Nature for Water

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WARMA

Lower Kafue Sub-Catchment Watershed Investment Programme, Zambia

Feasibility Study Summary Report 2024

ACKNOWLEDGMENTS

The undertaking of this Feasibility Study for a Watershed Investment Program (WIP) in the Lower Kafue Sub-catchment in Zambia was a partnership between the Water Resources Management Authority (WARMA) of Zambia, Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) through the EU and BMZ funded AWARE 2.0 project, and Nature for Water (N4W).

The partners are grateful for the technical assistance provided by N4W through generous support of its funders and donors. This Summary Report provides a concise overview of the Feasibility Study. The intention is to provide local stakeholders and potential funders with an overview of the key findings,including: the priority Nature-based Solutions (NbS) selected, the overarching environmental and socio-economic benefits, and the investment case for a prospective WIP. The full Feasibility Study document provides further technical details, maps and references. It can be provided upon request, using the contact details below.

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PROJECT OVERVIEW

The Zambian Water Resources Management Authority (WARMA) has identified the need to improve integrated catchment management activities within the Lower Kafue Sub-catchment (LKSC) to protect and restore water resources for the long-term. WARMA, with support from the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) is working to understand how Nature-based Solutions (NbS) can contribute to long-term water security for both people and the environment.

Effective implementation of NbS requires a sustainable mechanism for collective action that brings together different water users to invest in ecosystem protection and upstream communities within the catchments they depend on. A Watershed Investment Programme (WIP) is an initiative designed to deliver water security ecosystem services by investing in the protection and/or restoration of nature through the implementation of NbS.

Nature based solutions are actions to protect, sustainably manage and restore natural or modified ecosystems that address water security challenges effectively and adaptively, while simultaneously providing human well-being and biodiversity benefits (Trémolet et al. 2019).

The Nature for Water (N4W) Facility supported **WARMA** and **GIZ** with a Feasibility Study to determine the viability of setting up a WIP within the **Lower Kafue Sub-Catchment in Zambia**. This Feasibility Study comprised of the following key elements:

A detailed assessment of the **stakeholders and beneficiaries** within the landscape, to ascertain their understanding of the key water security challenges as well as their potential commitment to supporting a WIP;

Rigorous **scientific modelling** to determine the most suitable NbS to address the pressing water security issues;

A **Return on Investment** Analysis that compared the benefits of the priority NbS versus the costs;

An assessment of **potential funding opportunities** alongside the likely delivery models of the NbS interventions that would help to scale up activities across the wider area;

A **roadmap**, with key milestones needed for taking this initiative forward.

THE LOWER KAFUE SUB-CATCHMENT

The LKSC covers an area of approximately 59 000 km supporting commercial and small-holder agriculture.

The catchment provides water for 64% of national irrigation needs and supplies >50%
of the water demand for the capital city, Lusaka.

Around 50% of the country's electricity is generated through hydropower, which is critical for Zambia's industry, mining, agriculture and domestic use (90% of electricity supply in Zambia is from hydropower).

In addition, the LKSC supports more than a quarter of the national head of cattle.

Two National Parks and three Game Management Areas, as well as the Kafue Flats wetlands, which is a Ramsar wetland, provide important ecosystem services, supporting diverse fauna and flora, wildlife and tourism, as well as communities.

64%

of national irrigation needs are provided by the catchment

>50%

supplies the capital city, Lusaka with water

50%

of the country's electricity is generated through hydropower

CHALLENGES FACED BY LKSC

The upstream Itezhi-tezhi dam and hydropower activities have significantly altered the flow within the Kafue Flats wetlands. Human encroachment and activities also directly impact on ecosystem health and the ability of the Kafue Flats to function optimally.

The main drivers of catchment degradation can be attributed to deforestation for charcoal and firewood, expansion of agriculture areas as populations increase, loss of wetlands through the spread of invasive plant species, such as *Mimosa pigra* and *Salvina molesta*, and land degradation through activities such as overgrazing.

