The Economic Implications of Water Resources Management in the Western Cape Water Supply System

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2030 Water Resources Group

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ABBREVIATIONS

CGE	Computable general equilibrium
CoCT	City of Cape Town
DWS	Department of Water and Sanitation
EDP	Western Cape Economic Development Partnership
GDP	Gross domestic product
Mm^3/a	Million cubic meters per year
PSC	Project Steering Committee
WCWSS	Western Cape Water Supply System
ZAR/R	South African rand

Introduction

South Africa is a water-scarce country. Annual precipitation is about 52 percent of the global average, and in most systems, dam sites and available yield are fully utilized (or overallocated), while there is a water Sustainable Development Goal funding gap of R33 billion/year.[1] All of South Africa's largest cities face high water security risks, which poses a systemic risk to the country as they are home to 40 percent of the country's population and produce 60 percent of its gross domestic product (GDP).

The City of Cape Town (CoCT) and the surrounding towns, industries, and farms supplied by the Western Cape Water Supply System (WCWSS) account for almost 80 percent of the Western Cape Province's GDP and 9.5 percent of the national GDP of South Africa. In the past, the increasing demand for water has been managed by building dams, diversions, and inter-basin transfers, and more recently by improving water use efficiency.

Between 2016 and 2019, the Western Cape experienced one of the worst droughts in recorded history, which peaked with the globally publicized "Day Zero" countdown in early 2018. The water shortages and availability outlook in turn had a considerable impact on the economy and contributed to reduced investor confidence in the Western Cape and the country more broadly. The resulting restrictions on domestic users, farmers, and businesses were severe and disrupted normal life, with a significant impact on

Source: Phonix_a Pk.sarote / Shutterstock

1. Department of Water and Sanitation. 2018. *National Water and Sanitation Master Plan.* Pretoria, South Africa: DWS.

the economy. These users and the three spheres of government (national, provincial, and the CoCT and other municipalities) realized that they are in it together and that there is a need to find cooperative solutions for mutual benefit.

The CoCT's Water Strategy and the Department of Water and Sanitation's Reconciliation Annual Status Report recognize that the recent "Day Zero" water crisis was primarily caused by a low rainfall event and that even more frequent low rainfall events are predicted in the future. The pressures of a changing climate, an increasing population, a growing economy, encroaching alien vegetation, and limited additional surface water sources mean that the reliable yield from the system is no longer able to meet demand. New augmentation options and ways of managing them are required to avoid climate-water constraints and thereby sustain resilient economic development of the CoCT, the surrounding areas, and ultimately the Western Cape as a whole.

A multi-stakeholder dialogue process was initiated in 2020 and supported by a hydro-economic analysis. It focused on improving understanding of the economic implications of water resources management in the WCWSS for the Western Cape and strengthening relationships between key stakeholders. This was done by co-creating economic narratives on the costs and benefits of augmentation and the opportunities to build a climate-water resilient economy for the CoCT and province.

This paper summarizes the immediate outputs and outcomes of that process. While this work focused on Cape Town and the WCWSS, it is relevant to most large metropolitan or secondary cities and the water systems from which they derive their bulk supplies, whether in South Africa or beyond. The conclusions are therefore highly relevant to many cities globally experiencing similar levels of increasing water stress, the stressed systems in which they are located, and the diverse stakeholders that depend on them.

Source: City of Cape Town

The Western Cape Water Supply System

The WCWSS is one of several integrated bulk water supply systems that have been developed across South Africa in response to increasing water demands from the main economic development nodes in the country.

The WCWSS is the primary water supply source for the City of Cape Town, Stellenbosch, Drakenstein, and the West Coast municipalities. It provides water to these municipalities for commercial, residential, and industrial use as well as directly to a few large industries and to several agricultural irrigation schemes. The current water supply infrastructure for the WCWSS consists of six major dams and several connecting pipelines, weirs, diversions, and supplement schemes (Figure 1). Of these dams, the CoCT owns and manages the Steenbras Dam and the Wemmershoek Dam, while the other dams, and the overall operation of the WCWSS, are managed by the national Department of Water and Sanitation (DWS).

FIGURE 1: Overview of the WCWSS

Source: Original to this publication.

The CoCT and the other municipalities also have some of their own water supply sources, and there are many farm dams used for irrigation, some of which are filled by releases from the major dams, including Voëlvlei and Theewaterskloof, but the vast majority of the water currently comes from the WCWSS.

Based on a draft DWS reconciliation strategy update,[2] the total current allocation from the WCWSS is 576 Mm^3/a, consisting of the following main users:

- City of Cape Town = 347 Mm^3/a (60 percent)
- Other urban and industry = 43 Mm^3/a (7 percent)
- Agriculture = 186 Mm^3/a (33 percent).

It is important to recognize that the total supply from the WCWSS (576 Mm^3/a) represents only a small portion of the water used within the entire Western Cape (3,037 Mm^3/a). Moreover, three-quarters of all the water used in the Western Cape is for agriculture, whether from government schemes, own surface supplies, or groundwater.

Conversely, it is important to acknowledge that more than 70 percent of the Western Cape's GDP is generated in the CoCT (over 9 percent of the GDP of the entire country). Agriculture, on the other hand, represents 4 percent of provincial GDP and 8 percent of employment in the Western Cape.

The yield from the WCWSS is already considered to be less than originally planned, which is further adding to the challenge of water security for the CoCT and other users. After updating the hydrology to include the recent drought and the estimated impact of invasive alien plants, DWS and CoCT modeling shows that yield dropped by 33–35 Mm^3/a.

