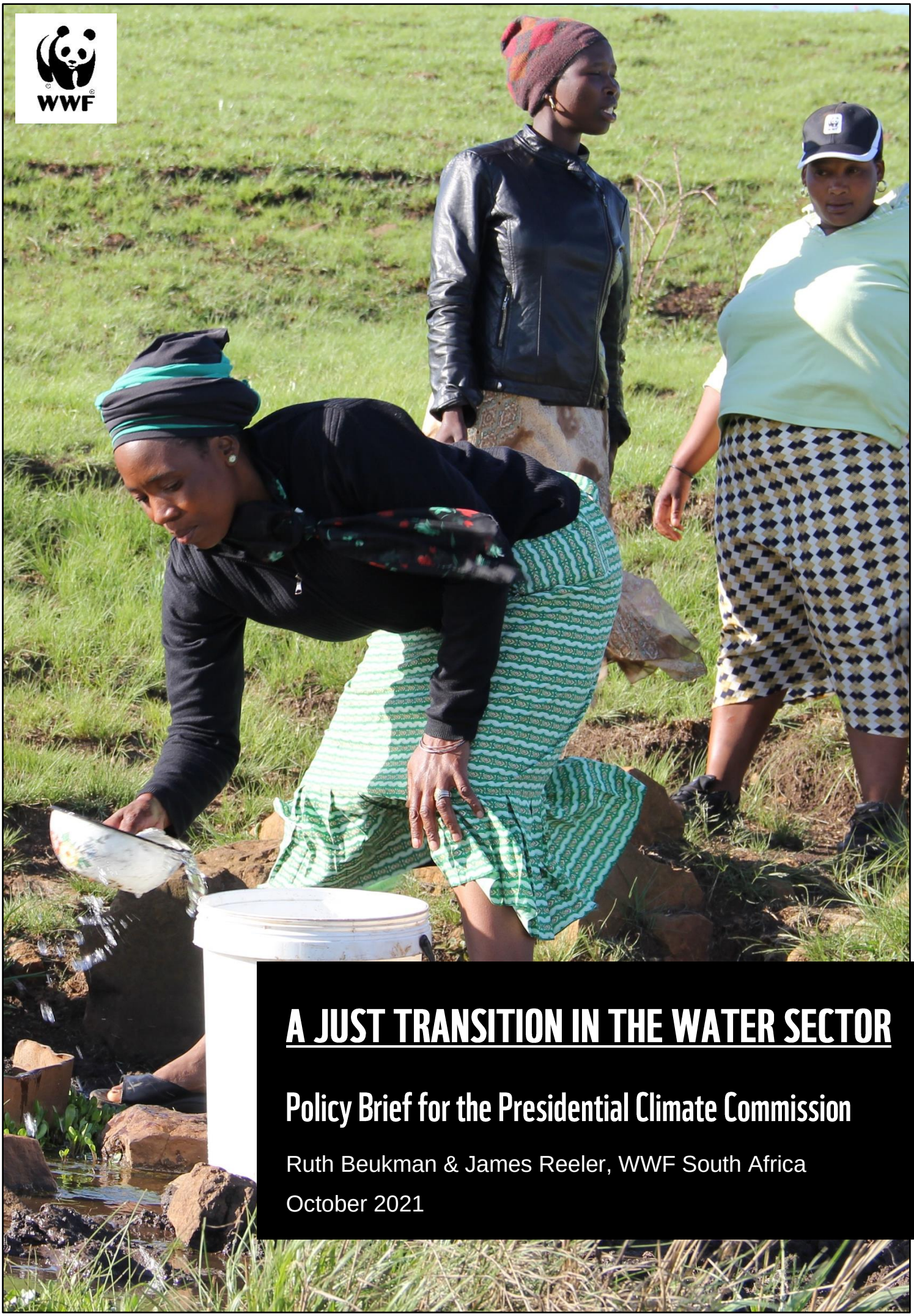

A JUST TRANSITION IN THE WATER SECTOR

Policy Brief for the Presidential Climate Commission

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This policy brief has been commissioned by South Africa's Presidential Climate Commission (PCC) as an input to the process of planning for a just transition. Specifically, this policy brief forms part of a series of briefs that will provide an evidence-based foundation for a new "Framework for a Just Transition"—a practical guide to ensure that South Africa's transition to a low-emissions economy is well-managed, just, and equitable. The Framework will also build on existing just transition debates in the country, the vision set out by the National Planning Commission, and a new series of thematic and social-partner consultations that will gather a diverse range of views on what it means to achieve a just transition.

The views expressed in this policy brief represent those of its authors, and do not necessarily reflect the views of the PCC or its Commissioners.

About the Presidential Climate Commission:

The PCC is a multi-stakeholder body established by the President of the Republic of South Africa to advise on the country's climate change response and pathways to a low-carbon climate-resilient economy and society. In building this society, we need to ensure decent work for all, social inclusion, and the eradication of poverty. We also need to protect those most vulnerable to climate change, including women, children, people with disabilities, the poor and the unemployed, and protect workers' jobs and livelihoods. The PCC facilitates dialogue between social partners on these issues—and in particular, defining the type of society we want to achieve, and detailed pathways for how to get there.

1. INTRODUCTION & CONTEXT

This policy brief has been requested by South Africa's Presidential Climate Commission (PCC) as an input to the process of planning for a just transition. Specifically, this brief, *Just Transition in the Water Sector* forms part of a series that will inform the development of a new "Framework for a Just Transition", which will be developed by the PCC.

The overall framing of this brief is aligned with the PCC's recently developed amalgamated vision (Box 1) of a Just Transition (building on the National Planning Commission's 2020) vision.

In addition, the NPC social partner dialogues on Pathways for a Just Transition concluded with delegates emphasizing the importance of just management of the **energy-water-land use nexus in South Africa's economic and social future**.

This brief on a Just Transition in the Water Sector aims to take this discussion one step further.

> "Through putting people, especially those living in poverty and the vulnerable at the forefront, South Africa will have completed a just transition to a net-zero CO2 economy and society by 2050. In a just transition, we emphasise urgent action on climate change and social justice. We have built the resilience of our economy and our people through affordable, decentralised, diversely owned renewable energy systems; conservation of our natural resources; equitable access to our water resources and sustainable, equitable and inclusive land use for all, especially for the most vulnerable, including women. The high value we place on healthy ecosystems, land, water, and air, underpins our future, and ensures a better and healthier life for all who live in South Africa, and contributes to the creation goals of decent work for all, social inclusion, and the eradication of poverty.

Box 1: PCC Vision for a Just Transition in South Africa (Patel, 2021)

1.1 The series of PCC Dialogues on a Just Transition

The introduction starts with setting the context of the water dialogue in relation to the other five PCC dialogues.

The PCC dialogue on Water Security is the 5th in a series of six. It is worth mentioning the other thematic dialogues to demonstrate the centrality and relevance of this brief due to the cross-cutting nature of water. The first dialogue set the scene, introduced the series and focused on *Policy Primers for a South African Just Transition (JT) framework,* which unpacked the meaning of a JT and the tools to foster it in the country context.

The second dialogue focused on *The Just Transition in Coal* and examined the nature of the transition and the associated costs and benefits for different stakeholders; the nature of governance systems; and key debates arising around the way forward in the coal value chain.

The coal discussion raised several significant issues for 'water and the JT' since coal is not only highly dependent on large volumes of water but also has significant negative impacts on the water resource (quality), people's health, agriculture, ecosystems and the environment more broadly. Water for power

generation is also under-valued (LAC 2018). Cheaper prices tend to encourage over-use as there is no incentive to be more water efficient. Valuing water more accurately would influence our energy choices and associated water allocation of a scarce resource. Costs to treat mine water are also considerable and in terms of equity – LAC (2018) states that "Coal power disproportionately affects marginalised communities located around coal mines and power stations". It has also been said that "*A decarbonised future not only has far lower water consumption, but also costs less and creates more jobs in the energy sector by 2050" (CSIR, 2017 cited by LAC, 2018).*

This last statement provides an easy segue into the third dialogue, which addressed ''Employment and Livelihoods'' considering the JT approaches in the face of equality. The brief highlighted not only the issue of future risk of losing jobs through a JT but the need to consider the currently unemployed vulnerable groups: "*climate change impacts affect everyone but resilience depends on resources"*. In considering a JT in the water sector the jobs and livelihoods discussion is critical. UN-Water (WWDR, 2016) points out that *"Unsustainable management of water and other natural resources can cause severe damages to economies and to society, thus reversing many poverty reduction, job creation and hard-won development gains"*. The report demonstrates further that focusing on the economic sectors that are most relevant for *environmental sustainability and job creation* will prove to be the ultimate key to success. Reaching these targets involves coherence and shared vision, notably between water, energy, food and environment policies, in order to ensure that incentives are aligned for the benefit of all stakeholders.

The fourth dialogue dedicated to Financing a Just Transition, to explore how climate finance strategy can enable a Just Transition. In the water context, increasing access and the capacity to secure and utilise climate finance as well as JT funding - for adaptation and climate resilience building initiatives is important. Water financing and investments in water directly facilitate adaptation to climate change. There is a strong focus on the need for a spectrum of investments in this water security brief.

