irrigation planning. The Institute had published the 'Green Book' giving the irrigation requirements of crops in different cultivation areas. The reorganisation was traumatic and carried through with inappropriate haste. Hugo heard of the change from the television news. No management personnel were transferred from Water Affairs; the relevant files arrived in a truck. Hugo describes taking a despairing walk up the ***koppie*** (hill) while he tried to decide what to do with his new responsibility. He had never met an Irrigation Board before; now he had to deal with 250 of them without knowing their legal functions or, indeed, his own. (He was given a personal tour over a Cape Board in the Breede Valley.)

Crosby and Hugo exploited the new arrangement as an opportunity to bring together scientific analysis and the practitioners on the farms. Improvising as they went, Crosby encouraged Hugo to seek help wherever he could find it ('from private consultants, from fertilizer reps if necessary') but to keep the correct protocol with the Minister and the Department of Water Affairs. The two men were now also responsible for the 6 Regional Offices originally established

[67] Our gratitude to Charles Crosby, Frans Hugo, Adriaan Louw and Gerhard Backeberg for their contributions to what follows.

by Water Affairs. The manner of the new Chief Directorate's formation, and the fact that it undertook both research and extension work gave it an unusual degree of autonomy, as well as enabling it to operate a strikingly successful holistic approach. The next eight years (before irrigation was again incorporated in Water Affairs in 1994) were to have a tonic effect on South Africa's irrigation history.

Irrigation Boards distributed and managed irrigation water supplies to their members by virtue of government loans for infrastructure and organisation. As extensions and repairs were required, Boards applied for additional funding or, in adverse circumstances, for loans to be written off. Silverton saw its role as to assist the farmers, advising and interpreting at first hand. The many applications from Boards in financial trouble[68] convinced Hugo of the need to seek solutions rather than resort to hand-outs or write-offs. If Boards appealed to the Minister seeking government support for recurrent problems such as inadequate water, repeatedly low yields, or inability to sustain loan charges, the Minister was given a full briefing illustrated with slides and the appropriate Engineers were despatched to investigate the facts and arrive at holistic solutions.

The law relating to the setting up of a new Board required administrative controls and in controversial cases ministerial intervention. Water Affairs had in recent years given or refused permission for each new Irrigation Board after an initial, often cursory, pre-feasibility study, often without reference the actualities of local farm management. This scrutiny now fell to the Chief Directorate. Charles Crosby recalls,[69]

'This was new territory as far as we were concerned and we gave it a lot of thought. Eventually we set up two committees – a central one (the BOK) to undertake technical and economic studies to justify new developments or major improvements. This could require the services of several disciplines, and the findings would then be submitted to the Agriculture-Water Liaison Committee comprising senior officers of the two Departments. The second committees were irrigation action committees operating at a local regional level and ensuring that all who needed to be involved were involved and that things happened. Both committees functioned effectively.'

One of the most difficult questions to settle in advance was the level of subsidy appropriate to each Board, since 1937 supposedly reckoned according to its contribution to the national economy ('productive potential'). This now involved complex calculations, not merely of costs and benefits but of probability and risk using stochastic analysis based on historic data. After 1986 Hugo instituted a rigorous approach to preliminary studies with a multidisciplinary team of engineers, soil scientists, agriculturalists and economists who compiled a ***Manual for Feasibility Study for Irrigation Development*** – basically a shopping-list to be used when a scheme was considered, covering the project cycle from conceptualisation to evaluation[70]. If an application was turned down, an appeal to the Minister was permitted. At first, demand for these assessments outran official capacity, opening opportunities for independent consultants appointed by the central BOK

[68] F. Reinders, ***Agricultural Engineering, Silverton, 1961-2001***, unpublished.
[69] C.T. Crosby, ***Career Timeline*** (March 2010), unpublished.
[70] The Manual was drafted by a BOK sub-committee chaired by Frans Hugo with Messrs P.J. Maritz (Dep.Chief Engineer, Irrigation Boards, Agriculture), G.R. Backeberg (Dep. Director, Agricultural Economics, Agriculture), M.L. Badenhorst (Dep. Chief Engineer, Planning, DWAF), M.J. Schoeman (Soil Scientist, ISCW, Agricultural Research Council.)

to help compile the initial reports. Once the basic case was approved, the applicant Board could levy a water rate to fund a detailed investigation, on large schemes generally conducted by consultants or by the Department in the case of smaller enterprises.

Devolved responsibility to the six[71] Regional Action Committees (BAKs) brought together members from Agriculture, the Department of Water Affairs and Forestry (DWAF), the Regional Agricultural Extension Officer, the Research Institute and the Regional Department of Agricultural Economics. Initial discussion on irrigation development now began at the local level in direct communication with the Irrigation Boards and farmers. It was the proud boast at the time that important decisions were taken on the spot rather than being habitually referred back.

Demonstrating its extension orientation, one of the first productions of the Division in November 1986 was a ***Procedural Handbook for Irrigation Boards***. Silverton supported irrigation courses in Technikons and itself ran courses in such fields as planning the disposal of excess water in arable lands[72]. The Agricultural Engineering irrigation testing laboratory developed from catch cans and a single sprinkler into arguably one of the most advanced in the world, with special test beds for drippers, micro sprayers and sprinkler sprayers as well as filters and water flow meters. Felix Reinders considers it 'one of the most powerful educational instruments available,' not only for the hands-on expertise but for promoting understanding of what a machine was required to achieve and its biological impact[73]. When Dr George Green was appointed Research Manager of the WRC in 1983 he commissioned two reports from Reinders – a technical manual on subsurface drainage and research on the infiltration qualities of soils for use in the sizing of centre pivots. Research at Agricultural Engineering achieved a major breakthrough with the invention of the infiltration meter and the publication of the graphical design procedure in 1984, combining drops and booms equipped with ultra low-pressure regulators and 360-degree spray nozzles. Although agricultural research was centralised in a newly formed Agriculture Research Council (ARC) in 1992, the research function of Agricultural Engineering was not incorporated there until 1995, after irrigation had been returned to Water Affairs[74]. Shortly before the transfer, an ***Irrigation Design Manual*** was completed to record the accumulated knowledge and experience of the agricultural engineers, directed by Adriaan Louw, Hugo's successor.

THE 1991 IRRIGATION SYMPOSIUM

In 1989 F.W. de Klerk succeeded Botha as South African President; in 1990 black political movements were unbanned and Nelson Mandela left his prison cell for the political stage. In 1991, SABI convened an irrigation symposium (attended by ICID President John Hennessy). This was part of a carefully-prepared strategy preceding a South African application for membership to the non-political ICID – particularly sensitive in view of the country's increasing isolation. Papers were invited from South African scientists and high-profile international

[71] Unofficially 7, as the Eastern Cape and Karoo in practice functioned as separate regions.
[72] The WABB System (Water Run-off Control Planning), developed at Silverton, which became the basis on which farms are planned and a major tool of soil conservation technicians.
[73] F. Reinders, personal communication.
[74] Frans Hugo: 'In a conversation with the Minister, Dr van Niekerk, an animal scientist, I argued the point. I told him that an animal scientist will take a sheep, put it in a small pen, feed it with maize and note everything that resulted. They called it research. An engineer, however, will take a maize plant, put it on a test bench, feed it with maize and note its resulting performance in detail. That was not regarded as research. I told him I was too stupid to see the difference!'

guests who were taken on a preliminary irrigation tour of the country. It marked a significant moment in South Africa's irrigating history, leading directly, but not immediately, to admission to ICID in 1993.

It was equally significant in the local context. The multi-disciplinary approach and collegiality of the irrigating community was demonstrated by the papers, whose authors collaborated across institutions and occupations – the CSIR, universities and research institutes, equipment firms, farmers and consulting companies such as Ninham Shand and Murray, Biesenbach and Badenhorst Inc. They exemplify the extraordinary advances in familiar fields made since the 1967 Symposium – optimal use of water to minimise management-related distribution losses, the water requirements of crops, crop selection, irrigation methods and labour and mechanisation. The basic questions remained: what to irrigate, when to irrigate it and how much water to apply, but now elaborated in a 'technology-information explosion' of neutron hydroprobes, electronic weighing lysimeters and computerised management systems in soil water content and the detection and management of crop water stress[75]. It was estimated that efficiency in terms of land irrigated per unit volume of water had risen by 18% between 1965-90, and by a larger percentage expressed in terms of kilogram of product per cubic meter of water[76]. The combined constraints of the energy crisis, limited water and rising irrigation production costs relative to prices, directed attention to scheduling and the need to quantify crop water consumption; on the positive side effective scheduling models had been developed. The trick would be to increase efficiency without excessive capital expense by rehabilitating and modernising existing projects. The paper by F.J. Nel of the impressive Stillwater Estates (Pty) Ltd on the Vaal illustrated the problem. Nel explained how drought had precipitated his conversion from managerial judgement according to rainfall and climate, to science and the advice of soil scientist, Prof Alan Bennie from the University of the Orange Free State (OFS). He had optimised his use of water by substituting an MIR 3000 irrigation computer and a second-hand data-storing neutron hydroprobe for a hand augur and 162 individual tensiometers. Accuracy, speed and ease justified the cost and precision handling involved[77].

Prof Bennie, born on Vaalharts, lifelong irrigator and an acknowledged master of the subject, spoke on the development of the BEWAB scheduling programme for managing the water available to plants in the soil over a season. (BEWAB is an acronym for the Afrikaans ***BEsproeiingsWAterBestuursprogram*** – or irrigation water management programme). Bennie tackled the question of persuading farmers to apply the correct technology[78].

'Farmers will only adopt a more scientifically based system if it is affordable, comparatively easy to use and will result in considerable yield increases and/or water or energy savings ... The reasons why so many farmers abstain from applying sound on-farm water management principles are still not clear and need clarification.'

[75] Such as the PUTU model of De Jager et al, Schulze's ACRU, Bennie's BEWAB system to manage the soil water balance and Benade's Water Administration System to minimise distribution losses in irrigation canals, originated on a personal computer at Loskop. (N. Benade, 'Optimisation of distribution losses in irrigation canals', ***Proceedings of the Southern African Irrigation Symposium, 4-6 June 1991*** (Pretoria: WRC, 1995), 217.

[76] G.C. Green, 'Irrigation research and development for field crops: 25 years of progress', in ***Proceedings of the Southern African Irrigation Symposium,*** 110.

[77] F.J. Nel, 'Irrigation management on large farms, with special reference to the use of a neutron hydroprobe' in ***Proceedings of the Southern African Irrigation Symposium,*** 305.

[78] A.T.P. Bennie, 'Sound water management concepts and their application at farm level' in ***Proceedings of the Southern African Irrigation Symposium***, 294.

Research at Vaalharts had demonstrated the possibilities of efficiencies on flood irrigation schemes, the method used on 50% of irrigated land through gravity-fed Board schemes as well as along rivers and below farm dams. The results suggested that an average of on-farm flood irrigation efficiency of 75% was achievable, even where soils were not ideal; expanded across the country, this would produce savings 'the equivalent of another Vaalharts Irrigation Scheme'[79].

On the Riet River Scheme, the Free State Region of the Department of Agricultural Development, in partnership with the South Western Transvaal Cooperative and a Farmers' Association was developing a weekly scheduling service supplying the farming community with the water consumption of crops using the PUTU model to calculate water consumption. As a result, farmers began to consider replanning their flood systems to be able to apply the correct amount of water[80].

Pieter van Heerden described the processes involved. At Riet River chronic water shortages had been alleviated by the Sarel Hayward Canal but low crop yields, waterlogging and salination persisted. A team of experts (meteorologists, crop scientists, engineers, economists and extensionists) assembled to identify the problems. The extensionists 'used their expertise to combine technical, economic and management messages into a single meaningful extension message'. This was successfully 'converted to a felt need of the community' under the remarkable leadership of Kobus Nel by planning committees, including both experts and members of the target audience, which 'gave direction to and coordinated extension efforts in the area'. Van Heerden concluded that the multi-disciplinary nature of irrigation complicated the process of technology transfer, and that a top-down didactic approach to extension was unlikely to succeed[81].

As well as elaborating and greatly advancing the technical agendas set by the 1967 Symposium, the 1991 Symposium looked forward to a very different social and economic future for the country. It addressed ethical questions advanced by the agricultural economists: equity in water allocation for under-privileged and non-irrigating groups, the upstream and downstream costs of pollution control, etc. It also led directly, but not immediately (after an interruption at the time of the Boipathong incident), to full admission to the ICID in 1992 and the approval of SANCID's constitution the following year.

[79] D.J. du Rand and G.H.J .Kruger, 'Surface irrigation in South Africa – the challenge' in ***Proceedings of the Southern African Irrigation Symposium,*** 197.
[80] ***Ibid.***
[81] P.S. van Heerden, 'Approaches to technology transfer', in ***Proceedings of the Southern African Irrigation Symposium,*** 427.

CASE STUDIES IN PRIVATE COMMERCIAL IRRIGATION TRANSFORMATION

While the state sector has underpinned the theoretical and academic approach, the private commercial sector is larger and arguably as innovative. The leading American irrigation authority Dr Charles Burt[82] has emphasised the importance of research starting on the farm, where intuitive farmers have by continuous experimentation developed techniques of irrigated crop production and selection.

1. The evolution of an Afrikaner Farm, Grabouw, Western Cape: the *skilpad beleid* (tortoise tactic)[83]

Farmer A. was born on the farm, then 1 268 ha, part-cultivated with mixed vegetables, vines and grain with 500 sheep and a few deciduous fruit trees, part-bush which was burned off every six years or so and 'would not raise a tortoise'. The family lived off the farm, and although the young A. farmer had hoped to study Agriculture at Stellenbosch in 1949 his presence was required at home to replace the farm manager. His father did not irrigate and employed simple marketing methods: bartering with Mr Harris, the Jewish shopkeeper who had helped the family in the Gold Standard crisis of the 1930s when a bag of oats fetched 3/6d and selling fruit on the tree to Mr Neumark for marketing in Cape Town. But A. attended Farmers Association meetings and decided that the future lay in the export of fresh fruit in cold storage to Britain and Europe.

In the 1950s A. used the profits from the vegetables and the sheep to expand the orchard, watering with a tractor for the first four years and putting together a small grader with components designed by the National and Overseas Co. in Bloemfontein. A small packhouse was converted from a wine cellar and stable, and later a small cold store was added. A. married the local teacher who took on the management of the packhouse. By the later 1950s they were using sprinklers with water pumped from small farm dams by a Blackstone engine. Each advance was funded by the sale of vegetables – potatoes and cabbage interplanted with the orchard trees, against the advice of the extension officer. This was the low-risk ***skilpad beleid***: 'when I have the money I put it in the farm, when I don't I stop expanding.' By the 1960s trees planted without irrigation were no longer economic. When electricity arrived, A. made a large investment, selling 65 ha of the farm to his brother for R6 000 (he later repurchased it) to install electric pumping and quick-coupling aluminium pipes. He did not install drip irrigation to save water as the soil was unsuitable but later installed permanent plastic pipes with spitters, no longer requiring 30 people to move the heavy pipes but just 8 to deal with the valves until these were automated and programmed by computer.

By the 1970s the Elgin and Grabouw Irrigation Board was established with A. as a founding Board member. A bigger packhouse was now needed for the whole Valley, and A. replaced his original packhouse with new cold stores. He went to court to establish riparian rights and built a dam on the Palmiet River dividing the farm. Experts now came from the

[82] Chairman of the California Irrigation Training and Research Centre, Cal Poly, St Luis Obispo, Ca.
[83] Information from a personal interview.

big firms – Stewart & Lloyds, Ninham Shand and the irrigation designer Willem Laubscher. The year 1973 was a year of decision: whether or not to join the new cooperative, Kromco, as a founding director. After much deliberation and prayer he did so. This freed his hands to develop the dense ***fynbos*** on the land across the Palmiet. With the help of Solly, the bulldozer driver, and ten men a bridge and a road were built. The extension doubled the planted area of the farm, with virgin soil and better drainage. New trees were planted, rather than grafts; where A. had been supplying Kromco with 5 000 bins of fruit at 30 tons per ha, in 2012 the yield was 50 000 bins, with Granny Smith apples at 120 tons per ha and an average yield of 50 tons over the whole farm. More farms were bought and developed and more attention paid to quality and marketing after his son had watched the buying habits of elderly people in Europe and East Asia.

2. Douglas: Orange-Vaal Water User Association: high tech precision irrigation farming[84]

Louis Wilken, innovative manager of the Orange-Vaal Irrigation Board at Douglas in 1984 and pioneer of scientific water management there, described his approach:

'Farming is a constant cycle of investigations into the effectiveness of the practices you are applying, how you do things. Scheduling and the effectiveness of the irrigation systems in use are one of the first phases you consider: you carry on until you feel you have the situation under control and then you move on to the next phase. You start looking at cultivars and planting densities and this leads you to planters and their suitability for the various soil conditions that apply on the farm. Inevitably this raises the issues of soil cultivation methods and implement suitability and the impact on soil compaction and root development. Fertilisers are an important factor: how much, what sort, when and how should they be applied? As improvements are implemented they have an impact on irrigation management and this means revised scheduling and the suitability of irrigation equipment and management. This cycle of investigations followed by improvements may extend over some years but all the time you are striving for progress, always returning to the factors that make a difference.'

Under pressure from the then Department of Water Affairs to recover water costs by expensively metering farmers ('recording history'), Wilken persuaded the farmers instead to use SAPWAT to plan ahead on the basis of crop areas and crop water requirements allowing farmers to adjust their planting programmes and costs to be recovered equitably. 'We progressively refined the crop water requirement method. Each year the water use of each of the crops grown was revised and agreed' and tariffs set. 'If the calculated quantity of water used by a farmer exceeded his quote he was fined at a level that ensured cooperation.'

The Board formed The Griquland West Cooperative (later GWK HTF ltd.) to support high technology precision farming, making recommendations to farmers taking account of as many variables as possible: tillage and scheduling according to the soil physics and chemistry of a farm, yield management

[84] Anon, 'Orange-Vaal Water Users' Association – water always treasured', ***SABI,*** 1, 4, (2009), 53.

by plant physiology, hourly temperature records and yield maps. Targeted field surveys, penetrometers ('dip-sticks'), remote sensing and satellite imagery are used.

3. The science of success, Karsten Boerdery, Kanoneiland[85]

Piet Karsten started farming in a small way on Kanoneiland in 1968, buying his main farm Roepersfontein in 1980 to grow seeded black table grapes for raisins. Interest rates then stood at 26%: the infrastructure and telecommunications were self-installed. Growing conditions close to the Orange River were not ideal, with high humidity and insufficient light and ventilation making the crop prone to botritis. Karsten joined a number of farmers in experimenting with drip and micro irrigation in the sandy semi-desert hills behind the river on soils with a clay content of less than 3%, necessitating an initially high addition of nitrogen to promote a more vigorous rootstock for strong growth. Now Karsten Boerdery supplies export table grapes year-round, grown on 1 082 ha on 9 farms linked with others worldwide for continuous supply. On a further 732 ha in the same area citrus, dates, watermelons are irrigated with drip, micro or flood methods according to a refined scheduling system. Karsten Boerdery has deciduous fruit interests at Ceres and grows nuts, corn, wheat and seed vegetables at Prieska.

The Karsten methods are information-dependent and capital-intensive, experimenting with the management and manipulation of new technologies. Piet Karsten became interested in American research on the application of Gibberellic acid (GA3), a growth hormone contained in grape seeds, to encourage larger bunches and bigger seedless grape varieties. He searched out high quality scientific consultants – Herbert Harting, Klaus Orth, Pieter Raath – expanding his technical department and using high-tech methods. Optimised water use and huge improvement in water saving have been achieved by the in-house development of the automated Irricheck Scheduling programme, which continuously draws weather data from the internet and DFM soil water content probes to calculate the ratio between water used and actual evaporative demand, enabling the determination of the maximum safe depletion level with extraordinary accuracy. With this system, which simulates water use and irrigation requirements for the next seven days, irrigation scheduling can be delegated to lower levels of management. The system is constantly being evaluated, refined and extended and is now being widely applied on other farms.

The Karsten philosophy of empowerment has created equity partnerships for employees as well as training courses in skills and leadership, educational enterprises and an impressive programme of support and social welfare for the 600 permanent and 3 000 seasonal workers.

4. An 'emerging' white commercial company' – how Rugani Carrots (Greenway Farms) took off[86]

In 1992 Vito Rugani and Vincent Sequeira, both from long-established modest farming families in Gauteng, went into

[85] Personal interviews at Karsten Boerdery; Department of Water Affairs, Water Conservation and Water Demand Management Sector Awards, Nomination (Agricultural Sector), 'Karsten Farms, water saving with irrigation scheduling'.

[68] This account, quoting Vito Rugani, is drawn from L. van Rooyen, 'Lessons from Rugani Carrots', ***South African Farmers Weekly*** 31 January 2014, https://www.farmersweekly.co.za/crops/field-crops/carrot-lessons-from-rugani-carrots/, accessed 26 July 2023.

partnership to found Greenway Farms in Tarlton with 20 ha under irrigation. They were working 18 hours a day for relatively little.

'We were stuck in a typical emerging farmer dilemma. We were planting 25 different lines of vegetables and doing everything by hand. We hadn't found our niche. We had no capital, paid low wages and worked like hell. We realised we needed to make a drastic change.'

Their neighbours were in much the same position, so the two men went to Australia for enlightenment. 'We believed in the myth of cheap labour and that the more crops you planted, the more you spread your risk. Within two weeks we saw how wrong our thinking had been.'

Returning, they sold 40% of their farm, reinvested in mechanisation ('machines are there to enhance productivity not retrench people') and embraced specialisation. They are now the largest producers of carrots in Africa, farming 2 200 irrigated ha in two provinces. They plant weekly on a 3-year cycle and harvest year-round paying particular attention to the organic component of the soil and crop rotation while engaging in precision farming. They employ 200 people, and have a long record of expanding the labour force by 5% per year. 'The key understanding [must be] that machines will double productivity, so when the machine has been paid for, the Company will be in a position to double wages.' The marketing strategy is simple. 'There's a misconception that the fresh produce market is unstable because prices move. The reality is that a moving price is a "shock absorber" that counterbalances changing supply volumes. ... Farmers go under because of low income, not low prices.'


06

CHAPTER 6

BETTERMENT AND A BETTER FUTURE? AFRICAN IRRIGATION (1950-1994)

Deborah Lavin and Lani van Vuuren

This chapter provides an overview of irrigated agriculture in South Africa's traditional black communities in the years before 1994. The progress of formal black irrigation has been judged, before and after 1994, to be limited in terms of its potential, but for much of that time the significance of its diversity was not taken fully into account. In 1950, smallholder irrigators were habitually categorised as either cultivating to survive ('subsistence') or potentially enterprising ('commercial'). The Bantustans (or 'homelands') of the 1970s were under-farmed and over-populated; they were formally 'bettered' by large irrigation schemes which often became costly, inefficient and management dependent. An independent informal movement of highly productive community gardening and food schemes initiated by women, originally for survival, outlived apartheid and grew in strength as a means of empowering and encouraging a resilient and waterwise community. A debate over the record and potential of black schemes began in the late 1980s, when irrigation management transfer of state schemes to participating farmers became common internationally and was anticipated in South Africa also. From 1994 when the Bantustans were reincorporated into the 'new' South Africa, until 1996 when their parastatal agricultural development corporations were abolished, these corporations presided over the decline of many irrigation schemes owned by smallholder farmers. These farmers were heavily dependent on state funding. In the light of a series of scholarly and professional appraisals and case studies, and with the input of international experience and NGO interest, the debate over the rehabilitation and development potential of African irrigation resumed, reanimated by the prospect of the reform of water and land rights.

A NOTE ON TERMINOLOGY[1]

'**Smallholder**', once a term applied to successful probationers with holdings of 8 – 20 ha on white settlement schemes; after the 1950s more commonly applied to schemes for African farmers, most working dryland arable plots, a minority on irrigation schemes on multiple plots of about 1.5 ha with shared water distribution (or sometimes storage) systems. (Also '**small-scale'**, '**subsistence**').

'**Plotholders'** have legal right to the use of land, generally through Permission to Occupy (PTOs), some by quitrent or long lease. Many do not farm their plots.

'**Farmers':** actively engaged in farming enterprise, either on their own or on land where someone else has the right to occupy. The majority are women, responsible for 65% of farming activity in the former homelands in the year 2000.

Subsistence farmers': prevalent in communal areas, producing crops for home consumption; surplus may be traded.

'**Commercial farmers'**: producing primarily for cash sales or engaged in more diverse livelihoods. Also, more recently, '**emergent farmer'**: generally denoting a higher degree of commercialisation and aspiration for a relatively large-scale operation.

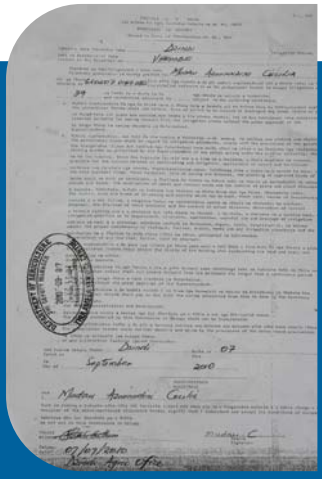
Note: After 1950 there was a universal trend of withdrawal from arable cultivation in the reserves, largely owing to overcrowding. In the Bantustan era employment opportunities in the homelands proliferated. Urban-based income streams (at first from migrant remittances, later also grants and pensions) form increasingly important livelihood elements throughout this period.

1 J. Denison and S. Manona, Principles, approaches and guidelines for the participatory revitalisation of smallholder irrigation schemes Vol. 2, (Pretoria: WRC, Report No. TT 309/07).

After the Second World War there was a spate of smallholder canal irrigation construction in the black areas, fed from diversion weirs or dams and delivering water by gravity in concrete canals to field edge. In 2011, 74 of these were still in existence (67 operational); a further 20 were operated by pumps (14 operational)[2]. In African irrigation schemes particularly related to Trust areas purchased after 1936 planning was easier because the State as trustee landowner was empowered to enforce 'sound farming methods'. Irrigated land was held on the basis of 'permission to occupy'; the State could prescribe land use and expel or replace non-compliant tenants, much as in the early days at Kakamas and Hartbeestpoort though on less land. In some areas families were said to make a living on 1/16th of an irrigated morgen, 'so the value of the schemes is much greater than their cost, especially as each scheme enables substantial numbers of people to be settled on small areas under stable and healthy conditions[3].' Plot sizes were generally 1.28 to 1.71 ha, where the white probationer settlers had been allocated 8 ha to 20 ha – clearly illustrating the unequal distribution of land among South Africans. (Land distribution remains a sensitive topic to this date and there has been fierce debate as to how address and correct the imbalances since 1994)

Too much success, however, provoked opposition. In the Tzaneen area ten black schemes, organised in Farmers Associations on 502 irrigated morgen, amalgamated to form the Letaba Bantu Farmers Cooperative, with shares of £1 and 1 000 fully paid up members. But when they produced over three million pounds (weight) of vegetables of which only half was sold, the local white farmers assembled an Action Committee protesting at the adverse effects of 'unfair competition' on 'the already variable and unsound market'. The Committee claimed the Trust's operations amounted to 'nothing less than large-scale farming by the State itself'; that 'the whole business is run for ['the Native farmer'] and the vitiating influence of the profit motive is already being rooted in him at this unripe stage', and recommended separate markets for black and white produce[4]. The Department of Native Agriculture encouraged 'Native markets' (such as at Pietersburg and Hammanskraal), together with local school feeding schemes.