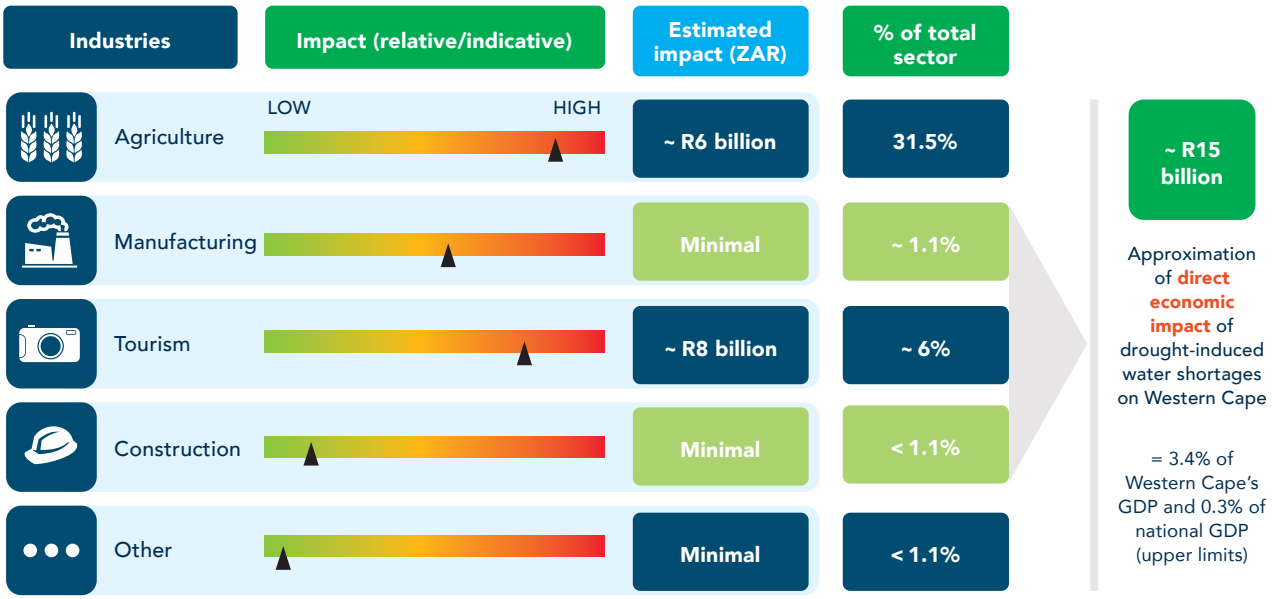
Source: City of Cape Town

Climate change is likely to further impact water availability, particularly for the WCWSS, as is a failure to manage the spread of invasive alien plants. The system is already overallocated, and with no intervention, is likely to become more so in the future.

The "Day Zero" drought had significant economic consequences for the Western Cape. Key high-level literature-based findings on the total economic impact of drought-induced water shortages on the various sectors of the Western Cape are summarized in Figure 2. [3,4,5,6]

2. Department of Water and Sanitation. 2019. "The Support for the Implementation and Maintenance of the Water Reconciliation Strategy for the WCWSS: Annual Status Report." Draft report, Pretoria, South Africa.
3. Pienaar, L., and Boonzaaier, J. 2018. *Drought Policy Brief: South Africa.* Western Cape Department of Agriculture and the Bureau for Food and Agricultural Policy.
4. OECD. 2021. *Water Governance in Cape Town, South Africa.* https://www.oecd-ilibrary.org/sites/4d68297a-en/index.html?itemId=/content/component/4d68297a-en#snotes-d7e3988.
5. Wesgro. 2019. *Western Cape Destination Performance Report: Annual 2019.* Cape Town, South Africa: Wesgro.
6. Dube, K., Nhamo, G., and Chikodzi, D. 2020. "Climate Change-Induced Droughts and Tourism: Impacts and Responses of Western Cape Province, South Africa." *Journal of Outdoor Recreation and Tourism*, 100319.

FIGURE 2: Literature review-based summary of drought impact on sectors in the Western Cape



Source: Original to this publication.

The direct economic impact of the drought on the Western Cape economy was estimated to be up to R15 billion—about 3.4 percent of provincial GDP and 0.3 percent of national GDP in 2018. The agricultural and tourism sectors were most impacted. Agricultural exports from the Western Cape, which account for 55–60 percent of national agricultural exports, fell 13–20 percent during the drought, with several major export categories declining in volume by more than 10 percent. These included wine grapes, apples, table grapes, plums, and prunes. Subsistence farmers were also significantly affected. In tourism, a decline in international and domestic arrivals resulted in reduced foreign and domestic direct spend. It is estimated that the drought cost the province 37,000 employment opportunities, 30,000 of which were in the agricultural sector.

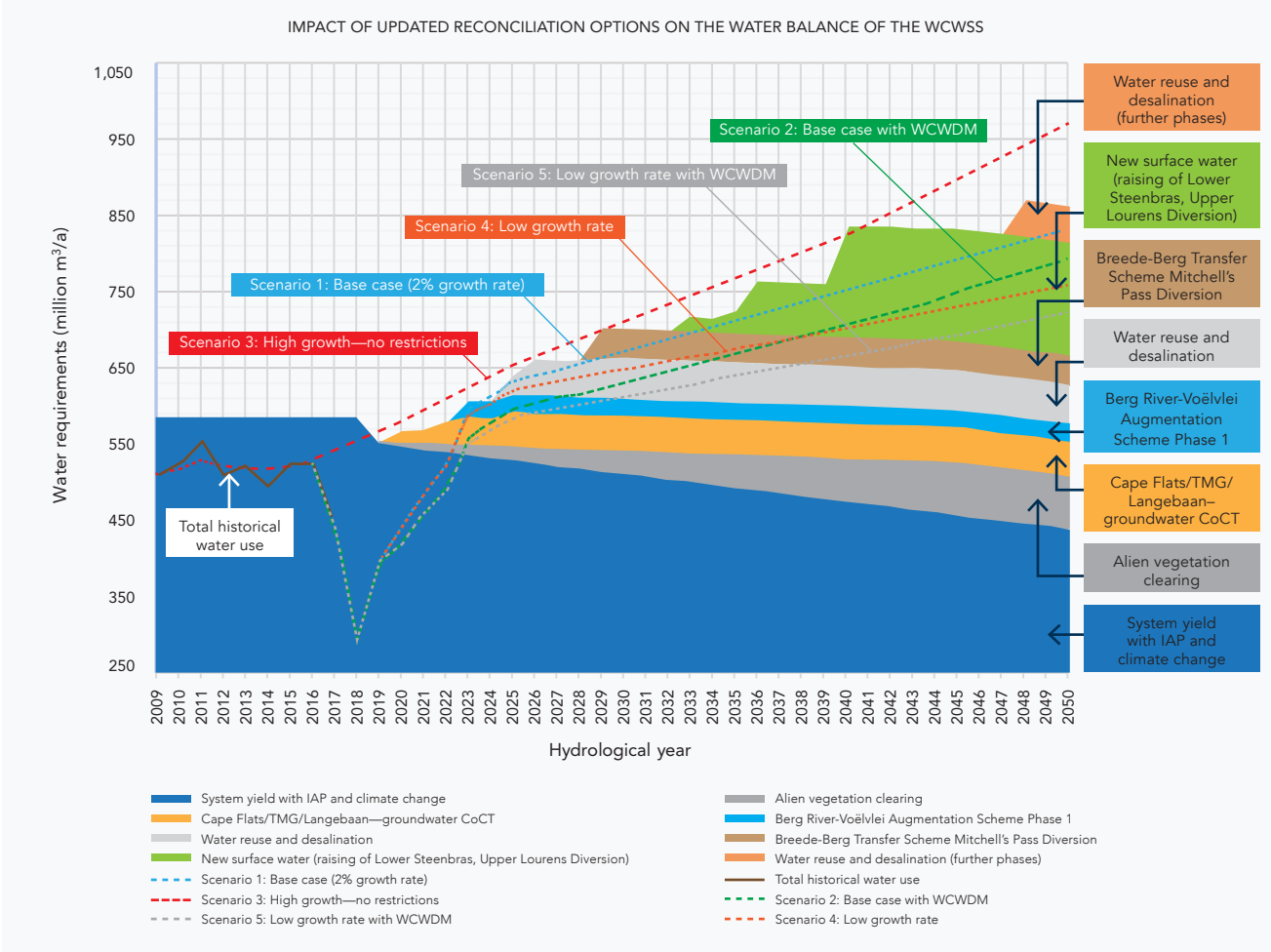
Several actions were taken across sectors that limited the total economic impact of the drought. For example, many farmers did not plant seasonal crops but prioritized already existing long-term investments such as orchards and vineyards (while delaying investing in new ones). Increased crop prices reduced the financial loss for some farmers while others diversified income sources. Municipalities across the province undertook significant capital and operating expenditure programs, including in groundwater development and demand management.

