MAKING THE CASE FOR UPSCALING INVESTMENT IN TRANSFORMATIVE RIVERINE MANAGEMENT IN DURBAN

About the C40 Cities Finance Facility

The C40 Cities Finance Facility (CFF) is a collaboration of the C40 Cities Climate Leadership Group and Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH. The CFF supports cities in developing and emerging economies to develop finance-ready projects to reduce emissions in support of limiting global temperature rise to 1.5°C and strengthening resilience for the impacts of a warming climate. The CFF is funded by the German Federal Ministry for Economic Development and Cooperation (BMZ), the UK Department for Business, Energy and Industrial Strategy (BEIS), the Children's Investment Fund Foundation (CIFF) and the United States Agency for International Development (USAID).

About the C40 Cities Finance Facility's support to eThekwini Municipality

With support from the CFF, the eThekwini Metropolitan Municipality is building a case for upscaling riverine management to encompass all rivers in the city. The project vision is to build a compelling business case for transformative urban riverine management which works in partnership with all affected stakeholders to rehabilitate and sustainably manage all riverine corridors in the city in a manner that:

- builds resilience to the impacts of climate change;
- enhances riverine ecosystem functioning;
- transforms riverine corridors into clean, safe, healthy, valuable and pleasant open spaces;
- generates social and economic opportunities;
- impacts positively on the city; and
- demonstrates community-ecosystem based adaptation as an inclusive, effective climate change response.

Funding partners:

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Executive summary

eThekwini Municipality[1] has recently prepared an evidence-based investment case for upscaling transformative riverine management across the entire eThekwini Municipal Area. Using a combination of Benefit Cost Analysis and river systems modelling, the municipal and societal costs associated with global climate change effects on Durban's rivers have been predicted, and the significant worth of riverine management as an effective risk-reducing and cost avoidance measure that benefits all city residents has been demonstrated. The Business Case has also generated a significant knowledge base for the city and others to build on.

eThekwini Municipality's Sihlanzimvelo Stream Cleaning Programme has demonstrated that riverine management on municipal land can reduce damage to municipal road culverts and create many job opportunities in the city's most vulnerable communities. This programme is part of the city's efforts to deliver financially, socially and environmentally sustainable municipal services. The potential climate adaptation co-benefits of Sihlanzimvelo are also of increasing interest, especially considering eThekwini Municipality's particular focus on ecosystem-based adaptation in the Durban Climate Change Strategy and Plan. Recognition of the climate resilience value that Sihlanzimvelo was creating inspired the city's ambition to upscale the programme, including bringing other landowners into a city-wide transformative riverine management programme.

The C40 Cities Finance Facility has assisted eThekwini Municipality to develop a Business Case for Durban's Transformative Riverine Management Programme that can be used to raise implementation funding from within the municipal fiscus, and from other actors.

An analysis of how this investment case was made has generated the following key lessons:

- Transformative[2] riverine management can restore social and economic benefits lost due to river degradation, as well as substantially reduce future climate change related loss and damage to rivers.

- Systems-scale transformative riverine governance that incentivises appropriate management action, pools resources and promotes co-investment is central to achieving sustainable, efficient and equitable benefits from rivers.

- Benefit and cost data from eThekwini Municipality's Sihlanzimvelo Stream Cleaning Programme was vital in making a credible case for upscaling riverine management investment in Durban, highlighting the importance of good monitoring.

[1] The city of Durban is administered by the eThekwini Metropolitan Municipality.
[2] See the following publication for more information on how eThekwini Municipality defines "transformative" riverine management: C40 Cities Finance Facility (2020). *Transformative riverine management projects in Durban: implementation.*

- Modelling the changes to ecosystem services flows under different future scenarios was useful to estimate the cumulative benefits from spatially and technically discrete management interventions in socially, ecologically and hydrologically complex river systems.

- Benefits from well-managed rivers could become more valuable over time, suggesting ecosystem-based adaptation is a prudent public and private investment strategy.