These activities negatively impact the health of the catchment – **with reduced water quantity identified as the main water security challenge.**

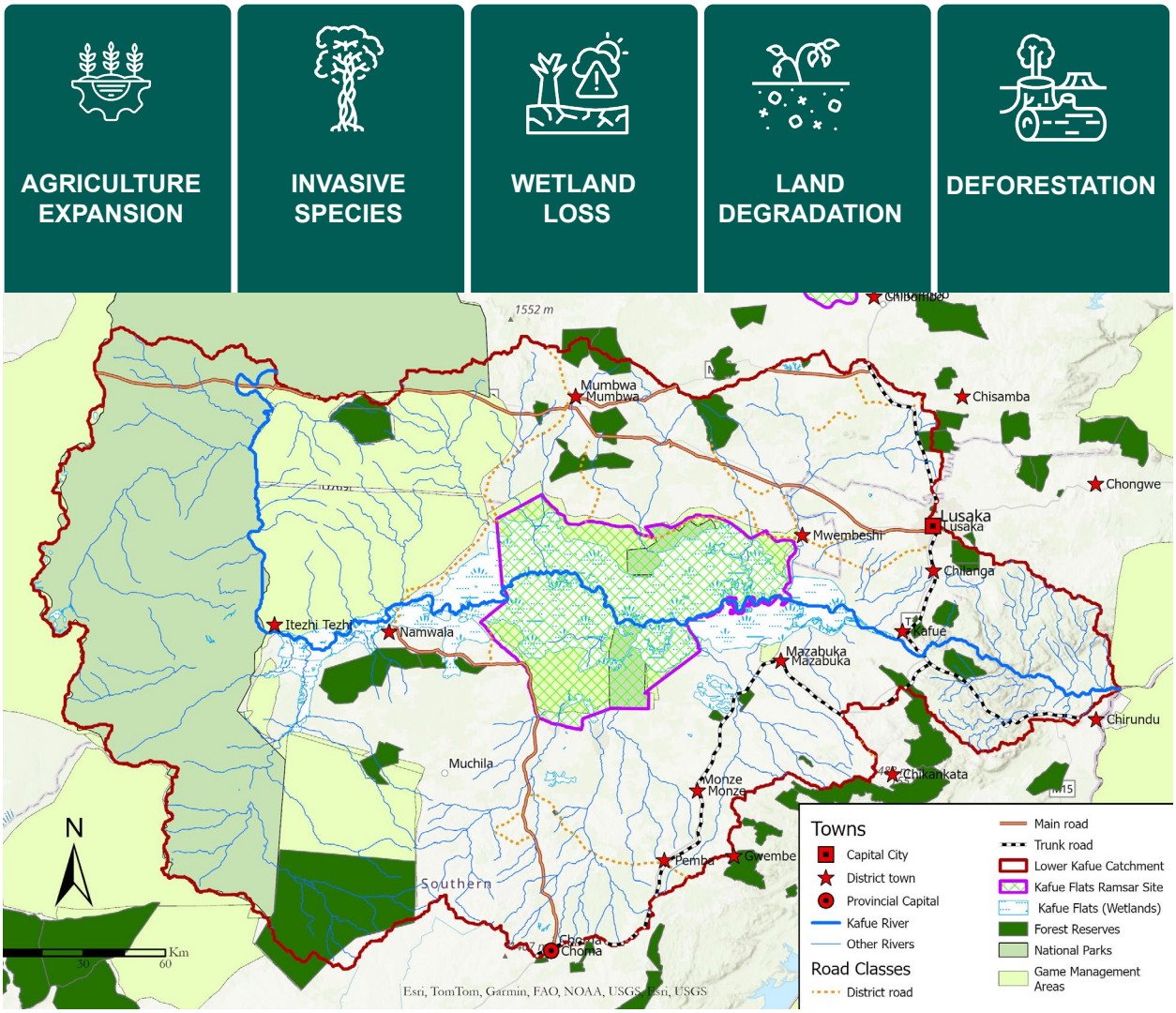


Figure 1: Lower Kafue Sub-catchment (study area)

NATURE-BASED SOLUTIONS TO ADDRESS WATER SECURITY

Through a multicriteria analysis, four priority NbS were identified to address water quantity/water availability:

Grazing Best Management Practices (BMPs)

Covering 230 000 ha of grasslands, restoring and protecting the natural grassland habitat and ecosystems.

Trenches and Bunds

Installing trenches and bunds within 344 000 ha helping to slow down overland water flows, and acting as temporary water storage areas, facilitating greater infiltration.

Wetland restoration

Through alien invasive plant clearing covering 56 000 ha to enable the local hydrology, plants and soils to re-establish.

Farmer Managed Natural Regeneration

Across 490 000 ha, including forested areas, to address land management, thereby improving the functionality of local ecosystems.