WRC archives



A typical 'permission to occupy' letter, which is still in use today. This letter dates from 2010 for the Dzindi irrigation scheme.

[2] W. Van Averbeke, 'Performance of small holder irrigation schemes in the Vhembe District of South Africa', citing Denison and Manona (2007) Principles, approaches and guidelines for the participatory revitalisation of smallholder irrigation schemes Vol. 2, figures updated in 2011.
[3] Report of the Director of Native Agriculture for 1952-3, UG 48-55.
[4] Report of the Native Affairs Commission for 1948-52, UG 36-54.

A NEW ERA OF SYSTEMATIC BETTERMENT

After World War II discussions for a better future proliferated throughout the world, in the colonial as well as the domestic and international spheres. In South Africa, Douglas Smit announced in 1945 'a new era in Bantu history ... a better, fuller life' to the Ciskei General Council. The Smuts government's Social and Economic Planning Council proposed 'a fully researched plan for a sound agricultural system to improve every aspect of human life in the Reserves, not merely more progressive agriculture[5].' After the 1948 electoral victory D.F. Malan's National Party government appointed Prof F.R. Tomlinson in 1950 to lead a Commission for the Socio-Economic Development of the Native Areas, now given a brief with a very different emphasis – to produce 'a comprehensive scheme for the rehabilitation of the Native Areas with a view to developing within them a social structure in keeping with the culture of the Native and based on effective socio-economic planning'.

THE TOMLINSON COMMISSION REPORT, 1954[6]

At the outset the Commission adopted 'a ***total*** approach ... to the development of the black areas on a large scale ... on the basis of proper planning ... and executed in accordance with sound and well-considered principles'. It debated, and accepted, the National Party's proposed acceleration of racial segregation and the development of black areas as 'the germinal point in the process of separate development of European and Bantu', involving the betterment strategy of reorganised and rationalised land use and resettlement, by consent if possible but without it if necessary[7]. The Report surveyed the historical, geographical, economic and political context of 'the position of the Bantu' and 'the population problem', estimating the 'carrying capacity ["in a way worthy of human beings"] of these areas[8].' Chapters 28-32 dealt with agriculture. African agriculture was to be replanned: betterment areas divided into residential, arable and grazing zones, with restricted ploughing and animal numbers. A total of 35 agricultural regions were identified, in which a number of full-time farmers settled on economic units would be able to buy land from the Trust. Families who could not be placed as farmers would be placed temporarily in residential areas without farming rights.

Chapter 20 of the Report dealt specifically with irrigation, on the basis of data from a total of 122 smallholder diversion schemes covering 11 406 ha. It found irrigation farming to be 'the only form of undertaking in which, under European leadership and control, the Bantu have shown themselves capable of making a full-time living from farming', quoting the Reports of the Director of Native Agriculture to cite examples of cooperation such as the Letaba shareholding scheme and the construction of 60 earthen irrigation dams in the Nebo District[9]. Results from the Olifants River Scheme in the north-eastern Transvaal suggested that an irrigated plot of 1.28 ha could generate a mean annual income of £110, as opposed to £57 from other land-based rural livelihoods. The Olifants Scheme was officially regulated and assisted; a comparable but informal and unregulated scheme, such as Nzhelele,

[5] 'The Native Reserves and their place in the economy of South Africa', Ninth Report of the Social and Economic Planning Council, UG 32-46. See too the Tenth Report, UG 37-46.
[6] 'Commission for the socio-economic development of the Bantu Areas within the Union of South Africa: summary of the Report', UG 61-55. The summary was prepared by the Commission.
[7] *Ibid*.
[8] 'The Native Reserves and their place in the economy of South Africa', Ninth Report of the Social and Economic Planning Council, UG 32-46. See too the Tenth Report, UG 37-46.
[9] Drawn from the Report of the Director of Native Agriculture 1944-5, UG 44-46.

generated an average income of only £28.79. The Commission recommended the expansion of smallholder diversion irrigation schemes subject to uniform regulations: plots of 1.28 ha to 1.71 ha, with stipulated systems of production and land use supervised by state-appointed superintendents empowered to expel and replace farmers. The total irrigation potential of the Reserves was given as 54 051 ha, to be developed as soon as possible. On this basis 36 000 families could be settled on irrigated holdings of 1.28 ha at a cost of 3 million pounds. The other 245 000 families (1 470 000 persons) would be displaced from land they had previously occupied or owned; housed in rural villages and (somehow) absorbed into other employment to be generated by state investment and white capital and initiative in or near the Reserves.

The distinguished economist Prof S.H. Frankel castigated the Tomlinson model of two separated economies as obsolete 'pyramid-building' couched in 'the language of the subsistence economy, not the language of the modern world, which requires the unfolding of new income-creating opportunities across and through the elimination of political and other artificial boundaries'. He had participated in the East African Royal Commission of 1953-5 investigating the promotion of economic development in Kenya, Uganda and Tanganyika, presenting colonial development through multiracial cooperation as the hope for East Africa's future. Frankel saw the economist's function as not to make choices but to examine what the cost of alternative choices was likely to be: in his view 'the real cost which ideological pyramid-building entails is avoidable economic misery, and the political and psychological discontents which it creates'[10].

A very full historiography exists on 'the economic misery and the political and psychological discontents' following the implementation of betterment as administered in South Africa, first by the Department and later by the Chiefs and headmen as new state-salaried 'Bantu Authorities', imposing deeply unpopular policies at community expense and often themselves emerging as the main beneficiaries of the Trust's land expansion[11]. The new version of Betterment, and the activities of the South African Native Trust, could turn the rural world of the reserves upside down, reordering space, depriving people of the use of land and the right to buy it, detaching homesteads from indigenous resources and disrupting the customs and ceremonies of rural life[12]. Its radical implications – the deteriorating living standards from shortage of arable land and declining soil fertility, the displacements and the uncertainties and broken communities to which they gave rise – help to account for a 'generalised background of unrest' emanating in repeated acts of more or less violent local rural resistance from 1940-65[13].

IRRIGATION IN THE BETTERMENT ERA

It is said that Tomlinson came under strong pressure to rescind the recommendations in the Report Summary, and that he refused to do so, banging the table at Hendrik Verwoerd in the process[14]. Much of the report was not accepted: in particular external investment in the Bantustans was rejected

[10] S.H. Frankel, 'Illusion and reality in Africa', ***Optima***, 7 (December, 1957), 197-205.
[11] See J. Yawitch, ***Betterment: The myth of homeland agriculture***, (Johannesburg: South African Institute of Race Relations, 1981)
[12] T. Lodge, ***Black Politics in South Africa since 1945*** (Harlow: Longman, 1983); W. Beinart and C. Bundy, 'Hidden struggles in rural South Africa: Politics and popular movements in the Transkei and Eastern Cape, 1890-1930', ***African Economic History***, 94, 4 (1988), 166-168.; P. McAllister, 'Resistance to betterment in the Transkei: a case study from the Willowmore District', ***Journal of Southern African Studies,*** 15, 2 (1989), 346-368.
[13] Lodge, ***Black politics in South Africa since 1945***. He cites Zoutpansberg and Sehukhuneland (1940s), Witziezhoek/QuaQua (early 1950s), Marico (1958), Sekhukhuneland again (1958-9), Natal (1958, 1959) Mpondoland (1960) Thembuland (1962-3), and Ciskei ('in a state of almost constant ferment').
[14] C.J. van Rooyen, 'F.R. Tomlinson memorial lecture: The dilemma of a contemporary agricultural economist: Will the real Professor Tomlinson please step forward, ***Agrekon***, 39, 3 (2000), 223-234.

and the suggestion that the Trust supply the capital for special irrigation and marketing initiatives,[15] 'if necessary at interest' and retaining a controlling interest in the organisation until the capital was redeemed, was not acted upon. The emphasis on the importance of smallholder agriculture and the expansion of irrigation in the black areas was, however, officially endorsed as existing policy and extended in 1963 when detailed regulations were applied, bringing irrigated land owned by mission and church societies, Native Councils and private individuals under the Department of Native Affairs where previously they had come under the Department of Irrigation[16]. By 1969 almost 40% of the total smallholder irrigation area as it was to be in 2004 had been developed (in the Vhembe District, 70%). But planned development was overtaken by the numbers of people forcibly dispossessed of land earmarked for large storage dams or taken for white irrigation farming as well as the millions 'endorsed out' of urban areas or relocated to achieve 'ethnic consolidation' in the tribal areas[17].

Total agricultural production in the reserves is said to have been more or less constant from 1946 to 1969; at the same time the population density rose from an average of 60 to 110 per square mile, increasing the dependence on external remittances, old age pensions and regional industrialisation rather than agricultural production for a livelihood[18].

Doornkop, near Middelburg (Transvaal), had been a black freehold irrigated farm since 1905. In 1974, the community was transplanted 250 km away to Bothashoek, situated on a river but with exhausted arable soils. Years after the move irrigation was still said not to be feasible. Designed for 190 families, Bothashoek contained more than 1000 families by 1983, many crowded onto plots no more than 0.1 ha in size. ('This plot is too small to produce bags [for sale or storage]. We just help ourselves from it to eat[19].') One long-established practice was for dispossessed Africans to register themselves as a tribe in order to get land. While providing a refuge for those displaced from the urban areas or removed as tenants from white farms, the Bantustans were overwhelmed by political and natural demography, growing in population from 4.2 million in 1960 to more than 11 million in 1980[20]. Their geography was reconfigured to include 'Bantustan townships' near big cities; by the late 1980s, 74 new towns and areas of closer settlement had been built within them. Platsky and Walker estimated that between 1960-80 there were 3.5 million removals to or between Bantustans[21].

[15] Such as the vegetable garden scheme at Rembander (Sibasa), the district associations formed by the Natal and Zululand Bantu Cane Growers Association and cooperative sales of produce by the Hammanskraal Amalgamated Native Farmers Association, all quoted in support of the case for irrigation by the Director of Native Agriculture in UG 44-46.

[16] Tomlinson had noted the failure in the Eastern Cape of 28 out of 37 small schemes not under departmental control. For schemes under the Irrigation Department see Department of Native Affairs General Circular 22/1935.

[17] L. Platsky and C. Walker, ***The surplus people: forced removals in South Africa***. (Johannesburg, Ravan Press, 1985)

[18] C. Simkins, 'Agricultural production in the African reserves of South Africa, 1918-69', ***Journal of Southern African Studies***, 7, 2 (1981), 256-283.

[19] D. James, ***The road from Doornkop: a case study of removals and resistance*** (Johannesburg, South African Institute of Race Relations, 1983)

[20] Beinart, ***Twentieth Century South Africa.***

[21] Platsky and Walker, ***The surplus people.***

Nico Swanepoel

The Flag Boshielo Dam (formerly Arabie Dam), prior to being raised in 2004. The dam was originally constructed by the Lebowa Government on the Olifants River in 1987.

Smallholder irrigators generally had better access than dryland farmers to land and services such as extension advice and the use of government tractors for land preparation, introduced by the Bantu Development Trust in the 1950s[22]. The state usually supplied the water and arranged for the cleaning and repair of the canals, covered by a small water charge. The Trust was particularly active in purchasing white farms in the Northeast Transvaal, the area containing 91 of Tomlinson's 122 existing smallholder schemes and distinguished for the intensity of its cultivation and the number of informal enterprises. The largest was the Arabie/Olifants scheme, developed on betterment lines from

[22] C. de Wet and M Whisson (eds), ***From reserve to region: apartheid and social change in the Keiskammahoek District of (former) Ciskei 1950-90.*** (Grahamstown: Rhodes University, 1997).

1938-63 on 14 farms bought to settle the increasing numbers of displaced people from outside – groups forcibly removed ***en masse*** for ethnic 'consolidation' or communities engineered from labour tenants evicted from white farms. To make room for them, at least part of the resident population was itself removed. Households were allocated a plot of irrigated land (1.2 ha), a residential stand and a share of communal grazing, approved by the chief and held on conditional terms by official Certificates of Permission to Occupy (PTO), with prescribed land use and standardised regulations including the stipulation that the plot should be worked full-time[23]. On irrigated Veeplaats (Arabie) very few changes in plotholders were recorded: PTOs were in practice held for life and handed on within families. This contrasted with 'adjoining non-irrigated land' where population pressure in the 1960s was accommodated by subdividing holdings[24].

Betterment was applied unevenly, its rigidity varying according to local circumstance, the views of individual officials and the degree of resistance encountered. Under regulation and formal farming many schemes were reasonably efficient and productive. On the Dzindi scheme (136 ha) established in 1954 in the northern Sibasa District, for example, a diligent Native Commissioner issued a succession of planting instructions: pigeon peas (1962), cotton (1964), tomatoes (1965), a wheat/cotton rotation (1966), which proved unprofitable or difficult to market[25]. Three simple rules governing the use of irrigation water were set by a white extension officer: individual daylight timetabled 'turns' of water with free access at night; the canal flow to be unrestricted; clean canal water with no washing or bathing allowed. In most cases these rules, like the resolution of conflicts, were implemented by informal mediation rather than through the elected Scheme Management Committee of 9 farmers officially tasked with promoting commercial farming and community cooperation. The original basic rules, confirmed and codified at a mass meeting in 1980 for transparency and consistency, survived radical political change. Van Averbeke and Letsoalo ascribe this to the equity and equality of the rules, their simplicity and their explicit endorsement of community cohesion[26]. This did not, however, inhibit differentiation in farming styles, related to differing objectives and production practices varying according to affordable and available techniques and resources[27].

By 1969 a total of 18 200 ha of black land was irrigated by gravity canals, predicated on community cooperation; there were claims that 'a considerable number' of full-time irrigating black farmers had been settled, earning R120 to R1 000 per year[28]. But small plots, inadequate supports and restrictions on landholding meant that few schemes provided full livelihoods; in any case agriculture was declining as a proportion of rural homestead incomes. Black farmers were faced with restrictions and discriminatory measures while alternative jobs and rising urban wages were incentives to work outside agriculture. In that year the Agricultural Economics Society took as the theme for its annual conference 'Economic development in less developed areas', for the first time publishing the conference papers in the journal, ***Agrekon***. The black irrigated area was given as 19 704 ha – 37% of the

[23] In terms of Proclamation 5 (1963) setting out the regulations for all black irrigation schemes.
[24] E. Lahiff, 'Land tenure in South Africa's communal areas: a case study of the Arabie/Olifants Scheme', ***African Studies,*** 59, 1 (2000), 45-69; see too P. Delius, ***A lion amongst the cattle***. ***Reconstruction and resistance in the Northern Transvaal***, (Johannesburg: James Curry, 1996).
[25] W. van Averbeke,, ***Best management practices for small-scale subsistence irrigation farming*** (Pretoria: WRC, 2008, WRC Report no. TT 344/08).
[26] W. van Averbeke and S. Letsoalo, 'Sharing the water: Institutional and organisational arrangements at Dzindi Irrigation Scheme in South Africa', ***Journal of Agriculture Extension***, 34 (2005), 34-43.
[27] W. van Averbeke and S.S. Mohamed, 'Smallholder farming styles and development policy in South Africa', ***Agrekon***, 45, 2 (2006), 136-157.
[28] J.H. Grobler, 'Die landboupotensiaal van die Bantoegebiede', ***Tydskrif vir rasse-aangeleenthede***, 21, 1 (1970), 3-10.

potential 53 972 ha. White trustee government was said to be encouraging the development of individual farming units outside the communal system of land tenure; the occupiers were 'already displaying development motives' and guidelines had been drawn up for the selection of ***bona fide*** probationer farmers. Of the 25 most important schemes, 16 were in the Transvaal, 4 in Natal, 4 in the Transkei with Qamata under construction. The authors identified the need for a credit scheme to meet operating requirements, provision for 'the orderly marketing of products' and machinery for accessing inputs – prescient comments, since all these were still deficient 30 years later[29].

Black agricultural development was impeded by the pattern of state spending, overloaded by 1983 with the bureaucratic duplication of 14 departments of agriculture and parastatals[30]. By the 1970s the Department of Bantu Affairs and Development Aid had lost much of its previously accumulated knowledge of agriculture and small-scale farming. Black farmers were faced with restrictions and discriminatory measures while alternative jobs and rising urban wages were incentives to work outside agriculture, which declined as a consequence.

IRRIGATION DEVELOPMENT UNDER THE BANTUSTANS

In 1970 the Bantustans Citizenship Act aimed to connect all Africans as 'citizens' to one of eight black Territorial Authorities according to language and 'tribal origins'. In a strange South African variant of decolonisation in colonial Africa, these Authorities were made eligible for 'self-government'. By 1981 ten Bantustans were self-governing, some (notably Bophuthatswana and KwaZulu) balkanised in dispersed geographical fragments. Four accepted 'independence'[31]. The Bantustans invested heavily in smallholder irrigation, particularly in the Eastern Cape and the northern areas of the country, which together accounted for 70% though with differing emphases – more food plotholders in the Eastern Cape, more potentially commercial small farmers in the North[32]. Bembridge listed 50 such schemes in the Eastern Cape established between 1970 and 1998, with irrigated areas varying in size from 0,8 ha upwards. Nearly a third of the irrigated area was affected by limited quantities of water, often also of poor quality, necessitating the planting of drought-resistant fodder crops rather than year-round cash-cropping.

'ESTATE FARM' DEVELOPMENT

The South African government made capital available to fund capital development projects (but not their running and management costs) in the Bantustans. The schemes of the 1970s and 1980s emphasised top-down planning and capital intensive high technology rather than capacity-building. In the era of heroic hydraulic engineering Bantustan politicians looked to larger-scale irrigation as a generator of regional economic growth and a potential regional asset. Major schemes were constructed in the Eastern Cape, consciously planned to achieve several objectives: economic viability, employment, improved farming methods, the relief of

[29] J.J.S. Weidemann and D.J.G. Smith, 'Economic planning of farming units in certain South African Bantu Areas', ***Agrekon,*** 9, 1 (1970), 35-49.
[30] In the 1970s the state spent 13 times more on each white than on each black farmer; in 1989-90 black farmers received 3.2% of the total agricultural budget outlay compared with 50% received as direct transfer payments by white farmers. (M. Lipton, M. de Klerk and M. Lipton (eds), ***Land, labour and livelihoods in rural South Africa*** (Durban: Indicator Press, 1996)
[31] Transkei, Venda, Bophuthatswana, Ciskei.
[32] T.J. Bembridge, Guidelines for rehabilitation of small-scale farmer irrigation schemes in South Africa (Pretoria: WRC, 2000, WRC Report no. 891/1/00)

poverty. Five larger schemes were developed in the Eastern Cape between 1975 – 90: Keiskammahoek (1976, 744 ha); Ncora (1979, 2 490 ha); Tyefu (1983, 641 [potentially 1 200] ha); Xonxa (1985, 780 ha); Zanyokwe (1989, 471 ha). Each was multi-functional, including several irrigation categories: a revenue- and employment-generating central estate farm, full-time commercial smallholders on 5 to 12 ha plots, and subsistence farmers on food plots of 0.1 to 0.25 ha producing for home consumption and some incidental cash sales.

Intended to promote community cooperation they were planned, managed and operated, initially by consultants Loxton Venn, later by agricultural development corporations (parastatal organisations ULIMOCOR in Ciskei, TRACOR in Transkei) with little local consultation or allowance for individuality. In many cases the estate's economic component came to dominate the schemes at every level, substituting rather than supporting farmer initiative.

THE TYEFU SCHEME

The Tyefu Scheme on the Great Fish River was started as a pilot project in 1976 at great expense in an impoverished area with a history of cooperation and conflict between Xhosa and Mfengu communities; betterment had been strongly resisted there. The scheme comprised three tribal farms to fund 'upliftment', 22 commercial farmers on 4 ha plots, and 66 food allotments of 0.16 ha. Many of the farmers were women whose husbands had been forced, in an area of high migrancy made worse by drought, to look for employment elsewhere. The scheme was managed by ULIMOCOR for the Ciskei government, the produce sold to a vegetable processing factory in Port Elizabeth. The financial arrangements were not transparent: agricultural inputs were advanced to the commercial farmers on credit and debited after marketing, but only at the year-end did farmers belatedly discover how they stood and receive any profits in cash. (Self-reliant farmers who used their own labour and managed themselves with little involvement in the development scheme earned six times as much, per ha, as those who depended on the scheme.) The black commercial farmers of the Eastern Province Agricultural Union protested at the accounting and at evictions imposed for poor performance, succeeding in forcing a change in 1986 with the appointment of the scheme's first black project manager in 1986. Until Orange River water from the Glenmore Dam was made available in 1985 the scheme depended on the saline water of the Fish River with high pumping costs and poor equipment. The scheme did significantly improve food security but made little contribution to alleviating rural poverty as a high proportion of its household heads were elderly; both commercial and foodplot farmers relied on pensions for 50% of their monthly expenditure. With only one extension officer there was little or no farmer development. Overall, the Scheme operated consistently at a deficit[33].

[33] W. van Averbeke, C.K. M'Marete, C.O. Igodan and A Belete, An investigation into food plot production at irrigation schemes in the central Eastern Cape (Pretoria: WRC, 1998, WRC Report no. 719/1/98)

Although there were some initial gains, such schemes disappointed the high expectations. One of the early and most trenchant analyses from 1991 proposed that these expectations were unrelated to the realities of the situation. The operators did not appreciate that[34]

'the (high) risk, the (high) cost, the level of mechanisation ... all result in a debt that the farmer does not appreciate and is not able to carry. ... The expectations of the rural emerging farmer normally encompasses an enterprise consisting of mixed farming with a flexibility which will accommodate multi-culture. His targeted yields would be relatively low requiring low inputs and minimal costs so that profits may be realised. Rural farmers need to grow into technology which will help them become successful larger operators. ... The irrigation designer should accept lower management levels and reduce the estimates of crop water demand to a level compatible with the cropping and scheduling approach opted for by the farmers.'

The multipurpose estate pattern proved an ill-chosen model and was not, in the end, sustainable. Designs and technology appropriate for large commercial enterprises aiming to expand into regional assets were not readily applicable to small-scale farmers with very different priorities. Some large composite schemes incorporated many different land uses and crop management styles (17 were identified on the 400 ha of the Thabina estate scheme in Limpopo) needing skilled management to reconcile the differing needs of the participants. Soils with high potential under intensive mechanisation and management were not necessarily suitable for resource-poor farmers with no access to inputs or capital [35]. The consultancies struggled to achieve the forecast profits and began to commercialise their support services. By the later 1980s they were superseded by the parastatal agricultural corporations, many of which were tied into interim guarantees to their employees so that salaries were paid but services to irrigators and the maintenance of infrastructure declined further.

SUGAR ESTATES

Long regarded as 'a remarkable paradigm for local economic development' contract and outgrower small-scale sugarcane farming was fostered by the milling companies[36]. The sugar industry operates in response to a world market of quotas and volatile prices; sugar mills need consistent throughputs of cane. The Sugar Act of 1936 granted the South African Sugar Association (SASA) statutory powers of self-regulation according to which the industry is divided between planters and processors (millers). In the process of Bantustan consolidation 17 000 ha of land suitable for cane-growing was acquired for the Bantustans, to which the millers gained access in the 1970s (when record prices were realised) by establishing full-time black sugarcane farmers on viable land units. In 1998, 8 of the 17 small-scale irrigation schemes in KwaZulu-Natal were commercial farmer schemes producing sugarcane; a similar system was later introduced in KaNgwane in the Eastern Transvaal on 7-10 ha irrigated plots. These were pioneering joint ventures based on contract farming and premised on ultimate transfer to the grower communities. In

[34] J.W. Badenhorst and C.T. Crosby, 'The South African agricultural engineers' viewpoints on appropriate irrigation technology in developing areas in ***Proceedings of the Southern African Irrigation Symposium , 4-6 June 1991***, published later as WRC Report No TT 71/95.
[35] M.C. Laker, Development of a general strategy of optimising the efficient use of primary water resources for effective alleviation of rural poverty, (Pretoria: WRC, 2004, WRC Report no. KV 149/04)
[36] A. McIntosh and A. Vaughan, 'Enhancing rural livelihoods in South Africa: myths and realities' in (eds) M. Lipton et al (1996) ***Land, labour and livelihoods in South Africa*** (Durban: Indicator Press, 1996), on which this account is based.

the meantime, the growers had a guaranteed market and cash income (significant sums in the case of irrigated production.) A credit system with assured loan recovery, extension advice, training and mentoring supports were delivered through the industry's Financial Aid Fund, later controversially supplemented by miller development companies such as Sukumani, operating more like the Bantustan parastatals though with greater efficiency. The model was shown to be effective: in 1972, 3 455 small growers delivered 376 986 tons of cane; by 1979, 8 070 small growers delivered 873 023 tons of cane.

BOPHUTHATSWANA: TAUNG AND MOILOA

Bophuthatswana included two of the potentially most technically advanced black irrigating areas in South Africa: Taung and the Moiloa Reserve.

By 1955 Taung had 3545 ha under irrigation. In the Bantustan era Taung came under the Bophuthatswana Department of Agriculture and then Agricor, the government's parastatal agency. In 1978-9 the scheme was upgraded and the number of farmers gradually reduced from 1 200 to 410. Plots were increased to 10 ha where flood irrigation was replaced by centre pivots, maintained at government expense, each pivot shared by a group of 2 or 4 farmers[37]. Sprinklers with quick-coupling pipes fed a further 1 000 ha, with 136 individual farmers on plots of 7.5 ha growing lucerne, each responsible for his own replacement pipes. With the agreement of an extension officer a farmer might obtain funding from Agribank. Produce could be marketed and inputs purchased through the Letsede Cooperative, although there is evidence that some Taung farmers partnered with farmers on Vaalharts to sell through the Vaalharts Cooperative and also employed them as contractors until the Bophuthatswana police put an end to the practice. A small number of farmers continued under flood irrigation on plots of 1.8 ha. The allocation of water to Taung was based on its scheduled area, but when the area was increased in 1978-9 the main canal was not expanded, resulting in inadequate supplies at peak summer demand periods. No demand system was instituted for the farmers to order water, resulting in sudden great variations of flow; the system is regulated according to the capacity of the three storage dams on the scheme and records of former practice. Bophuthatswana had a water allocation for 7 700 m^3/ha/year, with additional allowance for distribution losses, to be used on about 3 600 irrigated ha; waterlogging, salinisation and shallow soil compaction were common problems[38]. Water from the Vaal tends to be saline, but pressurised systems cannot flush the salts. In 1993 the Taung Dam was built, but has not been connected to the Taung canals; Taung therefore remained dependent on the original canals for supply. Though lined with concrete, the main canal is small for the area it is supposed to command; by 1987 the supply was sufficient for only 4 447 ha[39]. When the Vaalharts main canal was enlarged in 1994 the Taung section (still under the Bophuthatswana government) remained unchanged. When the scheme was transferred to the Department of Agriculture of North West Province it was in difficulties, with some farms abandoned, pivots not working and fences protecting the canals missing[40].

In the years after 1969, 13 000 people were relocated from

[37] In 2004 there were 52 40-ha. pivots, 2 30-ha pivots, 16 20-ha pivots and 3 10-ha pivots.
[38] My thanks to Johann van Heerden for his insights and information.
[39] Turton et al, ***Hydropolitical history***.
[40] J. Seshoka, W. de Lange, N. Faysse, 'The transformation of Irrigation Boards into Water User Associations in South Africa', IWMI Working Paper 72, 1 (2004); Agricultural Engineering Services, 'Revitalisation of the Vaalharts/Taung Irrigation Scheme, Master Plan 2008'.