Many stakeholders have emphasized that there were some lost opportunities to respond faster and better in the overall management of the WCWSS.

Potential water supply augmentation options have been identified for the WCWSS. The current proposed augmentation options are shown in Figure 3. Of these, environmental approval has already been given for the Berg River-Voëlvlei Augmentation Scheme, which is undergoing detailed design and will be implemented by DWS. Several other augmentation options are already under development by the CoCT, including the clearing of invasive alien trees, the development of the Cape Flats aquifer, the Atlantis aquifer project, and the Table Mountain Group aquifer project. The CoCT is also undertaking further feasibility studies and detailed design for a desalination plant and direct potable reuse.

The planned augmentation options, except for the Berg River-Voëlvlei Augmentation Scheme, are being implemented by the CoCT and are referred to as the "committed augmentation program" in the CoCT's Water Strategy. These more non-conventional augmentation options are shown in Table 1 with the original estimated dates for completion and provisional capital and operational costs for each of the proposed schemes. Following the suppressed demand and financial challenges related to recovery from the recent drought and the impact of COVID-19, several of the planned interventions have been pushed out, as indicated by the recently revised timelines.

FIGURE 3: Reconciliation of supply and demand for the WCWSS



Note: IAP = invasive alien plants, TMG = Table Mountain Group, WCWDM = water conservation and water demand management.

Source: Department of Water and Sanitation. 2019. "The Support for the Implementation and Maintenance of the Water Reconciliation Strategy for the WCWSS: Annual Status Report." Draft report, Pretoria, South Africa.

TABLE 1: Committed water augmentation program for 10 years—provisional costs (ZAR 2018) [7]

INTERVENTION	FIRST WATER		EFFECTIVE YIELD		TOTAL CAPEX	UNIT CAPEX	OPERATING COST
	Strategy (2018)	Revised (2021)	Ml/day	Mm^3/a	R million	R million/ MLD	R/kl
Demand management	2019	2019	70	26	410	6	3
Alien invasive vegetation clearing	2019	2019	55	20			~1–2
Management of WCWSS	N/A	N/A	27	10			~0.2–0.5
Cape Flats Aquifer P1	2020	2021	20	7.3	800	40	5
Table Mountain Group P1	2020	2020	15	5.5	375	25	5
Cape Flats Aquifer P2	2021	2025	25	9.1	1,200	48	9
Atlantis Aquifer	2021	2024	10	4	290	29	8
Table Mountain Group P2	2022	2026	15	5.5	335	23	5
Table Mountain Group P3	2022	2028	20	7.3	326	16	2
Berg River Augmentation	2023	2024	40	15			~3–5
Water Reuse P1	2024	2027	70	26	1,360	20	5
Desalination Phase 1	2026	2030	50	18	1,650	33–40	9
Total including water demand management			**417**	**154**	**6,746**		
Total new supply			**347**	**128**	**6,336**		

Note: capex = capital expenditure, kl = kiloliter, Ml = megaliter, MLD = megaliter per day.

7. City of Cape Town. 2020. *Water Strategy*. Cape Town, South Africa: CoCT.

In addition to the "committed" program, several other augmentation options are under consideration beyond 2030. These include further development of reuse and seawater desalination, as well as a few additional surface water options which mainly focus on transferring water from the Breede River catchment.

The WCWSS is a physically integrated and institutionally complex system that requires cooperation and investment by multiple sectors and stakeholders in the context of increasing water security risks. Clarifying some of the key institutional responsibilities is necessary to understand the need for cooperation.

DWS is mandated with managing and developing water resources nationally. This includes the allocation and authorization of water use and the coordinated planning and operation of water resources systems to provide raw water to urban, industrial, agricultural, and other users, while considering the requirements of the environment. In the WCWSS, the Breede-Gouritz Catchment Management Agency performs some of the above delegated water resources regulatory functions and is soon expected to be expanded to cover the Berg River.

DWS is also responsible for financing and operating water resources infrastructure through its Water Trading Entity and Infrastructure Branch; however, some local agricultural schemes are operated by water user associations.

The function of raising commercial debt finance and developing new surface water schemes on a project finance basis has historically been mandated to the Trans-Caledon Tunnel Authority (a national public entity) by DWS (as is the case for the Berg River Dam in the WCWSS). The financing is repaid through raw water charges levied on urban, industrial, and agricultural users.

Municipalities, including the CoCT, are authorized to plan and provide water supply and sanitation services, including bulk water treatment and distribution within their areas of jurisdiction, and set water tariffs for customers. The CoCT owns some water schemes that are operated as part of the WCWSS and will be responsible for developing and financing most of the planned augmentation in the system.

The provincial government is influential through agricultural, economic, and development planning processes that determine water demand and have an impact on water quality. Water demand and quality, in turn, influence investment confidence by the sectors. The provincial government also provides support to municipalities for infrastructure and drought management.

The private sector plays multiple roles as industrial, commercial, or agricultural water users and as a key partner for investment and economic growth. There is interest and potential for the private sector to play a greater role as commercial financiers or service providers in developing, operating, and managing water infrastructure and services.

All these pieces of the institutional puzzle must work in a complex broader political economy environment for the system to be resilient. The new non-conventional schemes that are proposed over the next decade and beyond, and the emerging "new normal" of climate-exacerbated water scarcity, further add to this complexity. Key stakeholders need to have an aligned understanding of the system (physical and economic), should trust how decision-making processes work, and should have confidence in accountability mechanisms. The drought negatively impacted on such trust and confidence. The CoCT took the initiative to get this hydro-economic analysis process started, recognizing that to be truly water resilient, it needed to both influence and be willing to be influenced by other users, water managers, and stakeholders.