- The Business Case justified a practical implementation pathway, starting with upscaling existing riverine management efforts on municipal land and incrementally phasing-in a more ambitious, city-wide, transformative approach over time.

Objectives of the report

This report is the third in a 3-part series presenting Durban's learnings from the establishment, implementation and planned upscaling of transformative riverine management projects. It presents the lessons learnt from preparing an evidence-based investment case for a city-wide, partnership-based transformative riverine management programme, and highlights the key results of this work. This 3-part series is complemented by a fourth report covering lessons from eThekwini Municipality's drive to implement and maintain a cost-efficient, low-environmental-impact, climate-resilient wastewater system that delivers socially inclusive services.

Background to Durban's Transformative Riverine Management Programme Business Case

In 2012, eThekwini Municipality began implementing the Sihlanzimvelo Stream Cleaning Programme with the main aim of reducing damage to road culverts caused by more frequent and intense flash floods. The programme adopted a labour-intensive approach, creating hundreds of jobs through community co-operatives employed to clear invasive alien plants, litter, and rubble from streams on municipal land in low income, high density settlements. While the main focus was on improved service delivery (i.e., avoided costs of flood damage to road culverts), the substantial social and environmental co-benefits of the programme soon became clear. The potential for Sihlanzimvelo to help buffer the municipality and vulnerable communities from climate change impacts in riverine areas also began to draw much interest, particularly considering the city's strong focus on ecosystem-based adaptation[3]. The conversation then turned to the potential for upscaling Sihlanzimvelo and its associated benefits, and how this could best be motivated and implemented.

In 2018, the C40 Cities Finance Facility brought technical and financial support to eThekwini Municipality for the preparation of an investment case supporting a city-wide, Transformative Riverine Management Programme. The resulting Business Case, which was completed in

[3] Roberts, D., Boon, R., Diederichs, N., Douwes, E., Govender, N., McInnes, A., McLean, A., O'Donoghue, S. and Spires, M. (2012). Exploring ecosystem-based adaptation in Durban, South Africa: "learning-by- doing" at the local government coal face. *Environment & Urbanization*, 24(1): 167:195.

January 2021, presents an evidence-based rationale for investment in a TRMP covering all of the approximately 7,000km of rivers and streams in the eThekwini Municipal Area. It motivates that the effective management of riverine areas can alleviate a service delivery backlog and avoid social productivity losses, as well as deliver a basket of valuable financial, socio-economic, human and ecological benefits in line with eThekwini Municipality's mandate to deliver services in a sustainable, cost-efficient and equitable manner. A clear link is made between these benefits and their role in improving the resilience of the municipal administration, business/industry, and all city residents to escalating climate change risks and impacts.

This work represents a key building block in the eThekwini Municipality's climate resilience pathway. It seeks to unlock increased investment from the municipality's budget, other government actors, non-governmental organisations, private sector stakeholders, and citizens toward riverine areas as a supplier of vital goods and services that underpin human wellbeing and a healthy economy.

Business Case preparation process

The Business Case for Durban's TRMP was developed over a three-year period. Initial efforts were directed towards defining the scope and method for preparation of the Business Case, followed by drafting of a detailed Terms of Reference for the work. Specialist consultants were then appointed to undertake technical studies to inform the Business Case, including:

1. A baseline assessment[4] of existing riverine management investments in the eThekwini Municipal Area, including gender[5], green economy[6] and river vulnerability[7,8] specialist studies,

2. Analysis of the regulatory framework[9] covering riverine management and implications for partnership-based riverine management,

3. Ecological infrastructure and social-ecological toolkit[10] providing guidance on transformative riverine management interventions,