Lani van Vuuren

Taung Dam in 2009. The dam was constructed in the early 1990s by the Bophuthatswana government, but never connected to the irrigation canals. It remains unused to this day.

the Reef or from white farms to the new Moiloa settlement of Welbedacht/Lehrurtshe. Water was diverted from Dinokana's furrows where every house had a tap. Despite the reserve's long history of successful irrigation, the Bophuthatswana Department of Agriculture and parastatal Agricor engaged Taiwanese advisers to set up and manage three rice-growing projects, one at Dinokana, and in 1984 engaged the Israeli firm Agri-Carmel to manage an irrigated vegetable growing scheme at Lehurutshe, complete with a computer-controlled drip fertigation system costing R2.3 million. Such initiatives did not work sympathetically with what was already there. Production of popular cheap vegetables for

local consumption was replaced within a year by high-value produce for the South African market; the irrigation of the settlement furrows was reduced to 1 day per week[41]. At the time of the Marico Revolt of 1957 the cultivated area in Dinokana was 470 ha in extent; by 1984 it had fallen to 206 ha and many people had left the area permanently.

CASE STUDY: THE FORMAL AND INFORMAL IRRIGATORS OF THE THE MUTALE VALLEY, VENDA[42]

By 1970, the black irrigation areas of the Northern Transvaal were intensively cultivated, with 183 schemes of which 78 were irrigated by canal. The Tshiombo scheme of 1 150 ha had been developed on the Mutale River from 1959-64 as a betterment project with gravity-fed canals and furrows watering 930 plots of 1.28 ha. The beneficiaries were not the tribal elite, nor were new settlers brought in. People who were moved off the land were settled in 6 betterment villages. Edward Lahiff's study of the Mutale Valley in 1994-5 illustrates how irrigation developed both formally and informally as the population of the area doubled between 1970-90, while over the same period the river flow dramatically diminished from changing rainfall patterns, ever-increasing extractions for irrigation and the damming of the Tshirovha tributary for the large state Makhumbane tea project.

In the late 1970s the Venda Department of Agriculture built two additional schemes 'as prestige projects for the Tribal Areas concerned' where plots of 3 to 6 ha, irrigated by sprinkler and diesel pump at an annual rate of R60 per year, were allocated to well-connected people from outside the area. (In 1994, Lahiff found them to have deteriorated, with dilapidated equipment and only a handful of farmers cultivating – one running a highly successful commercial vegetable and tomato business, the others struggling to grow a little maize and sorghum.) After 'independence' in 1979 the Venda government also developed the Makonde Scheme close to Tshiombo, with larger plots (8 to 25 ha) irrigated by sprinkler and run by the parastatal Agriven (Venda Agricultural Corporation). Allocation on this scheme, with formal leases and written contracts, was conducted by the department and the Tribal Authority and is said to have been 'highly politicised, which often meant preferment for tribal leaders, politicians or business figures close to the Bantustan regime[43]'.

On the lower Mutale we get a rare documented glimpse of private black irrigation initiative. There, 50 farmers created their own irrigation scheme on 25 ha plots. Many had experience of farming in white areas and owned some form of transport and enough cash to install pumps and sprinklers. With little or no state support they farmed tomatoes, vegetables and fruit[44]. One farmer, with capital from urban-based retail businesses, accumulated 150 ha of land for tomatoes under drip irrigation on the Mbwede.

The less favoured marsh lands round the formal schemes and the poorer soils of the Lower Mutale were colonised by informal irrigators, some with PTOs on surveyed land. Women and younger men did not in practice access land on equal terms with others.
Lahiff records that, for once, land was not a constraint on

[41] J.H. Drummond, 'Development and change: irrigation and agricultural production in Dinokana Village, North West Province, South Africa' in T. Binns (ed), ***People and Environment in Africa*** (New York: Wiley,1995); M. Lawrence and A. Manson, '"The Dog of the Boers": the rise and fall of Lucas Mangope in Bophuthatswana', ***Journal of Southern African Studies,*** 20, 3 (1994), 447-461.
[42] This case study has been compiled from the research of Edward Lahiff, especially ***An apartheid oasis? Agriculture and rural livelihoods in Venda,*** (London and New York: Routledge, 2000)
[43] E.P. Lahiff, Agriculture and rural livelihoods in a South African 'homeland', (PhD thesis, University of London, 1997)
[44] E. Lahiff, Land, water and local governance in South Africa; A case study of the Mutale River Valley, University of Manchester, Rural Resources Rural Livelihoods Working Paper Series, 1997

the Mutale. From the mid-1980s Tshiombo followed a pattern familiar at Vaalharts – the gradual accumulation of plots by households with at least one source of additional non-agricultural income. (Agriculture in 1994-5 averaged about 25% of household income – a freak climatic year and an unusually low figure for the scheme.) New employment options opened up to staff and service of the new Bantustan bureaucracies; pensions and public welfare grants provided alternative sources of income. About half of the irrigators on Tshiombo cultivated a single plot; one-third had multiple plots on the scheme, and a quarter of the households were cultivating additional wasteland which they brought under irrigation themselves. (One irrigator even moved his main activities to the wasteland and cultivated his scheme plots as rainfed, such was the shortage of water from poor management.)

The Mutale example shows how various forms of market-related irrigation could stimulate differentiation in landholding, production and income. The Tshiombo scheme had started by producing for domestic consumption: there were then no local markets. Over the years this changed until in 1994/5 Lahiff found most of the Tshiombo smallholders marketing up to 80% of their produce (by value) through informal channels, though a minority sold to local processing factories and a few sent produce to Johannesburg. Production records, where they existed, were haphazard, but it appears that at that time 40-50% of the cultivated area was devoted to maize (the local staple), round which the production year was organised. The larger maize producers sold their surplus summer maize to the Northern Transvaal Kooperasie roller mill, where it could be stored. Smaller producers used older tractor-powered mills and later an electric mill at Tshiombo, none of which had storage facilities. A further 40% of the area was planted with groundnuts, various spinaches, tomatoes, sweet potatoes, dry beans and cabbage. Tomatoes were sold to the Gants canning factory at Makhado/Louis Trichardt; there was also a large informal market for them. Very small areas grew chilli peppers, pumpkins and onions; there was also evidence of tobacco, sugar cane, sweet melons, sorghum (for brewing), carrots, lettuce and okra. Fruit trees were grown on residential stands and on non-irrigated wasteland. Diversification minimised the risk of crop failure and ensured maximum continuity of food and cash income. It also meant that the most labour-intensive activities could be phased. With two possible planting seasons a year, Lahiff's sample of 87 cultivators averaged 56.2% irrigated cultivation of the total area over the two-crop cycle (leaving 44% unused).

SMALL BANTUSTAN SCHEMES OLD AND NEW

Under Bantustan administration the strict canons of betterment were not enforced on the older smallholder schemes. This could have a liberating effect, especially where irrigation farming was firmly established. At Dzindi (Venda), for instance, from 1971 the farmers themselves chose which crops to plant, exhibiting a high degree of diversity, and when plots were reallocated the one-family-one-plot restriction was removed. After Venda became self-governing in 1973 the requirement to farm full time fell away and trading

restrictions were lifted. As a result of population shifts and Bantustan consolidation newcomers were allocated land. Being unacquainted with the rationale of the old collective system of regular maintenance by the irrigators (ensuring the uniformity of distribution essential to short-furrow irrigation) the newcomers persuaded the scheme to employ contractors to do the work. The cleaning and repair of canals collapsed, fences were not mended and pollution became a problem – hence the Dzindi meeting in 1982, referred to above, when the rules for the use of water were discussed and codified, remaining substantially unchanged thereafter. Prof Wim van Averbeke and others have since 2003 conducted a study of the institutions and organisations of Dzindi, as well as the livelihood and farming practices among the plotholders there, seeing irrigation as an important social activity. 'The assumption underlying the study was that a lot could be learnt ... from a project that has persisted for five decades[45].'

WRC archives

An unnamed female farmer tends her fields on the Dzindi irrigation scheme. Note the small furrow irrigation being used to irrigate crops.

[45] W. van Averbeke and S.S. Mohamed, 'Smallholder farming styles and development policy in South Africa', ***Agrekon***, 45, 2 (2006), 136-157.

At **Middle Letaba** (Gazankulu) the smaller plotholders developed a highly successful farming system, abandoning the recommended maize/wheat rotation for a variety of high-income crops with different cropping regimes so that markets were not glutted. (According to Laker, the patterns varied according to distance from the main road.) Tomato farmers employed labour for picking, grading and packing, often paying the workers in kind to enable them to sell the produce. Local conventions of labour management made retrenchment rare[46].

New schemes did not thrive when not well supported. **Mpembene** (KwaZulu) was such a scheme, requested by the Tribal Authority in 1979 but begun only in 1984 with sponsorship from Mobiloil for the pump, main lines and sprinklers 'on the understanding of meaningful involvement of the local people'. A Management Committee was formed to assist with the development of the project and with maintenance. Women were prominent among the 11 commercial farmers who were all over the age of 50, and accounted for half the foodplot holders. The scheme was assessed after a year of operation by Prof Tim Bembridge, causing him to remark that 'irrigation is no panacea for rural poverty[47].' The pump was broken and in any case there was insufficient water. Essential elements of the scheme were missing – storm drains, the foodplot storage dam. The standards of farming and management were poor, extension advice inadequate. Community cohesion was strong, yields extremely low[48]. He concluded that only the foodplot holders were likely to benefit in terms of providing for their households. Nevertheless, he had qualified hopes of such schemes, given the necessary supports:

'Small community schemes ... are not very costly and can ultimately be managed by the communities themselves. Such schemes have the greatest chance of success if they are geared to producing subsistence needs and have the support and interest of the local participants. Proposals for irrigation schemes should be weighed against alternative options for improving agricultural production and rural life, both agricultural and non-agricultural.

Schemes should only be introduced where the Department of Agriculture in co-operation with other organisations is able to provide institutional support in terms of extension services, specialised back-up, inputs and suitable technology.'

FOOD PLOTS, COMMUNITY GARDENS AND BACKYARD VEGETABLE-GROWING

On large centrally managed irrigation schemes small foodplots of 0,25 ha or less were commonly allocated to compensate people who had lost dryland arable fields to the construction of the irrigation scheme. These irrigated plots or allotments were calculated to produce an equivalent to dryland maize for household consumption, though in practice they seldom achieved the target yield, unsurprisingly, as irrigation demands particular skills and transition between the two is conventionally thought to take years to effect. Food plot farming was designed to use the scheme's supply

[46] M.C. Laker, Development of a general strategy of optimising the efficient use of primary water resources for effective alleviation of rural poverty, (Pretoria: WRC, 2004, WRC Report no. KV 149/04)
[47] T. Bembridge, ***An evaluation of the Mpembeni Irrigation Scheme, KwaZulu*** (United Kingdom: Oxford University, 1988)
[48] 1.83 tons of maize per ha where 5-6 tons could be expected; 9.43 tons of vegetables and green mealies instead of at least 26 tons.

of irrigation water and to rely on the central facilities for mechanised land preparation, chemical fertilisers and hybrid seeds in place of the familiar and simpler animal draught, pollinated seeds and kraal manure. In a survey conducted on six schemes in the Eastern Cape in 1996 such households were found to derive only about 11% of income from their food plots, the main source of cash income (33-45%) being state pensions[49].

By the later 1970s community food gardens were appearing within the settlement pattern of the villages. These were group projects of farmers, usually elderly women, using shared water supply infrastructure, often no more than bucketsful from a nearby stream or scooped from a 200 L drum, sometimes hosepipe and sprinkler. The irrigated gardens are said to 'constitute one of the biggest success stories in agricultural development in South Africa,'[50] producing fresh vegetables for the benefit of the community outside the irrigation scheme while supplementing family income. Participants have micro-holdings (at Wonderboom on the Arabie scheme one plot of 0.7 ha was shared by 44 people) and autonomy in planting, harvesting and marketing their own produce, and manage their gardens applying ingenuity and know-how often disregarded elsewhere. The gardens originated formally, local tribal authorities allocating arable land and extension or agricultural officers advising on seeding or pest control, and with support from NGOs, the Department of Health and Welfare or the local community. A single PTO applies to each group. The schemes are popular, with plots small enough to be worked easily yet economically viable. A survey published in 1988[51] concluded that initial community scepticism was soon replaced by enthusiasm and optimism. The gardens display the social cooperation often missing from more formal schemes and are usually coordinated by an elected committee meeting regularly with the headman and agricultural or extension officer. A small fund pays for inputs and improvements – a storage shed, fencing, tractor hire, the purchase of fertilizers and insecticides.

Paul Weinberg/South Photos/African Picture

Mma Tshepo Khumbane in her garden in 2009

[49] Van Averbeke et al, An investigation into food plot production.
[50] M. de Lange, Small-scale irrigation in South Africa (Pretoria: WRC, 1994, WRC report no. 578/1/94)
[51] C.J. van Vuuren, 'Community gardens as food producing units', ***Development Southern Africa,*** 5, 1 (1988), 40-45.

One of the most redoubtable campaigners for food security among the poorest households in rural and peri-urban South Africa was herself a victim of forced removal in 1957. 'Mma' Tshepo Khumbane, a passionate activist and small-scale farmer, launched the independent 'Water for Food' movement to boost food production and water harvesting in homestead yards as a tool of social upliftment and empowerment ('You need to deal with their heads'). Informal courses and workshops in how to capture rainwater, soil water retention, multicropping, food storage and processing and recycling organic household waste for plant nutrition, end with individual plans for household production[52].

It is in these gardens, and the backyard vegetable patches (some on substantial pieces of ground) that innovative methods of water harvesting and moisture conservation have been used, largely by women, to boost production as a secure and convenient alternative to the 'bettered' but now remote arable fields.

A QUESTION OF PRIORITIES: MAKATINI, IRRIGATION *VERSUS* THE ENVIRONMENT

The Pongolapoort-Makatini Flats Government Water Scheme was proposed in 1960 as a settlement scheme for 3 200 white families to grow irrigated sugar on the Flats, which were said to be undeveloped 'except for some negligible areas of private development in the north and a small amount of native agriculture[53].' This assessment glossed over the downstream Temba-Thonga communities, 40 000 strong, who for generations had synchronised their livelihoods on and off the floodplain with the natural river flows, engaging in fishing, growing crops when floods receded, grazing livestock and gathering winter grasses[54].

The Pongola floodplain became a famous example of the difficulties of balancing allocations for a multiplicity of different water needs with natural stream flow[55]. A fall in the world price of sugar in 1970 terminated the original irrigation project. The scheme was taken over (without any change of design) by the Department of Native Affairs but reduced from 28 000 ha to 3 500 ha when the money ran out. With irrigation development thus curtailed, in the 1970s Prof Charles Breen and Jan Heeg of the University of Natal began a study of the costs and benefits of allocating water for irrigation as compared with the natural processes of the floodplain. With the express objective of delivering both social and economic justice, the study broke new ground by regarding people as integral to river ecosystems and concluded that water would produce greater benefit if applied to sustaining the floodplain[56]. This pioneering socio-ecological approach originated thinking that was later to influence the concept of 'the Reserve' in the Water Act of 1998; it was not, however, immediately applied to managing the flow below the Pongolapoort Dam.

[52] J. Goldin and T. Gordon, The journey of Mma Tshepo Khumbane (Pretoria: WRC, 2010, WRC Report no. SP 6/10); L. van Vuuren, ***Amakhosazana emvula: celebrating South Africa's women in water*** (Pretoria: WRC, 2006).
[53] Report on the proposed Pongolapoort-Makatini Flats Government Water Scheme, WP F-60.
[54] J. Jaganyi, M. Salagae, N. Matiwane, Integrating floodplain livelihoods into a diverse rural economy by enhancing cooperative management, (Pretoria: WRC, 2008, WRC Report no. 1299/1/08)
[55] W.M. Adams, ***Wasting the rain. River, people and planning in Africa,*** (London and New York: Routledge, 1992)
[56] J. Heeg and C.M. Breen, ***Man and the Pongolo floodplain*** (Pretoria: CSIR, 1982)

At first, inflows were immediately released since the dam had to be kept at 30% of capacity to avoid flooding an area of Swaziland. The dam was thus able to attenuate flooding from the Demoina cyclone in 1984 by filling to 85% capacity, but in anticipation of an immediately imminent second cyclone (which in the event missed the area) the radial gates were opened to accommodate the expected extra flow without due warning to the communities below, resulting in major floods and the loss of the maize crop. Thereafter, until 1999 environmental releases were operated by the Hydrological Research Institute/Social and Ecological Studies Directorates of DWAF, for many years under the supervision of C.A. Bruwer. Aligning the timing and duration of flood releases to the various requirements of stakeholders and the floodplain ecosystem was a considerable challenge. Bruwer negotiated annually with 13 water committees on the floodplain and a range of organised but varied stakeholders, taking into account the planting and harvesting times of local crops; the need of learners to cross the river to get to school; the needs of the scheme irrigators managed by Mjindi Farming (Pty) Ltd; cotton growers on the floodplain organised as POWADETA (Pongola Water Association for the Development of Traditional Agriculture); the growing cycle of indigenous grasses and white maize; the timing of hippo counts, the interests of the lower users of Mozambique, etc. An elaborate consultation procedure attends a request for a flood release, with public post-flood meetings and official release reports containing monitored data. This was at variance with the regime proposed in the original research and appeared to suffer from 'unstructured decision making[57]'.

THE CHANGES OF THE 1980S: DEREGULATION, LIBERALISATION AND THE FARMER SUPPORT PROGRAMME

In the 1970s apartheid was challenged. Black political resistance, strengthened by the Black Consciousness movement and triggered by the costs of inflation, was renewed in the Durban strikes of 1973 and the Soweto youth revolt of 1976. By then the economy was in recession. Mounting fiscal deficits and a reordering of state priorities towards Defence and Education meant that the national Agriculture budget shrank from 1.5% to 0.6% of GDP, much of it going to the Bantustans[58]. In the face of P.W. Botha's injunction in 1979 to 'adapt or die', a series of government commissions began to modify the policy of influx controls to the cities and establish the right to unionise; from the late 1970s the financial sector began to liberalise, in the process ending Land Bank subsidies of the interest rates of white farmers, raising their agricultural costs in the drought years of the early 1980s.

In 1981, 80% of South Africa's poor were in the Bantustans. During the drought of 1982 nineteen districts were declared disaster areas, prompting a second Carnegie inquiry, revealing that where subsistence agriculture had collapsed some 1 400 000 impoverished people were left with no income[59]. The movement of people continued unabated as socio-geographic lines were drawn and re-drawn defining the boundaries of self-governing Bantustans, to include new communities on ethnic grounds without providing for their

[57] My thanks to James Perkins for his insights and information. See too L. van Vuuren, 'Pongolapoort Dam, development steeped in controversy', ***The Water Wheel***, 8, 3 (2009), 23-27; B. Schreiner, 'The government-and-society challenge in a fledgling democracy- ecosystem governance in South Africa, with particular focus on the management of the Pongola floodplains and reservoir' in A.R. Turton, H.J. Hattingh, G.A. Maree, D.J. Roux, M. Claassen and W.F. Strydom (eds) , ***Governance as a triologue: government-society-science in transition*** (Berlin: Springer-Verlag, 2007).

[58] N. Vink and Ss Schirmer, 'Agriculture, 1970-2000' in S. Jones (ed), ***The decline of the South African economy*** (Johannesburg: University of the Witwatersrand, 2002)

[59] F. Wilson and M. Ramphele, ***Uprooting poverty: the South African challenge. Overview report for the 2nd Carnegie inquiry into poverty and development in southern Africa*** (New York: WW Norton, 1989)

resettlement. Bantustan 'independence' involved loss of citizenship in South Africa together with its employment opportunities. (The black population of the Ciskei grew from 357 801 to 630 353 between 1970 and 1980)[60].

In the prevailing climate of reform the Development Bank of Southern Africa (DBSA) was established in 1983 on the initiative of Simon Brand, one of the '***verligte***' Afrikaner intellectuals advocating a positive rather than a siege response to sanctions and economic stagnation. Brand was the Bank's first executive chairman (1983-92). The Bank sought to improve the development record of both dryland and irrigated agriculture in the Bantustans where production was low and the anticipated commercial farming had failed to materialise on any scale. Its initial objective of commercial production – perhaps in response to persuasive evidence of the historical activities of black commercial farmers[61] - was later revised 'to promote economic development by improving farmers' access to support services over a broad base in a sequential and evolutionary manner.' The 'two agricultures' had resulted in support to white farmers whereas in the Bantustans support was given to projects under corporate management rather than to individual settler farmers[62]. The DBSA analysis reflected international trends promoting food security at household level by using trade policies 'to exploit the comparative advantages of different producers and regions, both domestically and internationally[63].' An example was the Uruguay Round of GATT (1986-94), coinciding with South Africa's transition to democracy. This influenced not only the elimination of subsidies but also the thinking of the DBSA in switching support from centralised settlements in the Bantustans to individual farmers. It emphasised farmer self-reliance and an integrated system of rural upliftment and economic growth to increase productivity and generate the multiplier effects of agriculture throughout the economy. The bank regularly consulted Prof F.R. Tomlinson on the design of its Farmer Support investment strategy[64].

The Farmer Support Programme (FSP) was inaugurated in 1987 in selected areas to assure security of production rights undermined by the legal restrictions on black landholding (such as legally protected rental agreements), and to give individual smallholder black farmers input subsidies and access to services,[65] integrating farming with other rural development activities. The DBSA provided 68% of the funding, working through the Bantustan parastatals or sugar programmes as implementing agents to receive loan funds for lending on to farmers. The initiative was criticised for not being cost-effective[66] and in general for not achieving food security but had some effect in Venda and was credited with at least one outstanding success. Phokoane (Nebo District, Lebowa) was a dryland project launched under Farmer Support by the Lebowa government when the area's total shortfall in maize was 92%. After a difficult start, a team led by the inspirational Johann Adendorff achieved extraordinary results working with 7 000 farmers to produce yields sufficient to give saleable surpluses. The failure rate was 4%. Adendorff designed his own training programme using participatory methods; his assessment was that the support programme

[60] See Platsky and Walker, ***The surplus people.***

[61] For instance, C. Bundy, ***The rise and fall of the South African peasantry*** (London: Heinemann, 1979)

[62] C.J. van Rooyen, 'Overview of the DBSA's Farmer Support Programme, 1987-93' in R. Singini and C.J. van Rooyen (eds), ***Serving small-scale farmers : an evaluation of the DBSA's farmers support programmes*** (Halfway House: DBSA, 1985)***;*** C.J. van Rooyen, N. Vink and N.T. Christodoulos, 'Access to the agricultural market for small farmers in Southern Africa', ***Development Southern Africa***, 4,2 (1987); S. Brand, N. Christodoulou, C.J. van Rooyen and N Vink, 'Agriculture and redistribution; a growth with equity approach' (Halfway House: DBSA, 1992)

[63] Department of Agriculture, Report of the Committee of Inquiry into the Marketing Act (Pretoria: Department of Agriculture, 1992)

[64] C.J. van Rooyen, 'The dilemma of the contemporary agricultural economist: will the real Professor Tomlinson please step forward!', ***Agrekon***, 39, 3 (2000), 1-12.

[65] The services were identified as: production inputs and capital; mechanisation; marketing; extension, demonstration and research; training; bulk infrastructure. (B. Hollingworth and T. Matsetela, Water allocation studies: on existing set aside allocations, (Pretoria: WRC, 2007, WRC report no. KV 296/12)

[66] Disputed by J.F. Kirsten and J. van Zyl, 'The costs and benefits of providing agriculture support services to rural households in the developing areas of South Africa', ***Development Southern Africa***, 13, 3 (1996), 415-428.

had restored people's self-image as well as reinstating the dignity and value of agriculture. (Later this initiative collapsed; according to Adendorff, the programme was expanded too rapidly and the new needs and requirements generated by the development for both the community and the land were not satisfied[67].)

The record of the FSP in the Ciskei was less happy. At Chata (Keiskammahoek) the programme and its agricultural legacy became entangled in village dynamics and local politics in the margins of a Bantustan military coup[68]. The DBSA, to which Lenox Sebe appealed for funds for the new Zanyokwe estate scheme, stipulated that the plans for 174 foodplot holders on 0.02 ha and 64 commercial holdings of 6 ha, should be reworked to provide for independent management on 'economically viable farming units'. During the reconstruction the farmers would receive agricultural training at Fort Cox; Agri-Carmel would redesign, manage, and then transfer the scheme. For the first three years the farmers would be cushioned with a stipend of R240 per month, and could farm loss-free, marketing through the scheme. At the end of this induction period many left; those who remained preferred to deal directly with the Ciskei Agricultural Bank but defaulted on their land rental agreements and their loans, claiming that ULIMOCOR, successor to Cis-Carmel, had not explained the changed system. Thereafter the scheme deteriorated. The farmers, fearful of further debts, attempted unsuccessfully to reinstate the original plots, which did not match the redesigned water system. Land boundaries were disputed; water costs were high; ULIMOCOR delivered very poor services. Tensions mounted, morale plummeted and after two years less than 20% of the land was under production[69].

The Tricameral Constitution of 1984 had left the question of the Bantustans, whether self-governing or 'independent', in the air. It appeared that Africans were to be citizens of a unified African state, but this was hardly elaborated. Opposition erupted. In July 1985 a state of emergency was declared in South Africa; on 15 August the President delivered his 'Rubicon' speech which fell far short of international expectations and inaugurated an era of economic sanctions and international isolation. The emergency was renewed in 1986 in a crisis that had, as William Beinart has pointed out, agrarian and demographic roots: 'By the 1980s unemployment and poverty could no longer be externalised to the homelands and remnant smallholding could no longer give a significant number of people either income or social support[70].' The Transkei and Ciskei were 'imploding',[71] there was an attempted military coup in Bophuthatswana, Natal was in conflict. South Africa progressively extended direct control over Bantustan administrations.

By the later 1980s other private agencies were going the way of Cis-Carmel, failing to meet their targets and withdrawing. Scheme management was taken up by the parastatal agricultural development corporations with high overheads and often with guaranteed contracts for their staff: they now levied service charges on irrigators for reduced services. This hastened a process of decline and prompted a move for irrigation management transfer (IMT) to the farmers

[67] Laker, Development of a general strategy.
[68] D. Deliwe, 'The Farmer Support Programme in Chatha Village, Keiskammahoek district', ***Development Southern Africa,*** 12, 4 (1995), 519-534.
[69] Van Averbeke, An investigation into food plot production at irrigation schemes.
[70] Beinart, ***Twentieth Century South Africa***.
[71] J.B. Peires, 'The implosion of Transkei and Ciskei', ***African Affairs***, 91 (1992), 365-387.

themselves, in line with many such transfers throughout Africa[72] and an aspect of South Africa's belated reform process. Research and action on smallholder irrigation: reorientation after 1985.

In 1985 the Water Research Commission (WRC) assessed the potential contribution of smallholder irrigation farming to food security, homestead income and employment in the Bantustans. The Commission invited Jean-Claude Legoupil of the French agricultural research institute CIRAD to participate in an irrigation workshop the same year. After visiting six South African schemes, Legoupil concluded that smallholder irrigation was only marginally effective but that food output could be increased by rehabilitating defunct schemes and increasing the number of new ones while addressing the associated technical and other problems, including 'the difficulty experienced in integrating national development objectives and the personal objectives and aspirations of farmers[73].' Further analysis came from an International Agricultural Engineering Symposium held in Pretoria under French auspices in 1986, where a proposal was made for a symposium on Mechanisation and Irrigation farming in Developing Areas (MIDA) of Southern Africa.