Source: Selwyn Willoughby

The Hydro-Economic Analysis

The hydro-economic analysis focused on improving understanding of the economic implications (for the economy of the Western Cape as a whole) of water resources management in the WCWSS and strengthening relationships between key stakeholders.

This was done by co-creating economic narratives on the costs and benefits of augmentation and the opportunities to build a climate-water resilient economy for the CoCT and province. The process had two overall objectives:

- To better understand the relationship of the WCWSS and the Western Cape economy. This deepened understanding is intended to improve the analytical information base on which water resources management decisions can be based.
- To support the strengthening of relationships between key stakeholders of the WCWSS, both public and private, toward fostering institutional cooperation and partnership.

Source: DmitryStock / Shutterstock

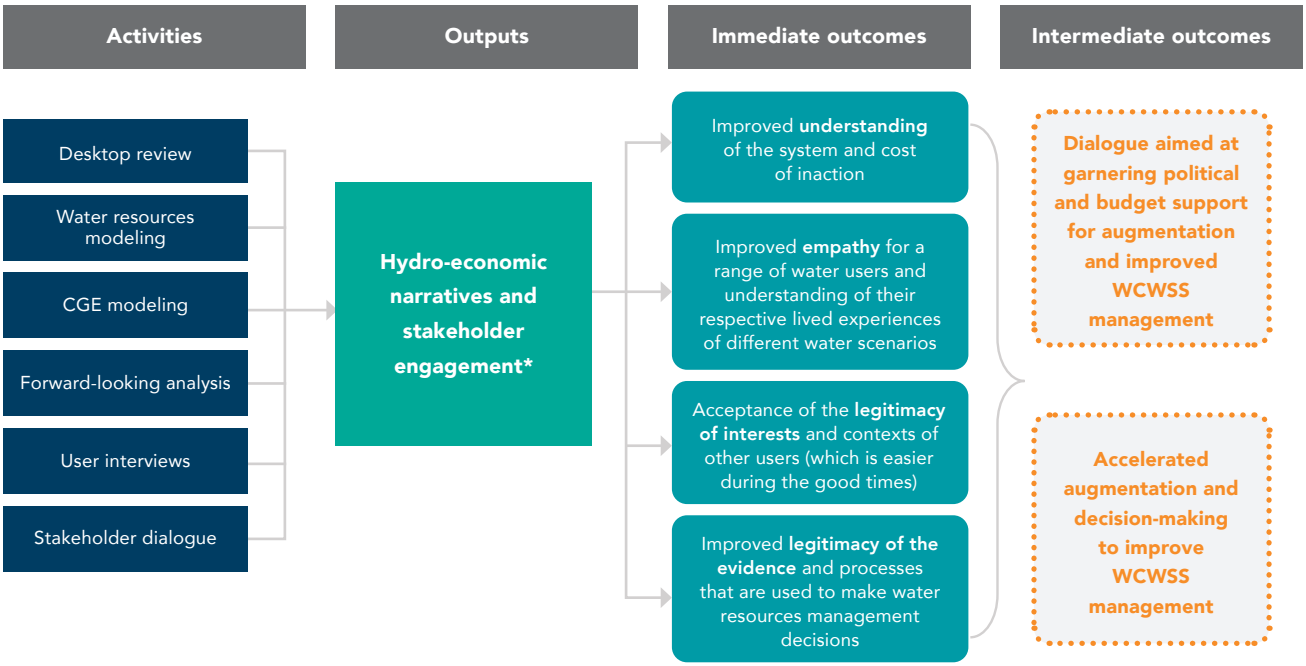
As shown in the theory of change below, this was initiated by conducting desktop research, modeling (water resources and economic analysis), water user interviews, a forward-looking analysis, and stakeholder dialogues. These activities improved system understanding by key stakeholders, stimulated empathy between users, and initiated a dialogue within the three spheres of government and across users to accelerate augmentation and improve water resources management decisions.

This work supports implementation of Commitment 4 of the CoCT's Water Strategy, which requires collaboration between the CoCT, other users, and other spheres of government; and is aligned with other priorities and strategies at city, provincial, and national level.

The scope of the project, its trust-building procedural approach, and the requirements for the hydro-economic analysis were developed by a Project Steering Committee (PSC) consisting of all three spheres of government.

A team of internationally recognized local and international experts was appointed to execute this analysis and process.

FIGURE 4: Theory of change for the analysis and associated stakeholder process



* The activities produced a series of document and dialogue outputs, including client reports for the PSC, short memos for internal use, a modeling report, a narratives report, PSC meetings with proceedings notes, bilateral meetings with notes, stakeholder workshops with pre- and post-workshop notes, a modeling validation workshop, and a capacity-building workshop on quantitative economic analysis.

Source: Original to this publication.

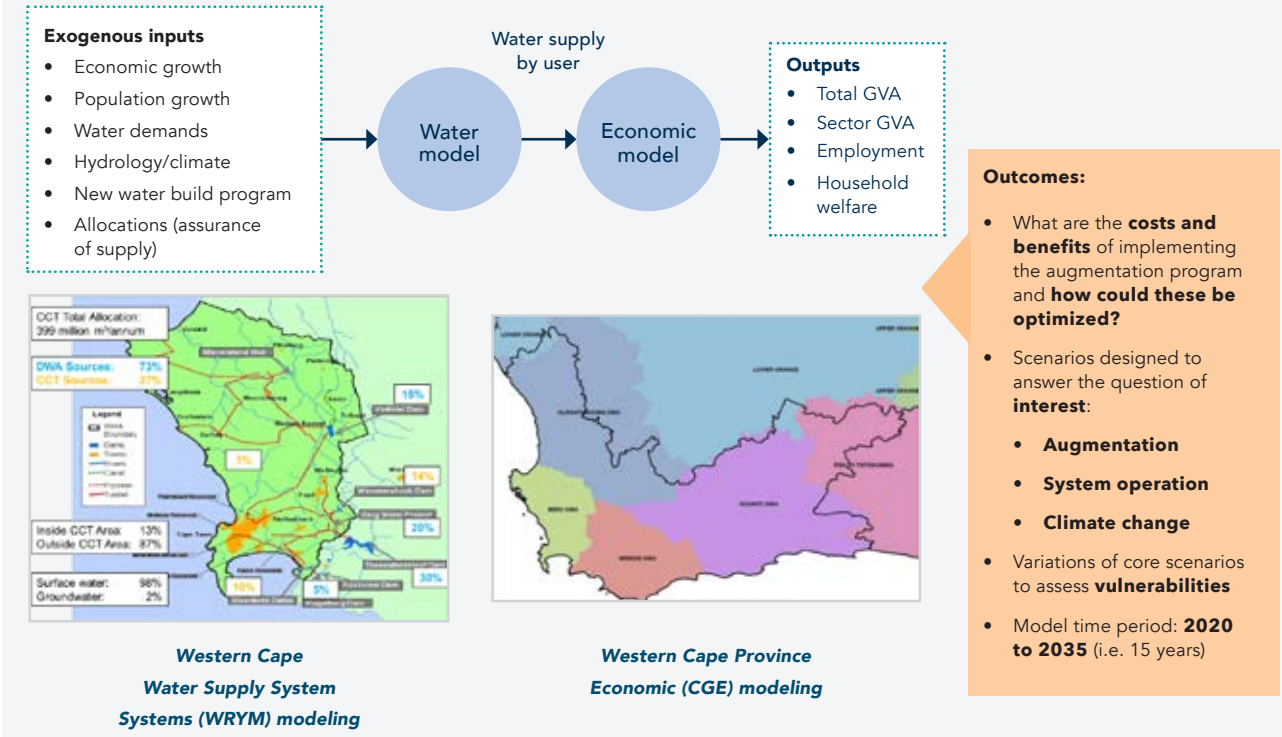
Given the objectives of improving understanding and empathy in the relationship process, quantitative modeling was used to provide evidence that supported dialogue rather than to lead the process, as is usually the case.