The fifth dialogue in this series focuses on Governance for a Just Transition. There are many governance aspects that a JT in the water sector will need to address. Given the cross-cutting nature of water – inclusive governance systems and institutions to address multi-level, multi-sectoral and multiple spatial scales governance that will need to be strengthened.

1.2 Purpose of Brief & Structure

The purpose of this brief is to primarily to catalyse discussion in answering the question: ***What does a Just Transition mean for the water sector, and how should EQUITY, ACCESS, ECOLOGICAL and FOOD SECURITY be reconciled with increasingly constrained water resources?***

The brief considers the complex water interlinkages throughout the food/water/land nexus to highlight the critical adaptation elements of the JT. This broad nexus approach is essential given the interconnectedness of water within the landscape and economy, and ultimately many adaptation decisions will be predicated on careful husbandry, prioritization, and allocation of these limited resources. The brief therefore highlights the current South African water security situation considering regional connections as well as in terms of likely impacts of climate change. Given that neither water resources nor climate change are limited by human political boundaries, these regional and continental water and climate priority frameworks are very pertinent.

We are also reminded that South Africa is part of and signatory to various global processes and is committed to the global water, climate and development agendas.

Following the introduction, this brief explains why water is important in tackling climate change, highlighting that shifts in water regimes are central to the impacts in South Africa. In addition to increased temperatures, climate change-induced variance in the rainfall characteristics of the region is likely to be a destabilizing stressor to national water resources. This will likely compound South Africa's already dire triple challenge inequality, poverty and unemployment as well as a growing population's increased demands on water resources.

- Over 3 million people still do not have access to a basic water supply service, and **14.1** million people do not have access to safe sanitation.
- Only **64%** of households have access to a reliable water supply service.
- **56%** of wastewater treatment works and **44%** of water treatment works are in a poor or critical condition. **11%** are dysfunctional.
- More than **50%** of South Africa's wetlands have been lost, and of those that remain, **33%** are in poor ecological condition.
- Only **5%** of agricultural water is used by black farmers
- **41%** of municipal water does not generate revenue. **35%** is lost through leakage.
- Municipalities are losing about 1660 million m^3 per year through non-revenue water. At a cost of R6/m^3, this amounts to **R9.9 billion** each year.
- **R33** million more is needed each year for the next 10 years to achieve water security.
- **98%** of South Africa's rainfall is allocated each year with a high assurance of supply

Box 2: South African Water challenges in numbers (extract from NW&SMP, DWS 2018)

Water is critical for adaptation to climate change and because it is cross-cutting, we need to also understand the impacts, risks and potential solutions well beyond the water sector. Consideration of other key sectors such as agriculture, energy, industry, health, forestry, human settlements and biodiversity, is critical. This brief highlights key sectors and the water sector inter-dependencies and promotes essential holistic, integrated and cross sectoral approaches to tackle the climate change challenges.

The third section of the brief highlights key principles and concepts for consideration that are relevant to a just transition in the water sector, building on some of the outcomes of the NPC dialogues and subsequent PCC processes.

The fourth section therefore makes a case for urgent and necessary actions to ensure we seize the implementation opportunities that arise from these challenges.

1.3 Snapshot of South African water situation

Box 2 illustrates the current situation with respect to water and sanitation, illustrating South Africa's development challenges that must be addressed with or without a focus on a just transition.

The NPC's National Water Security Framework (NWSF) (Nepfumbada & Seetal,2020) highlights that South Africa is water insecure and that the country's water crisis can be attributed to insufficient water infrastructure maintenance and investment, recurrent droughts driven by climatic variability and change, inequities in access to water and sanitation, deteriorating water quality, deteriorating condition of water-related ecological infrastructure, including Strategic Water Source Areas (SWSAs), as well as lack of skilled and competent professionals to address these water challenges.

South Africa is still striving to overcome the inequity of the apartheid legacy. Pre-1994 water management and governance in South Africa were characterized by an unjust water law and rights system that mirrored apartheid. Access to water was attached to land ownership, effectively

disenfranchising most of the population from legal water rights, because 87% of the land belonged to the minority white population (Seetal and Quibell, 2005).

The post-apartheid National Water Act sought to transform this injustice by de-linking water rights and land ownership, and taking a more holistic, decentralized and participatory approach to water management with the aim of increasing water use efficiency. The Act also keenly recognized water resources management within the entire hydrological cycle and the provision of ecological (environmental) water needs as well as the social free basic water policy. Whilst there have been achievements in the water sector in the last 20 plus years, the country still faces many critical challenges on water governance, inequitable access and inefficiency (wastage/losses), and this water crisis is impacting economic growth and the well-being of people in the country. It is therefore apparent that substantial obstacles continue to prevent the full realisation of the national water plans (Jacobs-Mata et al, 2021); key amongst these challenges are implementation and governance. For all that, the legislative framework is solid, mismanagement, corruption and capacity challenges, linked to the lack of clearly articulated impact pathways mean that governance is the most critical challenge facing the water sector.

The NWSF also highlights that chronic underpricing of water prevents adequate cost recovery, and consequently undermines the functioning of the sector. Whilst a just allocation of water resources is essential, the current capital-funding gap, estimated at R33 billion per annum for the next 10 years must be filled to enable realization of water security.

The relevant national priority policy and strategy framework for water, climate and development (relevant to this discussion on water and a JT) are:

- The National Water Security Framework and the results of the Just Transition dialogues – National Planning Commission, 2020
- The National Water & Sanitation Master Plan (2018, DWS), which is the implementation plan for the National Water Resources Strategy, and the National Water Act, 1998
- The National Climate Change Adaptation Strategy (DFFE,2020), which serves as South Africa's National Adaptation Plan- NAP in the international climate context) and South Africa's updated Nationally Determined Contribution (2021, DFFE)
- The Water and Sanitation Sector Policy on Climate Change (2017, DWS)
- National Climate Change Response Policy (2011, DEA)
- National Development Plan (2012, NPC)

South Africa already faces a water crisis resulting from insufficient maintenance of and investment in water infrastructure. Climate change is projected to increase both the severity and the frequency of both droughts and intense rainfall events (see "Impacts" below). These changes will directly impact on South Africa's natural resources and infrastructure, affecting food security and health, threatening water and coastal resources and impacting on development. This will be especially felt by the poor, who will be more exposed to these impacts and have fewer resources to cope with them (DEFF, 2019).

The problem is compounded by the fact that strategic water source areas (SWSAs) are poorly secured. The 22 defined surface SWSAs cover only 10% of the land area (124 075 km^2 including Lesotho and Eswatini) but provide 50% of South Africa's mean annual runoff (24 954 million m^3/year), which sustains lowland areas downstream. Well-managed SWSAs are consequently essential to ensuring water and economic security for South Africa.

1.4 Regional, Continental and Global contexts

It is important also to acknowledge the relevant regional (SADC), continental, Pan-African and international priority policy and strategy instruments for water, climate and development. In brief, these are:

The SADC climate change adaptation strategy for the water sector was launched in November 2011. The overall goal of the strategy is to improve climate resilience in SADC. Key priorities for the CCA are outlined in three main areas: **water governance, infrastructure development and water resources management.**

At the continental level, the African Union and the African Ministers' Council on Water (**AMCOW**) have prioritized climate change in the **Water Resources Priority Action Plan (PAP, 2016-2025)**, which focuses on four pillars: I) ensuring **water security** in Africa; ii) enhancing resilience to climate change and **water related disaster risks**; iii) strengthening **information systems for water resources monitoring** and assessment; and iv) improving **environmental integrity** through wastewater and water quality management.

At the global level, the **United Nations Framework Convention on Climate Change** overall and the **Paris Agreement (PA)** are relevant. The PA sets out a global framework to limit global warming to well below 2°C and it also aims to strengthen countries' ability to deal with the impacts of climate change and support them in their efforts. Countries developed **Nationally Determined Contributions** (national climate plans on actions).

Sustainable Development Goals. There are 17 SDGs - all are important – as are the linkages between them. *SDG 6 on water is considered an enabler of the other goals.* In the context of this brief **SDG6 (water)** and **SDG 13 (climate)** and their **interlinkages with SDG 1 (poverty), SDG 2 (no hunger), SDG3 (health), SDG 7 (energy)** and **SDG15** (life on land) are key.

Sendai framework for Disaster Risk Reduction - aims to **achieve the substantial reduction of disaster risk and losses in lives, livelihoods and health** and in the economic, physical, social, cultural and environmental assets of persons, businesses, communities and countries.

2. CLIMATE CHANGE IMPACTS, ADAPTATION & RESILIENCE

2.1 Climate Change Impacts

The Long-Term Adaptation Scenarios (LTAS) (DEA, 2013) and the most recent IPCC WG1 report provide some clarity on the likely impacts of climate change. Climate change is predicted to worsen water scarcity; increase rainfall variability and increase both frequency and intensity of extreme events such as droughts and floods, intensify erosion and sedimentation, and cause damage to water quality and ecosystems. These impacts on water resources will have cascading effects on human health and many parts of the economy and society, particularly water-dependent sectors such as agriculture, energy, health, tourism and the environment more broadly (UNECE, 2009).