Over the next five years annual MIDA symposia were held with farmers and operators meeting to explain their requirements at practical farm level, overseas experience brought to bear on the role of agricultural projects in developing countries, and an assessment made of how the contribution of the engineering profession could most helpfully be extended and optimised[74]. A significant paper based on the outcomes of the MIDA series was presented by J.W. Badenhorst and Charles Crosby at the Second Southern African Irrigation Symposium held in Durban in 1991, emphasising the mis-match between, on the one hand, the conventional Bantustan irrigation scheme, specifying high-cost sophisticated monoculture suitable for intensive irrigation areas but forcing the farmers on 1.28 ha plots into debt, and on the other the developing needs of the rural emerging farmer for bigger modules and a simpler flexible multi-culture – low-cost, low-input and relatively low-yield – which could nevertheless realise a profit. The paper made the case for a wholly new approach[75]:

'The first duty of the professional planners is to determine, beyond any shadow of doubt, the real requirements of the community and to establish the applicable physical, sociological and economic restraints. The planners must identify with the community, and this can only be achieved by talking with all strata of the society out in the field.'

The National Irrigation Symposium of 1991 was an important element in South Africa's strategy of accession to ICID as part of the country's re-emergence on the international scene (see chapter 5). Internationally, funding for irrigation development was declining in the 1980s. New ideas were gaining traction from Mexico and Chile to Morocco, transferring responsibility and authority for irrigation system management from government agencies to water users. These ideas were seen by donors as improving the sustainability, performance and productivity of irrigation schemes and a prerequisite for funding irrigation rehabilitation, while relieving the expenditure of governments on operation and maintenance.

[72] T.N. Shah, B. van Koppen, D.J. Merrey and M. de Lange, Institutional alternatives in African smallholder irrigation, (International Water Management Institute, 2002, IWMI Report no. 60).
[73] ***Ibid***. See too W. van Averbeke, J. Denison and P.N.S. Mnkeni, 'Smallholder irrigation schemes in South Africa: a review of knowledge generated by the Water Research Commission'. ***Water SA***, 37, 5 (2011), 797-808.
[74] South African Institute of Agricultural Engineers, Proceedings of the MIDA symposia held in Pretoria (1986), Mmabatho (1987), Pietermaritzburg (1988) and Dikhololo/Brits (1989).
[75] J.W. Badenhorst and C.T. Crosby, 'The South African Institute of Agricultural Engineers' viewpoints on appropriate irrigation technology in developing areas' in Proceedings of the Southern African Irrigation Symposium, Durban 4-6 June 1991, (Pretoria: Water Research Commission, 1995, WRC report no. TT 71/95).

The MIDA conclusions seemed to resonate with these approaches.

Unexpectedly, MIDA became a catalyst for a new approach in South Africa. The DBSA contracted the consulting engineering firm of Murray, Biesenbach and Badenhorst (MBB) as part of the Farmer Support Programme. In turn, MBB in association with Charles Crosby (now officially retired) approached the WRC to support further studies on water use in rural development. The years 1992/93 were devastatingly dry, as a result of which the Irrigation Committee of the WRC prioritised the irrigation practices and problems of the subsistence sector. At about the same time a young civil engineer, Marna de Lange, received support from Felix Reinders at the Agriculture Directorate Irrigation Engineering at Silverton for a technical research proposal in the field of smallholder irrigation. In 1992 this evolved into a WRC-funded project led by De Lange, becoming a multidisciplinary team exercise in the evaluation of schemes and the understanding of the needs of small farmers in the Northern Province/Limpopo by innovative methods of Participatory Rural Appraisal. The outcome was de Lange's research report ***Small Scale Irrigation in South Africa***[76] and later a series of parallel reports developed by MBB consulting engineers[77].

At the same time, rural NGOs were beginning to organise rural communities to press for land reform, linking rural communities with Derek Hanekom on the ANC's Agriculture Desk. Reformers were supported by organisations like the Urban Foundation and Independent Development Trust, university researchers from the agricultural faculties at Afrikaans universities with financial and technical support from foreign donors. There was widespread adherence to the idea of land reform – whether restoring historic claims to relocated communities or redistributing farmland to likely producers. Initiatives such as the Newick Park Conference on Land Reform and Agricultural Development in 1990 emphasised the potential of black smallholder farmers; in 1991 the National African Farmers Union, speaking for 'emerging farmers' lobbied for access to credit and services and for 'the right to compete in the market place[78]'. At the 1991 Irrigation Symposium Mike Muller and Brian Hollingworth applied DBSA experience to argue that although agriculture was acknowledged as an efficient channel for job creation, this was not necessarily true of irrigation because of the high capital cost involved. South Africa's water resources were limited in quantity and highly unequally and variably distributed in both space and time. To be justified in economic terms the value of using the water would have to be greater than the cost of providing it. Land and water reform would increase access by small farmers; but in South Africa, like Brazil, high-cost irrigation investments for the production of basic commodities by small farmers 'could only be justified if there were clear social benefits to compensate the economic costs incurred'[79].

In 1994, the departments of Land Affairs and Water Affairs of the Government of National Unity gave priority to land and water reform and the debate on commercial farmers and smallholders went into abeyance. The terms of that debate, and its locus, would change in the light of the reincorporation of the Bantustans into South Africa from 27 April 1994 and the implementation of the National Water Act of 1998.

[76] De Lange, Small-scale irrigation.

[77] M. de Lange, J. Adendorff and C.T. Crosby, Developing sustainable small-scale farmer irrigation in poor rural communities – guidelines and checklists for trainers and development facilitators (Pretoria: WRC, 2000, WRC report no. 774/1/00); C.T. Crosby, M. de Lange, C.M. Stimie and I. van der Stoep, A review of planning and design procedures applicable to small-scale farmer irrigation (Pretoria: WRC, 2000, WRC report no. 578/2/00); F.J. du Plessis, W. van Averbeke and I. van der Stoep, Micro-irrigation for smallholders: guidelines for funders, planners, designers and support staff in South Africa (Pretoria: WRC, 2001, WRC report no. TT 164/01; C.T. Crosby and C.P. Crosby, SAPWAT – a computer programme for establishing irrigation requirements and scheduling strategies in South Africa (Pretoria: WRC, 1999, WRC report no. 624/1/99).

[78] Lipton et al, Land, labour and livelihoods.

[79] A.M. Muller and B. Hollingworth, 'Water resources, economics and the future of irrigation in Southern Africa – a perspective' in Proceedings of the Southern African Irrigation Symposium, 4-6 June 1991 (Pretoria: WRC, 1995, WRC Report TT 71/95).

07

CHAPTER 7

IRRIGATED AGRICULTURE IN POST-DEMOCRATIC SOUTH AFRICA

Petro Kotzé

In 1994, after a decades-long struggle for democracy and more than three years of peace negotiations, the National Party's reign over South Africa, which started in 1948 and resulted in the establishment of the apartheid system, came to an end. Winning 62% of the votes, the African National Congress (ANC) swept to victory in the country's first democratic elections and anti-apartheid activist Nelson Mandela was sworn in as the country's president.

To ensure inclusivity during the transition period from apartheid to democracy, a Government of National Unity (GNU) was established. The GNU encompassed all political parties that won a threshold of 10% in the elections. The GNU's main mission was to oversee a new Constitution, to radically improve the quality of lives of all South Africans, and to rectify the inequalities of the past.

It would be no easy task. Serious challenges included a stagnant economy with high and rising unemployment, high inequality between and within different race groups and widespread poverty.

The GNU quickly started ushering in new policies across the entire range of state activities. The era in parliament is remembered as one marked by a sense of hope, excitement and tension as members from various political parties, representing a wide range of racial and ethnic backgrounds forged the way ahead for the transition from a system of racial segregation to a multiracial democracy.

The new Constitution would replace the South African Act of 1909, which created the Union of South Africa from the colonies of the British Cape and Natal and the previous Boer colonies of the Orange Free State and Transvaal. South Africa now also included ten 'homelands,' the so-called Bantustans, territories designated by the apartheid government for the country's black African population according to ethnic and linguistic groups. These pockets of land were rural, impoverished, underutilised and reliant on subsidies from the South African government.

Paul Weinberg/South Photos/African Pictures

Voters queue to vote in South Africa's first democratic elections in 1994.

Following the democratic elections in 1994, the homelands were dismantled and incorporated into the country's newly defined provinces. The territories of Natal and the Orange Free State were renamed KwaZulu-Natal and the Free State, while the Cape and Transvaal with the homelands included were broken up into smaller provinces. The Cape became the Northern Cape, Eastern Cape, Western Cape and western part of North West. The Transvaal became Gauteng, Limpopo, Mpumalanga and the eastern part of North West.

Adopted in May 1996, South Africa's new supreme law, the Constitution[1], entrenched human dignity, human rights, non-racialism and non-sexism and recognised South Africans' right to access sufficient water and a healthy environment. The slew of new policies that followed strove towards this vision and aimed to rectify the injustices of the past. The policy changes that affected the irrigated agriculture sector were mostly swift and comprehensive, and set the tone for the development of the sector for generations to come. Regulations pertaining to land ownership, water use and market access were some of the main tools employed by a state that aimed to quickly rid itself of the 'cosy' and beneficially supportive relationship with large, commercial farmers.

Over and above that, the era of large water transfer and irrigation schemes ended. Government focus shifted to using the water already allocated and the existing schemes more wisely in order to facilitate a food-secure South Africa and create employment opportunities and economic security, especially for the rural poor.

The new government's first socio-economic policy framework was the Reconstruction and Development (R&D) Programme. The broader aims encapsulated in the policy were the establishment of a more equal society through reconstruction and development, and strengthening democracy for all. It

[1] RSA, Constitution of South Africa, 1996

addressed various sectors, with a focus on housing, healthcare, education and infrastructure. Agriculture was identified as a key sector to achieve economic growth, poverty reduction and rural development and the programme aimed to transform the sector to be more inclusive and equitable and addressed the historical imbalances in land ownership and access to resources.

COMPREHENSIVE CHANGES TO AGRICULTURAL TRADE AND LAND OWNERSHIP POLICIES

In addition to keeping control of the finance ministry in the GNU, the NP also retained the agriculture ministry, along with key staff. The Minister of the Department of Agriculture continued to be Dr André Isak 'Kraai' van Niekerk, a sheep farmer from Rugseer near Kenhardt before he embarked on a political career. The GNU came to power in a dry period that resulted in a severe drop in the main agricultural crops. Many perennial crop producers were unable to scrape together the financing to re-establish orchards that had died off because of the shortage of irrigation water. Cabinet allocated an amount of R199,5 million to agriculture in October/November 1995 for financing aid to small-scale irrigation farmers, an animal feeding scheme and assistance with the re-establishment of perennial crops, or input financing of dryland crops[2]. It would be one of the last such large financial packages for the agricultural sector. In future, farmers had to essentially bear the risk of unfavourable economic and climatic conditions themselves.

Many major, direct policy changes were postponed until 1996 when the NP, and van Niekerk, withdrew from the South African government. The Department of Agriculture was then merged with the Department of Land Affairs (DLA), which was responsible for restoring land to those unjustly deprived of land rights since 1913; redistributing land to those denied equitable access to it under segregation and apartheid; and securing tenure rights of those excluded in the past from acquiring title to land. It took over the responsibilities of the Department of Regional and Land Affairs, itself the heir to the bankrupt Department of Development Aid. The Minister of the new DLA was Derek Hanekom, an anti-apartheid activist who served time in prison and exile for his political activities. He was reportedly selected by Mandela to take over from van Niekerk in part because of his ability as an Afrikaner to negotiate with white landowners[3].

To achieve the 'formidable' challenges the government faced, Hanekom said, the task of agriculture was to establish an environment where opportunities for higher incomes and employment are created for resource-poor farmers alongside a thriving commercial farming sector. To do this, Government set three major goals for policy reform. The first was to build an efficient and internationally competitive agricultural sector; the second, to support the emergence of a more diverse structure of production with a large increase in the numbers of successful smallholder farming enterprises; and, the third, to conserve the agricultural natural resources and put in place policies and institutions for sustainable resource use[4].

[2] Grain SA, ***The Grain and Oilseed Industry of South Africa – A Journey Through Time,*** https://www.grainsa.co.za/about-us/our-history, last accessed on 16 August 2023.
[3] This statement is widely quoted, but the original source is unknown.
[4] Agricultural policy in South Africa: Discussion document, A Vision for Agriculture, November 1998, https://www.gov.za/documents/agricultural-policy-south-africa-discussion-document, last accessed on 16 August 2023.

As minister of Land Affairs, Hanekom dismissed a 1993 model put forward by the World Bank for radical redistribution of 30% of medium and high-quality land from large-scale white commercial farmers to 600 000 small-scale, part-time black farm households. The model was converted into the ANC's Reconstruction and Development Plan in 1993, but deemed fiscally and administratively unrealistic by the new minister. Instead, the land redistribution programme enabled approved beneficiaries to claim Settlement/ Land Allocation Grants (SLAGs) of R15 000 per household.

However, in its first five years the DLA fell far short of its objectives and failed to spend the modest budget that had been allocated to it. Most of that had gone to pay salaries rather than to purchase land. An official review of the department's work described it as 'a highly centralised and fragmented bureaucracy' driven by 'poor race relations' and a 'high black staff turnover'[5]. Over and above the land reform programme, policy initiatives included laws protecting agricultural workers and labour tenants against eviction and extending their rights, a new rural development policy and institutional restructuring in the public sector. This phase also included radical policies to liberalise external and internal agricultural markets. International sanctions on South Africa were being lifted, opening unrestricted access to lucrative export markets, exposure to profitable international business and increased investment[6].

The Marketing of Agricultural Products Act of 1996 (MAP) promoted market deregulation and transformation within the agricultural sector. It brought an abrupt end to the marketing boards that used to handle agricultural marketing and set the prices for agricultural commodities. The 22 marketing schemes, and the state control of the markets for sugar and vine products that lay at the heart of the beneficial relations between 'organised' agriculture and the old regime, were ended. It signaled the end of the single-channel agricultural export marketing schemes and measures that had been introduced in the 1968 Act.

All government interventions in the setting of prices were abolished from 1 May 1997. Producers now had to market their own crops and compete in a highly competitive global trading market. Farmers and other enterprises in the value chain had to restructure themselves as business-driven players. The change set the first tumultuous steps in place for South African agriculture as a fully integrated member of the global trade environment. In the following decades irrigated agriculture in South Africa would undergo major changes, switching from grain, fodder and similar crops to more lucrative, high-value and industrial crops, coupled with a drastic intensification of production. Field crops declined from almost half of the total output from 1978 to 1979 to less than a third in 1999, while more lucrative horticultural production increased.

Irrigation supports an estimated 25-30% of the national agricultural production[7]. The high-value crops (like potatoes, vegetables, grapes and other fruit) are predominantly produced under irrigation (up to 90%), as well as 25-40% of

[5] This paper, ***Land Reform in South Africa: Problems and Prospects*** by Ruth Hall and Gavin Williams draws on Gavin Williams 'Policies and Prospects: Land Reform in South Africa', Workshop on The Politics of Land Reform in the New South Africa, Development Studies Institute (DESTIN), London School of Economics, June 2000 and on Ruth Hall, ***Contested Terrain: The Politics of Land Reform Policy in Post-Apartheid South Africa*** (M. Phil. thesis, University of Oxford, 1998)

[6] BFAP (Bureau for Food and Agricultural Policy) BFAP Baseline agriculture outlook 2016-2025 (no itals), https://www.sagis.org.za/BFAP_Baseline_2016.pdf, last accessed on 16 April 2024. Putting plans into action: agriculture and economic growth in South Africa.

[7] I. Meza, E.E. Rezaei, S. Siebert, G. Ghazaryan, H. Nouri, O. Dubovyk, H. Gerdener, C. Herbert, J. Kusche, E. Popat, J. Rhyner, A. Jordaan, Y. Walz, M. Hagenlocher, 'Drought risk for agricultural systems in South Africa: Drivers, spatial patterns, and implications for drought risk management', ***Science of the Total Environment***, 799 (2021), https://doi.org/10.1016/j.scitotenv.2021.149505

the production of industrial crops like sugarcane and cotton, wheat and grazing crops (and up to 73%, depending on the crops and years)[8]. Regarding cereals, in 2008 about 34% of the planted area of wheat was irrigated, 9% of the planted area of maize and some areas of barley in North West and Limpopo provinces. In the early 1990s, potatoes previously mostly grown as a rainfed crop shifted to an irrigated crop[9]. Cotton yields under irrigation have reached 3.9 t/ha on average, compared to 0.7 t/ha in dryland.

Fruits are grown in the Western and Eastern Cape while vineyards are mostly grown in the Lower Orange area. Together, fruits including grapes, represent up to 40% of the agricultural exports in some years[10]. The main irrigated crops are cereals representing almost 30% of the irrigated area in 2008, maize in summer and wheat in winter, vegetables, pulses and fruits. With the shift from the production of low-value primary food crops to high-value export crops such as fruit and wine, South Africa became a net importer of food, including meat, cereals, milk, cheese and vegetables in terms of quantity in the middle 1990s, but a net exporter of agricultural products by value. Although negative in terms of national food security (national production meeting demands), it generated foreign revenue[11].

The late nineties (1997) also saw the liquidation of the large parastatal irrigation schemes established in the previous homelands for occupation and use by black farmers. Even before 1994, the smallholder irrigation schemes failed to provide high yields due to a myriad of technical, management, training, agricultural policy, and financing issues[12]. Their management and the government assets established at the schemes were transferred to communities, farmers or local non-governmental organisations for them to manage and generate their own income.

THE REVIEW OF WATER LAW

The new Constitution necessitated another urgent item on the fledgling government's agenda – the review of water policy. The White Paper on the National Water Policy of 1994 reviewed and proposed the repealing of the National Water Act of 1956. This work was spearheaded by Kader Asmal, who took over the position of Minister of the Department of Water Affairs and Forestry (DWAF) in the new government from apartheid's Magnus Malan. Asmal had spent 30 years in exile, during which time he qualified as a barrister in Britain and Ireland, studied at the London School of Economics and taught law for 27 years at Trinity College in Dublin, returning to South Africa in 1990 as a Professor in Human Rights.
The review gave 'enormous scope for improvement,' he would later recall[13]. "South Africa's water management was not equitable, not efficient, and not sustainable. It was grounded in race-based privilege, with a perhaps inevitable resultant decadence in water management practices by the "haves," he said. While he acknowledged that managers did engage in research, modelling, strategic planning, pricing structures and associated paraphernalia, it resulted in (for some) a grand self-delusion that water was being managed in a sustainable manner, when most people, "the invisible people in the eyes

[8] G.R. Backeberg, Water institutional reforms in South Africa, ***Water Policy***, 7,1 (2005), 107-123.
[9] DAFF, Trends in the agriculture sector 2012 (Pretoria: DAFF)
[10] FAO, Country profile – South Africa, https://www.fao.org/aquastat/en/countries-and-basins/country-profiles/country/ZAF, last accessed on 21 August 2021.
[11] J. Greyling, 'A look at the contribution of the agricultural sector to the South African economy', 2015, https://www.grainsa.co.za/a-look-at-the-contribution-of-the-agricultural-sector-to-the-south-african-economy, last accessed on 16 August 2023
[12] J. Day, B. Day & J. Reizenberg (eds), ***WRC@50 Celebrating a Half-century of Excellence***, (Pretoria: WRC, 2021: WRC Report no. SP 148/21)
[13] K. Asmal, 'Reflections on the birth of the National Water Act, 1998', ***Water SA***, 34, 6 (IWRM Special Edition 2008), 662-664.

of the apartheid," did not have access to safe water.

The new Act proposed several important changes. As a first, the Act introduced universal water law, which obliges the State to provide clean drinking water and sanitation to all as a human right. This would be a key focus area of the Department of Water Affairs & Forestry (DWAF) going forward. The department inherited a backlog of 14 million people lacking access to safe water and 21 million (half the population) lacking access to safe sanitation. Another large-scale change was the introduction of the concept of the Ecological Reserve, a world first. This stipulated that water for basic human needs and for basic ecological functioning has priority over commercial or other uses. The concept is fundamental to the conservation of the resource for sustainable development.

Then, importantly, the new Act abolished riparian rights. Instead, the National Government now acts as the custodian of the country's water resources[14]. This resolved the significant difficulties of the Water Act of 1956 that resulted in no single organisation or institution being able to exercise complete authority over water in South Africa.

Since the new policy recognises that 'water is a natural resource that belongs to all people,' the government does not own the water, but the minister has overall responsibility and the authority to ensure that water is managed to the benefit of all people. This includes groundwater, which is now seen as part of the resource that should be managed for the greater good, instead of being seen as private property. The new policy thus called for an end to permanent ownership of water allocations. 'Water rights' changed to 'water-use rights.' The state can now charge all major water users for their consumption and can declare water uses as lawful through the approval and extension of permits and exemptions.

Licensing water use provides the government with multiple benefits. For one, it creates a desperately needed income stream. It also provides a method for water conservation. Licensing can, for example, address problems in areas where the groundwater is being over-abstracted for irrigation, like Dendron, the Springbok Flats and the Coetzersdam, while any irrigation can be stopped in arid areas unsuitable to the practice. In Namaqualand, for example, irrigation with groundwater funded by NGOs failed because of limited aquifer storage, irregular recharge and lack of water for flushing salt accumulation in the soil[15].

At the time of the promulgation of the new Act, it was also thought that licensing could be an important tool to bring about more equal distribution of water use rights in South Africa. Another world first was the noteworthy implication encapsulated in the new water policy that land use practices responsible for a major reduction in run-off, such as forestry and sugar plantations, would be held accountable for their actions. Furthermore, the new policy acknowledged that South Africa has a duty to ensure that its neighbouring states have an equitable share of water from internationally shared rivers since development cannot happen in isolation

[14] Q.W. Chiluwe, B. Ncube, B. Msimang & I. Modiba, Strengthening the knowledge base and capacity to support the transformation of irrigation boards to water user associations, (Pretoria: WRC, WRC Report No. 3022/1/22)
[15] RSA, Water conservation and demand management strategy for the agricultural sector, 2000, https://www.gov.za/sites/default/files/gcis_document/201409/wateragric0.pdf, last accessed on 16 August 2023.

and regional success is the only viable option for long-term prosperity.

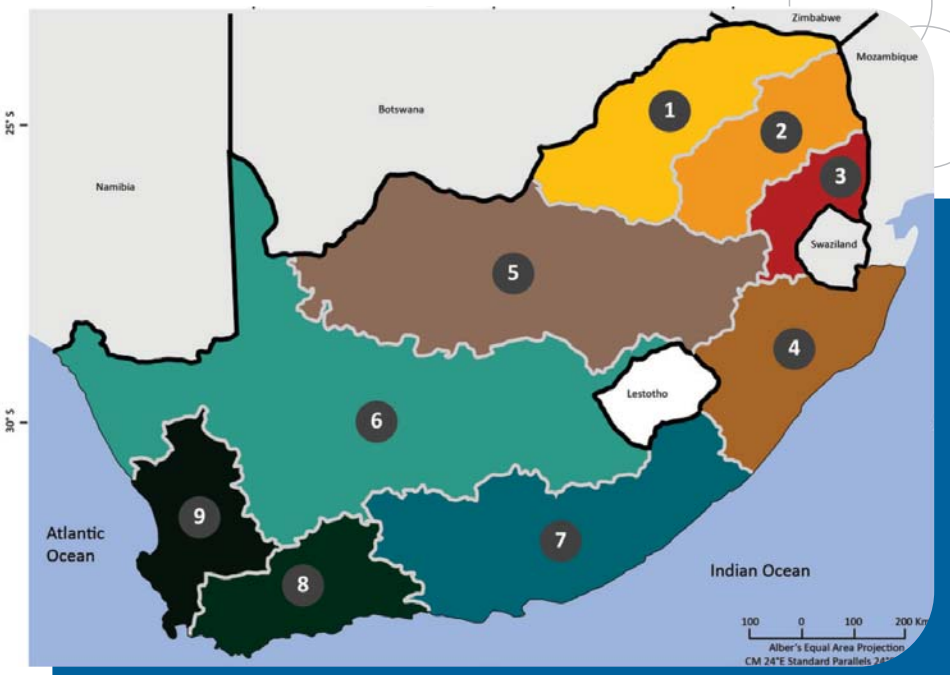
The government also looked to the new Act, and the National Water Resources Strategy (NWRS) that guided the implementation of the Act, to set the basis for integrated water resources management (IWRM) in South Africa. This approach 'promotes the coordinated development and management of water- and land-related resources, in order to maximize economic and social welfare in an equitable manner without compromising the sustainability of ecosystems'[16]. IWRM calls for integrated and cooperative governance and the engagement of stakeholders and agencies across all spheres of government. People are given the opportunity to make decisions that are in their joint self-interest though, in South Africa, the national department as custodian of the water must ensure that the decisions made are developmental in nature and can serve and protect the interests of the poor.

These institutional changes were also seen as necessary to transcend the 'vicious cycle of government-induced dependency of farmers on the state and their consequent under-investment in the maintenance of irrigation infrastructure'[17]. The hope was that such reforms could create the right combination of incentives to induce an optimal mix of state and local investment to achieve sustainable infrastructure maintenance.

To facilitate this, the Act, and the NWRS, called for the establishment of catchment management agencies (CMAs) and water user associations (WUAs). CMAs were to act as basin water authorities to manage, develop and protect water resources within defined water management areas. Through CMAs, water resources management is delegated to the catchment level and involves local communities within the framework of the NWRS. The role of the CMA includes investigating and advising interested and affected persons on, and promoting community participation in, the protection, use, development, conservation, management, and control of the water resources in its water management area; developing a catchment management strategy; to coordinate the related activities of water users and the water management institutions within its water management area.

The NWRS divided the country into 19 Water Management Areas (WMAs) defined according to hydrological catchments, and the initial plan was that a CMA should be established in each. The department was to lead the creation of the new institutions, both CMAs and WUAs and support and guide them in the execution of their tasks. The implementation plan drawn by DWAF for the establishment of CMAs at the time envisioned all 19 to be established by 2000.

[16] Definition according to the Department of Water and Sanitation, https://www.dws.gov.za/Projects/sdg/Integrated%20Water%20Resources%20Management.aspx#:~:text=IWRM%20promotes%20the%20coordinated%20development,compromising%20the%20sustainability%20of%20ecosystems. Last accessed on 16 August 2023.
[17] RSA, Water conservation and demand management strategy for the agricultural sector, 2000, https://www.gov.za/sites/default/files/gcis_document/201409/wateragric0.pdf, last accessed on 16 August 2023..



The nine water management areas as at 2024.

However, the number of CMAs was systematically reduced over time in ongoing attempts by national government to reduce their administrative burden. Most recently, the country was to be covered by six CMAs. Two CMAs are currently functioning. The first CMA to be gazetted was the Inkomati Catchment Management Agency (ICMA) in 2004. In 2014, it was extended by merging the Inkomati WMA with the Usuthu Catchment which was part of the dissolved Mhlatuzi-Usuthu CMA. The name was then changed to the Inkomati-Usuthu Catchment Management Agency (IUCMA).

The second CMA to become operational was the Breede-Gouritz Catchment Agency (BGCMA), officially established in July 2005. It became operational with the appointment of the CEO and personnel following the appointment of a Governing Board in 2007. The BGCMA is the result of the amalgamation of the Breede WMA and the Gouritz WMA.

Irrigation boards that originated from the Irrigation and Conservation of Water Act in 1912 were to be transformed into WUAs. These voluntary organisations are to operate at a local level and are defined as cooperative associations of individual water users who wish to undertake water-related activities for their mutual benefit. WUAs manage water on behalf of the end users. They bring together, for example, farmers for the purpose of managing a common irrigation system, including those who were previously disadvantaged. Where emerging farmers are present, the initial expectation was that more experienced farmers would assist them in skills transfer.