[4] CFF (2020) Integrated Baseline Assessment Report. Report produced by FutureWorks for C40 Cities Finance Facility.
[5] CFF (2020) Gender Narrative Report. Report produced by FutureWorks for C40 Cities Finance Facility.
[6] CFF (2020) Green Economy Report. Report produced by FutureWorks for C40 Cities Finance Facility.
[7] CFF (2020) Vulnerability Assessment Report. Report produced by Isikhungusethu Environmental Services for C40 Cities Finance Facility.
[8] CFF (2020) River Vulnerability Assessment for the eThekwini Municipality. Report produced by FutureWorks for C40 Cities Finance Facility.
[9] CFF (2020). The regulatory framework and implications for partnership-based river management, based on lessons from key river partnership programmes. Report produced by Groundtruth cc for C40 Cities Finance Facility.
[10] CFF (202) Transformative Adaptation of Rivers in an Urban Context: An ecological infrastructure and socio-ecological toolkit. Available at: https://www.c40cff.org/knowledge-library/transformative-adaptation-of-rivers-in-an-urban-context-an-ecological-infrastructure-and-socio-ecological-toolkit

4. A transformative riverine management proto-masterplan[11] for a representative river catchment, including riverine ecosystem services flow modelling under climate change and various future riverine management scenarios,

5. A Benefit Cost Analysis[12,13] incorporating "do nothing", "basic management" and "transformative riverine management" scenarios for municipal, private and Traditional Authority owned land in river corridors across the eThekwini Municipal Area.

Many of the technical studies included consultative and/or participatory modelling processes aiming for meaningful inclusion of local stakeholder knowledge and perspectives. This included modelling the effects of predicted climate changes on Durban's rivers, and how different management approaches could influence river condition.

The Business Case preparation process ran parallel to the International Science Council's Leading Integrated Research for Agenda 2030 in Africa, which brought clarity to the meaning of "transformative riverine management" in the context of Durban and became the cornerstone of increased ambition in the TRMP. This interface between science and practice has become a hallmark of eThekwini Municipality's approach to climate change adaptation.

A Business Case Sub-Committee comprising municipal officials across several sectors (including environment, stormwater management, water services, health, city planning, parks and recreation, economic development, and business development) oversaw the work and reported progress on the Business Case preparation process to the city's executive Climate Change Committee.

Using Benefit Cost Analysis and river systems modelling to build an investment case

Developing an evidence-based argument for investment requires good data, or defensible proxies where data is limited. This is especially challenging for ecological infrastructure investments (such as rivers), where management interventions in natural systems can produce benefits that vary spatially and over time, and are therefore difficult to quantify and value.

Benefit and cost data from eThekwini Municipality's Sihlanzimvelo Stream Cleaning Programme was vital in making a credible case for upscaling riverine management investment at city-wide scale, highlighting the importance of good monitoring.

Benefit Cost Analysis (BCA) was a crucial tool used in building the investment case for Durban's TRMP. Its primary objective was to demonstrate how the financial and economic benefits of riverine management compared with the costs of implementation. eThekwini

[11] CFF (2020). Ohlanga Proto-Masterplan for Transformative Riverine Management. Report produced by FutureWorks for C40 Cities Finance Facility.
[12] CFF (2020) Riverine Management Models Report. Report produced by FutureWorks for C40 Cities Finance Facility.
[13] CFF (2020). Benefit Cost Analysis Technical Report. Report produced by FutureWorks for C40 Cities Finance Facility.

Municipality planned to use this in arguing for increased municipal expenditure on riverine management, as well as to encourage private landowners and Traditional Authorities to invest in managing the riverine areas on their own land.

This required several scenarios to be assessed in the BCA (see Figure 1). These were designed to contrast the climate change related costs of not managing rivers, with the benefits and costs of implementing "basic" and "transformative" riverine management. The "basic" scenarios assumed that riverine areas would be managed similarly to the existing Sihlanzimvelo Stream Cleaning Programme (i.e., removal of invasive alien vegetation, litter and rubble from within and alongside streams, with limited repairs of streambed and bank erosion). The "transformative" scenarios assumed the same basic management in addition to the restoration of associated ecological infrastructure (e.g. wetlands and floodplains), stimulating the green and circular economies, and social interventions that could foster enhanced river stewardship. It was assumed throughout that eThekwini Municipality would establish institutional capacity for "transformative riverine governance" as the mechanism to champion, support, incentivise and unlock basic and/or transformative riverine management investment by others.