A dynamic computable general equilibrium (CGE) model, based on the social accounting matrix developed by the Western Cape Government, was linked to the water resource yield model used for water planning by DWS in South Africa. Building on existing trusted models was deemed to be an important part of gaining credibility and ensuring use of the hydro-economic analysis. These linked models were used to explore the economic impacts and interrelationships of various future augmentation scenarios of the WCWSS. The water allocation and augmentation scenarios were based on those developed as part of the water resources planning process led by DWS. Future applications of the modeling may vary allocation and assurance levels, as well as augmentation options.

The exercise was built on existing model calibrations, which resulted in a disjuncture between the boundaries of the WCWSS for the water resources modeling and the Western Cape for the economic modeling. This challenge was overcome by reflecting the water resources of the remainder of the project as input to the CGE, while focusing on augmentation of the WCWSS directly.

A PSC-approved expert reference group reviewed the economic modeling and concluded that the use of CGE modeling and the choice of model were appropriate and that the assumptions made were reasonable.

FIGURE 5: The water resources-economic modeling

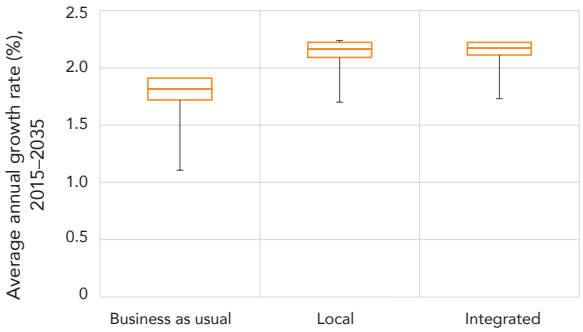


Note: GVA = gross value added.
Source: Original to this publication.

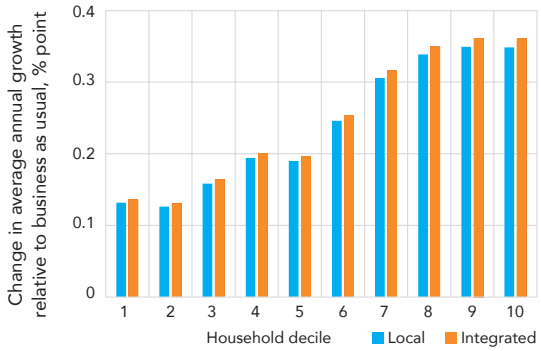
The augmentation interventions considered in this analysis and process were limited to those proposed to be implemented by 2030, the details of which were outlined above. Combined, the interventions planned within this period will add 128 Mm^3/a additional capacity to the system, at an estimated capital investment of R7.5 billion. The focus of the assessment was on the period up to 2030, but because some of the schemes are only expected to be commissioned just before 2030, the modeling was continued until 2035 to allow the economic consequences to flow through the dynamic model. While this period does not allow long-term economic impacts of further augmentation and climate change to be reflected, it served the purpose of this process. Future hydro-economic analysis can be performed using these models to evaluate other longer-term considerations.

Source: Daniel Jacobus Nel

FIGURE 6: Headline findings from the hydro-economic modeling



There is a 7 percent increase in the Western Cape's annual GDP and 195,000 jobs by 2035 with the augmentation compared with no augmentation, with a marginal benefit with integrated operation



While all households benefit from the augmentation program, the structure of the economy means that benefits are disproportionately distributed

Source: Original to this publication.

From the results derived from this stochastic modeling of multiple scarcity futures, two fundamental insights should be highlighted. First, not implementing the augmentation program over the next decade will have significant negative consequences for economic growth and employment in the Western Cape, both during average hydrological cycles but even more so during more extreme drought-related cycles. Second, while augmentation has positive benefits for all households, it disproportionately benefits those that are already part of the formal economy, thus raising the need for pro-poor interventions.

The findings from the drought review and the hydro-economic modeling were used to stimulate engagement with and among a broad spectrum of key stakeholders in the WCWSS, which included water and environmental management representatives from local, provincial, and national government, as well as representatives of the tourism, agricultural, and industrial sectors. Both stakeholder workshops and detailed interviews with individual water users and user groups were conducted to obtain diverse perspectives, interests, and anecdotes on the impacts of the drought, the management of the system, and future investment requirements.

Hydro-Economic Narratives

With the aim of improving collective understanding of the WCWSS and fostering empathy, a narrative approach was used to synthesize, infer, and present the evidence of the bottom-up (interviews and literature review) and top-down (economic modeling) approaches.

That inference is required to reflect on two overarching questions: "what" the planned augmentation of the WCWSS does for the Western Cape economy and "how" these impacts take effect.

The first set of narratives involved four **big picture** conclusions that convey the broad economic impacts of augmentation and inaction.

First, the planned **augmentation program must urgently be implemented**, despite the current seeming availability of water. Augmentation of the WCWSS is needed to ensure reliability in the assurance of supply even under future droughts, and thereby to mitigate the risk of economic loss from constrained production and to create long-term economic value for businesses and people in the CoCT and province.

- Without augmentation, increasing variability and reduced reliability of supply will constrain economic growth by 7 percent and 195,000 fewer jobs will be created by 2035.
- This economic benefit accrues primarily to the CoCT, but significant indirect benefits are also derived by other communities, businesses, and farms throughout the province.
- The economic relationships and dependencies between the water-dependent urban and rural economy are positively reinforcing through supply chains, services, and movement of people.
- Water augmentation is generally good for the Western Cape's trade balance, but as water becomes scarcer and more expensive, there may be a shift to import some water-intensive products.