It is also up to WUAs to draw up and submit Water Management Plans, in which each WUA describes its current irrigation water use and conservation measures and how it plans to improve its irrigation water supply services and to achieve water conservation and water demand management.

A REVOLUTIONARY LAW, SHACKLED

A water law review panel was set up to stimulate debate on water rights and solicit comments. The new water act resulted in fierce negotiation and lobbying by those that benefited from earlier legislation[18], including the agricultural sector. It took over three years for the National Water Act (NWA) to come into law, which it did in 1998. At the time, it was hailed as one of the most progressive pieces of water legislation in the world. Several countries ranging from China to Zambia have used the NWA as an example for the revision of their own water legislation. However, the Act that was promulgated also included various compensations that would have ramifications for decades to come and, in many ways impede the lofty aspirations it contained. For example, the water use license is specific to a user, property and use, must be reviewed every five years and is valid for a specific time period not exceeding five years. The Act stipulates that all water use activities that exceed the parameters of so-called Schedule 1 water uses require a water use license and are subject to the application process. Schedule 1 uses include water use for a garden, to water household animals or for small-scale non-commercial food gardens.

However, the NWA allows for a large, important, exception. Entitlement to water as recognised under the old water law is honoured as Existing Lawful Use (ELU). According to ELU, abstraction allocated before 1998 does not require a new permit, and users do not have to go through the new licensing process. Existing formal users' existing entitlements to water are thus authorised by government, simply through registration, until such time as Compulsory Licensing is introduced in a catchment and all existing lawful users are called on to apply for licences.

[18] Chiluwe et al, Strengthening the knowledge base and capacity.

However, new users and those without existing permits have to formally apply for licenses. The new Act thus gives, inadvertently, legal status to the unequal distribution of water rights enforced under the previous regime. The NWA also includes the option of water trading, which allows for the voluntary exchange of water-use entitlements or allocations between different users or sectors.

Furthermore, the new law introduced General Authorisation, which exempts certain water users from the need to apply for a permit. General Authorisations can be declared for a specific water resource or for a certain water user category, in the form of a permit to use raw water without a licence, without going through the formal processes to obtain one. It can be issued, for example, for ELU or to redress past racial and gender discrimination. At the time the Act was passed, the rationale was to reduce the administrative burden on the state for users of relatively negligible quantities in areas where sufficient water resources were available.

Even for those water users who want to comply, the water use licensing processes have been 'costly, very lengthy, bureaucratic and inaccessible to many South Africans'[19]. In some cases, delays to finalise applications have taken up to eight years. As a result, small-scale users that are obliged to apply for a permit, and are criminalised without one, have been practically unable to obtain it.

Around 60 000 existing water users complied after 1998, registering a total of around 80 000 different water uses under ELU. The overwhelming majority of registered water users were white. Rural water abstractors, such as mines and commercial farmers, constituted 1.2% of all registered users but use 95% of the water. A similar bias has been found in the permits issued for water uptake after 1998. Out of the 4 284 new water use permits issued between 1998 and 2012, only 1 518 were for historically disadvantaged individuals, with a mere 1.6% of the water allocated through the 4 284 permits being assigned for these small-scale users[20].

In 2003, the government embarked on a resource-intensive, national programme to validate and verify the quantity and legality of water uses that exceed Schedule 1 uses. The objective of the project was to determine how much water was allocated for ELU and set the first steps in place for compulsory licensing. After 20 years, except for three small pilot projects, the later steps were not been applied and there has been no change in the 'lawful' inequities of those pre-1998 uses.

Over and above the loopholes in licensing stipulations, the Act allows for existing irrigation boards, subterranean water control boards and water boards established for stock watering purposes to continue operation until they are restructured or transformed into WUAs, resulting in many simply continuing to function as before. Though section 92 of the Act stipulated that irrigation boards had to be transformed in six months, 99 of the 278 irrigation boards that existed in 1998 met the transformation requirements 19 years later, by 2017[21]. The requirements include amongst others, access

[19] DWA, The second edition of the National Water Resources Strategy, 2013: https://www.dws.gov.za/documents/Other/Strategic%20Plan/NWRS2-Final-email-version.pdf, last accessed on 16 April 2024.
[20] B. van Koppen and B. Schreiner,. A hybrid approach to decolonize formal water law in Africa (Colombo, Sri Lanka: International Water Management Institute (IWMI), 2018, IWMI Research report no. 173)

to water for the previously disadvantaged communities and representation in gender, race, youth and people with disabilities. According to the National Water and Sanitation Master Plan of 2019, only 5% of agricultural water is used by historically disadvantaged farmers.

Regardless of the aspirations of the Water Act of 1998, those who benefited under the colonial system have mostly kept their advantage, again to the disadvantage of those who did not.

THE COST OF WATER

The NWA also calls for the cost of water to be reviewed. In 1998 irrigation was still a highly subsidised sector, with water charges not sufficient to cover the operation and maintenance costs of government irrigation schemes. Agricultural water prices were based on affordability, rather than cost recovery[22].

In the 1999 Raw Water Pricing Strategy, among other costs, the water resources management charge (WRMC) was calculated according to the costs associated with managing a geographically defined area. Charges stipulated in the strategy covered the cost of, among others, planning and implementation of catchment management strategies; monitoring and assessment of water resource availability and quality; flood and drought management; management of raw water allocations; evaluation and processing of water-use authorisation and registration applications; and water resource protection and pollution control. The strategy stipulated that these tasks would be initially be performed by DWAF and later by the CMAs.

The WRMC is levied on registered use but was capped in the 1999 strategy at a maximum of 2 c/m^3 increasing with inflation, to ensure that costs were contained. The original calculation of the WRMC was too low and with the legal caps on charges in place, water resources management activities were constantly underfunded. The new strategy promulgated in 1999 thus still did not result in fees that covered the cost of managing water resources but it was seen as a temporary measure to introduce the new fees on those affected, like farmers.

The pricing strategy was revised in 2007 in order to address numerous challenges, including the heavy subsidisation of the irrigation sector. Caps were again placed on WRMC to the afforestation and irrigation sectors, though at a higher figure than the first strategy stipulated. The WRCM charge to the irrigation sector was capped at 15 c/m^3 plus the PPI rate (%) in April of each year with 2007-08 as the base year. The WRMC for resource-poor farmers and forest growers was to be phased in over a period of five years from the first registration of their water use to enable them to build up sufficient capital to be able to pay the charges[23].

These tariffs still did not necessarily reflect the cost of producing or managing the water but were again artificially kept at a certain level to gradually introduce the new costs to

[21] Minutes of the meeting of the Parliamentary Portfolio Committee on Water and Sanitation with the Deputy Minister of Water and Sanitation, 20 June 2017, https://pmg.org.za/committee-meeting/24644/, last accessed on 18 August 2023.
[22] B. Schreiner, 'Water pricing – The Case of South Africa', in ***Water pricing experiences and innovations***, eds. A. Dinar, V. Pochat & J Albiac-Murillo (Springer Nature, 2015). See also the study by the ICID Task Force for Financing Water for Agriculture study on this subject, file:///C:/Users/laniv/Downloads/FinalReportofTF-FINICID2015.pdf, last accessed on 13 May 2024.
[23] V. Munnik, The reluctant roll-out of catchment management agencies: Assessing the key risks and consequences of delays in finalising institutional arrangements for decentralised water resource management (Pretoria: WRC, WRC Report No. 2943/1/20)

the affected sectors until the next pricing strategy. A further review was initiated in 2012 but had not been completed by 2023 due to disagreements about the finer details of an updated strategy. It has resulted in substantial under-recovery of costs over time[24].

THE DEVELOPMENT OF TWO IRRIGATION SECTORS

The changes in the irrigated agricultural sector since 1994 have been dramatic. Some irrigation schemes developed into large, globally competitive enterprises, while others decreased production substantially, or even ceased completely. The latter has often been the case in areas with limited other economic activities or potential.

Citrus production is an example of a sector that went the first route. Along with deciduous fruit and table grapes, citrus has become a main export product. After deregulation in the mid-nineties, competition in the fruit export industry increased, as hundreds of marketing agents and marketers entered the sector – over 160 by 1999.

Lani van Vuuren

Rosle Boerdery, outside Groblersdal in Mpumalanga, is a prime example of a citrus export facility. Citrus is grown here mainly for the export market, irrigated with water from Loskop Dam.

[24] P. Kotzé, 'How research helped break the deadlock in updating SA's outdated raw water pricing strategy', ***The Water Wheel***, 21, 6 (2022), 10-13.

This resulted in a huge drop in prices and in the quality brought to an international market. A group of concerned citrus growers have formed the Citrus Growers Association (CGA). Their mission is to maximise the long-term profitability of its members by providing the industry with access to the global markets; optimising cost-effective production of quality fruit; continual commitment to research, development and communication with all stakeholders; and, caring for the environment and community within which they operate. The fruit industry has since revealed great refinements in terms of developing new strategies and innovative systems for supplying foreign markets. South Africa has become one of the leading citrus-exporting countries[25].

On the other side of the spectrum, after the parastatal smallholder irrigation schemes were liquidated in 1997, they performed poorly and, in some cases, collapsed. The immediate result was widespread asset stripping, including tractors, spares and other agricultural equipment[26]. Later reviews indicated that a fatal flaw was the lack of concurrent training or support programmes offered at the time. More major problems included inappropriate planning and design, poor operational and management processes, inappropriate land tenure arrangements and a lack of technical knowledge.

However, though smallholder irrigation schemes only constitute a small area (an estimated 3.3%) of the total irrigated area in South Africa, their effective revitalisation remains important for the government. Though their rehabilitation was originally meant to address the injustices of the past, their locations in rural areas still hold the potential to increase food security, create employment and uplift rural livelihoods. Various government incentives have attempted to revitalise these schemes.

Initially, DAFF set a target to revitalise 2% of small-scale government irrigation schemes which amounts to a total of 1 000 ha. It was envisaged that 250 ha would be revitalised every year. This decision was mainly due to financial constraints as the revitalisation of irrigation schemes at that time was estimated to cost about R200 000 per hectare. Funding for this initiative was sourced mainly from the Comprehensive Agricultural Support Programme (CASP) and Ilima/Letsema programmes.

CASP, launched in 2004, aimed to provide emerging farmers with funding to improve production, alleviate poverty and create jobs. The grant aimed to provide effective agricultural support services and promote and facilitate agricultural development by targeting beneficiaries of land restitution and redistribution. Other previously disadvantaged producers who had acquired land through private means and were engaged in value-adding enterprises domestically, or involved in exports were also to benefit.

The Ilima/Letsema Project allocated funds to assist vulnerable South African farming communities to achieve an increase in agricultural production and invest in infrastructure that unlocks agricultural production. This grant (100%) was also

[25] X. Dlikilili and J. van Rooyen, Measuring the competitive trends of the South African citrus industry, SA-TIED Working Paper #11, May 2018.
[26] S. Hofstätter, 'Qamata: how deep is the rot?', ***Farmers Weekly***, 18 June 2007, https://www.farmersweekly.co.za/rural-insight/qamata-how-deep-is-the-rot/, last accessed on 18 August 2023.

allocated to support food production (crops and livestock production) including the rehabilitation of irrigation schemes[27].

In Limpopo Province, the revitalisation of smallholder irrigation schemes was undertaken in the Revitalisation of Smallholder Irrigation Schemes (RESIS) Programme between 2001–2004 and subsequently the RESIS–Recharge Programme from 2005-2007. However, none of the programmes performed as intended, or resulted in many improvements on the ground.

The first national review of CASP conducted in 2007 concluded that the programme did not achieve near-any of its goals. By 2009 the beneficiaries that received CASP support accounted for less than 1% of smallholder farmers, suggesting that the bulk of state funding for smallholder farmers went to less than 0.02% of the intended beneficiaries. In general, most of the money was funnelled to ineffective expenses. Food security funds, for example, were channelled to provide starter packs of seeds and implements – the sustainability of which was questionable then, and proved to be unsustainable over time.

Only 10% of the total budget of CASP was allocated to training and capacity building. An impact assessment done in the Limpopo Province showed that the income for CASP beneficiaries was higher before training and decreased by 75% after they received training. Other reports indicated that most of the provinces that benefited through CASP had not improved in terms of productivity. An impact assessment of CASP in the Free State showed that only one out of five projects were successful and sustainable[28].

Cropping intensity (the number of crops that are cultivated on a particular surface area per year) remains low in those provinces with smallholder irrigation schemes. Under irrigated conditions in most parts of South Africa, it is possible to grow two crops per year, which would translate into a cropping intensity of 200%. Average cropping intensities of 48% were reported in the Eastern Cape. In this province, cropping intensity was related to plot size, with higher intensities at smaller plots than at plots larger than one hectare. Reviews implied that larger plots are too labour-intensive and expensive to handle within the constraints of the smallholder farmers' farming systems.

In KwaZulu-Natal, approximately 75% of the area of the irrigation schemes was not being utilised due to a lack of motivation and resources, while in the Limpopo Province, only about 15% of the Arabie-Olifants River irrigation scheme was cultivated. Also in Limpopo, 42% of the Thabina irrigation scheme was unused because the plot holders were not interested in farming[29].

Revitalisation, a more holistic development philosophy, is currently preferred instead of the traditional focus on the rehabilitation of infrastructure. Reviews have shown that the weaknesses of prior efforts to revitalise irrigation schemes included limited consultation and engagement with the

[27] DAFF, Irrigation Strategy for South Africa (Pretoria: Government Printer, 2015).
[28] M. Fanadzo and B. Ncube, 'Challenges and opportunities for revitalising smallholder irrigation schemes in South Africa', ***Water SA***, 44, 3 (2018), 436-447.
[29] S. Perret, M. Lavigne, N. Stirer, S. Yokwe and S. Dikgale, The Thabina irrigation scheme in a context of rehabilitation and management transfer: prospective analysis and local empowerment. Final Report. (Pretoria: DWAF, CIRAD-IWMI-UP, 2003)

intended beneficiary and human and social capital, and this approach would improve future attempts to do so.
Still, the revitalisation of the smallholder irrigation schemes remains an integral part of the land and agrarian reform and food security of the Department of Agriculture Forestry and Fisheries (DAFF). Their success remains integral to the need to tackle issues of rural poverty, unemployment and increase food and nutrition security in former homelands situated in Eastern Cape, Limpopo and KwaZulu-Natal provinces. The current role envisaged is that the schemes create employment and reduce poverty, particularly among rural women farmers in South Africa.

WRC archives

Women remain the main cultivators on smallholder irrigation schemes.

Table 7.1. Smallholder irrigation schemes under the Strategic Partnership programme of Limpopo Province as at July 2023[30]

No	Smallholder irrigation scheme	Area (Ha)	No of Farmers	Local Municipality	District Municipality	Type of Irrigation
1	Phetwane (Hindustan)	52	48	Ephraim Mogale	Sekhukhune	Floppy irrigation system
2	Mogalatjane (Coetzeesdraai)	133	99	Ephraim Mogale	Sekhukhune	Floppy irrigation system
3	Krokodilheuwel (Kolokotela)	243	188	Makhuduthamaga	Sekhukhune	Floppy irrigation system
4	Setlaboswane (Vogelstruiskoppie)	119	96	Makhuduthamaga	Sekhukhune	Floppy irrigation system
5	Elandskraal	130	28	Ephraim Mogale	Sekhukhune	Centre pivots irrigation
6	Strydkraal (Ga-Masha)	380	329	Fetakgomo	Sekhukhune	300 ha centre pivots, 25 ha floppy irrigation
7	Tswelopele (Praktiseer)	440	83	Greater Tubatse	Sekhukhune	Floppy irrigation system
8	Badfontein (Sepitsi)	70	31	Lepelle-Nkumpi	Capricorn	60 ha centre pivot, 10 ha drip irrigation system
9	Grootfontein	103	58	Lepelle-Nkumpi	Capricorn	Centre pivots, floppy irrigation system used on a small scale

[30] J. Jiyane, C. Sambo & M. Ndlovu, Investigation into the performance of Strategic Partnership Programme for Smallholder Irrigation Schemes in Limpopo Province and opportunities for revitalisation of affected schemes, (Pretoria: WRC, WRC report no. TT 919/23)

No	Smallholder irrigation scheme	Area (Ha)	No of Farmers	Local Municipality	District Municipality	Type of Irrigation
10	Mapela	90	60	Mogalakwena	Waterberg	50 ha floppy irrigation, 40 ha drip. Now used by Anglo-American appointed investor.
11	Homu	165	22	Greater Giyani	Mopani	Micro-ject irrigation system
12	Tshiombo-Mbahela	110	86	Thulamela	Vhembe	Floppy irrigation system
13	Makuleke	235	41	Thulamela	Vhembe	Centre pivots irrigation

WRC archives

Typical drip irrigation at an unnamed smallholder irrigation scheme. Vandalism of irrigation infrastructure remains a huge challenge at most of these schemes.

FUTURE EXPANSION OF IRRIGATED AGRICULTURE AS AN IMPORTANT TOOL FOR ECONOMIC DEVELOPMENT AND INTEGRATION

More than twenty years after democracy, agriculture has remained crucial for achieving sustainable economic growth, reducing poverty and promoting rural development. Irrigated agriculture has remained an important factor in the South African economy although this is often masked by the official Gross National Product (GNP) statistics. To illustrate, the direct contribution of the agricultural sector to the gross domestic product (GDP) was only about 4.5% (in 2015) of which only an estimated 25 to 30% was from irrigated agriculture. So, 60% of the country's water was used to contribute less than 1.5% to the GDP. However, the figures mask the larger contribution of agriculture to the country's economy and development.

The sector supplies raw materials as inputs to other primary and secondary sectors. Agriculture also creates a strong demand for goods and services such as fertiliser, machinery and financial services through its backward linkages. Agriculture is estimated to support approximately 25% of the manufacturing sector's contribution to the GDP. Irrigated agriculture, especially sectors such as fruit and vegetable farming, is relatively labour-intensive. Irrigation and rain-fed farming combined account for about 11% of total national employment, a number significantly higher than the proportionate economic production of the sector.

It has also been estimated that at least 35% of South Africa's economically active population are directly or indirectly dependent on agriculture[31].

Although the sector requires large amounts of water, the number of jobs created by 1 million m^3 of water in agriculture is of the same order of magnitude as that created in mining, with both being far lower than the number created in industry[32].

Over and above the importance of the fruit industry as an export commodity, irrigation contributes substantially to a healthy diet for South Africans. Though vegetables are not exported as much as fruit and wine crops, the 90% of crops produced under irrigation is essential to national food security. Supplementary wheat, an important staple in the country, is imported to South Africa to fulfil demand, due to poor dry land potential. However, although only 12% of the total area planted for wheat is under irrigation, irrigated wheat contributes 30% of the national production. Increasing wheat production under irrigation could contribute significantly to improving national food security and reduce the spending of foreign exchange on food importation.

The country's most recent long-term socio-economic development roadmap, the National Development Plan 2030 (NDP) adopted in 2012/13, paves the road to eliminating poverty and reducing inequality in the country by 2030. It identifies irrigated agriculture (supplemented by dry-land production where feasible) as the driving force behind better

[31] G.R. Backeberg & A.J. Sanewe, 'The research and development strategy for water utilization in agriculture –responding to diverse needs of farmers in South Africa', ***Irrigation and Drainage Special Issue: 19th ICID International Congress, Beijing, 2005***, DOI: https://doi.org/10.1002/ird.232

[32] W.L. Nieuwoudt, G.R. Backeberg and H.M. du Plessis, 'The value of water in the South African economy: Some implications', ***Agrekon***, 43, 2 (2004), 162-183.

integration of the country's rural areas achieved through successful land reform, infrastructure development, job creation and poverty alleviation.

The NDP stipulates the possible expansion of agriculture to create close to 1 million jobs in the sector by 2030, especially in rural areas, a significant contribution to the overall employment target, highlighting labour intensive agricultural sectors like citrus, grapes and subtropical fruits. According to the NDP, the 1.5 million ha under irrigation (which produce virtually all South Africa's horticultural harvest and some field crops) could be expanded by at least 500 000 ha through water savings, the better use of existing water resources and developing new water schemes. This figure was substantially reduced and refined to 34 863 ha in the subsequent Irrigation Strategy for South Africa, published in 2015.

According to the irrigation strategy, the largest area for expansion is in KwaZulu-Natal, where 10 000 ha could be added at the Makhatini Irrigation Scheme, established in the late 1970s in the uMkhanyakude district. The scheme is approximately 4 500 ha in size and services over 300 farmers and 10 primary cooperatives[33]. Land for the proposed expansion has been identified within the uMkhanyakude District, stretching from the Pongola Dam in the south to the Ndumo River in the north close to the Mozambican border[34].

At the Upper Orange River Catchment, a potential 4 000 ha has been identified in the Eastern Cape, and 3 000 ha in the Free State. A potential 5 000 has also been identified in the Northern Cape, but indications are that most of the land has already been allocated. A potential further expansion of 2 354 ha could take place in the Eastern Cape when a dam is constructed on the Umzimvubu River, but the project remains in the planning and feasibility assessment stages.

A potential expansion of 1 250 ha could also be gained should the Foxwood Dam be constructed. The proposal is for the dam to be constructed on the Koonap River, a tributary of the Great Fish River, close to Adelaide, approximately 200 km north-east of Port Elizabeth. The Koonap River is the only major undeveloped river in the area and water is currently being abstracted by either canals or pumping. The feasibility of a major dam on the Koonap River, for the purpose of supplying water for domestic use and for irrigation, has been investigated since the early 1960s. Different reports either incorporate a bulk water supply to Adelaide with a municipal irrigation scheme or solely as a potable water supply for the town. The motivation for the construction of a dam, initially, appears to have been for the town[35].

In addition, a potential 1 259 ha could be developed at the Taung Irrigation Scheme in the North West Province, part of the Vaalharts irrigation scheme. The scheme has approximately 35 302 ha of land under irrigation, of which 31 732 ha are located within the Northern Cape, and 3 570 ha in the North West Province[36]. The Taung Irrigation Scheme was established in 1939 by the South African government as part of the Vaalharts scheme and was incorporated into the Bophuthatswana homeland during the independent

[33] Agribusiness Development Agency, Makhathini Irrigation Scheme, https://ada-kzn.co.za/ada-makhathini-irrigation-scheme/. Last accessed on 21 August 2023.
[34] Anon, Expansion of Makhathini Irrigation Scheme, https://sahris.sahra.org.za/cases/expansion-makhathini-irigation-scheme. Last accessed on 21 August 2023.
[35] DWS, Foxwood Dam, https://www.dws.gov.za/iwrp/FoxwoodDam/. Last accessed on 21 August 2023.
[36] Agrifusion (Pty) Ltd, Funding and investment plan for the Vaalharts / Taung Irrigation Scheme Revitalisation Project, 2015, https://www.swpn.org.za/wp-content/uploads/2020/03/4.-Vaalharts-FIP-Final.pdf. Last accessed on 21 August 2023.

homeland era from 1970 until the nineties. The scheme has since deteriorated and some farms have been abandoned[37]. The investment plan for the scheme's revitalisation estimates the hectares to be developed much higher than the irrigation strategy, and stipulates that an additional 2 854 ha could be made available to farmers in the Taung area if the North canal of the irrigation scheme were to be refurbished.

In the Western Cape, a potential 5 000 ha could be developed if the 85-year-old Clanwilliam Dam wall was raised to increase its capacity. The extra capacity would increase the yield of the dam by about 40%, allowing for the additional 5 000 ha of land to be irrigated and creating almost four thousand new jobs.

The ongoing challenges in the way of completing the project are one example of the larger challenges that developed in the management of South Africa's water resources.

THE OBSTACLES TO RAISING THE CLANWILLIAM DAM WALL

In 2014, former Gauteng Premier Nomvula Mokonyane became the first Minister of the newly-named Department of Water and Sanitation. Her four-year tenure was marked by high-level institutional corruption and mismanagement. One of the projects started under her tenure was the raising of the Clanwilliam Dam.

The project was to be completed by the DWS's construction unit, providing on-the-job training to staff at the same time. The project had already been delayed by previous ministers, but after Mokonyane announced in her 2015 budget speech that the project would start, the DWS team moved onto site and began preparations. Surrounding land was also acquired and the Cape Town-Namibia N7 national highway was diverted to make way for construction.

The minister then abruptly stopped the project. In 2017, National Treasury was asked to approve a new budget. They were informed that the project construction would now be handled by external contractors to accelerate the project. Before the minister's arrival, external investigations into allegations of corruption were already underway from 2012. The scale was relatively small, and the Special Investigating Unit (SIU) reported 28 criminal cases involving R50-million. By the end of Mokonyane tenure, irregular expenditure was well over R4-billion with new cases still being uncovered.

In 2018, the Auditor-General and Parliament's Standing Committee on Public Accounts reported that the management of the DWS had collapsed, with billions of Rand of irregular expenditure, huge debts and failed projects. Many of these problems have been attributed to corruption. The problems were reportedly be systemic, involving people at all levels, from plumbers and tanker drivers to mayors and ministers. Many private businesses benefited richly from corruption and, in some cases, actively organised and encouraged it[38].

[37] S.S. Tekana & O.I. Oladele, 'Impact analysis of Taung Irrigation Scheme on household welfare among farmers in North-west Province, South Africa', ***Journal of Human Ecology,*** 36, 1 (2011), 69-77.
[38] M. Muller, ***Money down the Drain – Corruption in South Africa's water sector*** (Water Integrity Network & Corruption Watch, 2020)

Mokonyane was replaced by Gugile Nkwinti in 2018. He overturned an earlier decision by his predecessor to create one CMA to service the whole South Africa and announced that the establishment of nine CMAs would now go ahead again. He also instructed the DWS to revert to the original approach for the Clanwilliam Dam. Construction began again in the next year and was due for completion in 2023.

PROGRESS WITH LAND REFORM

In 2000, under Hanekom' successor Thoko Didiza, a new policy was released, called the Integrated Programme of Land Redistribution and Agricultural Development in South Africa. It shifted the emphasis away from the previous focus on alleviating the plight of the rural poor to establishing a class of black commercial farmers. Numerous policies followed. Land reform in South Africa remains an ongoing and complex process and it has raised concern about the potential negative impact on agricultural production, food security, and investment in the agricultural sector.

By 2019, government had settled 80 664 claims benefitting 2,1 million beneficiaries at the cost of R40 billion inclusive of financial compensation to beneficiaries. Of these, 163 463 were female-headed households. Government also restored 3,5 million ha of land which can be used as a catalyst for agricultural and economic development. According to a 2017 Land Audit[39] conducted by the government, white people own 26 663 144 ha or 72% of the total 37 031 283 ha farms and agricultural holdings by individual landowners. Coloured people own 5 371 383 ha or 15%, Indians own 2 031 790 ha or 5% and Africans, 1 314 873 ha or 4% of land.

The audit also revealed that individual males own 26 202 689 ha or 72% of the total farms and agricultural holdings owned by individual owners; followed by females at 4 871 013 ha or 13%. Male-female partnerships own 3 970 315 ha or 11%, co-owners 655 242 ha or 2%, and 'other' categories 1 379 029 ha or 3%.

In recent years, there has been a growing debate around expropriation without compensation to accelerate land reform. The government has proposed a constitutional amendment to clarify the conditions under which land can be expropriated without compensation, emphasising the need for a fair and just process.