Increased intensity of global heating drives concomitantly more intense events. Droughts are already 1.7 times more likely than in the last century, and 0.3 standard deviations (sd) dryer (IPCC, 2021). With warming of 1.5°C, droughts would be twice as likely as last century, and 0.5 sd more intense, rising to 2.4 times as likely (0.6 sd drier) at 2°C, and 4.1 times as likely (1.0 sd) at 4°C (IPCC, 2021).

However, as highlighted in the LTAS (DEA, 2013), the effects of climate change will differ on a very localized scale, such as the potential water supply impacts in the western and southern Cape, the significant risk to road infrastructure across the country, increases in irrigation demand and the potential reduction in crop yields from staple crops such as maize and wheat. Overall, the economic impact was found to be most significant at a sub-national scale and for specific sectors such as dryland agriculture. The CSIR Green Book (CSIR, 2019) provides municipal-level assessments of local climate risk, and the biome-level adaptation (DEA, 2016) products highlight how the impacts will vary within different ecological regimes.

The Department of Water and Sanitation acknowledges that climate change will increase the pressure on already-stressed water resources, and that there is a crucial requirement for the effective management, use, allocation and re-allocation of available water resources. Climate change objectives must be integrated into the short-, medium- and long-term planning for water resources. (DWS 2017).

The Regional Climate Change Programme (led by OneWorld Sustainable Investments, 2007-2012) developed a simple framework to understand the order of climate impacts (Chapman et al, 2011).

There are:

- 1st order impacts: basic climate parameters;
- 2nd order impacts: chemical and physical processes in physical and biotic environments;
- 3rd order impacts: ecosystem and infrastructure functioning and services;
- 4th order impacts: socio-economic impacts (human health, livelihoods, coping strategies, conflict, vulnerable populations, macro-economy).

Figure 1 below shows the 1st to 4th order impacts for the water sector.

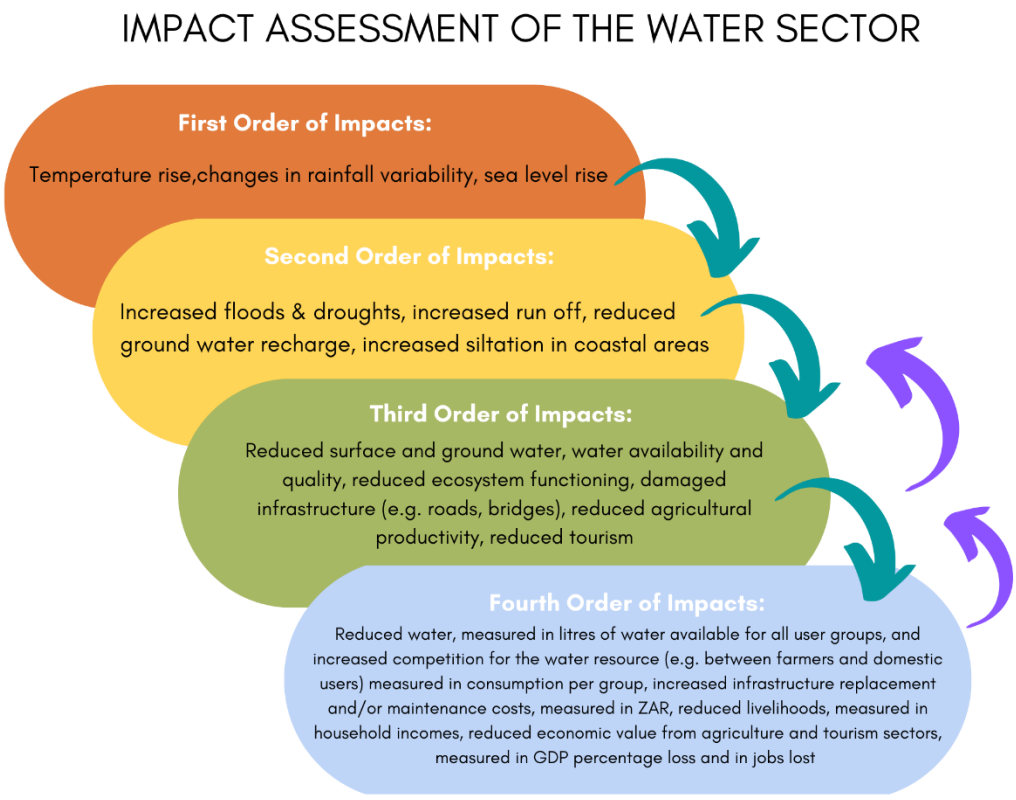

Figure 1: Impact Assessment of the Water sector. Impacts flow from 1st to 4th orders, but the upward arrows reflect feedback mechanisms (Source: Chapman et al - OneWorld Sustainable Investments, RCCP 2007-2012)

Climate change impacts are particularly felt in the human sphere through their impacts on food, energy and water, as described below:

Agriculture in South Africa faces a variety of climate change-driven risks, such as changes in rain patterns, higher temperatures, increased evaporation rates, increased pests and diseases and distribution ranges, reduced yields and spatial shift in optimum growing regions. The changes in productivity, quality of yield, crop failures, loss of livestock, will affect food availability and accessibility and the stability of the food system (WWF-SA 2014). In addition to the obvious food security impacts, agriculture and fisheries play a significant role in livelihood and employment opportunities. Small scale and subsistence farmers are most vulnerable to the effects of water shortages and droughts: with limited access to improved infrastructure, they are typically unable to cope with water shortages. This leads to food insecurity and reduces agricultural production in rural areas.

These impacts could be amplified by the interconnections and interdependence between the water, energy and food resources (see Table 1) below.

Table 1: Impact of Climate Change on Food Security through the WEF Nexus (adapted from WWF-SA, 2014)

CLIMATE CHANGE IMPACT	DIRECT CONSEQUENCES	INDIRECT CONSEQUENCES
Average temperature increase	• Reduced quantity & reliability of agricultural yields • Increased susceptibility to crop burning • Increased heat stress in livestock • Increased evapotranspiration rate • Destruction of crops and impact on livestock due to increased prevalence and incidence of pests • Decline in certain fish stocks due to increased sea temperatures • Increased disease transmission in fish species and influence on marine pathogens • Shift in the range of fish species	• Intensified competition for water between food and energy sectors due to increased evaporation and decreased water balance, and increased demand for energy for cooling • Lowering crop productivity or damage to crops due to reduced soil moisture • Increased energy usage due to greater need for cooling/refrigeration to maintain food quality & safety • Increased evapotranspiration resulting in reduced soil moisture • Disruption to fish reproductive patterns
Change in rainfall amount and patterns (frequency & intensity)	• Reduced quantity & quality of agricultural yields & forest products • Reduced water availability for crops and livestock due to decrease in water resources, decrease in run-off/stream flow • Heavy reliance on irrigation • Increase of energy consumption for irrigation & crop-spraying systems • Fisheries will be affected by changing water levels	• Lowering crop productivity due to soil erosion • Increased probability of fire • Inferior quality of crops due to deteriorating water quality
Increased severity of drought	• Decreased crops yields • Trade-offs for food production as water reservoirs come under pressure to meet residential and commercial needs	• Lowering crop productivity due to damage to soil and increased probability of fire
Increased intensity of extreme events	• Increased land degradation and desertification • Damage to crops and food stores • Soil erosion • Inability to cultivate land because it has become water-logged • Fisheries will be affected by flooding events • Damage to infrastructure from extreme events	• Lowering crop productivity from increased soil erosion

For **energy**, the primary driver of negative impacts is through changes in water availability. For example, rising temperatures will increase evapotranspiration rates, which will in turn reduce the amount of water available for cooling. Consequently, energy sources dependent on large quantities of water (such as coal and nuclear power plants) or impacting on water quality (such as coal) would need to be reassessed – a central issue in moving towards a decarbonised economy.

Renewable energy has lower water usage requirements, which will be an important consideration for future energy planning in water-scarce areas of the country. Changes in wind patterns, cloud cover and rainfall can impact on renewable energy production from solar and wind, but it is primarily hydropower that is vulnerable to a drier future climate. Biofuels dependent on purpose-grown crops require both water and arable land, diverting it from food production, and consequently large-scale biofuel production is likely to be limited to waste biomass.

2.2 Climate Change Adaptation, water security and resilience building

According to GWP (2009), water is the primary medium through which climate change will impact people, economies and ecosystems and *actions to implement robust water management and a focus on water security are adaptation actions.* To ensure that water management systems are well adapted to increased climate variability, an integrated water resource management (IWRM) approach is likely to provide the best results.