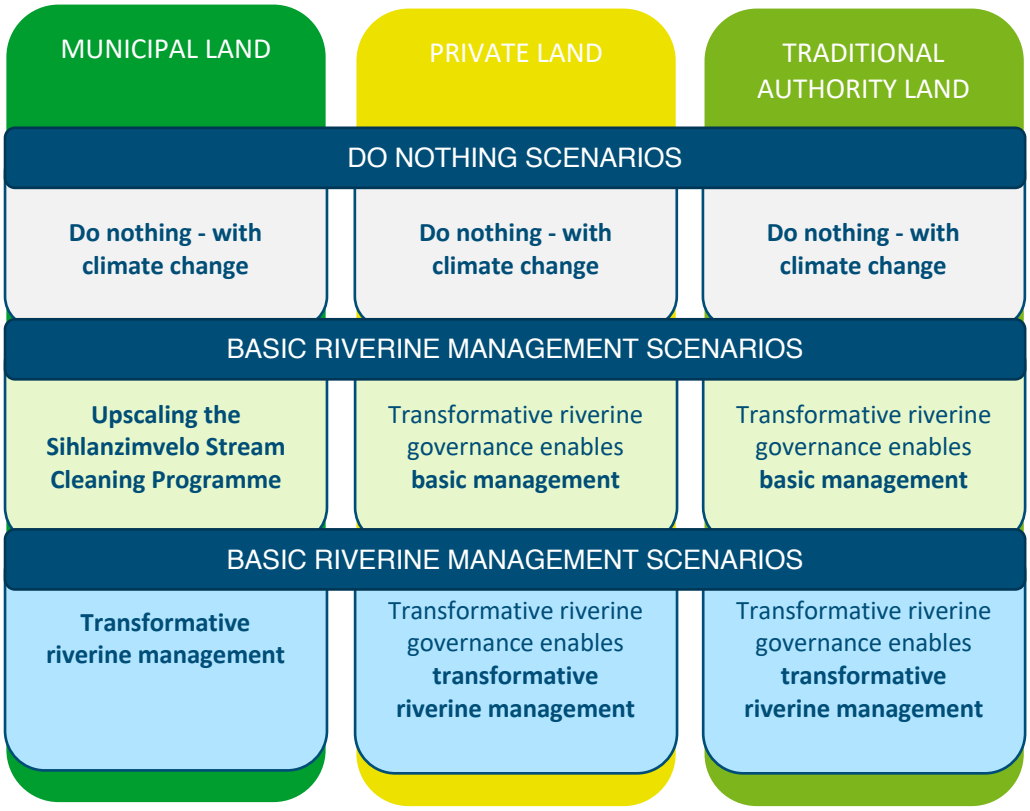

Figure 1: Benefit Cost Analysis scenarios

The appointed specialists gathered data on the known financial benefits and costs of implementing the Sihlanzimvelo Stream Cleaning Programme as a model of "basic" riverine management. This included calculating the avoided costs of damage to municipal road culverts that were directly attributable to the Sihlanzimvelo Programme. Data was not available on other possible financial benefits, for example avoided damage to other municipal

infrastructure (such as water and wastewater pipelines, electricity cables and roads) and avoided damage to private property. **This strongly suggests that the avoided costs and societal benefits estimated in the BCA are a significant under-estimate**.