IRRIGATION IN SOUTH AFRICA IN A CHANGING CLIMATE

Across South Africa, climate change is likely to result in shifting rainfall patterns, increasing temperatures, as well as more intense and frequent extreme events. The major forecasted trends are for a decrease in rainfall over the western parts of the country, and a major increase over the central and eastern parts of the country, associated with more extreme rainfall events. Over and above, the geographical and temporal distribution of rainfall seems to have shifted over time. Anecdotal evidence suggests a delay in the onset of the summer season[40]. This translates into a shift in optimal

[39] SA Government, Land reform, https://www.gov.za/issues/land-reform, last accessed on 21 August 2023.
[40] W. Sihlobo, 'Changing weather patterns a challenge for farmers', ***Business Day***, 20 February 2019.

planting dates for summer grain and oilseeds, and subsequent maturing periods.

The most significant changes to temperatures will be over the central and northern parts of the country. Temperatures are likely to increase by up to two degrees along the coast and six degrees moving in-land by 2050 and beyond. It is thus likely that the western and interior parts of the country will become drier and hotter, and the eastern parts of the country wetter and warmer. Increased rainfall intensity will exacerbate scouring in rivers and sedimentation in dams and potentially impact on water infrastructure. Higher temperatures will contribute to increased evaporation rates, which will again have a negative impact on water quantity, quality and, therefore, the availability of water[41]. Changes in soil water content and in recharge and runoff are also likely, and will have an impact upon water availability and water quality.

The agricultural areas most at risk are those where rainfall is projected to decrease with rising temperatures – effectively the northwestern and central parts of the Western Cape, large areas of the Northern Cape as well as western parts of the Eastern Cape and southwestern areas of the Free State. Rainfed agricultural crops are likely to experience a decline in average annual yields, in particular for the staple food crops of maize and wheat. As temperatures and evaporation increase, climate change is likely to lead to an increase in irrigation demands across the country. As the sector already uses the bulk of the country's available water, the increase is likely to result in added pressure on water resources, which can in turn lead to more uncertain supply and yields for and from irrigated agriculture.

Modelling has shown that under unconstrained global emissions, irrigation will see a median, or midpoint, increase of 6.4% by 2050 in South Africa, with increases of more than 12% possible. Should stringent global strategies be applied to limit emissions, a median in total annual average irrigation demand is 3.6%, with a maximum surge of 8.6% (some models even show the possibility of a slight reduction due to increased precipitation). A wide range of potential impacts on average annual crop yields has been suggested, but the likely impact for most crops is a reduction in yields by 2050. Of most concern is the large potential decline in the two staple food crops, maize and wheat, as a result of drier conditions. The potential impact on maize yields is an average decline of 3.5%. The predicted impacts on wheat are similar, with a median average annual yield decline of 4.3%[42].

Any mitigation strategies would still result in a decrease in yield, though a smaller percentage. There are, however, some exceptions. Soybean and sugarcane are likely to experience no change or an increase in average annual crop yields, as precipitation increases offset higher evaporation rates in regions where these crops are grown. Sunflower in most estimates will see an increase in yields. High-value crops such as wine grapes, apples and pears, which depend on irrigation, are likely to be particularly vulnerable to water shortages. These crops are also at risk of temperature changes, which could affect their chilling requirements. High-value export

[41] DWS, Draft National Water Resources Strategy 3, ***Government Gazette***, 47133, (29 July 2022) 64-280.
[42] J. Cullis, T. Alton, C. Arndt, A. Cartwright, A. Chang, S. Gabriel, Y. Gebretsadik, F. Hartley, G. de Jager, K. Makrelov, G. Robertson, A. Schlosser, K. Strzepek, and J. Thurlow, Climate change effects on irrigation demand and crop yields in South Africa, United Nations University Research Brief 5/16, https://www.wider.unu.edu/sites/default/files/RB2016-5-Climate-change-effects-on-irrigation-and-crop-yields-in-South-Africa.pdf, last accessed on 21 August 2023.

Petro Kotzé

Farmer, Wynand Bezuidenhout, on his farm just outside Kenhardt, in the Northern Cape in 2020, four years into an extreme drought. Climate change is expected to create more intense drought events as has been experienced in South Africa in recent years.

crops need specific optimum climate conditions to yield high-quality fruit for export.

In combination with significant non-climatic pressures, like increasing competition for water from the urban and industrial sectors, climate change forms a potent threat to agricultural sustainability. An example of the impact of severe, prolonged drought on the irrigation sector transpired in the Western Cape from 2014 (when dams were 100% full) to 2017, when dams were 38% full – not nearly enough to fulfil all domestic, industrial and agricultural water demands during the South African summer. As a result, the widely publicised 'Day Zero', when the City of Cape Town would run out of water, was set for March, then April 2018. Beyond the Mother City, the impact of the drought on irrigated agriculture during the 2017/18 season in the Western Cape was high.

THE IMPACT OF THE DAY ZERO DROUGHT ON IRRIGATED AGRICULTURE IN THE WESTERN CAPE

During the 2017/18 summer production season water restrictions of 50% were implemented in the Breede Valley, 60% in the Berg River and Riviersonderend region and various other regions and 85% or more in the Lower Olifants River Valley[43].

In response to the water limitations, in many areas, crops were removed and shredded to produce mulch for fields that were kept in production. For orchards and vineyards, this approach would have a long-term impact on productivity as it will take substantial time to replace the trees and vines that were removed. Where such extreme actions were not followed, an insufficient amount of water resulted in a reduction in yield

[43] R. Goudriaan, C. Jarmain, M. Andriessen, K. Abraham, R. Naudé, P. Keuck, 'What was the impact of the Western Cape's 2017-18 drought?, ***SABI***, April/May 2019, 18-21.

Ashraf Hendricks / Groundup

A dry Theewaterskloof Dam, one of the main dams serving the City of Cape Town and surrounds, in May 2017, during one of the worst droughts ever recorded in the area.

quantity and quality, that continued in the 2018/19 season due to the absence of post-harvest irrigations. In total, the Western Cape province saw a 20.4% drop in production in wine grapes, table grapes, pome and stone fruit, citrus, alternative fruit, major vegetables and grapes and, across the same categories, more than 30 000 jobs were shed in the 2017/18 season[44]. However, the impact of the drought varied widely across the province.

The Lower Olifants Water Management Area (LORWUA) is highly dependent on the Clanwilliam Dam, which feeds water through a system of canals to the water users downstream. In this area, 90% of all irrigated fields are under wine and table grape cultivation, which are especially vulnerable to drought conditions. The WMA faced a water deficit of approximately 85% at the start of the 2017/18 season when the Clanwilliam Dam was filled to only 40% of its capacity, causing the introduction of major water restrictions for irrigated crop production. Under 20% of the normal water quota was made available to producers. Low water availability from the Clanwilliam Dam led to reduced crop vigour, smaller canopies and increased water stress. Modelling analysis of close to 15 000 ha (covering 5 027 fields) showed that an average of 25% less biomass was produced over the entire Lower Olifants WMA. Over the course of the 2017/18 season, several vineyards (close to 5% or, 200 fields) were also removed or died off completely.

In comparison, the Groenland area south of the Western Cape, near Grabouw, is relatively wet and experienced minimal impacts. Eikenhof is the main dam in this WMA, and the water in this dam is primarily used for irrigated fruit farming. The major irrigated crop types in this region are pears and apples, with some wine grapes and stone fruit also present in the area. The Groenland WUA, allowing for a 10% curtailment, could adequately supply water in the demand of their users. This area had adequate water for plant growth and the data reflects the fact that little water conservations measures were needed. At the end of their irrigation season, the three agricultural irrigation boards around Grabouw and Elgin agreed to have their surplus water cut entirely. One was the Groenland WUA, which donated 10 billion litres (10 million m^3) of water to the city of Cape Town. In exchange, the blanket 60% restriction imposed by DWS on the WUA was eased to 10%. At the time, the WUA argued that this worked for both sides: it freed up water in the system for Cape Town (and other towns) and protected the agricultural economy of the area from ruin. However, this "donation" drew attention to the share of water controlled by the irrigation board and increased pressure for its transformation[45].

The impacts of climate change will be reduced if global policies are put in place to limit global temperature increases. However, climate change will force farmers to adapt, and many of them already are. In general, better agricultural practices, which include improved irrigation efficiency and the development of more resistant and high-yielding crop varieties could also help offset small declines in crop yields due to climate change. In South Africa, producers on the western side of the country, where rainfall is projected to

[44] M. van der Merwe, 'Western Cape drought impact: Hard, long-term, and requiring tough intervention, ***Daily Maverick***, 23 April 2018, https://www.dailymaverick.co.za/article/2018-04-23-western-cape-drought-impact-hard-long-term-and-requiring-tough-intervention/, last accessed on 22 August 2023.
[45] V. Munnik, The reluctant rollout of catchment management agencies: Assessing the key risks and consequences of delays in finalising institutional arrangements for decentralised water resource management (Pretoria: WRC, WRC Report No. 2943/1/20)

decrease, should consider diversifying crops and switching to heat-tolerant crops. They will also have to adapt their planting seasons, in general planting earlier than normal to counter any natural disasters. Farmers in the eastern region of the country where rainfall is likely to increase, need to scale up their agricultural practices to produce more food, potentially creating a food basket for South Africa.

Furthermore, crop diversification away from widespread maize production can play a significant role in mitigating against climate shocks. Switching from grain and fodder crops to high-value horticulture and industrial crops such as pecan nuts and macadamia nuts and citrus is already taking place[46]. Commercial irrigation farmers are continuously improving their water use efficiency. So-called 'Climate Smart' innovations, such as solar-powered irrigation pumps and affordable soil water content sensors, are becoming available but have not been introduced on a large scale yet. Small-scale farmers dependent on rainfall are still most vulnerable to climate shocks.

TECHNOLOGICAL ADVANCEMENT OF SOUTH AFRICA'S IRRIGATED AGRICULTURE SECTOR POST-1994

The technological advancement of irrigated agriculture since the mid-nineties has been driven by several factors. In the cut-throat commercial farming industry of today, producers must be more efficient and economical to increase their farming operations' gross profit. The predominant factor that has driven the development of technologies in the irrigation sector is the efficient use of water[47]. According to the National Water Resource Strategy, an estimated 98% of the country's water resources were allocated to various uses by 2004. By that stage, it had already been reported that 12 of the 19 water management areas in South Africa faced a water deficit (with the shortfalls being pumped from elsewhere). Demand for water is projected to exceed supply by 17% in 2030[48]. Yet, the population and economy are growing and are set to demand more water, placing greater pressure on the agricultural sector, especially since the sector uses the bulk of the country's withdrawals. (Though an average of 60% of the country's annual withdrawals still compares well[49] to a global average of 70% of all freshwater withdrawals[50] used for agriculture globally.)

The availability of water has been singled out as the most important factor that limits agricultural production in South Africa[51]. Scientists forecast that farmers will need to double their current water use or produce more with the water available to meet rising food demands by 2050. In 2016, Felicity Mitchell, agricultural resource manager at the KwaZulu-Natal Department of Agriculture and Rural Development (KZN DARD) was quoted as saying that irrigation farmers will have to halve the area of irrigated land under production, or use only 50% of their normal water requirements for the whole area, and hope that sufficient rainfall arrives to provide the needed shortfall[52]. However, the challenge to optimise water use and achieve greater output to save costs and continue to operate a sustainable business continues to be met with progress in irrigation technology.

[46] WRC Executive Manager, Sylvester Mpandeli, in video, ***Overview: Irrigation in South Africa,*** published by the International Water Management Institute (IWMI).
[47] In conversation with Dup Haarhoff, Head of Agricultural Services at GWK Beperk/Limited.
[48] According to the 2030 Water Resources Group, https://2030wrg.org/, last accessed on 22 August 2023.
[49] In conversation with Janse Rabie.
[50] This figure is quoted widely, including by the World Bank, the FAO and the OECD.
[51] Worldwide Fund for Nature (WWF), Agriculture: Facts and trends South Africa. 2014, http://awsassets.wwf.org.za/downloads/facts_brochure_mockup_04_b.pdf, last accessed on 22 August 2023.
[52] L. Phillips, 'Super-efficient irrigation: tips for crop farmers, ***Farmers Weekly***, 26 November 2016.

Further impetus to drive technological advancement of the irrigation sector is to adapt to the changing climatic conditions. Increasingly, irrigation technologies need to be able to help producers cope with water scarcity, increased temperatures and changing rainfall patterns.

Advances are not only driven by farmers and the government but also by South Africa's research institutions, universities, and agricultural organisations, which produce internationally recognised work. The country has become a global forerunner of technological advancements in the field of irrigated agriculture[53]. In recent years, major technological advances have been driven by input suppliers such as New Holland and John Deere that push for precision farming; as well as champion farmers that buy into the technologies and consulting companies that make use of the opportunity to convey the technologies[54].

South African research and technologies have won global acclaim. They have been recipients of ICID awards that recognise outstanding work in the fields of water-saving technology, innovative water management and young professionals seven times since 2003[55]. Technological advancements since the mid-nineties have been characterised by the emergence of the so-called 'Internet of Things', a reference to the connection of various devices to the Internet, allowing them to communicate and share data. Since the early 2000s advances in wireless technologies and the availability of affordable sensors contributed further to advances in water saving innovation.

It has transformed irrigation technologies. Producers can collect real-time data from various sensors placed in the field to measure parameters like soil water content, temperature, and humidity, allowing the farmer to make data-driven decisions about how much water to apply, and when. Irrigation systems can be automated and controlled remotely, and adjusted based on real-time data. Mobile apps and other social media platforms can now be relied on for information on weather, rainfall, and soil humidity for better farm management, productivity and information on markets[56]. In essence, farmers can now manage their farms through laptops and cellphones.

This trend has resulted in fewer commercial farmers that run bigger farming operations. Bigger farms allow farmers to implement more large-scale technologies that come at a higher cost, creating a competitive advantage against smaller farmers that must spend time and resources on manual operations. Over and above technological interventions to improve water losses and management in the water distribution and on farm level, estimates of the area of irrigated crops in South Africa, and the amount of water that the sector used, have improved. This information is key to understanding the pressure on the country's water resources and on the agriculture sector to reduce the water used, in order to consider any expansion of irrigation, or the reallocation of water to do so.

[53] In conversation with Felix Reinders
[54] In conversation with Dup Haarhoff, Head of Agricultural Services at GWK Beperk/Limited.
[55] See for example, Anon, 'SA irrigation innovation scoops international award, ***the Water Wheel***, 6, 1 (2007), 33.
[56] Day et al, ***WRC@50***.

MAPPING IRRIGATED AREAS AND QUANTIFYING THE WATER USE BY IRRIGATED CROPS

Various estimates of the area of irrigated crops and quantifying crop water in South Africa have been made since the nineties. The methods used were laborious and costly, especially since they needed to be applied over large areas. As a result, most of the estimates at the national level depended on qualitative methods and secondary data sources. Exact figures are also difficult because irrigation changes over time, throughout seasons, across the climatic-diverse regions of South Africa, according to the water available and its source (surface or groundwater).

Different assessments have documented either the actual area under irrigated crops or the registered area under irrigation. Findings indicate that the area under irrigation range between 1.21 and 1.58 million hectares and the area registered for irrigation use between 1.44 and 1.68 million hectares. Estimates of the amount of water used by the sector range from 51% to 63% of South Africa's water resources[57] [58].
The advent of remotely sensed earth observations has made it possible to overcome at least some of the challenges in the way of more specific estimates of water use for irrigation. The technology was applied for the first time in South Africa in 2018 to determine the area under irrigated agriculture and update the estimated amount of water used by irrigated agriculture. Along with earth observation, the project[59] also leaned on geographical information systems (GIS), energy balance modelling and machine learning techniques. This

Table 7.2. Water use by irrigated agriculture (2014/15)

Region	Total area (ha)	Irrigated area (ha)	Irrigated area (% of total area)
Eastern Cape	16 896 600	152 866	0.90
Free State	12 982 520	129 077	0.99
Gauteng	1 817 831	20 115	1.11
KwaZulu-Natal	9 436 132	177 341	1.88
Mpumalanga	7 649 132	125 595	1.64
Northern Cape	37 288 940	144 579	0.39
Limpopo	12 575 390	218 302	1.74
North West	10 488 170	97 211	0.93
Western Cape	12 946 220	269 476	2.08
National	**122 081 272**	**1 334 562**	**1.09**

Source: Van Niekerk.

[57] F. Reinders, Contribution of irrigation to stable agricultural production. Agri SA Water Conference, Birchwood Conference Centre, Kempton Park, South Africa, 2010.
[58] G.R. Backeberg, T.J. Bembridge, A.T.P. Bennie, J.A. Groenewald, P.S. Hammes, R.A. Pullen & H. Thompson H, Policy proposal for irrigated agriculture in South Africa, (Pretoria: WRC, 1996, WRC Report no. KV 96/96).
[59] A. Van Niekerk, C. Jarmain, R. Goudriaan, S.J. Muller, F. Ferreira, Z. Münch, T. Pauw, G. Stephenson & L. Gibson, An earth observation approach towards mapping irrigated areas and quantifying water use by irrigated crops in South Africa (Pretoria: WRC, 2017, WRC Report No. TT 745/17)

allowed for irrigated agricultural areas to be mapped in order to model actual evapotranspiration (plant consumptive water use) at the national scale.

Twelve monthly evapotranspiration maps that represent the consumptive water use across South Africa for the period from 1 August 2014 to 31 July 2015 were produced and aggregated. Modelling accounted for rainfall variations and seasonal influences. The Irrigated Area Map produced showed that 1 334 562 ha (1.1%) of SA's land surface was actively irrigated during 2014/15. This constituted 10% of the total area under cultivation (including fallow areas) of the area used for agriculture in 2014/15. It was found that the Western Cape contributes the most (269 476 ha), with Limpopo having the second largest area under irrigation (218 302 ha).

The total consumptive water use from irrigated agriculture in South Africa in 2014/15 was 10 221 million m^3/year which compares well with previous estimates[60] of the water use by irrigated agriculture to be 10 740 million m^3/year and 7 836 million m^3/year in 2000[61], with the latter based on a 98% assurance of supply[62]. The water use estimate for irrigated agriculture in 2014/15 was marginally lower than this estimate, despite the 44 430 ha increase under irrigation, implying either improved water use efficiencies or production of crops with lower water use requirements. Differences in accuracies and methods between the 1996 estimations and the 2018 study may also account for the differences.

TECHNOLOGIES TO IMPROVE IRRIGATION WATER SUPPLY

A notable technological advancement to increase the efficiency of water delivery to irrigation schemes is the Water Administration System (WAS) Release Module, first implemented in the early nineties. Developed in South Africa by Dr Nico Benadé, it is an integrated management tool for irrigation schemes that deliver water on demand through canal networks, pipelines and rivers. Many years of research went into the development of the program, with the main aim to minimise water losses on irrigation schemes.

Among its capabilities, WAS calculates water releases from rivers and canal networks, taking lag times and various water losses into account. The model enables the release of the correct amount of water from a dam (source) according to applications (demand) to prevent water from being wasted. Due to the model's success, Benadé won the ICID Innovative Water Management Award in 2007, a significant recognition for two decades of hard work and dedication. At the time, the model was being implemented on irrigation schemes with a total area of 142 843 ha, which is almost 28% of the irrigated area of South Africa serviced by WUAs and included about 9 500 abstraction points. Field measurements have shown that losses at these schemes were reduced by 10% to 20% through improved water releases in canals and rivers. With an average water allocation of 8 147 m^3 per hectare and estimated losses of 20%, this translates to an average water saving of between 23 to 46 million m^3 of water per year[63].

[60] DWAF, Overview of Water Resource Availability and Utilisation in South Africa (Pretoria: DWA, 1997)
[61] As part of the National Water Resources Strategy (NWRS).
[62] G.R. Backeberg, Water use and irrigation policy. In L. Niewoudt and J. Groenewald (eds) The Challenge of Change, 149-170. (Pietermaritzburg: University of Natal, 2003)
[63] Anon, 'SA Irrigation Innovation Scoops International Award'.

Lani van Vuuren

One of the main canals on the Vaalharts irrigation scheme.

Three years later, in 2010, Vaalharts Water Head Water Control Officer, Kobus Harbron, again won the ICID Award for South Africa for the use of WAS at the Vaalharts scheme. The largest irrigation scheme in the country, Vaalharts covers a total scheduled area of around 29 181 ha with 1 900 abstraction points. In the first year of implementing the system, the scheme managed to reduce water losses by 5% or 17,5 million m^3. This is especially impressive considering the age of the scheme and the general state of the canal infrastructure.

During the 62nd IEC meeting held in Iran, 2011, South Africa was awarded the ICID WatSave Technology Award. This reward was received by Messrs Pieter S van Heerden and Charles T Crosby for their development and work on the SAPWAT 3: Irrigation water planning tool. The tool is an easy-to-use planning tool to estimate water requirements and enable the supply of the right amount of water at the right time. The user-friendly computer model enables irrigation water users to plan the amount of irrigation water required by an irrigation farm, an irrigation scheme, or a water management

area monthly. This tool, SAPWAT, was a further development of CROPWAT and is being used by more than 300 users in 13 countries, even though it was designed against the background of South African needs. SAPWAT 3 the latest version of the computer model is not a crop growth model. It is designed to allow the user to imitate through interaction the situation in an irrigated field. This allows the user to do 'what if' with different irrigation scenarios to see what the effect of a specific management decision is on irrigation water requirements.

TECHNOLOGICAL ADVANCEMENTS IN IRRIGATION TECHNOLOGIES ON FARM

Several irrigation technologies are in use in South Africa. Static systems are systems that are not normally moved after installation, such as micro, drip and permanent sprinkler systems. Portable systems are moved mechanically or manually from one position to another, in order to irrigate the entire farm's land surface. This includes quick-couple, dragline, hop-along, big gun, side-roll and irrigating boom systems. Moving systems move over the field under their own power

Lani van Vuuren

Grapes watered with drip irrigation on the lower Orange River.

while it irrigates. These include centre pivot, linear, moving gun and moving irrigating boom systems. During flood irrigation, water flows with the pull of gravity over fields. Flood irrigation systems include basin, border, furrow, short furrow and contour irrigation[64].

Until the 1930s, flood irrigation, with the gravitational flow of water, was primarily applied. In the 1940s, farmer started irrigating under pressure. Sprinkler irrigation also increased. The use of microsystems became established in the 1970s and the use of self-driven kinetic systems became popular later during the same decade. In general, the irrigation mix has changed significantly over the past 50 years alongside a drastic had increase in ha under irrigation. In 2002, 1 498 000 ha were equipped for full control irrigation. In 2012, the equipped area increased to 1 670 000 ha.

In 2002, 55% of irrigated area was equipped with sprinkler irrigation including moving devices, while the rest was divided almost equally between surface irrigation (23%) and localised irrigation (22%)[65]. Though the technology is not universally applicable, many South African farmers have realised the necessity to improve water-use efficiencies in recent years, and have shifted away from flood irrigation to drip irrigation. Since the nineties, micro (drip and micro-sprinkler irrigation) and mobile irrigation have increased in general, while flood irrigation has decreased[66].

Innovations here include pivot-drip systems that combine the efficiency of surface drip irrigation with the flexibility and cost-effectiveness of mechanised irrigation systems and integrated sensors to monitor soil and plants. Through wireless communication, the sensors help algorithms to better control and manage irrigation systems. Another technology that has advanced is micro-irrigation. Though it constitutes only 6% of irrigated land in South Africa, its use continues to grow. More innovations include ultra-low-flow (0,4ℓ/ha) compensated drip lines; low-flow spray or micro-sprinkler irrigation[67].

IRRIGATION SCHEDULING

The primary aim of irrigation scheduling is to minimise water waste and maximise transpiration, which is the beneficial loss of water due to its direct link with the production of dry matter production. Scheduling plays a fundamental role in determining crop water productivity (CWP), which is a performance indicator used to describe the relationship between water applied and agricultural product output. By the late 1980s research focus had shifted to atmospheric-based soil-water balance modelling, with much of the results of this work put into practice by the late 1990s with the development of a variety of computer-based scheduling approaches[68]. The turn of the millennium saw the first social science research looking at technology adoption issues. The development of existing methods and their deployment in a variety of specific applications continued, with a greater focus on technology transfer. Lastly, there was an attempt to develop irrigation scheduling tools for the small-scale irrigation sector[69].

[64] WRC, Irrigation user manual, (Pretoria: WRC, 2020, WRC report no. TT 819/2/20)
[65] FAO Country Profile – South Africa, version 2016.
[66] F. Reinders, I van der Stoep & G.R. Backeberg, 'Improved efficiency of irrigation water use: A South African framework', ***Irrigation & Drainage***, 62, 3 (2013), 262-272.
[67] L. Botha, 'New irrigation systems: making do with less', ***Farmers Weekly***, 15 September 2020, https://www.farmersweekly.co.za/crops/field-crops/new-irrigation-systems-making-do-with-less/#:~:text=What%20is%20needed%20is%20more,optimally%20while%20using%20less%20water. Last accessed on 22 August 2023.
[68] Funded by the WRC
[69] J.G. Annandale, R.J. Stirzaker, A. Singels, M. van der Laan & M.C. Laker, 'Irrigation scheduling research: South African experiences and future prospects', ***Water SA***, 37, 5 (2011), 751-764.

Remote sensing (including drones) has become an important component of irrigation scheduling. The technology can help to pinpoint areas of wet and dry zones in cultivated fields and estimate crop water requirements. It is also used to model crop evapotranspiration. Standout technologies include the Wetting Front Detector (WFD), for which Dr Richard Stirzaker of Australia won the ICID WatSave Innovative Technology Award in 2003[70]. Very simply put, the WFD shows how deep water infiltrates into the soil after irrigation or rain and when to stop water application.

In 2007, Dr Abraham Singels of the South Agrican Sugar Research Institute (SASRI) was awarded the prize for Innovative Water Management for the MyCanesim system of irrigation scheduling based on crop growth modelling and cell phone communication, for smallholder sugar-cane growers in the KwaZulu-Natal Province, resulting in increased efficiency and lower water use.

Unfortunately, savings in irrigation water is marred by the low uptake of research being conducted, and the general low adoption of irrigation scheduling. A recent study has indicated that only 18% of irrigation farmers in South Africa make use of objective irrigation scheduling methods, while the rest make use of subjective scheduling methods based on intuition, observation, local knowledge, and experience[71]. The expert opinion is that there is a gap in the market for the translation of technical and scientific knowledge into practical know-how that farmers can apply. These processes are further hampered by a lack of data, which is further aggravated by the commercial value of data, which results in the parties that own the data being unwilling to share it for the greater good and broader development and improvement of the farming industry[72].

[70] Research and development for the wetting front detector was mainly done in South Africa.
[71] J. Stevens, Adoption of irrigation.
[72] In conversation with Dup Haarhoff, Head of Agricultural Services at GWK Beperk/Limited.

08

CHAPTER 8

FUTURE IRRIGATION DEVELOPMENT: APPLYING THE WATER-ENERGY-FOOD (WEF) NEXUS AS A CROSS-SECTORAL STRATEGY FOR IRRIGATION DEVELOPMENT IN SOUTH AFRICA

Sylvester Mpandeli, Stanley Liphadzi, Tafadzwanashe Mabhaudhi, Palo Kgasago, Mary Jean Gabriel, Siboniso Mkhaliphi and Luxon Nhamo

South Africa has prioritised agriculture as key to addressing food and nutrition security as well as the poverty-unemployment-inequality nexus. The National Development Plan (NDP) has set a target to increase the country's irrigated area by 45 000 ha by 2030. However, the fundamental question that needs to be addressed before embarking on irrigation expansion is whether there is enough water and energy to service expanded irrigated areas. This chapter applies the water-energy-food (WEF) nexus to guide a holistic irrigation expansion strategy. While the WEF does not focus on the land issue, it is recognised that land reform is a development imperative in South Africa.