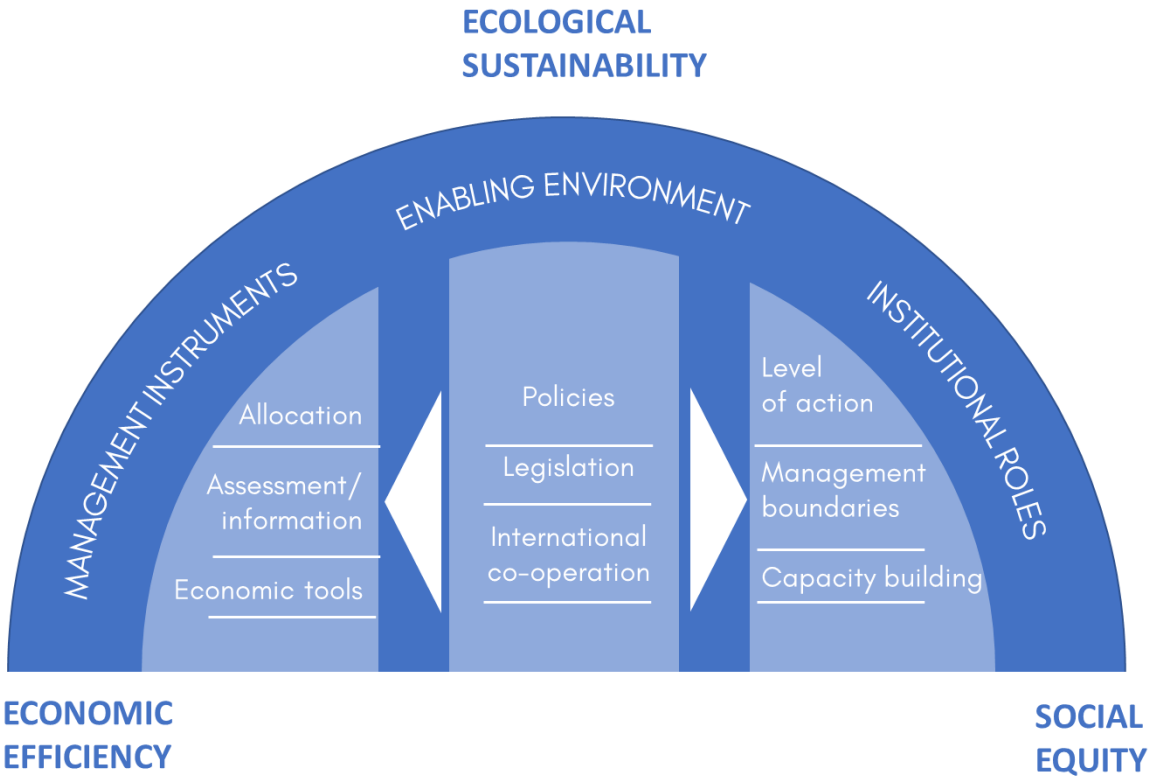

Figure 2: The 3 E's of the IWRM Framework (from GWP 2000)

The IWRM framework is useful in that it highlights the principles of **Equity, Economic efficiency & Ecological sustainability** (the 3 E's), but also a holistic and integrated approach (see Figure 2)

Within this framework, the three pillars of IWRM emphasise the enabling environment (policies, laws etc.), governance and institutional roles as well as highlighting tools for water resources management (water allocation between sectors and groups, water conservation and demand management – including reuse, recycling and economic tools are examples). The 3 E's and integrated approaches are key principles for a JT in water and are considered further in section 3.

UN-Water defines water security as "the capacity of a population to safeguard sustainable access to adequate quantities of acceptable quality water for sustaining livelihoods, human wellbeing, and socio-economic development, for ensuring protection against waterborne pollution and water-related disasters, and for preserving ecosystems in a climate of peace and political stability."

To ensure water security in the face of climate change impacts on the resource ensuring no one is left behind, strategic investments in critical processes are needed. A concept of the 6 I's (building on GWP's 3 I's (GWP, 2009) is useful in this regard. The 6 I's refer to making: Inclusive Integrated Investments in Information, Institutions & Infrastructure. These I's are evident as strategic actions (to build resilience and reduce vulnerability) in the Water & Sanitation Sector Policy on Climate Change (DWS, 2017), as depicted in Table 2.

The 3 E's and 6 I's will be used as key pillars and principles to focus the discussion on critical considerations for a just transition in the water sector and highlights what is needed.

Table 2: Strategic actions to build resilience and reduce vulnerability to climate change (DWS, 2017)

WATER & SANITATION GOVERNANCE	INFRASTRUCTURE DEVELOPMENT	WATER & SANITATION MANAGEMENT
1. Building adaptive institutions 2. Intergovernmental relations 3. Awareness, communication and shared learning 4. Research & Development 5. Stakeholder participation 6. Regional engagement 7. Climate financing	8. Multipurpose water storage 9. Water supply & sanitation 10. Groundwater development 11. Alternative water supply sources 12. Flood protection measures 13. Infrastructure safety 14. Hydro-geo-meteorological monitoring system	15. Data & Information 16. Scenarios and climate modelling 17. Vulnerability assessments 18. Precipitation & flow forecasting 19. Planning 20. Water allocation & authorization 21. Optimisation of dam and groundwater operations 22. Water conservation & water demand management 23. Groundwater management 24. Water quality management 25. Resource management & protection 26. Disaster management

2.3 Embracing Integrated approaches

Climate change-driven water impacts will necessarily drive further shifts in water-dependent sectors such as agriculture, energy, some mining and industrial activities, and natural ecosystems.

To make sound investment decisions in adaptation and a JT, it is essential to understand these inter-linkages and dynamics, and to then consider trade-offs and synergies between sectors for Efficiency,

Equity and Ecosystem sustainability. Integrated approaches such as IWRM provide a framework for implementation of these trade-offs, whilst the Water-Energy-Food-Ecosystem (WEFE) nexus provides a framework for understanding the drivers and interlinkages of impacts. The WEFE nexus presents opportunities for greater resource coordination, management, and policy convergence across sectors. These integrated approaches must be pursued in striving for a just transition in South Africa.

The WEFE lens is used throughout this document as a means of exploring the interlinkages of the impacts, adaptation needs and potential just transition approaches to address the climate impacts in the water sphere.

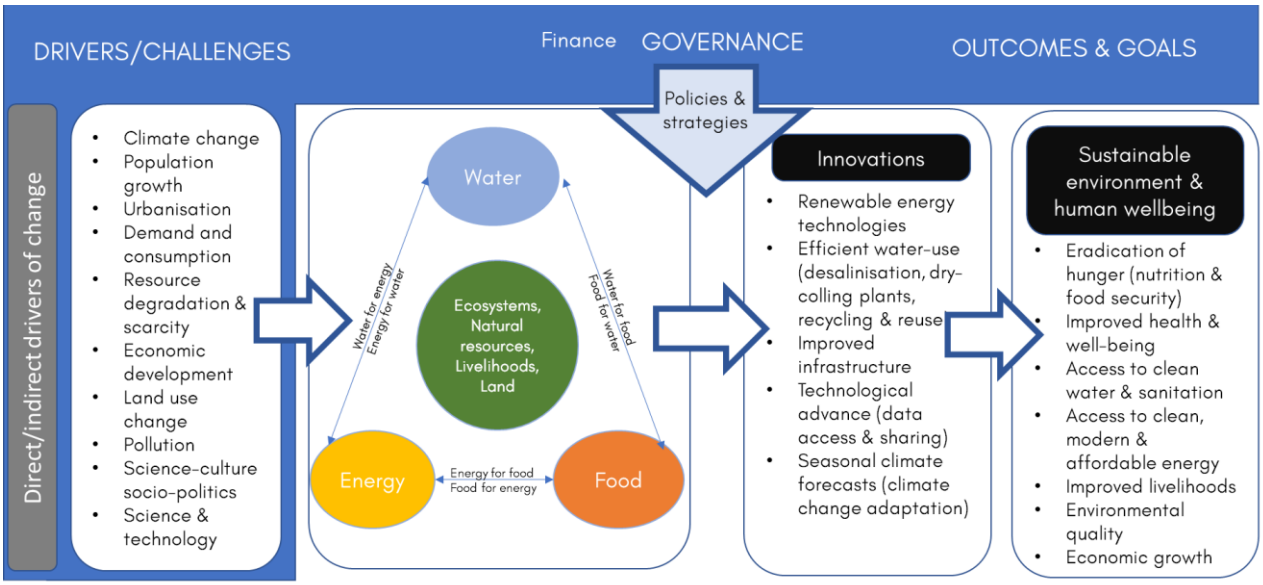

Figure 3: The proposed WEF framework for South Africa, WRC 2020

2.4 Mitigation, Adaptation and Co-benefits

Whilst climate action in the water sphere has primarily been focused on climate adaptation, there are significant linkages with mitigation (reducing the drivers of climate change) as well. Indeed, for many of the landscape management approaches necessary for addressing climate change, there are strong impacts on both mitigation and adaptation.

Adaptation approaches should consider mitigation impacts. For instance, whilst irrigation may be a viable adaptation solution (in catchments that are not already limited by available water) to addressing drying trends in agricultural systems (DWA, 2013), the increased energy use can be a driver of increased climate change. Similarly, whilst widespread implementation of drip irrigation can reduce the water footprint of agriculture, the material impacts and energy used in producing and maintaining these systems is significant. For both these instances, a focus on supporting alternative energy systems and durability of the approach will mitigate the impacts.

Many landscape-level approaches provide opportunities to address both climate mitigation and adaptation at the same time. For purposes of investment in the just transition, unlocking the job opportunities linked to such activities as restoration is critical, although it should be noted that there is poor sectoral crossover in many cases: that is, jobs linked to the AFOLU (Agriculture, Forestry and Other Land Use) sector require different skillsets and are often poorly spatially correlated to those landscapes in which the transition will impact most highly on employment.