A proto-type transformative riverine management model was developed for a representative river catchment in the eThekwini Municipal Area. This was used to define how "basic" and "transformative" riverine management would be implemented at a catchment system scale. As part of this process, a combination of eco-hydrological[14] and ecosystem services modelling[15] was used to determine, (i) the current state of rivers and their ability to deliver ecosystem services, (ii) how climate change would alter this *status quo*, and (iii) how basic and transformative riverine management would affect river conditions and associated ecosystem services supply, with the impacts of climate change accounted for. This determined the "factors of change" that could be applied in the BCA when calculating the "do nothing", "basic" and "transformative" riverine management scenarios. For example, climate change was found to reduce riverine ecosystem services supply by an average of 11%, and this was used calculate the societal costs of unmanaged rivers. This method was also particularly useful for identifying the beneficiaries of riverine management at catchment systems scale.

Modelling the changes to ecosystem services flows under different future scenarios was useful to estimate the cumulative benefits from spatially and technically discrete management interventions in socially, ecologically and hydrologically complex river systems.

A proxy value for the societal benefits of riverine management was developed using a Human Capital Approach[16,17,18,19,20]. Gross geographic product (i.e., average income per capita in the region) was used to put an economic value on the impact of riverine management to the productivity and wellbeing of riverine and coastal communities. This allowed the generation of Benefit Cost Ratios (BCRs) for all scenarios evaluated in the BCA. These BCRs articulate the combined financial, social and economic benefits of basic and transformative riverine management in Rands, which is directly comparable to the Rand-based cost of implementation.

The costs of climate change impacts to rivers

The study showed that poorly planned and serviced urban and agricultural development in river catchments have already degraded Durban's rivers. As a result of ongoing degradation, riverine ecosystem services (for example surface water supply, water quality maintenance,

[14] Using the ACRU (Agricultural Catchments Research Unit) model - https://cwrr.ukzn.ac.za/resources/acru/
[15] Using the Eco-Futures model - https://www.futureworks.co.za/index.php/services.html
[16] An approach often used with respect to the economic valuation of investments in ecosystem and public benefit services.
[17] Beli, P., Anderson, J.R., Barnum, H.N., Dixon, J.A. and Tan, J-P. 2001. Economic Analysis of Investment Operations. Washington D.C.: World Bank
[18] Blignaut, J.N. and Lumby, A. 2004. Economic valuation. In Blignaut, J.N. and De Wit., M.P. *Sustainable options.* UCT Press.
[19] Mooney G.H. 1977. The Accounting or Human Capital Approach to Life Valuation. In: The Valuation of Human Life. Palgrave, London. https://doi.org/10.1007/978-1-349-03193-1_5.
[20] Tietenberg, T. 1996. Environmental and Natural Resource Economics. New York: Harper Collins.

erosion and sediment control, and recreational amenity) are currently supplied on average 42% below potential (see "current state" scenario in Figure 3).

Climate change was shown to significantly exacerbate current river flooding and water quality problems, accelerate erosion and sedimentation impacts, and drive faster growth of invasive alien species which further transform and destabilise Durban's riverine areas. These climate change pressures were predicted to reduce Durban's riverine ecosystem services by a further 11% by 2040, reducing the average supply to 53% below potential (see "climate change" scenario in Figure 3). This was anticipated to translate into rapidly increasing risks and service delivery costs that would be felt by all residents of Durban. The poorest communities were recognised as the most vulnerable, due to their existing service delivery deficit and limited capacity to cope with risk and loss.

eThekwini Municipality was also identified as being directly affected, with additional flood damage to municipal road culverts alone estimated to rise to at least R151 million each year by 2040. Declining river water quality was anticipated to affect coastal tourism and property values, as well as the ability of riverine communities to access and use rivers for household water provision / supplementation, crop irrigation, and recreation. The annual value of the impact on the productivity and wellbeing of the city's riverine communities and coastal users was estimated in the study to reach at least R224 million by 2040.