South Africa is a water scarce country, with projections indicating an increased physical and/or economic water scarcity by as early as 2030[1]. The current reliable yield of surface water at an acceptable assurance of supply is approximately 10 200 million m^3/year nationally. The combined storage capacity of large dams is in the order of 31 000 million m^3. The total nationally accessible groundwater potential is about 4 500 million m^3/year of which between 2 000 and 3 000 million m^3/year is currently being utilised[2].

[1] F.X. Prins, A. Etale, A.D. Ablo & A. Thatcher, 'Water scarcity and alternative water sources in South Africa: can information provision shift perceptions?', ***Urban Water Journal***, 20, 10 (2022), 1438-1449.
[2] DWS, National Water Resources Strategy III (Pretoria: DWS, 2023).

The changes in water availability regimes will have negative impacts on water, energy, and food production. The intensity and frequency of droughts in the country reaffirm the sensitive issues of food and energy insecurity as well as water scarcity[3]. Further, it is conjectured that the Kalahari Desert is spreading eastward into agriculturally productive lands, threatening livelihoods and resources in southern Africa[4]. The hydrology projections also show a continued drying trend to semi-arid conditions, yielding a 50 000 km^2 expansion of semi-arid conditions[5].

Concomitantly, current projections indicate that an additional 19 to 24 million people will be added to the country's current population by 2050, which will result in increased demand for water, energy, and food[6]. As irrigated agriculture already accounts for about 62% of freshwater withdrawals, increasing the area under irrigation will place additional demand on already strained energy grids and scarce water resources. The only hope for expanding irrigation lies in improving efficiencies in the irrigation sector, which implies 'more crop per drop'.

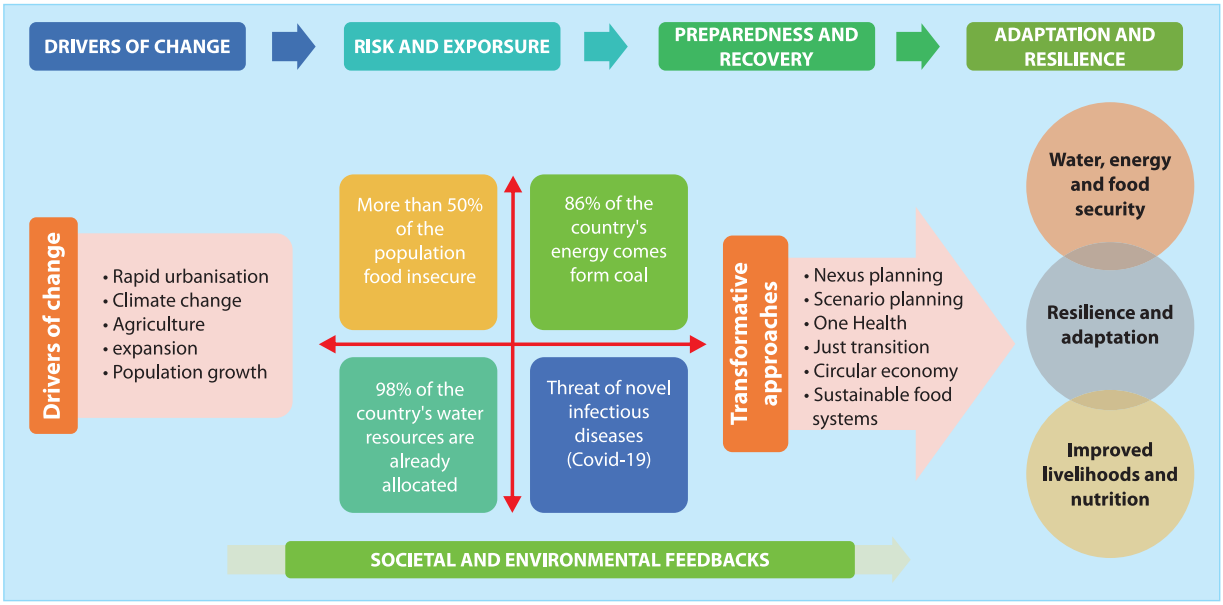
There are also challenges limiting the expansion of irrigation on the agricultural land front. While the potential of farmland being used to create full-time sustainable livelihoods is already limited, with only 17%-20% suitable for field crop, irrigation, and horticultural production, it is gradually declining[7]. This decline and conversion of agricultural to built-up areas can be attributed to an ineffective land use management system[8]. Further to this, South Africa has been struggling with making meaningful strides in land reform since the advent of democratic rule in 1994. The need to expedite land reform in the country has given rise to several radical approaches, including the expropriation of land without compensation discourse, which is causing some uncertainty and instability that may impact the WEF nexus.

The question that needs to be addressed is whether a unilateral and sector-based increase in irrigated area provides solutions to water and food insecurity challenges. While there are benefits from increasing the area under irrigation, including improved agricultural productivity, this should be done through the WEF nexus, a transformative and circular approach that mitigates trade-offs and undesired consequences[9]. Consideration of the WEF nexus in integrated resources planning and management eliminates the possibility of transferring problems from one sector to another, as it is capable of identifying and managing synergies and trade-offs. While it is acknowledged that improving water productivity in irrigated agriculture could reduce water and energy use while increasing yield output, there is a need to decide how such savings would then be reallocated. Any intervention to increase the irrigated area should be undertaken in the context of a WEF nexus analytical framework to guide the decision-making process. Technical planning should evolve around the WEF nexus approach in setting targets, as WEF nexus indicators would reveal the performance and impact of proposed interventions on any of the three WEF nexus components.

[3] G. Matchaya, L. Nhamo, S. Nhlengethwa & C. Nhemachena, 'An overview of water markets in Southern Africa: An option for water management in times of scarcity', ***Water***, 11, 5 (2006), 1006.
[4] P.P Tyson & S.J. Crimp, 'The climate of the Kalahari Transect', ***Transactions of the Royal Society of South Africa***, 53, 2 (1998), 93-112.
[5] M.R. Jury, 'Spreading of the semi-arid climate across South Africa', ***Journal of Water and Climate Chang***e, 12, 8 (2021), 3734-3749.
[6] D. Naidoo, L. Nhamo, S. Mpandeli, N. Sobratee, A. Senzanje, S. Liphadzi, R. Slotow, M. Jacobson, A. Modi & T. Mabhaudi, 'Operationalising the water-energy-food nexus through the theory of change', ***Renewable and Sustainable Energy Reviews***, 149, 11416 (2021), https://doi.org/10.1016/j.rser.2021.111416.
[7] J. Kirsten & W. Sihlobo, 'Land reform in South Africa: Five myths about farming debunked, ***The Conversation***, 26 November 2022, https://theconversation.com/land-reform-in-south-africa-5-myths-about-farming-debunked-195045, last accessed on 9 May 2024.
[8] Z. Lidzhegu, & T. Kabanda, Declining land for subsistence and small-scale farming in South Africa: A case study of Thulamela local Municipality. ***Land Use Policy***, 119 (2022), https://doi.org/10.1016/j.landusepol.2022.106170.
[9] T. Mabhaudi, S. Mpandeli, L. Nhamo, V.G. Chimonyo, C. Nhemachena, A. Senzanje, D. Naidoo & A.T. Modi, 'Prospects for improving irrigated agriculture in southern Africa: Linking water, energy and food, Water, 10, 12 (2018), https://doi.org/10.3390/w10121881.

Apart from using large volumes of freshwater, the agriculture sector also has broad interlinkages with the energy sector[10]. Energy is required to produce food, pump, and distribute water, power tractors and irrigation machinery, and process and transport agricultural goods. While the National Development Plan (NDP) has earmarked to increase the irrigated areas by 45 000 ha by 2030, the framework is silent on the full extent of the linkages between the sector with energy and water[11]. However, current governance frameworks in the country are sector-based as they still follow a linear approach, yet the WEF nexus plays an important role as a platform for stakeholder engagement and harmonisation of strategies[12].

While most of the irrigation potential land in South Africa is already under productive use, many smallholder farmers



The main themes driving the WEF nexus research and the interlinkages between resources in South Africa. The illustration also shows the role of transformative approaches in enhancing adaptation and resilience.

[10] L. Nhamo, B. Ndlela, C. Nhemachema, T. Mabhaudi, S. Mpandeli & G. Matchaya, 'The water-energy-food nexus: Climate risks and opportunities in southern Africa', ***Water***, 10, 5 (2018), https://doi.org/10.3390/w10050567.

[11] National Planning Commission, National Development Plan.

[12] C. Hoolohan, A. Larkin, C Mclachlan, R Falconer, I Soutar, J Suckling, L. Varga, I Haltas, A. Druckman & D Lumbroso, 'Engaging stakeholders in research to address water-energy-food (WEF) nexus challenges', ***Sustainability Science***, 13,5 (2018), 1415-1426.

reside in marginalised lands lacking basic resources[13]. Smallholder farmers generally lack access to water, energy, infrastructure and technical skills to irrigate. Promoting water and energy-efficient irrigation technologies such as drip and sub-surface irrigation could go some way in alleviating the challenge[14]. Another alternative would be to explore rainwater harvesting and soil water conservation techniques, which involve inducing, collecting, storing and conserving runoff water for agriculture.

Within the framework of the UN Sustainable Development Goals (SDGs), the WEF nexus offers significant opportunities for addressing most of the SDGs, especially Goals 2, 6 and 7. However, the realisation of the SDGs has been hindered by the lack of a holistic, harmonised and cross-sectoral governance framework to guide the WEF nexus implementation. Despite increasing interest over the recent past, the WEF nexus largely remains on paper without any meaningful implementation outside research circles. The chapter addresses South Africa's policy landscape that governs the WEF sectors and recommends the pathways for policy convergence.

STATE OF WEF RESOURCES SECURITY IN SOUTH AFRICA IN 2015 AND 2020

A synopsis of the status of the security of WEF resources in South Africa in 2015 and 2020 is indicated in Table 8.1. The data used to assess resource management in the country was obtained from the World Bank Indicators[15]. The data is based on WEF resources security indicators which are also the SDGs indicators. The indicators are then applied in the integrative analytical WEF nexus model[16]. The Analytic Hierarchy Process (AHP) was the multi-criteria- decision method (MCDM) that was used to establish the pairwise comparison matrix PCM), the normalisation of the indices and provide the quantitative relationships between the distinct WEF security indicators.

The process can be applied at any spatio-temporal scale. In this particular case, the comparison between 2015 and 2020 also forms the basis to assess progress towards achieving the SDGs. The essence of the procedure is to simplify human understanding of the complex interrelationships between the WEF sectors, ease interpretation and guide policy decisions on holistic interventions from a cross-sectoral perspective[17].

[13] L. Nhamo, S. Mpandeli, S. Liphadzi, T. Mabhaudhi, 'Securing land and water for food production through sustainable land reform: A nexus planning perspective. ***Land***,11,7 (2022), 974, doi: https://doi.org/10.3390/land11070974

[14] L. Nhamo, S. Mpandeli, S. Liphadzi, S. Hlophe-Ginindza, M. Kapari, J. Molwantwa & T. Mabhaudi, 'Advances in water research: Enhancing sustainable water use in irrigated agriculture in South Africa' in (eds) D.-S. K. Ting & P.G. O'Brien, ***Progress in sustainable development: Sustainable engineering practices*** (Amsterdam: Elsevier, 2023)

[15] World Bank, ***World Bank indicators*** (Washington DC: World Bank, 2024).

[16] L. Nhamo, T. Mabhaudhi, S. Mpandeli, C. Dickens, C. Nhemachena, A. Senzanje, D. Naidoo, S. Liphadzi, A.T. Modi, 'An integrative analytical model for the water-energy-food nexus: South Africa case study', ***Environmental Science and Policy***,109 (2020), 15-24.

[17] D. Naidoo, L. Nhamo, S. Lottering, S. Liphadzi, A.T. Modi, C. Trois & T. Mabhaudi, 'Transitional pathways towards achieving a circular economy in the water, energy and food sectors', ***Sustainability*** 13, 17 (2021), https://doi.org/10.3390/su13179978.

Table 8.1. State of the WEF resources indicators for South Africa in 2015 and 2020

Indicator and short name	Indicator status		
	2015	2020	Units
Proportion of available freshwater resources per capita (**availability**)	821.3	821.4	m^3
Proportion of crops/energy produced per unit of water used (**water productivity**)	26.2	26.2	$/$m^3$
Proportion of population with access to electricity (**accessibility**)	85.5	84.4	%
Energy intensity measured in terms of primary energy and GDP (**productivity**)	8.7	8.7	MJ/GDP
Prevalence of moderate/severe food insecurity in the population (**self-sufficiency**)	5.7	6.2	%
Proportion of sustainable agricultural production per unit area (**cereal productivity**)	3.5	5.6	kg/ha

Source: World Bank Indicators (2024)

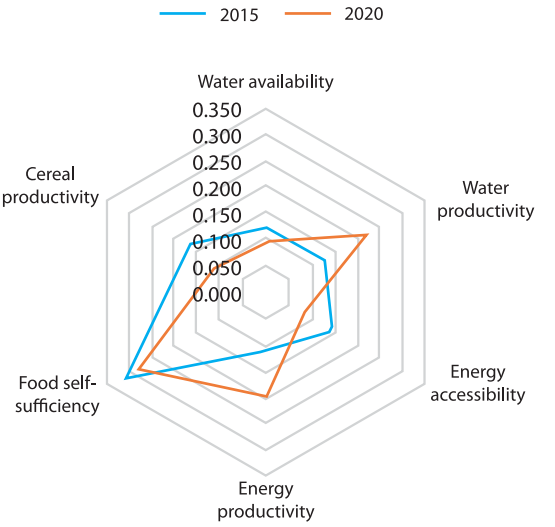
The PCM and the normalisation of indices are repeated for both reference years so as to generate specific composite indices shown in Table 8.2. The composite indices for the indicators represent how each of the indicators is numerically related to the other indicators, however, they are still difficult to interpret. Therefore, this numeric relationship is best conveyed through a spider graph, which clearly illustrates how resources are managed. The WEF nexus integrated index is the weighted average of the composite indices and is only an indicator of the level of a country in resource management.

Table 8.2. WEF resources security composite indices for South Africa in 2015 and 2020

Indicator	Composite indices	
	2015	2020
Water availability	0.126	0.099
Water productivity	0.128	0.221
Energy accessibility	0.141	0.079
Energy productivity	0.111	0.199
Food self-sufficiency	0.314	0.292
Cereal productivity	0.180	0.111
WEF integrated index	0.203	0.155

The spider graph on this page provides a graphical presentation of the relationships between the WEF indicators in 2015 and 2020. This represents the numerical relationships and interlinkages between the WEF resources in South Africa. The centrepieces for both 2015 and 2020 are deformed, an indicator of sector-based and linear management of resources still being pursued in the country. Only when the centrepieces are circular can a country be described as having a balanced economy and well-managed resources. This representation of resource management is critical for providing the pathways towards sustainability. Therefore, the shape of the centrepieces is key to providing an outlook on the state of resource management and the models being pursued, either linear or circular. It also provides an over of the sector-based policies still being pursued.

Thus, the WEF nexus is essential in providing coherent strategies to guide the optimal use of resources and policy formulation. However, for South Africa, the current sector-based and linear approaches being pursued are only good at exacerbating the contemporary challenges that cut across all sectors and are the main reason for the stagnation of the SDGs. The shape of the centrepieces also guides decisions on indicating priority areas for immediate and priority intervention from a cross-sectoral and holistic perspective. The other importance of the spider graph is that it can be used to assess progress towards the SDGs at different period intervals. The SDGs, for example, can be assessed for time intervals of five years (2015, 2020, 2025, and 2030), thus offering the potential for monitoring and evaluation of SDG targets.



Changes in WEF resources indicators between 2015 and 2020 in South Africa. The comparison facilitates periodic assessment of progress towards SDGs. The deformed centrepieces indicate an imbalanced and unsustainable resource management resulting from sector-based policies.

The integrative analytical WEF nexus model is, therefore, a decision support tool (DST) for evaluating the state of resource management at any given time and spatial scale[18]. The integrative analytical WEF nexus model, therefore, provides pathways to (a) enhance a holistic, cross-sectoral, harmonised and sustainable resource use efficiency of the WEF resources, (b) promote equitable and balanced

[18] Nhamo et al, 'An integrative analytical model'.

resource management and distribution and offers pathways towards climate change resilience and adaptation, (c) ensures human and environmental health for people and the planet, and (d) supports unlimited provision of ecosystem services[19]. These characteristics have transformed the WEF nexus into an essential systems approach to achieving the SDGs and supporting climate change adaptation and resilience initiatives. The WEF nexus is, therefore, key to enhancing resource use efficiency, and the production of more with the same or fewer resources[20]. However, besides the current evidence of the importance of the WEF nexus, its implementation has been hindered by the lack of a harmonised and holistic governance framework.

SELECTED WEF SECTORS-RELATED INSTITUTIONS AND POLICIES

The Constitution of South Africa is the overarching document guiding all legislative and policy instruments adopted by the government[21]. The right to water is enshrined in the Constitution and implemented by the work of ordinary statutes as highlighted by the Constitution. The Constitution states that everybody has the right to access sufficient water, food, and energy. It informs the development and implementation of the National Water Act, Energy Act and The White Paper on Agriculture, among others (Table 8.3). National legislative frameworks are also informed by international and regional agreements. While South Africa has good legislative and policy instruments that guide the management of WEF sectors, the country still has a long way to go in integrating these frameworks. Integrating policy frameworks for interlinked sectors is a priority as current challenges cut across all sectors and, therefore, require cross-sectoral interventions and guide the transition from the current linear approach to a circular model. The WEF nexus provides pathways that guide the equitable distribution of resources and achieve sustainable development.

[19] Naidoo et al, 'Operationalising the water-energy-food nexus'.
[20] *Ibid.*
[21] RSA, Constitution of the Republic of South Africa, Act 108 of 1996 (Pretoria: Government Printer, 1996)

Table 8.3. Main policy frameworks governing WEF sectors in South Africa

Water sector	Energy sector	Agriculture (food) sector
• National Water Act 36 of 1998 • National Environmental Management Act 107 of 1998 • The Water Research Act 34 of 1971 • National Water Resource Strategy 3 (2023) • South African National Water Policy Review (2013) • Irrigation Strategy (2015) • Water Allocation Reform (2006), • White Paper on a National Water Policy for South Africa (1997) • Water for Growth and Development Framework	• White paper on energy policy (1998) • White paper on renewable energy (2003) • National Energy Act 34 of 2008 • Integrated Energy Plan (IEP, 2003 and 2005) • Integrated resource plan (IRP, 2011)	• White paper on energy policy (1998) • White paper on renewable energy (2003) • Integrated energy plan (IEP, 2003 and 2005) • Integrated resource plan (IRP, 2011) • Strategic Agriculture Sector Plan

The WEF sector policies in South Africa are still hinged on the different sectors without a clear pathway towards harmonisation, yet there is a strong realisation of the need to transition from the linear model to the circular model. Today's challenges are interlinked, for example, climate change affects all sectors and is the major driver of migration, resource and environmental depletion and degradation, the emergence of novel infectious diseases and migration, among other grand challenges[22]. Yet, focusing on sector challenges only creates over-efficiencies in that sector at the expense of the other equally important sectors. This conundrum requires a rapid transition to transformative and circular approaches that support holistic management of resources, but the missing link has been the absence of a cross-sectoral and harmonised governance framework to support WEF nexus implementation.

REGIONAL INSTITUTIONS AND POLICIES RELATED TO THE WEF NEXUS

Institutions and policies have been put in place in the SADC region to oversee and direct water, energy and agriculture resources at the regional level. However, there is a lack of coordination among the policies and institutions, which

[22] L. Nhamo, S. Mpandeli, S. Liphadzi, & T. Mabhaudhi, ***Circular and Transformative Economy*** (Florida: CRC Press, 2024).

normally results in policy spillovers[23]. There is, therefore, a need to harmonise policies in the region. The SADC Treaty is the overarching framework for the region, whose objective is to achieve economic development, peace and security, and growth; and also, to alleviate poverty and improve the livelihoods of the people, all these achieved through regional integration[24]. To date, the region has ratified the following nexus-related institutions and policies:

- The Regional Strategic Action Plan IV (RSAP IV) is based on the SADC Water Policy and Strategy that aims to achieve an equitable and sustainable utilisation of water for social and environmental justice, regional integration and economic benefit for present and future generations. The RSAP IV emphasises the importance of infrastructure development and water resource management for food security in the WEF nexus, and the stronger urgency to act in the view of climate variability and change[25].

- The SADC protocol on shared watercourses fosters closer cooperation for judicious, sustainable, and coordinated management, protection and utilisation of shared watercourses, and advances SADC's agenda of regional integration and poverty alleviation. As a result, most shared river basins have basin-level agreements in place which oversee the day-to-day management of the basins with assistance from the SADC Water Division. Current shared river basin agreements include the Limpopo Watercourse Commission (LIMCOM), Okavango River Basin Commission (OKAKOM), Orange-Senqu River Commission (ORASECOM) and Zambezi River Basin Commission (ZAMCOM)[26].

- The Southern African Power Pool (SAPP) is a grouping that was established in 1995 and guided by the Protocol on Energy, which highlights the development and updating of a regional electricity master plan, the development, and utilisation of electricity in an environmentally sound manner, and emphasising the need for universal access to affordable and quality services. The mandate of the SAPP is to enhance regional cooperation in power development and trade and to provide non-binding regional master plans to guide electricity generation and transmission infrastructure delivery[27].

- The SADC Regional Agricultural Policy (RAP) envisages integrated approaches to water resources management and emphasises the importance of improving agriculture performance to meet food and water security as well as attain sustainable economic development objectives at the regional level. The RAP oversees the upgrading and expansion of water infrastructure for agriculture, data collection for dams, irrigated areas and irrigation management[28].

- The SADC's Regional Indicative Strategic Development Plan (RISDP) is derived from the Africa-wide Comprehensive Africa Agricultural Development Programme (CAADP) that promotes the doubling of

[23] C.L. Kling, R.W. Arritt, G. Calhoun, D.A. Keiser, 'Integrated assessment models of the food, energy, and water nexus: A review and an outline of research needs', ***Annual Review of Resource Economics***, 9, 1 (2017), 143-163.
[24] SADC, The Consolidated Treaty of the Southern Africa Development Community (SADC) (Gaborone: SADC, 2011).
[25] SADC, Regional Strategic Action Plan on Integrated Water Resources Development and Management (2016–2020) RSAP IV (Gaborone: SADC, 2015).
[26] SADC, Revised Protocol on Shared Watercourses in the SADC (Gaborone: SADC, 2000)
[27] SADC, Protocol on Energy in the SADC (Gaborone: SADC, 1996).
[28] SADC, SADC Regional Agricultural Policy (Gaborone: SADC, 2014).

irrigated areas from 3.5% to 7% by 2025. The CAADP provides a common framework for stimulating and guiding national, regional, and continental initiatives on enhanced agricultural productivity and food security[29].

TOWARDS POLICY CONVERGENCE OF THE WEF SECTORS

The increasing competition for WEF resources has impacted negatively on South Africa's socio-economic security due to the pursuance of a linear model to manage resources instead of transitioning to the circular economy. While it is important to understand the interlinkages between the WEF sectors, it is also important to know the transformative approaches capable of addressing the current interlinked challenges that cut across all sectors. However, the main drawback is the lack of a holistic and harmonised framework and supporting institutions that recognise the interconnectedness of WEF resources. The lack of such a framework is contributing to resource depletion and insecurity as development strategies are duplicated[30]. This has also resulted in failure to achieve the SDGs.

There is, therefore, a need to formulate a harmonised and holistic policy framework to guide the transition to circularity and to timely address synergies and trade-offs across sectors. This is based on the fact that the WEF nexus has capabilities to indicate priority areas for intervention. A holistic governance framework is key to policy convergence and stakeholder engagement as it guides decisions on meeting national and international targets, including the SDGs and NDP goals. Research and development should focus on advancing integrated planning, and policy convergence and demonstrate the benefits to policymakers, highlighting the disadvantages of sector-based policies in resource management. WEF nexus models have recently been developed to monitor and evaluate the WEF resources planning and management[31].

CONCLUSIONS AND RECOMMENDATIONS

This chapter has shown that South Africa's broad policy framework advocates for broader social and economic reforms in which access to water, energy and food security are featured prominently. However, few policies and legislation explicitly recognise the interlinkages between water, energy and food. Consequently, there is duplication of efforts, lack of synergies and convergence between the three sectors which challenges sustainable development. As South Africa adopts the new SDGs and aims to implement NDP Vision 2030, adopting a WEF nexus perspective could help it address (a) the high demand for water by various key sectors, especially agriculture, and energy, (b) high population growth, (c) high priorities for infrastructural development as outlined in the NDP and other key government strategic documents and (d) climate change associated challenges. A nexus approach will foster convergence and enhance the government's capacity to deliver social and economic reforms.

While there is a clear understanding of the roles played by the water, energy, agriculture, and environment sectors,

[30] G. Rasul & N. Neupane, 'Improving policy coordination across the water, energy, and food, sectors in South Asia: a framework', ***Frontiers in Sustainable Food Systems***, 5 (2021), 602475.
[31] Nhamo et al, 'An integrative analytical model'.

existing policies, strategies and plans are still pursuing the sectoral or 'silo' approach. This approach continues to strain relationships between these sectors, creating disharmony and duplication of activities. This results in inefficient use and allocation of limited resources. The WEF nexus provides an excellent platform for building policy convergence and augmenting integrated resource management. In this context, the government needs to champion the nexus mentality as opposed to the current 'silo' mentality. Currently, the lack of policy that recognises the WEF nexus results in conflict, not complementarity.

Since the dawn of democracy several acts, policies, strategies and plans have been developed across water, energy, and agriculture sectors. However, lack of proper coordination; alignment and synergy amongst policies across sectors are the main barriers to policy implementation. The precursor for this coordination is already in place, in the form of the Economic Sectors, Investment, Employment and Infrastructure Development (ESIEID) Cluster of Ministers. Although this cluster is not tasked with policy formulation, it brings departments for water, energy, food and others, under one roof to ensure coordinated policy implementation.

The NDP creates an opportunity for the government to integrate policies, strategies and plans together for government departments to collaborate, manage their resources in efficient and effective ways, and enforce policies and legislation. Government recognition of the water-energy-food nexus in future Acts, policies, strategies and plans is strongly recommended.

09

CHAPTER 9

SANCID – THREE DECADES OF COMMITMENT TO SOUTH AFRICA'S IRRIGATED AGRICULTURE

Felix Reinders, Dawid van der Merwe, Gerhard Backeberg and Sylvester Mpandeli

Established in 1993, the South African National Committee on Irrigation and Drainage (SANCID) is the sole organisation representing South Africa at the International Commission on Irrigation and Drainage. A short history of South Africa's membership to ICID is described here[1].

By 1993, South Africa was a member of three international water-related organisations:

- International Commission on Large Dams (ICOLD, established in 1928)
- International Association on Water Pollution and Research (IAWPRC, 1947), which evolved into the International Water Association in 1999
- International Commission on Irrigation and Drainage (ICID, 1950)

1977 TO 1992

In 1953, ICID invited the Republic of South Africa (RSA) to join its membership. This invitation was addressed to the then Minister of Lands and Irrigation (now the Minister of Water and Sanitation). This initial invitation was not reacted on, and ICID remained below the country's radar until 1977 when Dawid van der Merwe (later Deputy Executive Director of the Water Research Commission (WRC)) spotted an announcement advertising the upcoming 10th ICID Congress on Irrigation and Drainage to be held in Athens, Greece in an American journal.