The science analysis demonstrated that an additional **~10% of water would flow annually in the Kafue River** – this equates to ~1.1 billion m³ of water annually – through the implementation of these four priority NbS (considered as the 100% implementation scenario in the priority sub-catchments).

A multi-criteria decision analysis approach was applied to identify where efforts should be focused, combining all geospatial layers. A weighted overlay analysis was then used to prioritize sub-catchments based on their vulnerability and ecological importance.

Figure 2. represents the most vulnerable ecosystems where conservation efforts would yield the highest water quantity impact.

~10%
additional water annually

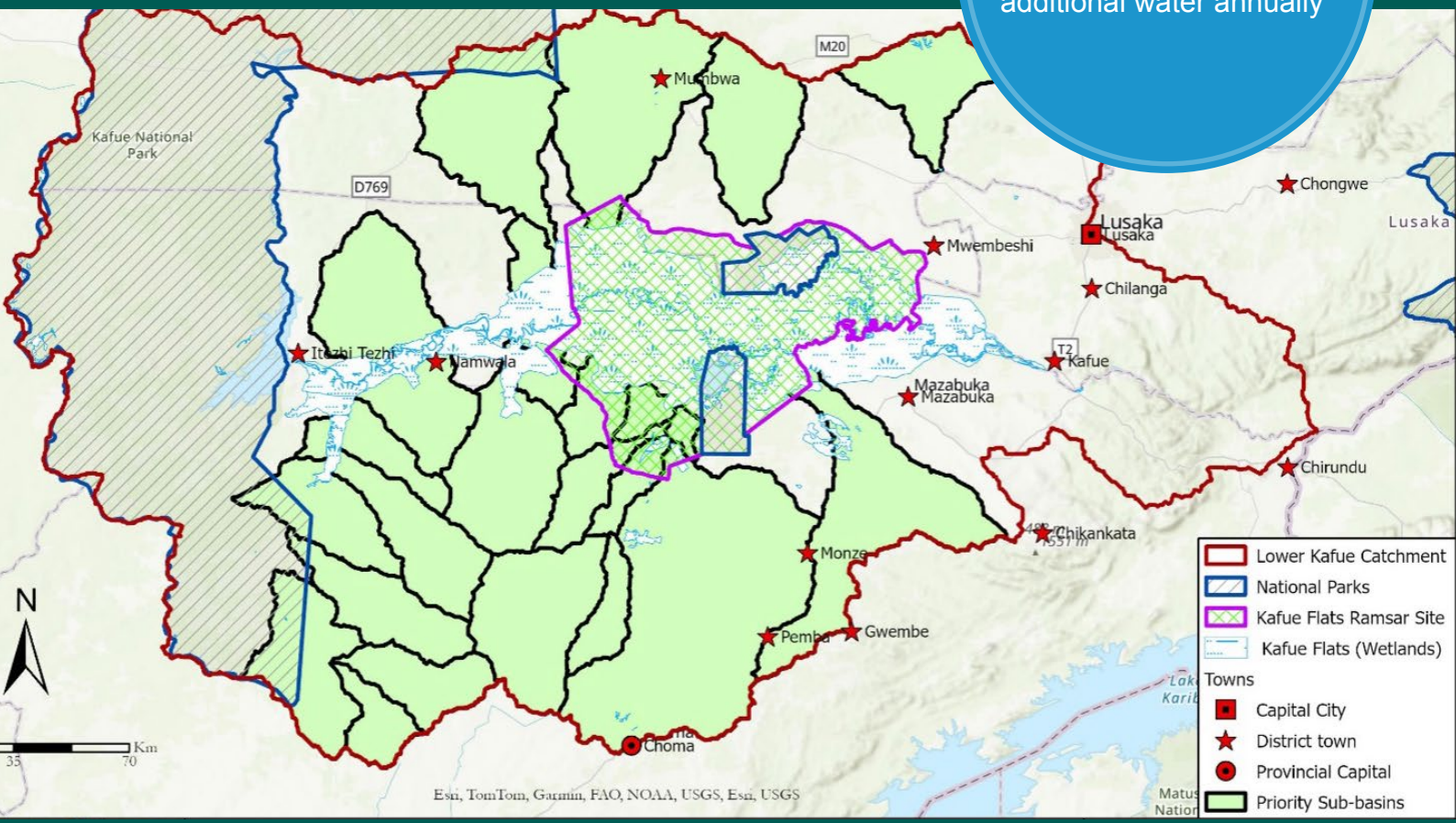


Fig 2: Priority sub-catchments where conservation efforts would be targeted for the 100% implementation scenario.