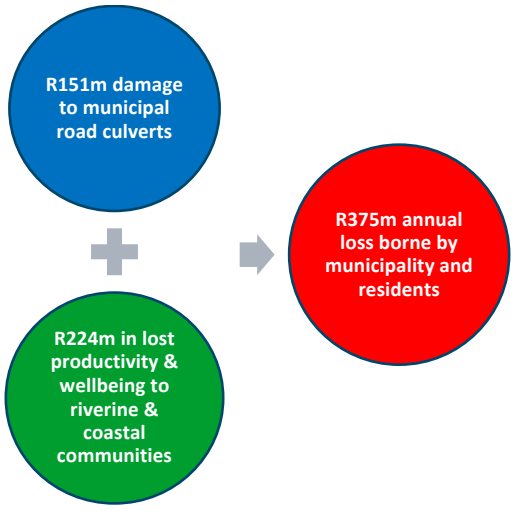

Figure 2: Predicted annual costs of climate change impacts on Durban's rivers by 2040

The case for transformative riverine management

Transformative riverine management can restore social and economic benefits lost due to river degradation, as well as substantially reduce future climate change related loss and damage to rivers.

The study showed that "basic" riverine management could play a significant role in mitigating climate change related losses of riverine ecosystem services (see "basic riverine management" scenario in Figure 3). However, in some instances, basic management would not be sufficient, and notable costs / losses could still occur. On the other hand, transformative

riverine management showed potential to effectively mitigate all climate change losses, as well as increase ecosystem services supplies an average of 10% above current levels (see "transformative riverine management" scenario in Figure 3).

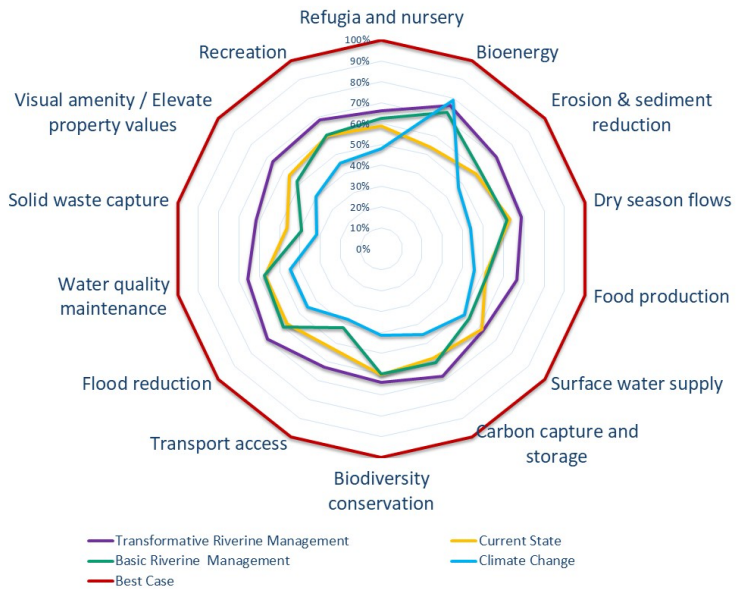

Figure 3: Modelled riverine ecosystem services flows under a range of scenarios

The Business Case concluded that it would cost approximately R7.5 billion over 20 years to implement a TRMP at city-wide scale, assuming a combination of public and private investment. Importantly, it also showed that for every R1 spent on the TRMP, between R1.80 and R3.40 in municipal and societal benefits could be achieved. This included avoided damage to municipal road culverts and the value of protecting human productivity and wellbeing amongst the city's riverine and coastal communities.

The lower value in the above range of benefits assumes a social discount rate (SDR) of 6%, while the higher value assumes -1%. Conventional economic analysis in South Africa typically uses a SDR of 6%, reflecting that built capital depreciates in value over time. However, natural capital (such as rivers) usually appreciates in value as populations grow and demand for ecosystem services increases (i.e., scarcity of supply of ecosystem services drives up the value of the natural capital that produces it). To demonstrate this alternative perspective, a -1% discount rate was also used. The real value of the benefits is likely to lie somewhere between the traditional and alternative values.

Benefits from well-managed rivers could become more valuable over time, suggesting ecosystem-based adaptation is a prudent public and private investment strategy.

The study also showed that transformative riverine management investment at city-wide scale could create over 9,000 new permanent jobs and enable significant opportunities for new green economy enterprises that add value to the organic biomass and inorganic waste removed from riverine areas.