[1] This account is based on the personal archives of the authors.

The WRC Board, chaired by Dr G.J. Stander and including Dr J.P. Kriel (Director-General of Water Affairs) and Dr P.W. Vorster (retired DG of Agriculture), at its meeting in November 1977 approved Mr van der Merwe's request to attend the Athens Congress. The Department of Water Affairs (DWA, now DWS) also approved the participation of two of its employees.

During the Congress, Mr van der Merwe had an opportunity to discuss the possibility of RSA membership of the ICID with Dr M. Jensen (ICID Vice President). Dr Jensen in his personal capacity fully supported RSA membership, and as Vice President gave valuable advice on the development of a South African application for membership, to be submitted at a meeting of the International Executive Council (IEC) of the ICID.

South Africa took the first step to become a member of ICID in 1980 by initiating an ad hoc committee. Members of the committee with the following objectives:

- To obtain the views of representatives of various organisations on the need for membership of a

The ad hoc committee that led to the establishment of SANCID. Front row, left to right: Dr G.S. Bredell (Department of Agriculture), M.J Erasmus (Department of Water Affairs), D.S. van der Merwe (Water Research Commission) and J. Visser (South African Agricultural Union). Back row, left to right: Dr G.C. Green (Water Research Commission), Dr P.C. Reid (Soil Science Society), Prof M.C Laker (University of Pretoria), F.J.C. Hugo (S.A. Institute of Agricultural Engineers), Dr. J. Piaget (SA Irrigation Institute) and Dr P.W.L. Lyne (University of Natal).

multi-disciplinary international irrigation and drainage forum with a view to promoting international research cooperation and application of research results.

- To discuss the extent to which membership of the ICID and its activities are addressing these needs.
- If the views on the above were acceptable and supported by the ad hoc committee, to obtain the committee's views on:
    - Should membership be for individuals and / or organisations involved in various facets of irrigation
    - The establishment of SANCID, should membership to ICID have been successful
    - To make recommendations on possible sources of funding for the annual fees of ICID membership

Follow in-depth discussions, the ad hoc committee unanimously recommended that an application be sent for South African membership of ICID incorporating the advice and approach recommended by Dr Jensen. The application was to be developed by Mr van der Merwe and submitted under the aegis of the South African Irrigation Institute (SABI). SABI agreed to submit an application to ICID under their banner. Felix Reinders, then Secretary of SABI, was nominated by SABI to assist with the administration of the application.

Further, it was recommended that, once the application had been accepted by ICID, the ad hoc committee was to be replaced by SANCID with a membership of organisations. The latter decision was taken to simplify the administration of SANCID.

In view of their existing involvement in local committees for international organisations, it was proposed that funding for the ICID annual membership fee be sourced from the DWA, the Agricultural Research Council, the Department of Agriculture (DoA) and the WRC. This funding was secured through the active involvement of M.J. Erasmus (DWA), Dr G.S. Bredell (DoA), and Mr van der Merwe.

A draft application for membership of the ICID was prepared by Mr van der Merwe and informally discussed with Dr Jensen (then the President of the ICID) at the 12th ICID Congress at Fort Collins, Colorado, USA, in 1984. In addition to Mr van der Merwe, the congress was attended by Mr Reinders and John Eckard.

Subsequent finalisation of the application and further discussions internally led to the submission of an official South African application for membership of the ICID in 1992 at the commission's 43rd IEC meeting in Budapest, Hungary. This meeting was attended by Mr van der Merwe and Dr J. Piaget, the then President of SABI. The application was approved, and South Africa became Active Member number 41. (The ICID constitution also allows for a further grade of members, i.e. Associate Member, of which there were 60 countries in 2020)

1993-2023

Prior to 1993, SANCID operated as an interim committee which had seven meetings. After being accepted as an Active Member of ICID, SANCID was formally constituted and

Mr van der Merwe was elected as the first Chair of SANCID. At SANCID's first meeting on 29 November 1993, SANCID considered and approved its constitution. Subsequent amendments to the constitution were approved on 6 October 2010. The SANCID constitution is aligned with the ICID constitution, including vision, programme of action, themes etc.

Since the establishment of SANCID, the chair has changed in accordance with the constitution. The chair is elected for three years, with a maximum service period of six years. The election takes place at the annual general meeting (AGM) of SANCID following the annual congress or conference of ICID.

The chairs of SANCID have been as follows:

- 1993-1999 – Dawid van der Merwe
- 1999-2002 – Felix Reinders
- 2002-2008 – Dr Gerhard Backeberg
- 2008-2014 – Felix Reinders
- 2014-2020 – Dr Joe Stevens
- 2020-2023 – Prof Sylvester Mpandeli (re-elected in 2023)

SANCID OBJECTIVES

The objectives of SANCID are to:

- Serve as the South African national committee to ICID, and to further the aims and objectives of ICID in South Africa.
- Act as the liaison body for ICID activities in South Africa
- Be concerned with irrigation, drainage and flood control and to stimulate interest and advance knowledge of developments in these field in South Africa.
- Act as the coordinating centre for individuals, organisations, institutions, or national committees of ICID, and other international organisations sharing common interests in the field of irrigation, drainage and flood control.
- Liaise with local institutions and bodies insofar as the matters referred to above are concerned.
- Promote South African and African participation in the activities of ICID, including participation in the activities of other bodies established or to be established by ICID.
- Actively contribute to the stimulation and promotion of research and the development of technologies in the fields of irrigation, drainage and flood control in South Africa.
- Initiate and organise specialised and regional ICID conferences on subject matter related to irrigation, drainage and flood control, either independently or in association with other organisations.
- Encourage the submission of papers for presentation at the ICID congresses, conferences, symposia and workshops.
- Keep members informed on international activities in the fields of irrigation, drainage and flood control.
- Exchange technical information with ICID and its member countries on irrigation, drainage and flood control.

SANCID MEMBERSHIP

The membership of SANCID is as widely representative as practical of government, quasi-government, and private organisations as well as learned societies involved in various facets of irrigation, drainage and flood control. The following organisations are considered the 'founding' members of SANCID:

- Agricultural Research Council
- Department of Agriculture (now the Department of Agriculture, Land Reform and Rural Development)
- Department of Water Affairs and Forestry (now the DWS)
- WRC
- SABI is considered an 'Honorary Founding Member' of SANCID

The first three organisations pay the annual ICID membership fee, while the WRC pays subsistence and travel expenditures for SANCID members and invited individuals to attend local meetings, specifically the AGM, the ordinary meeting and the SANCID Lecture.

Other members are:

- Agri South Africa
- Agricultural Economics Association of South Africa
- Committee of University Principals
- Committee of Agricultural College Principals
- Grassland Society of South Africa
- International Water Management Institute (South African Office)
- Land Bank
- MBB Consulting Engineers
- African Farmers' Association of South Africa
- Soil Science Society of South Africa
- South African Association of Water User Associations
- South African Institute of Agricultural Engineers
- Southern African Regional Irrigation Association
- South African Society for Agricultural Extension
- South African Society for Crop Production
- South African Society of Horticultural Science
- South African Sugar Research Institute
- South African Society of Enology and Viticulture

PARTICIPATION IN ICID ACTIVITIES

South Africa has been an active participant in ICID activities since it joined 30 years ago. From 1993 to 2023 up to 15 members of SANCID attend every meeting of the commission. SANCID members are encouraged to participate in the annual congresses or regional conferences; to submit papers to these international events and, when selected, present these papers; submit papers or articles to the ICID journal; and participate and make inputs on behalf of South Africa in ICID working group and work bodies. SANCID members have also been nominated to serve on working groups in occasion.

This record of attendance has not been without its challenges. During 2008 the annual congress of ICID was held in Lahore,

Pakistan. Due to security concerns the Embassy of South Africa discouraged members of SANCID from travelling to Pakistan. Felix Reinders decided to attend and ended up being one of only 36 international delegates attending the congress. SANCID members have also served as Chairs, Vice-chairs and members of working groups.

In accordance with the ICID constitution and bylaws, elections for the post of President of ICID is held every congress year. Felix Reinders served as President of ICID between 2017 and 2020 and was the first South African to be elected to this position. Several South Africans have, however, been elected to Vice President posts over the years, namely Dawid van der Merwe (1997 to 2000), Felix Reinders (2005 to 2008), Dr Gerhard Backeberg (2011 TO 2014) and Prof Sylvester Mpandeli (2022 to 2025).

SANCID has also had several members serving as chairs of working groups, namely Dr Gerhard Backeberg (Task Force on Financing Water for Agriculture), Felix Reinders (Working Group on On-Farm Irrigation Systems and Permanent Committee for Technical Activities), Dr Andrew Sanewe (Working Group on Water and Crops), Prof Sylvester Mpandeli (African Regional Working Group) and Mrs Mary Jean Gabriel (Working Group on Irrigation Development and Management).

The SANCID delegation that attend the 15th ICID congress in the Hague, Netherlands, in 1993.

Dawid van der Merwe (on the left) receiving a plaque in 2000 to commemorate his term as Vice President of ICID.

The delegation of SANCID members that attended the 57th ICID IEC meeting in Kuala Lumpur, Malaysia, in 2006.

The delegation of SANCID members attending the 58th ICID IEC meeting in Sacramento, USA.

Felix Reinders, the first SANCID member, and the first South African, to be elected as President of ICID in 2017.

Prof Sylvester Mpandeli (on the left) was appointed Vice President of ICID in 2022.

The SANCID delegation attending the 70th ICID IEC meeting in Indonesia, in 2019.

LOCAL ICID, SANCID SYMPOSIA AND REGIONAL COOPERATION

In addition to the international events, members of SANCID have also been encouraged to participate in annual congresses or regional congresses of ICID.

During the IEC meeting held in 2006 in Kuala Lumpur, Malaysia, approval was obtained for SANCID to present the Second African Regional Conference of ICID in 2007 in Johannesburg. About 17 countries were represented by the 120 registered delegates that attended. The theme of the conference was 'Contribution of rainfed and irrigated agriculture to poverty alleviation through increased productivity in Africa.'

Another event, the 6th International Micro Irrigation Congress (MIC), was held in Cape Town in October 2000. To promote the congress, Mr van der Merwe, Mr Reinders and Mr van Niekerk attended the 5th MIC in Orlando, Florida from 2-5 April 1995. On return to South Africa, SANCID started to prepare an application to host the 51st IEC in South Africa as well. The application, dated 24 May 1996, was sent to ICID and the request was tabled to the IEC in Cairo, Egypt, on 19 September 1996. The request was to host the 51st IEC in South Africa in combination with the 6th MIC. Mr Reinders was appointed by SANCID to chair the organising committee of the 6th MIC. The conference had the theme 'Micro-irrigation for developing agriculture'. ICID agreed to combine this event with the 51st IEC and 316 delegates attended the congress in Cape Town.

SANCID EVENTS

In addition to the AGM and the ordinary meeting (OM) of SANCID, the committee also hosts the SANCID Symposium and the SANCID Lecture. The SANCID symposium is held every two years to allow members to attend the SABI congress in alternate years. Further, SANCID symposia are organised alternately in a coastal province and an inland province.

Different SANCID members are involved in the organising committee of each symposium to enable some continuity. Part of this activity is to organise a technical tour to places of interest for individual members. In addition, emphasis is placed on inviting local non-SANCID members as participants in the symposium. Although the management committee of SANCID appoints the symposium organising committee, it is the responsibility of the organising committee to formulate the theme with sub-themes, organise the technical tour and send invitations to present papers or posters as well as to attend the SANCID Symposium. This is an opportunity for multi-disciplinary interactions and discussions. The last SANCID Symposium, which took place at the time of writing, was held in Tzaneen with the theme 'Research and innovation towards meeting new challenges and a thriving irrigation sector'.

Within the SANCID initiative, the Southern African Regional Irrigation Association (SARIA) was launched in October 2000. The organisation comprises members from different SADC countries. SARIA's vision is to strengthen research,

communication, training and development of appropriate science and technologies in irrigation and drainage for gender balanced poverty eradication and economic development.

ICID REWARDS RECEIVED BY SANCID

WatSave Awards

ICID has instituted four categories of awards to recognise outstanding contributions in water conservation or water saving in agriculture, namely:

- Technology Award
- Innovative Water Management Award
- Young Professional Award
- Farmer Award

Several SANCID members as well as the organisation itself have won ICID awards:

- In 2003, Dr Richard Stirzaker won the WatSave Innovative Technology Award for the wetting front detector. Research and development of the wetting front detector was done mainly in South Africa. The wetting front detector assists farmers to reduce under or over-irrigation, thereby saving water.
- Dr Nico Benadé received the WatSave Innovative Technology Award in 2006 for his innovative research and practical implementation of the computerised Water Administration System (WAS). WAS is implemented on all the main irrigation schemes in South Africa, resulting in substantial water savings.
- Dr Abraham Singels received the WatSave Innovative Water Management Award in 2007 for the MyCanesim system, which aids especially smallholder sugarcane growers in KwaZulu-Natal to more accurately schedule irrigation.
- Further in 2007 Dr Gerhard Backeberg won the Best Paper Award for his article entitled 'Reform of user chargers, market pricing and management of water: Problem or opportunities for irrigated agriculture'.
- In 2010, Kobus Harbron received the WatSave Innovative Water Management Award for the application of the WAS at Vaalharts Irrigation Scheme, South Africa's largest irrigation scheme.
- In 2011, Pieter van Heerden and Charles Crosby received the WatSave Innovative Technology Award for their work on the SAPWAT3 irrigation water planning tool. This easy-to-use tool is used to estimate water requirements and enable the supply of the right amount of water at the right time. It is being used by more than 300 users in 13 countries.
- Also in 2011, SANCID won the fourth Best Performing National Committee Award. The award, accepted on behalf of SANCID by Felix Reinders at the 52nd meeting of the ICID in Tehran Iran, was first instituted in 2001.
- In 2014, the Best Performing Work Body Award was presented to Felix Reinders as the Chair of the Working Group on On-Farm based on the work undertaken by the working group over the preceding years.

The International Research Programme for Irrigation and Drainage (IRPID) was awarded to SANCID in 2023. At the time of writing there were only three such programmes within ICID. The WRC and SANCID are coordinating the IRPID programme and the first workshop was held in Pretoria where a ten-year programme of action was developed.

Among others, the programme encourages the study and research of engineering aspects of irrigation and drainage related issues such as reservoirs, canals, drains and other related infrastructure for storage, conveyance, distribution, collection and disposal of water; as well as the conducting of research on stakeholders' participation in irrigation and drainage and management; while investigating appropriate legislative requirements in different aspects of irrigation and drainage, among others.

Felix Reinders (left) receiving the award for best national committee (2008-2011) in Iran from ICID President, Chandra Madramootoo.

WatSave Award winner Dr Nico Benadé and Dr Gerhard Backeberg, past chair of SANCID and vice-president honoraire of ICID.

Dr Abraham Singels (right) receives the WatSave award from ICID President Peter Lee.

ANNEXURE

SANCID CHAIRPERSONS AND MANAGEMENT COMMITTEES

1993-1999
- Chairperson: D.S. van der Merwe
- Vice-chairpersons: F.J.C. Hugo and F.B. Reinders
- Treasurers: Dr G. Green and Dr G.R. Backeberg
- Secretary: H.M. du Plessis
- Additional member (elected members): Dr D.J. Beukes and Dr J.G. Annandale

1999-2002
- Chairperson: F.B. Reinders
- Vice-chairperson: Dr G.R. Backeberg
- Treasurer: A.A. Louw
- Secretary: C.M. Stimie
- Additional member (immediate past chairperson): D.S. van der Merwe

2002-2008
- Chairperson: Dr G.R. Backeberg
- Vice-chairpersons: Dr S.S. Mkhize and F.B. Reinders
- Treasurers: Dr H. Sally and Dr A.J. Sanewe
- Secretaries: Ms I. van der Stoep and Dr N.J. Taylor
- Additional member (immediate past chairperson): F.B. Reinders

2008-2014
- Chairperson: Mr F.B. Reinders
- Vice-chairperson: Dr J.B. Stevens
- Treasurers: Dr A.J. Sanewe and Ms I. van der Stoep
- Secretary: Dr N.J. Taylor
- Additional member (immediate past chairperson): Dr G.R. Backeberg

2014-2020
- Chairperson: Dr J.B. Stevens
- Vice-chairperson: Prof S. Mpandeli
- Treasurer: Dr M. van der Laan
- Secretary: Ms P. Mofokeng
- Additional member (immediate past chairperson): F.B. Reinders

2020-2023
- Chairperson: Prof S. Mpandeli
- Vice-chairperson: Ms P. Kgasago
- Treasurer: Dr M. van der Laan
- Secretary: L. Motsoko
- Additional member (immediate past chairperson): Dr J.B. Stevens

ATTENDANCE OF ICID IEC MEETINGS

SANCID participates every year in the ICID meetings:
- 1993 44th IEC, 15th Congress, Hague, The Netherlands
- 1994 45th IEC, Varna, Bulgaria
- 1995 46th IEC, Rome, Italy
- 1996 47th IEC, 16th Congress, Cairo, Egypt
- 1997 48th IEC, Oxford, Great Britain
- 1998 49th IEC, Sanur-Bali, Indonesia
- 1999 50th IEC, 17th Congress, Granada, Spain
- 2000 51st IEC, 6th Int Micro-Irrigation Congress, Cape Town, South Africa
- 2001 52nd IEC, Seoul, South Korea
- 2002 53rd IEC, 18th Congress, Montreal, Canada
- 2003 54th IEC, Montpellier, France
- 2004 55th IEC, Moscow, Russia
- 2005 56th IEC, 19th Congress, Beijing, China
- 2006 57th IEC, Kuala Lumpur, Malaysia
- 2007 58th IEC, Sacramento, USA
- 2008 59th IEC, 20th Congress, Lahore, Pakistan
- 2009 60th IEC, New Delhi, India
- 2010 61st IEC, Yogyakarta, Indonesia
- 2011 62nd IEC, 21st Congress, Tehran, Iran
- 2012 63rd IEC, Adelaide, Australia
- 2013 64th IEC, 1st World Irrigation Forum, Mardin, Turkey
- 2014 65th IEC, 22nd Congress, Gwangju, South Korea
- 2015 66th IEC, Montpellier, France
- 2016 67th IEC, 2nd World Irrigation Forum, Chiang Mai, Thailand
- 2017 68th IEC, 23rd Congress, Mexico City, Mexico
- 2018 69th IEC, Saskatoon, Canada
- 2019 70th IEC, 3rd World Irrigation Forum, Bali, Indonesia
- 2020 71st IEC, Virtual meeting, New Delhi, India
- 2021 72nd IEC, Marrakech, Morocco
- 2022 73rd IEC, 24th Congress, Adelaide, Australia
- 2023 74th IEC, 25th Congress, Visakhapatnam, Andhra Pradesh, India

PAPERS PRESENTED BY SANCID MEMBERS DURING WORKSHOPS AND SPECIAL SESSIONS OF ICID

20th International Congress and 59th IEC meeting of ICID, Lahore, Pakistan, 13-18 October 2008

Title	Author(s)
Lessons learnt from an integrated technology – exchange project of five water-related decision support models by the commercial irrigation sector in South Africa	A. Pott, J. Annandale, N. Benadé, B. Grové, P. van Heerden and G. Backeberg
Conditions for upscaled adoption of pressurised irrigation methods: Lessons from Indian case studies	M. Lygkonis, S.A. Kulkarni, F.B. Reinders & B. Schultz
Coal-mine water irrigation. Is it sustainable?	J.G. Annandale, Y.G. Beletse, K.L. Bristow
Impact of global changes on irrigation development and future trends in irrigation practice for South Africa	F.B. Reinders

60th IEC and 5th Asian regional conference of ICID, New Delhi, India, 6 – 11 December 2009

Title	Author(s)
Institutional reform and modernisation of irrigation systems in South Africa	G.R. Backeberg & F.B. Reinders
Applying modern technology to solve water-supply problems at Ebenhaeser in the Western Cape Province of South Africa	A. Roux
Micro-irrigation: World overview	F.B. Reinders

61st IEC and 6th Asian regional conference of ICID, Yogyakarta, Indonesia, 10-16 October 2010

Title	Author(s)
Vegetables irrigated with stored rainwater for household food security	S. Walker
Towards productive water use and household food security in South Africa	G.R. Backeberg & A.J. Sanewe

21st international congress and 62nd IEC meeting of ICID, Tehran, Iran, 15-23 October 2011

Title	Author(s)
Increasing water productivity towards food security through rainwater harvesting and conservation	J. Botha
Planning and monitoring of South African irrigation schemes	P. Nell
Improved efficiency of irrigation water use: A South African framework	F. Reinders, G. Backeberg, I. van der Stoep
Farming system impacts on water use productivity	N. Lecler, P. Tweddle
Adaptation to climate variability in SADC farming systems	S. Walker
Drip and filtration equipment's performance	F. Reinders

25th international congress and 78th IEC meeting of ICID, Vizag, Andrha, India, 1-7 November 2023

Title	Author(s)
Traditional pathways towards sustainable food systems through nexus planning	L. Nhamo & S. Mpandeli
Enhancing climate change resilience and adaptation through integrated nexus approaches	L. Nhamo, S. Mpandeli & T. Mabhaudi
Advance in water research: Enhance sustainable water use in irrigated agriculture in South Africa	L. Nhamo, S. Mpandeli, T. Mabhaudi, T. Dirwai & S. Hlophe-Ginindzha

PAPERS PUBLISHED IN THE ICID JOURNAL, *IRRIGATION AND DRAINAGE*

- G.R. Backeberg, 'Reform of user chargers, market pricing and management of water: Problem or opportunity for irrigated agriculture', ***Irrigation and Drainage***, 55, 1 (2006), 1-12.
- G.R. Backeberg, 'The research and development strategy for water use in agriculture – responding to diverse needs of farmers in South Africa', ***Irrigation and Drainage***, 55, 3 (2006), 281-290.
- B. van Koppen, S. Smits & M. Molchanov, 'Homestead'- and community-scale multiple-use water services: Unlocking new investment opportunities to achieve the Millennium Development Goals', ***Irrigation and Drainage***, 58, 51 (2009), 73-86.
- R.J. Stirzaker, J.B. Stevens, J.G. Annandale & J.M. Steyn, 'Stages in the adoption of a wetting front detector', ***Irrigation and Drainage***, 59, 4 (2010), 367-376.
- S. Speelman, A. Frija, S. Perret, M. D'Haese, .S Farolfi & L. D'Haese, 'Variability in smallholders' irrigation water values: Study in North West Province, South Africa', ***Irrigation and Drainage***, 60, 1 (2011), 11-19.
- F.B. Reinders, I. van der Stoep, G.R. Backeberg, 'Improved efficiency of irrigation water use: A South African framework', ***Irrigation and Drainage***, 62,3 (2013), 262-272.
- F.B. Reinders & A.S. van Niekerk, 'Technology smart approach to keep drip irrigation systems functional', ***Irrigation and Drainage***, 67, 1 (2018), 82-88
- F.B. Reinders, 'New products and emerging irrigation technologies in light of the ICID vision 2030', ***Irrigation and Drainage***, 69, 3 (2020), 294-298.

SANCID REPRESENTATIVES IN ICID WORKING GROUPS

SANCID member	ICID working group
D.S. van der Merwe	Permanent Committee for Technical Activities
Prof J.M. de Jager	ICID Journal Editorial Board
F.B. Reinders	Working Group on On-farm Irrigation Systems
M. du Plessis	Working Group on Use of Poor Quality Water for Irrigation
Prof L.K. Oosthuizen	Working Group on Integrated Land and Water Resources Management
Prof J.G. Annandale	Working Group on Research and Development
Prof J.G. Annandale	Working Group on Technology and Research Uptake and Exchange
Dr G.R. Backeberg	Working Group on Irrigated Agriculture under Drought and Water Scarcity
Dr G.R. Backeberg	Task Force on Financing Water for Agriculture
Dr H. Booysen	Working Group on Comprehensive Approaches to Flood Management

SANCID member	ICID working group
Dr Y. Beletse	Working Group on Young Irrigation Professionals Forum
Dr N. Benadé	Working Group on Water Saving for Agriculture
Dr Y. Beletse	Working Group on Young Irrigation Professionals Forum
Prof J.M. de Jager	Working Group on Sustainable Use of Natural Resources for Crop Production
H.M. du Plessis	Working Group on Use of Poor-Quality Water for Irrigation
Dr B. Grové	Working Group on Young Professionals Forum
Ms M.J. Gabriel	Working Group on the Role of Irrigation in Poverty Alleviation and Livelihood
Ms M.J. Gabriel	Working Group on Irrigation Development and Management
Dr E. Hoffman	Working Group on Capacity Building, Training and Education
Dr N.L. Lecler	Working Group on Water Saving for Agriculture
P.J. Maritz	Working Group on Environmental Impacts on Irrigation, Drainage and Flood Control
Dr S.S. Mkhize	African Regional Working Group
Prof S. Mpandeli	African Regional Working Group
Prof S. Mpandeli	Working Group on Water-Energy-Food nexus
Prof S.R. Perret	Working Group on Water-Energy-Food nexus
A.S. Roux	Working Group on Modernisation of Irrigation Services
F.B. Reinders	Working Group on On-Farm Irrigation Systems
F.B. Reinders	Permanent Committee for Technical Activities
F.B. Reinders	Task Force to Guide ICID inputs to World Water Forum
F.B. Reinders	Working Group on Conferences
Dr J.B. Stevens	Working Group on Capacity Building, Training and Education
Dr A. Sanewe	African Regional Working Group
Dr A. Sanewe	Working Group on Water and Crops
Prof R.E. Schultze	Working Group on Climate Change
Prof M.F. Viljoen	Working Group on Comprehensive Approaches to Flood Management
Prof M.F. Viljoen	ICID Journal Editorial Board
A.T. van Coller	Working Group on Drainage
Dr M. van der Laan	Working Group on Environment
Dr L. van Rensburg	Working Group on Use of Poor Quality Water for Irrigation
Dr L. van Rensburg	ICID Journal Editorial Board
Prof S. Walker	Working Group on Global Climate Change and Agricultural Water Management

SANCID SYMPOSIA

- 2004 – Symposium held at the Fish River Sun, in the Eastern Cape, with the theme 'Integrated water resource management: Challenges for irrigated agriculture'.
- 2006 – Symposium held at the Aventura Swadini Resort, Mpumalanga, with the theme 'The changing face of irrigation in South Africa'.
- 2008 – Symposium held at Club Mykonos, Langebaan Lagoon, in the Western Cape, with the theme 'Agricultural water management for sustainable livelihoods'.
- 2010 – Symposium held at Desert Palace Hotel in Upington. The theme was 'Efficient water use for food production'.
- 2012 – Symposium held at the Alpine Heath Resort in the Drakensberg with the theme 'Irrigation in a changing environment.'
- 2014 – Symposium held Glenburn Lodge, Muldersdrift, with the theme 'Water, food and energy for the 21st century.'
- 2016 – Symposium held at Goudini Spa, Worcester with the theme 'Sustainable irrigation water management for food production: Vision 2030'.
- 2018 – Symposium held at Ingwenyama Conference & Sports Resort White River, Mpumalanga, with the theme 'Opportunities to manage climate change'.
- 2023 – Symposium held at Tzaneen, Limpopo, with the theme 'Research and innovation towards meeting new challenges and a thriving irrigation sector'.

NOTATIONS

1 inch = 25.4 mm

1 mile = 1.609 km

1 acre = 0.4047 ha

1 morgen = 0.8567 ha

1 hectare = 10 000 m^2

1 acre foot = 1.233 L

WATER
RESEARCH
COMMISSION