The land sector provides ample opportunities for combined approaches to mitigation and adaption, through the linkages between ecological infrastructure and carbon sequestration. The National Carbon Sinks Assessment (DEA, 2015) clearly identifies functional ecosystems in the savannah and grasslands as holding the largest sequestration potential within the AFOLU sector, and protection and management of grasslands coincides with the priority SWSAs. In addition, climate-smart agricultural approaches such as minimum-till agriculture and organic fertilisers are both adaptive measures and lead to enhanced soil carbon sequestration as well as improved water resilience.

In addition, mitigation and adaptation actions outside of the water sector are likely to impact on the larger issues of water security. Mitigation options in all sectors should focus on ensuring long-term reduction of water consumption and enhance water availability. For example, renewable energy options such as solar photovoltaics and wind power have very low operational water consumption and can more readily be situated within dry catchment areas than nuclear or coal power. Increasing penetration of such technologies will reduce the water consumption of the energy sector, freeing up water for other purposes.

Hydroelectricity might generally be considered to meet mitigation objectives, since it does not combust fossil fuel. The total climate footprint of hydropower, however, can sometimes be worse even than coal power stations of equivalent capacity because of the high levels of associated methane emissions (Ocko and Hamburg 2019). Whilst not a feasible solution for South Africa at a national level, hydropower is significant at a regional level because of SADC's transboundary efforts (across member states) for energy, water, and food security. Consideration of scope 2 emissions from such undertakings as the Grand Inga dam as well as the broader regional water security implications should therefore be part of South Africa's adaptation strategy.

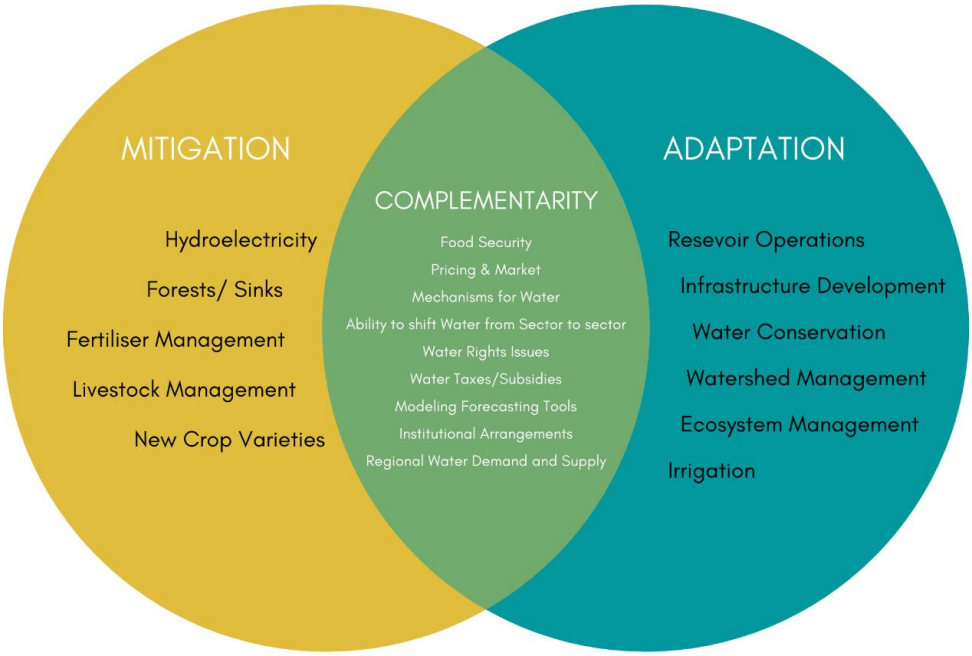

Figure 4: Mitigation, Adaptation and Areas of Complementarity (adapted from Mata & Budhooram, 2007)

3. UNPACKING A JUST TRANSITION THROUGH A WATER LENS

This section reminds us of the PCC's vision for a JT and highlights key principles that one must consider in a JT for the water sector. Emphasis is placed on the words in bold – in relation to the key principles (encapsulated in the 3 Es and 6 Is).

Tough trade-offs are likely to be unavoidable in balancing equity, environmental and economic priorities. Finding the right mix of the three I's (information, institutions and infrastructure) to achieve the desired balance between the three E's (equity, environment and economics), will be the 'art of adaptation' in water management (GWP, 2009).

3.1 Key Principles

Equity & Access: The basic right for all people to have access to water (of adequate quantity and quality) for the sustenance of human wellbeing; rights and access to land and food as well as energy, rights and access to natural resources, and a clean, safe and healthy (not harmful) environment. In this latter regard, it is also necessary to consider the essential water requirement for functional ecosystems, as enshrined in the National Water Act.

Inclusivity must highlight marginalised groups as well as consider youth and gender. The impacts of climate change will not be homogeneous, since the poorest countries and communities will be more vulnerable to the impacts of climate change (IPCC, 2007). Communities living in disadvantaged situations with high poverty prevalence are critically exposed to water challenges and the effects of climate change. Vulnerability to climate change intersects diverse forms of marginalisation, amplified by gender, socio-economic class, age, and other social variables. Concerted efforts to be inclusive are required to ensure opportunities are created in management and development, governance, access to opportunities and decision-making on planning and investments in water and natural resources, apart from ensuring reduced vulnerabilities.

Whilst women are typically the most vulnerable, it has also been acknowledged that they function as agents of change in community natural resource management, innovation, farming, and care giving. They therefore hold the key to adaptation to climate change (UNDP, 2009). The effectiveness of any action to reduce the impacts of climate change requires an understanding of these gender-differentiated impacts, vulnerabilities and capacities, so as to address the specific needs of women and men. Mainstreaming gender into climate change policies has therefore become a matter of urgency (Babugura, 2010).

Economic efficiency in water use: Because of the increasing scarcity of water and financial resources, the finite and vulnerable nature of water as a resource, and the increasing demands upon it, water must be used with maximum possible efficiency. In a changing climate with increased scarcity, economic efficiency principles must be more prominent in water allocation between sectors and within sectors. Allocation efficiency must inform our development planning and choices – for example between sectors

such as energy and agriculture or even within a sector, when making investment decisions regarding either fossil fuels or renewables.

Environmental and ecological sustainability: In addition to economic efficiency calculations, water allocations must also include strategic decisions regarding the value of sectors to the future low-carbon economy, including the necessity to sunset certain sectors that have high environmental footprints and low potential future economic value. Ultimately, sectors with high impacts that are not essential to the functioning of a sustainable economy will undermine human wellbeing and the ecological systems upon which we depend. The process of the just transition (as typified in the NPC outputs) will require their replacement with activities that are aligned with continued human welfare and ecological sustainability in the long term.

"Integrated" Investments & Climate finance (considering multiple sectors and benefits, efficiency and synergies between water-energy-food/land-health for example) will be needed in Information, Institutions and Infrastructure (both ecological and built as well as 'hard & soft' infrastructure). Whilst built engineering solutions are vitally important for water security, they will not by themselves be enough to solve the world's water problems. A range of social, economic and political challenges must addressed, requiring an equally wide range of hardware and software tools through which this can be done. A water-secure world necessitates investment in better and more accessible Information, stronger and more adaptable Institutions, and natural and man-made Infrastructure to store, transport and treat water. Balancing and sequencing a mix of 'soft' (institutional and capacity) and 'hard' (infrastructure) investment responses will be complex. Information, consultation and adaptive management will be essential (GWP 2009). Additional aspects of Information, Institutions and Infrastructure include:

- **Information** (monitoring, data, assessment, for Disaster Risk Reduction and early warning systems for greater safety and security against drought and flood extreme events – droughts and floods and vulnerability; the need for research is also considered under information)

- **Institutions** includes a focus on institutional and adaptive capacity but also must embrace integrated and cooperative **governance.**

Figure 5: The IWRM "comb" for cross-sectoral integration. Source: Adapted from GWP (2000)

Governance: Ensuring proper governance across sectors, the 3 spheres of SA government and hydrological / spatial boundaries is important. The traditional sectoral and fragmented approach to water resources management has often led to governing bodies representing conflicting interests. Policy objectives have been set without consideration of the implications for other water sectors & users, and without consultation across sectoral and institutional boundaries. Consequently, available financial and physical resources (including water) have not typically been employed to maximize total social welfare. Coordination of policymaking, planning and implementation in an integrated manner across sectoral, institutional and professional and spatial boundaries is a long-standing and urgent need to the water sector, which is only enhanced under conditions of climate change (GWP, 2000). See Figure 5.

In addition, as much as **cooperative governance** is enshrined in the Constitution, it remains a critical challenge to align between spheres and across-sectors. There is a need to facilitate greater engagement between the three spheres to promote a stable and responsive system of governance. Whilst dated, the challenges highlighted in the DPLG (2007) review of the implementation of the Intergovernmental Act are still relevant. These included that all spheres must comply with and align to priority development goals, policies, standards and programmes; that the constitutional principles of spheres of government that are 'distinctive, interdependent and interrelated' must be recognised and respected; and that each sphere has its own unique role to play in managing vertical and horizontal structural tensions, and yet must therein define its role in providing for Inter-governmental mutual interest and support (DPLG, 2007).