THE INVESTMENT CASE

The Feasibility Study assessed the financial and economic viability of a Watershed Investment Programme through the implementation of NbS, using an **8-step process:**

1 Identify degradation hotspots via biophysical modelling	**2** Identify priority NbS and model BaU vs NbS to determine impacts	**3** Perform reservoir simulations under BaU vs NbS impact	**4** Determine the delivery models
5 Estimate the costs based on implementation scenario	**6** Value the benefits of NbS	**7** Build a discounted	**8** Evaluate the net benefit of a WIP in the LKSC

The overarching benefits that arise include water security, economic resilience, livelihoods, biodiversity and carbon sequestration.

However, not all benefits are easy to quantify, e.g. increased resilience to drought and improved crop productivity.

This study quantified four key benefits. The economic analysis used the outputs of the scientific modelling and applied data and assumptions from desktop research, stakeholder engagements and direct engagements with beneficiaries.

Not all benefits are easy to quantify...

The following table summarises the quantified benefits, indicates the respective beneficiaries, links these benefits to the overarching categories within the benefit framework, and shows the present value benefit over the 30-year programme.

Benefit Description	Rationale	Beneficiaries	Benefit Category	Present Value Benefit over 30 years
Avoided cattle feedlot costs	Purchase heavier and healthier cattle due to grazing BMPs	Zambeef	Economic Resilience	USD 10 million
Employment & higher value cattle	Cash for work for alien invasive plant clearing and installation of trenches and bunds (implementation and maintenance phases), and additional income due to heavier cattle	Smallholder farmers and communities	Livelihoods	USD 64 million
Increased hydro-power revenue generation	Streamflow improvements result in increased and less variable dam levels and generating capacity at Kafue Gorge Upper hydropower	ZESCO	Water security; Economic Resilience	USD 210 million
Carbon credit sales	Restoration of grasslands provides increased carbon sequestration potential of the landscape	LKSC WIP, communities, carbon	Carbon	USD 43 million

DETERMINING FINANCIAL FEASIBILITY

To determine the financial feasibility of the WIP, the NbS benefits were offset against the associated costs, including both programmatic (i.e. implementation costs) and non-programmatic (i.e. operational and management costs).

The value of future flows of benefits and costs is determined in present terms. As the impact of NbS interventions take time to be realised, the benefits have been delayed.

The present values for each intervention and the benefits to each beneficiary across the entire implementation area of the WIP are presented as follows:

Figure 3: Waterfall chart showing discounted costs compared to benefits including the WIP Net Present Value

Over the 30-year period, the results show that a **lifetime investment of USD 75 million** in **NbS unlocks benefits worth USD 327 million**. This equates to a **net present value of USD 242 million** discounting at a rate of 3.3% (social discount rate for Zambia). To kickstart implementation, an ask of **USD 5.3 million per year is needed over the first five years.**

$242 M

Net Present Value

Net Present Value (NPV) is a financial metric to estimate the total value of an investment opportunity.

3.9

Benefit Cost-Ratio

Benefit Cost-Ratio (BCR) summarises the overall value for money of the programme. A BCR greater than 1 is an indication of a good investment and the higher the BCR, the more promising the returns.

16.09%

Internal Rate of Return

Internal Rate of Return (IRR) is a financial analysis metric used to estimate profitability of a potential investment.

The economic analysis of the NbS shows that for every USD 1 invested in NbS, a return of USD 3.9 is generated over the lifetime of the WIP activities.

FEASIBILITY STUDY OUTCOMES

This study demonstrated that NbS can meaningfully respond to water availability threats by contributing to increased river and dry season flows in the catchment.

The Return on Investment analysis demonstrated that the investment in NbS would deliver over USD 242 million in value to stakeholders. Short-term pilot funding of up to USD 3 million has been secured through the AWARE 2.0 programme, with multiple high-potential long-term funding options to be assessed in more detail in the Design Phase.

There is a strong willingness by stakeholders to work collaboratively, bringing expertise and knowledge to the WIP.