To establish a city-wide TRMP, the study estimated that eThekwini Municipality would need to invest R719 million over 20 years to provide capacity for incentivising and facilitating an estimated R4.5 billion in co-investment by others through a Transformative Riverine Governance approach, and to coordinate the city's transformative riverine management investment on municipal land, estimated at R2.3 billion over 20 years.

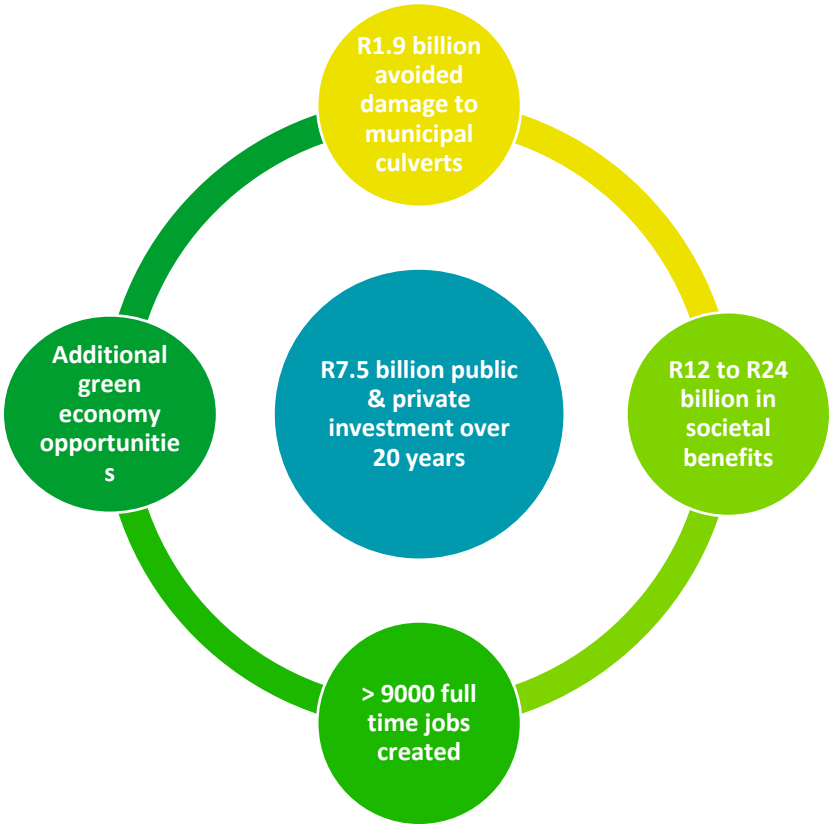

Figure 4: The benefits and costs of a city-wide Transformative Riverine Management Programme in Durban

As a climate change risk response, upscaling the Sihlanzimvelo Stream Cleaning Programme across all municipal land in upper catchment areas was argued to offer fair value, where each R1 spent could yield R2.60 in benefits. Notably, these benefits accrue to the municipality and all residents of the municipal area. The direct job creation and additional green economy opportunities (linked to alien plant biomass and riverine solid waste off-take agreements) were also significant, especially as these would be created in some of the most vulnerable riverine communities in the city.

The Business Case justified a practical implementation pathway, starting with upscaling existing riverine management efforts on municipal land and incrementally phasing-in a more ambitious, city-wide, transformative approach over time.

The Business Case contrasts different riverine management scenarios in a way that can direct a practical implementation pathway. Robust investment cases are made for both Sihlanzimvelo upscaling and a city-wide TRMP, although the costs and complexities of each of these options differ significantly. This was useful in providing eThekwini Municipality with

sound justification to start by investing in upscaling of Sihlanzimvelo as a known, tested implementation model, with incremental phasing-in of transformative approaches, which are more ambitious and costly, over time.