More attention is needed on examining inter-actions and interlinkages between sector policies and institutions, fostering better coherence on common objectives, policies, strategies, plans and implementation. What is also much needed is to define effective coordination mechanisms, and to ensure that sufficient budget and support is allocated to such mechanisms.

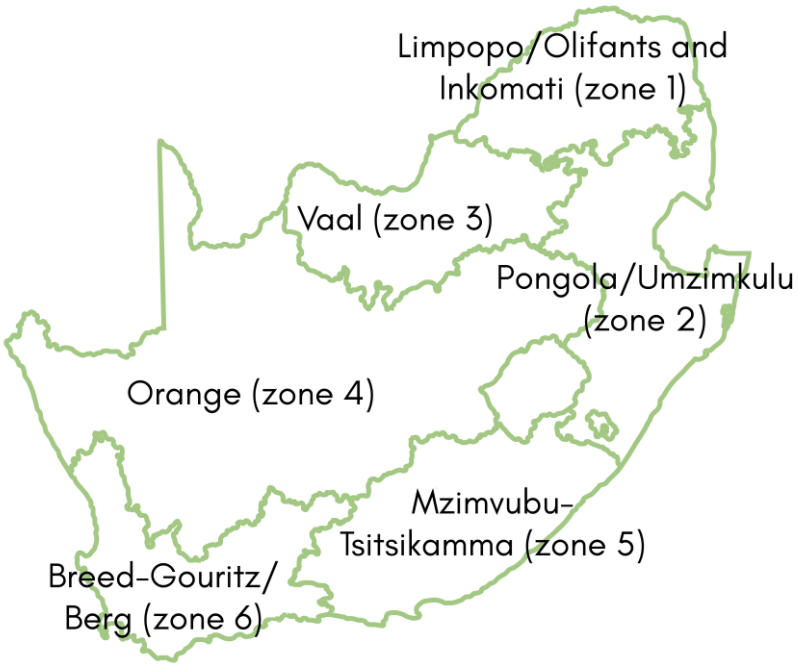

Figure 6: The proposed new configuration of Water Management Areas (DEA, 2013).

It is noteworthy that the draft Climate Change Bill provides a legislative basis for the implementation of the National Climate Change Adaptation Strategy (NCCAS), which will hopefully foster institutional coherence and enhance climate change adaptation governance across the spheres, national and sub-national layers of government in South Africa.

Governance, alignment & coordination between different hydrological / spatial boundaries: The NWA (1998) promulgated the establishment of initially 19 Water Management Areas, which were revised to just 9 WMAs (DWS, 2016) and more recently DWS has proposed even fewer WMAs - now 6 (see Figure 6). Establishment of stakeholder based, effective and efficient, capacitated and financially sustainable Catchment Management Agencies (CMA) has been delayed over the past twenty years by numerous barriers. Nevertheless, once the CMAs are amalgamated and established, a tremendous opportunity exists to incorporate adaptation and disaster management planning into the Catchment Management Strategies.

It is well known that there are challenges in alignment between administrative/ political and hydrologically delineated institutions but in addition, the WMA and Strategic Water Source Areas (SWSAs) delineations (see Figure 7) do not coincide, and there is a need for stronger collaboration and alignment between the governing institutions and partnerships (C-P-P-Ps) and platforms. Strengthening and establishment & functionality of the CMAs is critical.

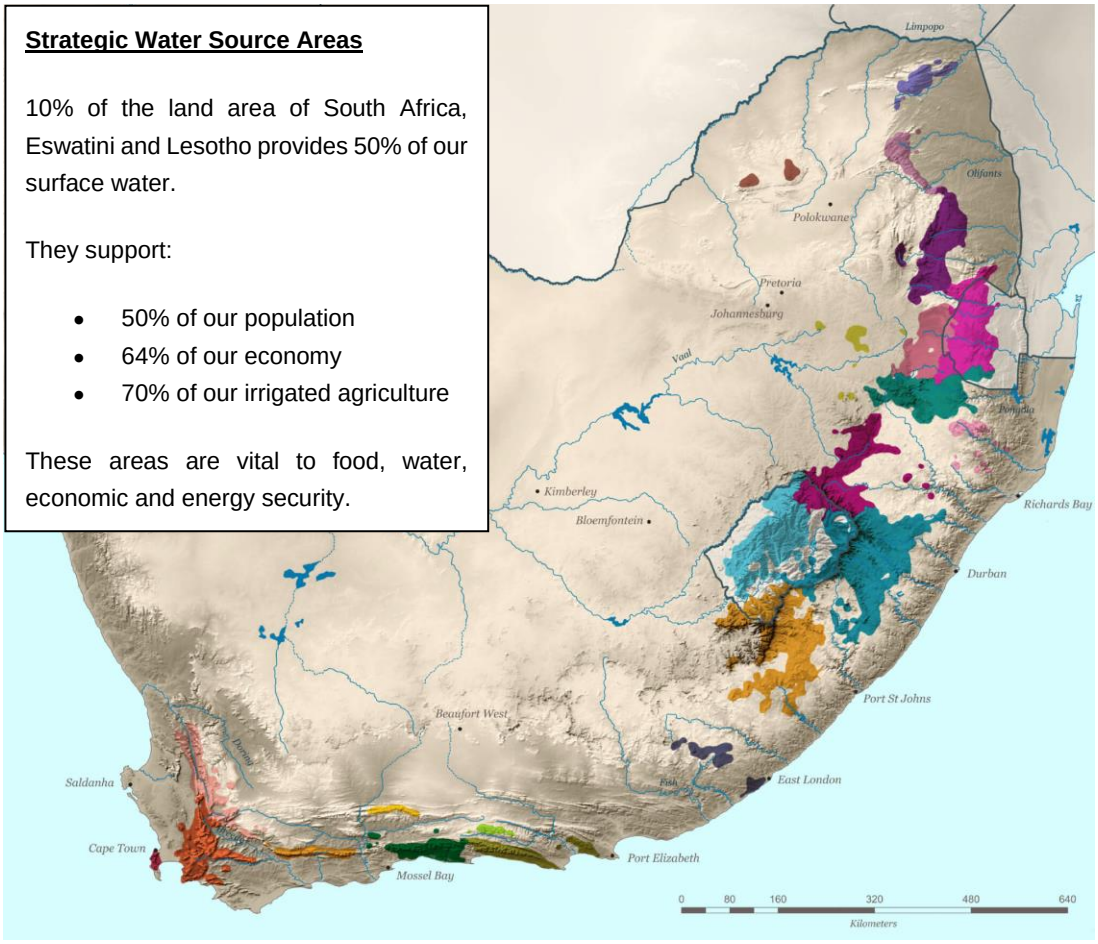

Figure 7: South Africa's 22 (surface) Strategic Water Source Areas – "water factories". WWF-SA"

- **Infrastructure (ecological and built)**

South Africa's water security depends not only on built water infrastructure, but also on the nature-based equivalent of hard infrastructure – the Ecological Infrastructure (EI). EI incudes healthy mountain catchments, rivers and wetlands for example, and refers to naturally functioning ecosystems that deliver valuable services (not only) to people, such as fresh water, climate regulation, soil formation and disaster risk reduction. EI is just as important for providing services and underpinning socio-economic development. Ecological infrastructure can generate and deliver significant improvements in water quantity and quality if well managed and looked after. Investing in ecological infrastructure in conjunction with built infrastructure, will therefore, deliver more clean water from the land.