Source: Abigail Keenan / Unsplash

Second, **augmentation alone is not necessarily sufficient to catalyze the full economic development benefits**, because **confidence in the system** and its ability to reliably supply water for residents, farms, and businesses and **trust in the processes** of water allocation and operational decision-making, are critical prerequisites for the sustained investment that is required to drive economic development.

- Farmers, businesses, and municipalities need to better understand the economic evidence, assurance of supply, and the basis on which decisions around allocation and restrictions are made, to have confidence that the system will continue to provide them with reliable clean water.
- Investor confidence requires transparency and communication, both to build understanding and acceptance of the tough trade-off decisions and to ensure predictability and consistency in operating the system including potential restrictions, particularly for them to make long-term investments.
- Decisions about alternative sources by municipalities and industrial users should be done in a planned and coherent manner, to avoid fragmentation and lost opportunities for economic benefit.
- Multi-stakeholder platforms building on existing mechanisms led by mandated government institutions should be adapted to provide suitable forums for trust building and economic dialogue around water and economic resilience.

Source: B Brown / Shutterstock

Third, **operation and financing of the new non-conventional augmentation schemes** (aquifers, water reuse, and desalination) should consider the economic benefit beyond the direct beneficiaries as they could increase assurance of supply for the entire WCWSS. This also provides the opportunity for new and innovative ways of financing the capital, managing these schemes, and funding the capital repayment and operations.

- Engaging key water users on the economics and operation of the system to increase and allocate assurance should raise the possibility of new financing, trading, and pricing models.
- Potential integration of the new augmentation schemes into the operation of the entire WCWSS has economic benefits for the Western Cape economy, but also imposes transaction and financial costs which should be borne by all those who benefit.
- Fostering agreement on the rules and expectations for restrictions during future droughts, before they occur, will build greater levels of confidence in the fairness of the system, and may allow an allocation and pricing regime that is economically oriented.
- Efficient water use must continue to be promoted, but more knowledge is required to design economically rational actions that catalyze the opportunities and remove constraints.
- The strong economic and supply chain linkages between the urban parts of the WCWSS that are enabled by this augmentation and the agricultural and urban areas in the remainder of the province should be leveraged to drive and enable augmentation of these other water resources systems.

Source: Bruce Sutherland, City of Cape Town

Fourth, a **deliberate pro-poor focus on water access and job creation is needed beyond the augmentation** investment, because the current structure of the economy results in disproportionate benefit to higher-income households, even though all households benefit economically from the augmentation-induced growth.

- These mechanisms could include, for example, ensuring access to reliable water supply and sanitation in informal settlements, creating labor-intensive jobs associated with the new build, and increasing water allocations to emerging resource-poor farmers.

These meta-themes may be contrasted by **user perspectives** that convey economic considerations associated with prototypical stakeholders in the WCWSS system at the individual or institutional level, inspired by stakeholder interviews. These user perspectives ranged from industry managers and tourist establishment owners, through both high-income suburban and informal settlement residents, to farmers and their seasonal laborers. The narratives explored the implications of water availability and decisions that these water users and providers have faced in the recent past, as well as those they may face in the future arising from differing augmentation scenarios. Rather than repeat the individual user perspectives, some important themes emerged from this process:

- Despite common assumptions about sector homogeneity, water user groups are typically diverse and have perspectives borne out of their histories, resources, and needs, which should be better understood.

"Some farmers benefited from higher crop prices during the drought, while others are still trying to recover"

Winelands farmer

- Many users do not trust that the water system is being managed fairly and transparently, which drives some households and businesses to find alternative sources or solutions, while a lack of confidence in the water system hampers investment in productive activities.

"During the drought, it was less about the actual water restrictions than people's confidence about government's messaging"

Guesthouse owner

- Most people recognize that economic prosperity, jobs, and trade are in everyone's interest and that a reliable supply of water is a basic building block for their household security and economic wellbeing.

"We need jobs at this difficult time and access to safe water for our children"

Informal settlement resident

- While businesses need water for their operations, they often understand their water risks in their supply chains, as well as that their customers need to be healthy and affluent enough to buy their products.

"We need to trust the system will provide water to us, and to our suppliers and our customers to ensure our business growth"

Business manager

- The drought and threats of future restrictions have driven production process and mechanization changes to improve water and economic efficiency in both businesses and farms.

"We worry because people lost their jobs during the drought and farmers are mechanizing"

Seasonal farm worker

- Lack of trust in the reliability of the water supply system has resulted in some consumers investing in (typically more expensive) alternatives, while perspectives on whether these investments enhance or reduce overall system reliance diverge between stakeholders.

"We retrofitted to reduce water demand and went off-grid with our borehole"

Suburban resident

Water demands or requirements are typically the way in which user groups frame discourse between each other in water management processes. However, engaging with representative users during this process has highlighted the economic underpinning and complexity of these groups' interests. There is a general understanding that a functioning, viable, equitable water system is the platform for economic and social development, and that water should be managed in the common interest rather than for narrow sectoral gain.

Water augmentation in the WCWSS is a prerequisite to catalyze and sustain economic development of the Western Cape but should also be seen as an opportunity to unlock key structural improvements and inclusivity in the provincial economy. Investment in water augmentation is critical to meet the Western Cape Government's priorities and the CoCT's Water and Resilience strategies. While this process focused on improving understanding and building empathy, rather than making clear recommendations about water allocation and alternative approaches to assurance of supply for different users, the economic models, narrative evidence, and robust dialogue processes initiated provide the platform for further analysis that could influence both these strategic and operational decisions—even given the constraints of COVID-19. A platform, with increasing trust from stakeholders, would also provide for continued open and innovative discourse on the role of water in the economy of the WCWSS and the province more broadly.

Financial and Institutional Considerations

The narratives attempted to give different economic perspectives of the WCWSS and its dependency on or resilience to climate and water, as well as its linkages to the broader Western Cape.

This leads to the question "So what?," which raises important institutional, financing, and process issues.

To start with, the **characteristics of the augmentation program lend the program to new and innovative institutional and financing opportunities**:

- The existing surface water resources storage and inter-basin transfers provide the backbone of the water supply system and may be augmented by selected new projects or improving existing schemes. However, they are vulnerable to climate variability and change, and overallocation of the system, and need to be operated in a coherent and integrated manner (as is currently done).
- The invasive alien plants clearing initiatives primarily benefit the surface water system by preventing further losses to the system in the long term, and thus should be planned and managed as part of the integrated system by those building surface water storage facilities and those benefiting from the supply of this stored water.
- The existing and new (deep and shallow) aquifer abstraction schemes provide water at high levels of assurance and would buffer the climate variability, but their climate resilience and environmental impacts are still uncertain. While they can feed into the system, they may also be operated distinctly from the surface water system by those developing the resources and using the water.
- The planned large-scale direct potable water reuse and local aquifer recharge schemes are primarily linked to the CoCT's distribution and treatment network. While they supplement the system with high-assurance water that is resilient to climate change, they may be operated either as part of the larger integrated water supply system (potentially incurring higher transaction costs) or independently.
- The desalination plants similarly have high assurance of supply but higher operating costs and associated energy requirements; they too could be operated either as independent sources run primarily for the benefit of the CoCT (or individual users) or as part of the integrated system, helping to increase the assurance of supply for all users.