Delivering NbS at Scale

Through stakeholder engagements and existing implementation modalities, two main overarching delivery archetypes were identified, which can be scaled:

1. Community-based delivery and implementation model

The WIP only supports with community engagement, training, materials and equipment (no labour costs). Relies on voluntary community buy-in and uptake to implement NbS.

2. Contract-management model

Individuals are employed for a period to undertake activities. The WIP would cover all associated costs (salaries, equipment, etc.)

The Feasibility Study recommends that the programme moves forward into the Design Phase.

NEXT STEPS

This roadmap outlines the future components needed as the programme moves towards a fully fledged WIP. Key milestones identified include:

1

Establish a Steering Committee

To oversee the WIP's continued development through the Design Phase.

2

Pilot Implementation

Support the AWARE 2.0 Programme during implementation.

3

Short-term Funding Opportunities

Confirm short-term funding opportunities where alignment has already been identified.

4

Detailed Science Modelling

Conduct focused biophysical modelling within the priority sub-catchment areas to specify precise NbS implementation sites.

5

Governance Structure

Identify the governance arrangement most suitable to the participating stakeholders and align on roles and responsibilities.

6

Develop 5-year Implementation Plan

Define the short-medium term level of implementation effort and the operational delivery strategy for each of the priority NbS.

7

Sustainable Funding Opportunities

Identify sustainable funding opportunities to meet long-term funding requirements, identifying any funding gaps.