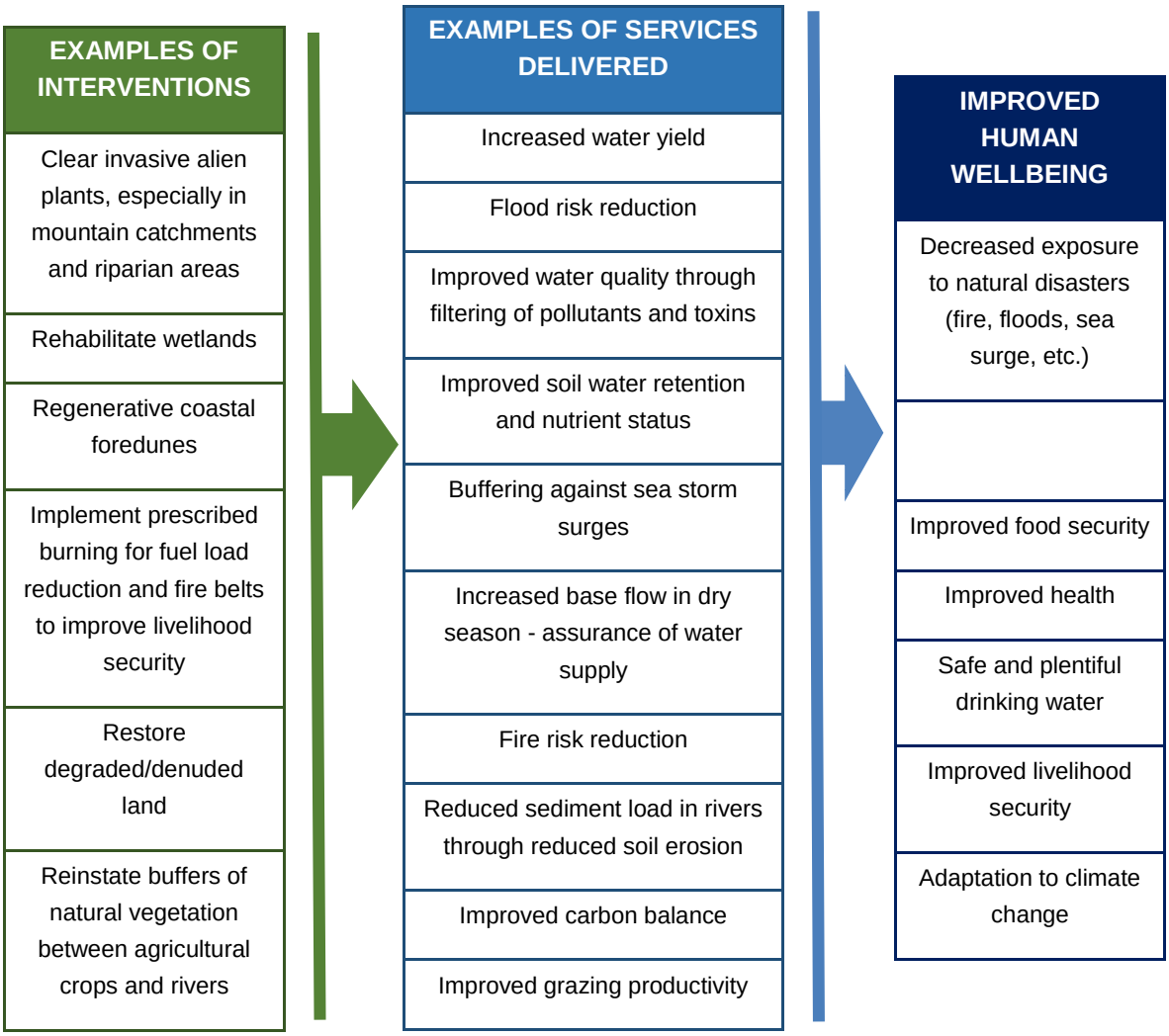

Figure 8: Linkages between ecological infrastructure investments, ecological service delivery and real adaptation benefits. Source: SANBI, 2014

4. IMPLEMENTATION ISSUES & OPPORTUNITIES FOR ACTION

Ultimately, whilst consideration of the principles above is essential for the just transition and development of suitable governance mechanisms to ensure their implementation, one of the most critical elements of justice within the transition to a low-carbon economy is around the realisation of developmental opportunities in the process, as outlined in the JT policy paper to the PCC (TIPS, 2021). We noted above that key adaptation actions are already delineated national planning documents such as the Long-Term Adaptation Strategies (DEA,2013), as well as the NCCAS (DEFF, 2019). For the water sector, as well as linked sectors such as agriculture, forestry, land use, energy and industry, a key focus is on improved efficiency, resilience and adaptive capacity.

The just transition lens applied to these priority actions provides a perspective that ensures not only are the key principles outlined in section 3 above adhered to, but that employment, development and livelihood components of the adaptation and mitigation options are maximised to enhance climate justice.

4.1 Climate smart energy and transitions in the coal sector

In all transition scenarios, South Africa will see a decline in coal consumption for the energy sector, with the rate dependent on the rollout of alternative energy and the development of other sectors, but with thermal coal likely to be phased out entirely by 2050.

At the same time, South Africa's energy demand will increase to 2050 and the global market demand from green hydrogen (produced by electrolysis of water using green electricity from renewable sources) is likely to be upwards of 100 Mt per annum. Capitalisation on South Africa's renewable energy resources to leapfrog gas as a transition fuel will put South Africa in a major export position, as well as decarbonising the 70% of exports that currently depend on coal production to ensure continued access to international markets as border carbon adjustments are rolled out.

Whilst green hydrogen still consumes water, the total water consumption of a heavy RE/green H2 penetration is well under a third of that of the current coal generation sector. Effectively, then, the process of mitigation within the energy sector by improving the penetration of renewable energy and green energy options also increases national adaptive capacity by freeing up water for other purposes.

Key just transition issues have been dealt with in the PCC's earlier *Just Transition in Coal* dialogue, but with a purely water-focused lens there are opportunities in coal transition municipalities. In terms of jobs and livelihoods within the just transition, additional adaptive capacity can be developed through investment in the restoration of coal mining areas. Rehabilitation of mine dumps, restoration of natural habitat and establishment of artificial wetlands linked to revegetation efforts can maintain water quality by addressing acid mine drainage as well as provide employment for reskilled communities in these areas.

4.2 Agriculture

Agriculture consumes 63% of the national water allocation (WWF, 2017), and a growing population will require additional food sources. Changing climate regimes including higher temperatures and atmospheric carbon dioxide, more frequent and intense drought periods and higher likelihoods of intense rainfall events will entail shifts in the viability and locations of agriculture.

Given that additional irrigation is largely unfeasible – only 2% of surface runoff is unallocated, and ground water availability, whilst poorly understood, is also likely to experience reduced recharge under climate change – the focus for agriculture must be primarily on climate smart approaches such as:

- Zero-till agriculture
- Improved water efficiency (drip irrigation, greenhouses, high resolution soil monitoring)
- Climate appropriate cultivars and improved yield crops

Such approaches do not readily lend themselves to smallholder agriculture, unless there is significant investment through government and financial incentive schemes, linked to agricultural extension services. On the other hand, smallholder agriculture can provide yields that readily equal those of commercial operations, given sufficient training and inputs, and can readily be integrated with improved ecological infrastructure approaches (see below). Consequently, the smallholder agriculture may be a key component of the just transition, but will require adequate investment and incentives to realise.

4.3 Infrastructure: Ecological and hard infrastructure opportunities

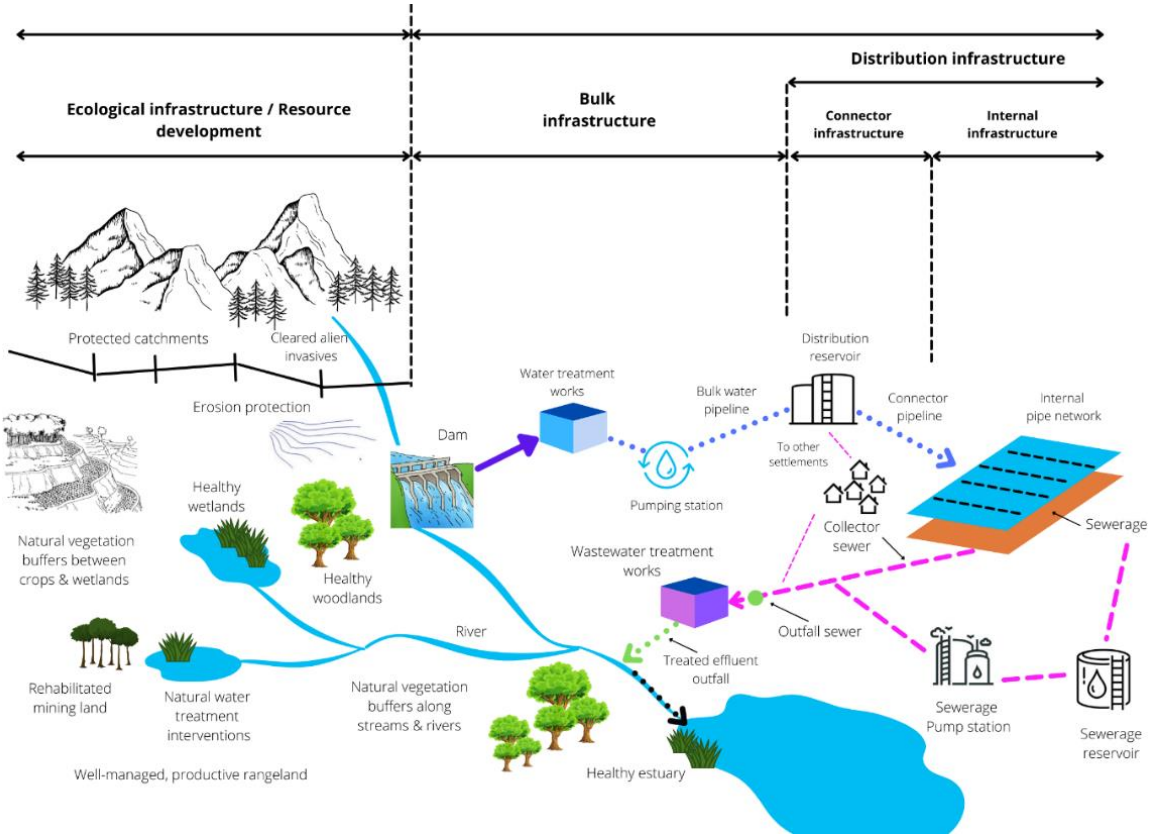

Figure 9: Linkages between ecological infrastructure and built water distribution and treatment infrastructure. Improved management of ecological infrastructure is critical for ensuring and enhancing water flows under conditions of climate change. Source: adapted from SANBI, 2014

In the water sector as for other areas, adapting to climate change will inevitably require investments in hard infrastructure, to ensure that it can cope with changing water flow regimes and extreme events such as floods. Such investments will necessarily create additional employment through the construction process and will be a part of a broader programme of infrastructural hardening nationally. For critical areas such as seaboard metropolitan municipalities, there may be scope for high-cost, high-energy approaches such as desalination, and in all cases improved wastewater management and circular reuse approaches for industry will be feasible and necessary. Such hard infrastructural investments will provide improved water availability, albeit to a limited extent.