The unconventional nature of the various projects in the augmentation program provides an opportunity to rethink the potential financing, operational, and institutional models, while building on historical and emerging institutional arrangements.

Source: Bruce Sutherland, City of Cape Town

This should take account of changing awareness and understanding of risk, as well as new technologies.

At the most integrated level, the desalination, water reuse, and aquifer schemes (all of which offer an almost 100 percent assurance of supply) could be operated to support the entire system and potentially free up water in wetter periods for other water users, as well as to meet environmental requirements. This would create a marginally increased economic and environmental benefit to the system, but comes at an increased operational and transactional cost that should therefore be more broadly shared by those that may directly benefit from increased assurance.

On the other hand, these schemes may be operated by the CoCT on a minimized cost basis only when there is a water supply shortfall to CoCT water users from the remainder of the system. Schemes have been operated in this way locally and internationally. The downside of this approach is that the system as a whole does not benefit from the additional capacity. These schemes may be underused (or considered partially stranded assets for many periods), but this would be the prerogative of the developers and financiers of these schemes.

There are obviously a range of operating scenarios in between. The decision about which approach is adopted will be the result of the institutional arrangements, operating rules, cost-sharing modalities, and financing arrangements in the system. Conversely, the way the schemes are operated will influence the possibilities for innovative financing and operating models, particularly if private sector capital financing and/or management contracting arrangements are proposed for any of them.

There is both **appetite and capability for the private sector to become more involved in the system**, not just as commercial, industrial, and agricultural water users, but as stakeholders that have a vested interest in the success of the entire economy and critical partners in the investments required to deliver economic growth and jobs. Some government-business forums have been established by the CoCT and could be improved to explore greater private sector involvement. There is a significant opportunity to leverage this private sector interest and engagement, and the non-conventional nature of the augmentation schemes also allows innovation in the role of the private sector as a partner in development, including as offtakers, operators, and financiers.

The underlying financing and funding issue is how to mobilize and recover the higher capital and operating costs of these new schemes in a fiscally constrained environment, and whether some mechanism could be adopted to partly share costs with all those who benefit directly or indirectly from the water-catalyzed growth in the region. This will influence whether there is an incentive for the developer of the non-conventional schemes (such as the CoCT, other municipalities, or industrial users) to operate these as part of the WCWSS, rather than as independent dedicated water sources. Importantly, these municipalities and users have allocations from the WCWSS that they are unlikely to relinquish, so will rather use these schemes to supplement their supply and understandably improve their own assurance.

The national Raw Water Pricing Strategy governs the **capital financing and associated funding models** applicable to the broad augmentation but has thus far been unclear about the financing arrangements for non-conventional water supply schemes. The planned revision during 2022 may clarify this issue, as well as the financing of infrastructure and the application of social versus economic benefit in terms of the financing and funding arrangements for augmentation schemes. Any financing models for the WCWSS will need to be cognizant of these developments. However, it should be noted that various public and private financing approaches have been adopted in the water sector in South Africa, and that in a fiscally constrained environment, the National Treasury has promoted the need to crowd in private finance into the water sector.

A key question for the WCWSS is whether the developers of new augmentation schemes will adopt a scheme-based financing, repayment, and operation model, or whether arguments for a more systems-based funding model will prevail. Similarly, there remain questions about the adoption of innovative economic instruments, such as water trading and water banking, to build resilience, assurance, and efficiency into the system.

The **policy and legislative framework related to the institutional arrangements for water management** in South Africa is clearly defined in the National Water Act and the Water Services Act. The implementation of this policy, legislative, and institutional framework in the WCWSS is well defined in other reports. While not intending to review these institutional arrangements, there are a few observations that are relevant going forward:

- The planning and operation of the WCWSS is informed by various actors under the leadership and coordination of DWS, through a collective process as part of the Annual Operating Analysis steering committee.
- The CoCT owns and operates part of the system, but also has its own supply options, and is likely to be the developer and operator of the non-conventional projects in the augmentation program.
- Various other municipalities, businesses, and farms are dependent on the system and have a role and interest in its planning, funding, and operation (but may decide to develop their own sources unconnected to the broader system), while environmental groups similarly have an interest in the impacts of the augmentation and operation.

Stakeholders have articulated the need for greater transparency in planning and decision-making to balance the accountability and responsibility of mandated institutions with the trust and confidence required by water users in the system and urban areas. Ultimately, the economic development and resilience of the system depends on investment, cooperation, and buy-in by key economic actors who are dependent on water and contribute to the cost of running the system. It also depends on efficient allocation of water at different levels of assurance, in order to optimally catalyze social and economic development. Further hydro-economic analyses will be required to inform these decisions, together with extensive engagement of all key role players.

A range of institutional options may enable this, building on existing competencies and mechanisms while remaining within the policy, legal, and institutional framework, including:

- Strengthening the existing multi-stakeholder platform (steering committee) used in the planning and operation of the WCWSS under the leadership of DWS.
- Creating a new multi-stakeholder platform emerging from this process, under the custodianship of an independent convenor, taking a more economically focused approach.
- Accelerating the establishment of the Berg-Breede Catchment Management Agency, with a relevant WCWSS Catchment Committee representing multi-stakeholders, to build water-economic resilience.

In practice these may not be mutually exclusive options, but rather elements of a phased evolution from the status quo to a future more representative and accountable institutional model reflecting the spirit and opportunity of South Africa's water policy and legislation. This does not imply that this platform should develop, finance, and operate the WCWSS and the new augmentation projects, but rather that a new platform may be useful in advising on the rules for regular operation and the intended response during a future drought. The combination of developers and operators outlined above would be required to adhere to these rules, and use clear mechanisms when adaptation is required. The application of the financing and funding arrangements adopted would be coordinated through this platform, in collaboration with the mandated institutions, including DWS, the CoCT, municipalities, water user associations, and any other relevant water funding mechanisms.

Source: Selwyn Willoughby

The Way Forward

This Discussion Paper has highlighted the interrelated nature of water and the economy of the WCWSS and the Western Cape as a whole. It has also argued for the importance of water augmentation as a catalyst to and prerequisite for building a better, more climate-water resilient, and inclusive economy.