8

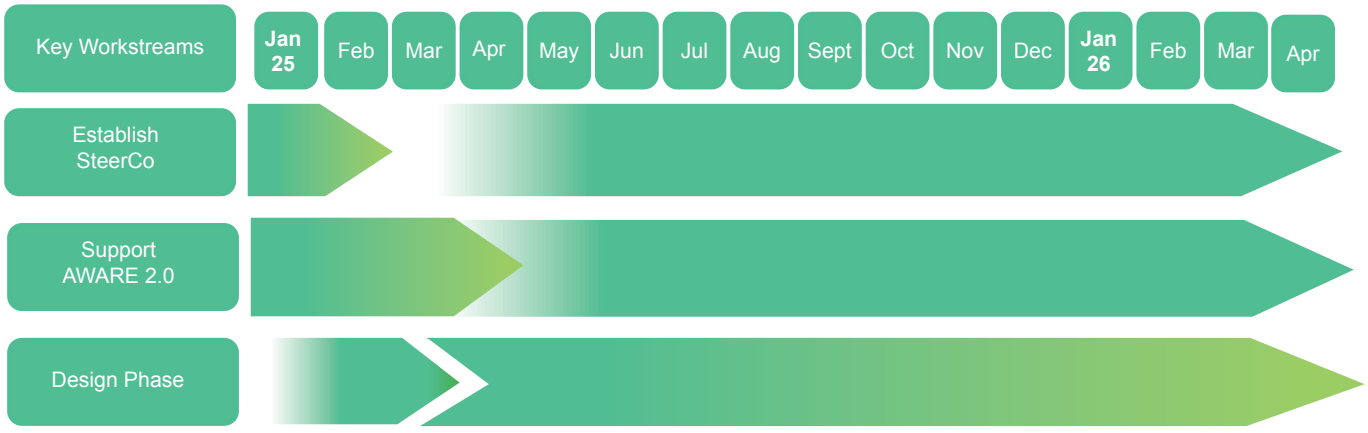
Monitoring & Evaluation

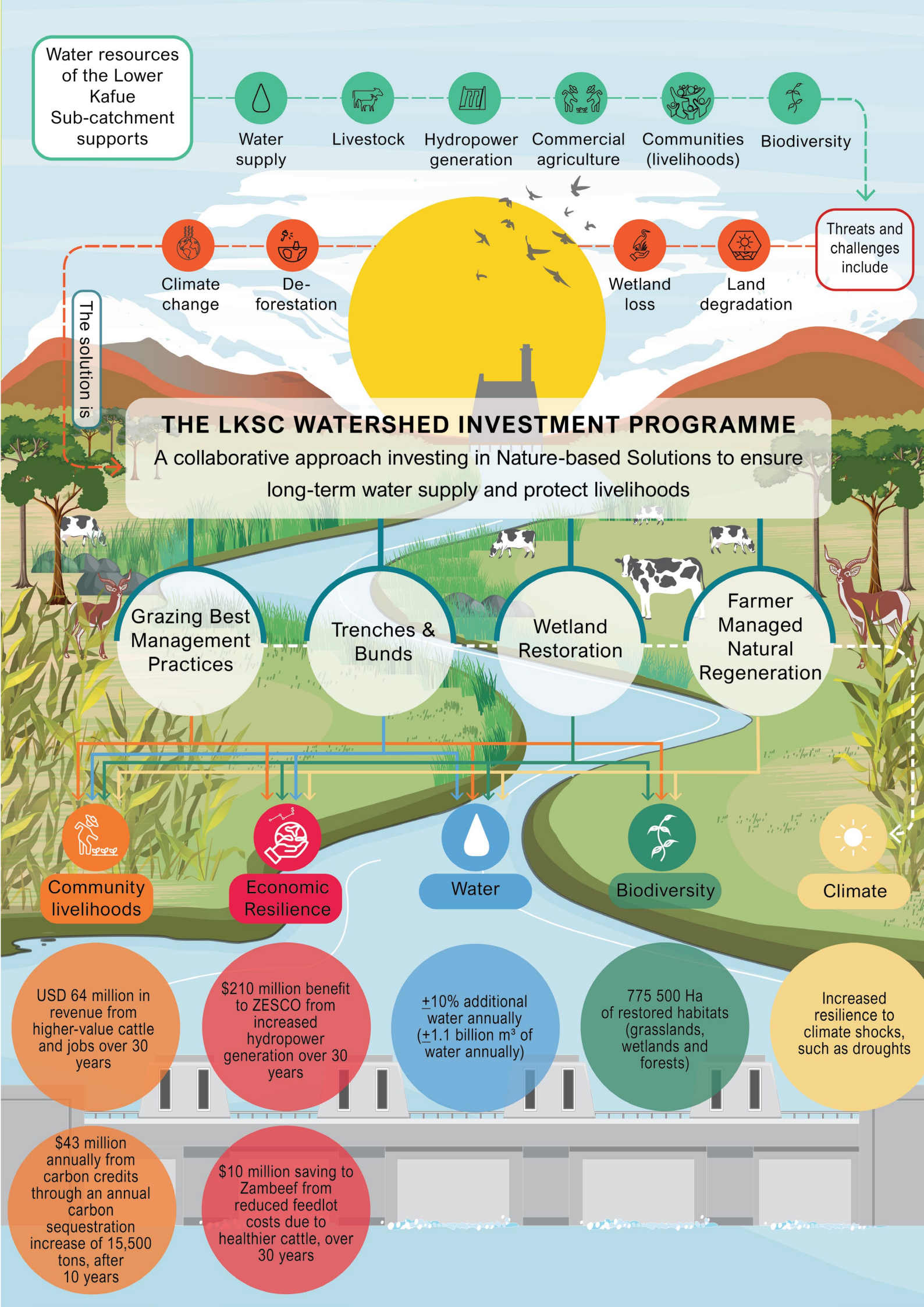
Develop a Monitoring, Reporting and Verification (MRV) framework and guide the collection of data from any pilot activities.

9

Stakeholder Engagement

Ongoing engagements across the multiple workstreams to ensure that stakeholders are consulted, are able to provide valuable input and that the Steering Committee plays a central role in moving the WIP forward.




Water resources of the Lower Kafue Sub-catchment supports
Water supply
Livestock
Hydropower generation
Commercial agriculture
Communities (livelihoods)
Biodiversity
Threats and challenges include
Climate change
De-forestation
Wetland loss
Land degradation
The solution is
THE LKSC WATERSHED INVESTMENT PROGRAMME
A collaborative approach investing in Nature-based Solutions to ensure long-term water supply and protect livelihoods
Grazing Best Management Practices
Trenches & Bunds
Wetland Restoration
Farmer Managed Natural Regeneration
Community livelihoods
Economic Resilience
Water
Biodiversity
Climate
USD 64 million in revenue from higher-value cattle and jobs over 30 years
$210 million benefit to ZESCO from increased hydropower generation over 30 years
±10% additional water annually (±1.1 billion m³ of water annually)
775 500 Ha of restored habitats (grasslands, wetlands and forests)
Increased resilience to climate shocks, such as droughts
$43 million annually from carbon credits through an annual carbon sequestration increase of 15,500 tons, after 10 years
$10 million saving to Zambeef from reduced feedlot costs due to healthier cattle, over 30 years

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2024