However, there is limited scope for additional water capture in South Africa, other than at household/building level, and within cities. Key focuses for infrastructure will therefore be in improved efficiency at municipal level – primarily in terms of maintenance and improvement of current bulk reticulation to reduce leakage and losses.

"The allocation of water resources and the provision of water services to different economic sectors will largely dictate the growth potential for high quality jobs at country and local levels. Focusing on the economic sectors that are most relevant for environmental sustainability and job creation will prove to be the ultimate key to success. Reaching those targets involves coherence and shared vision, notably between water, energy, food and environment policies, in order to ensure that incentives are aligned for the benefit of all stakeholders."

WWAP, 2016

The role of ecological infrastructure, however, is significant, and likely to increase under climate change. The development and protection of ecological infrastructure provides critical reinforcement for hard infrastructure.

Indeed, for the JT, real opportunities are unlocked through comprehensive investment in ecological infrastructure. Adaptation benefits for all water-dependent processes are realised through the functional ecological processes described in Figure 9, whilst the (typically) labour-intensive activities required to undertake the relevant interventions can provide green jobs that are linked directly to the relevant land areas.

4.4 Green jobs & local economies

The DFFE's "Working For…" programmes under the national Extended Public Works Programme are already major employers in South Africa, with women as important beneficiaries (53% of in the environmental and cultural sector in 2014/ 201). The potential of such programmes to target vulnerable and economically marginalised groups, and to ensure long-term employment through state subsidies is critical, both in term of addressing climate justice elements, enhancing adaptive capacity for key vulnerable groups, and securing critical ecological infrastructure and services. Working for Water (WfW) has provided jobs and training to approximately 20 000 people, 52% of whom are women. Strategic investment in these programmes will likely be a key intervention for just transition in the water space.

4.5 Protection of Strategic Water Source Areas

With 50% of South Africa's water deriving from only 8% of the land area, conservation of the nation's SWSAs is essential. Moreover, restoration of the function of ecosystems will enhance systemic resilience, and consequently provide increased adaptive capacity to all downstream users and municipalities. As with coal-mining areas (with which there is some spatial overlap), it is critical to ensure that communities within these areas that depend on the resources or are impacting on them through alternative uses be provided with alternative attractive livelihood options.

UNEP estimates that, depending on the specific biome, each dollar invested in restoration typically pays back between 3 and 75 dollars (UNEP and FAO 2020). Management and restoration of these critical areas should therefore be prioritised in a similar manner to hard infrastructural investment: as an enabler of the economy to be financed through the public purse. Local communities and householders in these areas can therefore be employed and tasked to maintain the **ecological infrastructure**, and payments to said communities as either incentives or salaries for activities to conserve and restore ecological infrastructure.

Mobilisation of private sector finance to support these processes through the issuance of green bonds and private-public partnerships can reinforce the beneficiation process. It should be noted, however, that prior payments for ecosystem services models (such as those implemented in Costa Rica (Porras et al. 2013)) have had mixed results (Büscher 2012; Roe et al. 2015) and demonstrate market-based measures alone are not typically adequate to achieve restoration and beneficiation goals. A comprehensive approach directed at ensuring that local communities are recognised for their custodial roles in providing water for the country as well as direct payments may be necessary (Henning 2015).

4.6 Disaster risk reduction

In the climate change context, given the increased frequency of extreme events, ecosystems are also important as they contribute to reducing disaster risk. Ecosystems, such as wetlands, forests and coastal systems, can reduce physical exposure to natural hazards by serving as natural protective barriers or buffers and thus mitigating hazard impacts. Well-managed ecosystems can provide natural protection against common natural hazards, such as landslides, flooding, avalanches, storm surges, wild fires and drought (Gupta & Nair, 2012). Ecosystems lessen disaster risk is by reducing social-economic vulnerability to hazard impacts. Ecosystems also sustain human livelihoods and provide essential goods such as food, fibre, medicines and construction materials, which are equally important for strengthening human security and resilience against disasters (Gupta & Nair 2012)

5. CONCLUSION – KEY ISSUES FOR THE DIALOGUE

This policy brief cannot completely cover the depth of complexities pertaining to the water sector interlinkages, adaptation and the JT, but it does aim to surface some key areas for focus and guidelines for discussion. In summary, there are a few pertinent messages from this brief:

- The JT vision is all encompassing, and whilst the focus may be on the shift to a low-carbon economy, it is not limited to decarbonisation. It recognizes the natural environment, social equity issues and economic growth and efficiency. The vision of the JT therefore encapsulates South Africa's national circumstances and frameworks for water, climate and development, which presents an opportunity for South Africa to address the triple challenges while transitioning to a low carbon and just society.
- This is incumbent upon more integrated approaches and particularly for water that is cross-cutting and central to development, affecting all economic sectors and ecosystems. Water is essential for resilience building in a Just Transition and we must therefore secure the SWSAs and ensure functioning ecological infrastructure. Securing SWSAs and their ecological infrastructure calls for the value of nature's services to be more accurately reflected in policy and implementation. At the same time, real beneficiation for vulnerable people must be central in the transition, both in terms of realization of water security, and intersectional growth for developmental outcomes. Tremendous opportunity exists for green jobs and small business development in this arena.
- The right investments must be made, acknowledging the complementarity and interdependence between built and natural infrastructure. Maintenance and functionality of built infrastructure under a changing climate is essential, but failure to adequately invest in and protect ecological infrastructure will undermine any gains made through improved efficiency and better governance in the sector. Natural systems provide crucial buffers in a changing environment, and the just transition must ensure that people within the landscape both support these systems and benefit appropriately from this stewardship role.
- A balanced approach considering the 3Es and encouraging the right investments (the 6 I's). We need to prioritise the means of implementation and must act urgently.
- Given the national context, it is also an opportunity for South Africa to focus simultaneously on mitigation and adaptation as well as identify those areas and activities of complementarity. The WEFE nexus is helpful as water is critical for climate change adaptation, energy is a key focus in mitigation, and agriculture and ecosystems play a vital role in both. Targeting activities that provide both mitigation and adaptation benefits can enhance benefits.
- Water allocations must be carefully considered. Whilst efficiency is desirable in most regards, it is important to prioritise allocations for those economic activities that are likely to be durable, productive and desirable in the low-carbon economy, and to build in a consideration of the deep justice lens to ensure benefits accrue to vulnerable communities.
- Governance for the water sector must be strengthened. Participatory and inclusive processes are critical, but strengthening of institutions is paramount to address the current capacity gaps and future needs to ensure adequate management of critical water resources.

Key discussion points

A few pertinent issues are listed below for further debate and discussion.

- Are the principles of equity, economic efficiency and ecological sustainability the correct foundation for making decisions in the climate transition?
- Equity & Access, Inclusivity, Economic efficiency, Environmental and ecological sustainability, “Integrated” Investments, Governance and alignment, Infrastructure (ecological and built) – is the balance here correct, can these be framed differently?
- Are the 6 I’s – inclusive, integrated investments in information, institutions and infrastructure – the correct way of framing interventions?
- Do the implementation issues highlighted adequately take account of the capacity and skills limitations in the sector, are there other ways of framing these?
- What are the key existing policies and regulatory frameworks that can be leveraged to ensure a just transition in the water sector, while strengthening and improving effectiveness of institutional frameworks?

ABBREVIATIONS & ACRONYMS

AfDB	African Development Bank
AFOLU	Agriculture, Forestry, and Other Land Use
AMCOW	African Ministers' Council on Water
AU	African Union
C-P-P-Ps	Community Public Private Partnerships
CSIR	Council for Scientific & Industrial Research
DEA	Department of Environment Affairs
DEFF	Department of Environment Forestry & Fisheries
DFFE	Department of Forestry Fisheries & Environment
DWS	Department of Water and Sanitation
EI	Ecological Infrastructure
FAO	Food and Agriculture Organisation (of the UN)
GWP	Global Water Partnership
IWRM	Integrated Water Resources Management
JT	Just Transition
LAC	Life After Coal
NCCAS	National Climate Change Adaptation Strategy
NDCs	Nationally Determined Contributions
NW&SMP	National Water and Sanitation Master Plan
PCC	Presidential Climate Commission
RE	Renewable Energy
SADC	Southern African Development Community
SANBI	South African National Biodiversity Institute
SDGs	Sustainable Development Goals
SWSAs	Strategic Water Source Areas
UNECE	United Nations Economic Commission for Europe
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
WEF	Water-Energy-Food
WEFE	Water-Energy-Food-Ecosystems

WfW	Working for Water
WRC	Water Research Commission
WWDR	World Water Development Report
WWF-SA	World Wide Fund for Nature South Africa

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