The need for augmentation and collaboration as the prerequisites to build **trust and confidence in the system** is a recurring theme. This can be seen in two distinct ways, namely (i) **trust** in the way that decisions are made about the management of the existing system, based on transparent, consistent, and predictable application of "the rules of the game" and considering diverse interests, and (ii) **confidence** that the system will be augmented and managed in a way that meets and enables future water requirements of water users, reflecting economic growth and investment intentions. At its heart, the process raised two fundamental and unresolved issues:

- *The way in which the existing system should be operated to build trust, confidence, predictability, and consistency in decision-making, particularly during periods of stress. This may include the possibility of refining current definitions of assurance of supply and providing more clarity on the specific rules and restrictions that will apply during droughts of varying severity.*
- *The way that the new augmentation program should be developed and incorporated as part of the system to support economic growth and resilience of the entire system. This must consider the way the new schemes are operated within the system or CoCT, the implications of this on the costs of operating the new schemes, and the potential sharing of these costs by those who would benefit.*

An important aspect of these conclusions is the building of confidence in the system to encourage investment, together with improved understanding of the social and economic consequences of alternative ways of developing, financing, managing, and operating the WCWSS.

In doing this, there are **four key activities** that should be adopted and driven by the mandated institutions.

ACTIVITY 1: STRENGTHEN STAKEHOLDER ENGAGEMENT AND COMMUNICATION

Dialogue and communication between stakeholders, *water users, and government has been fostered through this process and needs to be continuously strengthened, with transparent and accountable multi-stakeholder platforms and communication processes to build understanding and trust.*

This activity builds on the multi-stakeholder process initiated through this process, supported by the robust engagement, understanding, tools, and empathy that were fostered in the safe space provided by the neutral convening and facilitating of the Economic Development Partnership. Two elements of this activity were identified:

- Strengthen the existing DWS-led committees involved in the augmentation planning (Reconciliation Strategy Task Team) and annual operational planning (and/or build a trusted multi-stakeholder platform) through the introduction of economic evidence and ensuring that key parties are aware of the way decisions are made and the implications of assurance of supply to future drought allocations.
- Improve communication (strategically) around the planning and operation of the WCWSS by:
    - Expanding the database of stakeholders who receive information to include "urban" users, sector experts, representatives of users, and those in economic development, while strengthening representation of the interests of the poor.
    - Sending targeted communication at least to non-expert professional (users and economic planners) and investor (such as businesses and farmers) circles.
    - Increasing the frequency of communication and outreach to existing user and economic planning sector platforms that are not water focused.
    - Communicating plans and progress, allowing for feedback and feedback on feedback.

OUTCOME 1: EXISTING STAKEHOLDER PLATFORMS ARE STRENGTHENED TO IMPROVE COMMUNICATION AND BUILD TRUST.

ACTIVITY 2: RESOLVE FINANCING AND IMPLEMENTATION AGREEMENTS FOR AUGMENTATION PROJECTS

The economic risks associated with inaction on the augmentation program have been clearly outlined*, but there have been delays in concluding financing agreements for many of these schemes, including agreement on the way they will be funded and operated to improve assurance in part or all of the system, requiring convening of decision-makers and rapid provision of relevant supporting analysis.*

This activity builds on the economic evidence outlined in this paper and would benefit from further hydro-economic and financial analyses on the way that the new augmentation options are incorporated into the existing WCWSS, potential tariff structures, and opportunities for private sector participation.

- Conclude off-take and financing agreements for critical augmentation (Berg River-Voëlvlei Augmentation Scheme and invasive alien plants clearing projects), supported where necessary by:
    - Relevant financing, funding, pricing, and institutional options analyses supported by cost-benefit analyses, for key augmentation plans that are not already under way.
    - Convening key decision-makers to resolve outstanding issues, including operations and impact on assurance of supply within the entire WCWSS.
- Investigate and propose mechanisms for private sector involvement in the financing and operation of the new augmentation schemes (desalination and potable reuse), to overcome fiscal constraints and explore innovative operating modalities for these elements of the system.
- Ensure pro-poor initiatives and tariff structures are adopted as part of these initiatives, to ensure that the lowest-income households also benefit from the augmentation program.

OUTCOME 2: FASTER PROGRESS WITH AUGMENTATION IS ACHIEVED THROUGH CONCLUSION OF FINANCING AGREEMENTS.

ACTIVITY 3: DEVELOP AND COMMUNICATE AGREEMENTS ON ASSURANCE OF SUPPLY AND OPERATING RULES THAT INCLUDE FLEXIBILITY TO MANAGE WATER SECURITY IN A HOLISTIC WAY

Predictability and consistency are critical for long-term investment. *This requires clarity on the conditions under which restrictions will occur and the implications for specific water users and can be based on allocation of different levels of assurance, trading mechanisms, and operating regimes that reflect future potential drought conditions, in addition to the current year ahead operating rules currently being communicated.*

This activity builds on the base hydro-economic models developed during this process and could address allocation and assurance options that were explicitly not modeled due to resource constraints and the need to build credibility around the analysis tools in a relatively low-trust environment.

- Investigate the hydro-economic impacts of different levels of assurance and potential pricing regimes for user groups enabled by the introduction of alternative augmentation options, as well as the consequences (building on the analyses done in this project).
- Clarify and communicate the operating regimes that would be applied to different user groups under alternative future drought conditions to give investors confidence in the system.
- Explore trading mechanisms that enable individual users to respond more adaptively and flexibly during periods of stress, such as spot trading or water banking.
- Consider the distributional opportunities of reallocation or changing assurance, particularly for broad-based black-owned businesses and resource-poor farmers.

OUTCOME 3: CLARITY AND COMMUNICATION OF FLEXIBLE ASSURANCE AND OPERATING RULES FOR DROUGHT ARE IMPROVED TO BOOST INVESTOR CONFIDENCE.

ACTIVITY 4: IMPROVED INFORMATION SYSTEMS LINK CLIMATE, HYDROLOGY, CATCHMENTS, AND THE ECONOMY

The current analysis tools and knowledge systems *used for monitoring, planning, and operating the WCWSS can be improved to support better understanding and decision-making for the increasingly complex and integrated dynamics of the transition to a more climate-water resilient economy of the WCWSS.*

This activity would build on the credibility gained from the multi-stakeholder platform-driven, hydro-economic analysis-supported approach, by strengthening and sharing understanding of the system.

- Design a hydro-economic information and monitoring system (monitoring, analytics, and communication), together with the institutional and funding arrangements.

OUTCOME 4: A HYDRO-ECONOMIC INFORMATION SYSTEM IS ESTABLISHED AND FUNDED.

While the report findings apply to all stakeholders in the WCWSS as well as the broader Western Cape, they are particularly relevant for all three spheres of government with an interest in the economic development, social transformation, climate resilience, and water management of the system.

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