A systems-scale approach

Land in Durban's riverine corridors falls within a mosaic of public (23%), private (26%) and Traditional Authority (51%) ownership. As rivers are landscape-scale systems, individual landowners may not receive the full benefit of their river management efforts, and so tend to under-invest. The BCA highlighted this, showing that the municipality and coastal communities could benefit significantly from private landowner investment in riverine management. Arguing for private landowner action outside of a co-ordinated systems-scale and partnership-focused approach therefore proved difficult in the study.

The study also showed that a damage costs and management requirements for rivers may escalate disproportionately with declining condition of upper catchment areas. Conversely, management of upper catchment streams and rivers yields notably high ecosystem services benefits to all downstream users. Over half of Durban's rivers fall within Traditional Authority areas, mostly within upper catchments, emphasising the importance of a systems-scale approach to management that proactively includes Traditional Authority land.

Systems-scale transformative riverine governance that incentivises appropriate management action, pools resources and promotes co-investment is central to achieving sustainable, efficient and equitable benefits from rivers.

On this basis, the Business Case motivates for transformative riverine governance that facilitates resource pooling and co-investment at catchment systems-scale, such that all beneficiaries of riverine management contribute towards the costs of management; and that management takes place where it is most needed to limit impacts and costs elsewhere in the river system.

Using the outcomes

The Business Case focused on making a strong case for investment in riverine management at catchment system scale in the eThekwini Municipal Area. The next step involves developing an implementation plan. This will need to include pathways for phasing in investment to address key priorities and upscale successful initiatives, for example the Sihlanzimvelo Stream Cleaning Programme. Developing the appropriate institutional capacity and governance structures within the eThekwini Municipal Administration will also be required to drive implementation, including through financing and partnerships. Further work is also required on how best to unlock the full spectrum of green economy opportunities associated with riverine management investments in the eThekwini Municipality, and how to ensure that gender sensitive approaches are adopted throughout.

The knowledge and Benefit Cost Analysis methodologies developed through the Business Case provide a sound basis from which the eThekwini Municipality can grow its understanding and arguments for transformative riverine management investment. With improved data over

time, the city has the tools to more accurately estimate the benefits of transformative riverine management investments.

Conclusions

Climate change is predicted to have a significant impact on Durban's rivers, which are already compromised by poorly planned and managed urban and agricultural development, and under-investment in riverine management. This is expected to accelerate damage to municipal infrastructure and impact all of Durban's citizens, with riverine and coastal communities particularly affected. The financial and economic costs of climate change impacts on rivers have been conservatively estimated at R375 million per annum by 2040.

eThekwini Municipality has recognised the opportunities associated with managing riverine areas as part of its mandate to deliver cost-efficient services, create jobs, and build resilience to climate change. This concept has been mainstreamed into its Climate Action Plan which features the TRMP as an important intervention in building city-wide resilience to climate change. A Business Case has been prepared that presents an evidence-based investment case for a city-wide TRMP that seeks to harness these opportunities. The Business Case has established new knowledge and approaches that the city and others can build on. This will allow a deeper and more nuanced understanding of the full scale of benefits from transformative riverine management investments to be developed over time as more data and information becomes available.

Developing a credible investment case for ecological infrastructure investments (such as rivers) can be challenging, given that the benefits of intervening in complex natural systems may be hard to accurately predict and value. The work done to prepare Durban's TRMP Business Case offers several insights that may be of value to others seeking to undertake similar work.

Relevant websites

- C40 Cities Finance Facility web page containing further resources on Durban's TRMP: https://www.c40cff.org/projects/ethekwini-municipality-durban-transformative-riverine-management-programme
- eThekwini Municipality Environmental Planning and Climate Protection Department web page: http://www.durban.gov.za/City_Services/development_planning_management/environmental_planning_climate_protection/Pages/default.aspx
- eThekwini Municipality Roads and Stormwater Maintenance Department web page: http://www.durban.gov.za/City_Services/engineering%20unit/Roads_Stormwater_Maintenance/Pages/default.aspx

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