Sustainable Groundwater Development and Management for Humans, Wildlife, and Economic Growth in the Kavango Zambezi Transfrontier Conservation Area (KAZA-GROW)

2021-2022

INCEPTION REPORT

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Sustainable Groundwater Development and Management for Humans, Wildlife, and Economic Growth in the Kavango Zambezi Transfrontier Conservation Area

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Cover photo: Man fetching water in Simalaha Community Conservancy, Zambia. Credit: Peace Parks Foundation

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ACRONYMS AND ABREVIATIONS

BUPUSA	Buzi, Pungwe, and Save River Basins
CRIDF	Climate Resilient Infrastructure Development Facility
DWS	Department of Water and Sanitation, Botswana
GEF	Global Environment Facility
GIP	Groundwater Information Portal
GLTFCA	Great Limpopo TFCA
GWPZ	Groundwater potential zone
HWC	Human-wildlife conflict
IGRAC	International Groundwater Resources Assessment Centre
IW:LEARN	International Waters Learning Exchange and Resource Network
IWMI	International Water Management Institute
KAZA-GROW	The project: Sustainable Groundwater Development and Management for Humans, Wildlife, and Economic Growth in the Kavango Zambezi Transfrontier Conservation Area
KAZA	Kavango Zambezi
KRWDA	Kwando River Wildlife Dispersal Area
MCDM	Multi-criteria decision making
MEL	Monitoring, evaluation and learning
MIDP	Master Integrated Development Plan
MoU	Memorandum of Understanding
MUS	Multiple Use Water Services
NGO	Non-governmental organization
OKACOM	Permanent Okavango River Basin Water Commission
PPF	Peace Parks Foundation
PSC	Project Steering Committee
RBO	River Basin Organization
RESILIM	Resilience in the Limpopo Program
RWP	Resilient Waters Program
SADC	Southern African Development Community

SADC-GMI	Southern African Development Community Groundwater Management Institute
SAP	Strategic Action Plan
SAREP	Southern Africa Regional Environmental Program
SWP	Sustainable Water Partnership
SASSCAL	Southern African Science Service Centre for Climate Change and Adaptive Land Management
TBA	Transboundary Aquifer
TFCA	Transfrontier Conservation Area
TGMF	TFCA Groundwater Management Framework
TNC	The Nature Conservancy
USAID	United States Agency for International Development
WASH	Water Sanitation and Hygiene
WB	World Bank
WDA	Wildlife Dispersal Area
WBT	Wild Bird Trust
WG	Working Group
WWF	World Wide Fund for Nature
ZAMCOM	Zambezi Watercourse Commission
ZAMWIS	Zambezi Water Resources Information System
ZimParks	Zimbabwe Parks and Wildlife Management Authority

INTRODUCTION

This report serves as the Inception Report for the ***Sustainable Groundwater Development and Management for Humans, Wildlife, and Economic Growth in the Kavango Zambezi Transfrontier Conservation Area*** Project – shortly denoted **KAZA-GROW.** The KAZA_GROW flagship project (**Grant Agreement No. RWP-G13-IWMI**) is a project implemented by the International Water Management Institute (IWMI) in partnership with the KAZA TFCA Secretariat and the Peace Parks Foundation (PPF), and funded by the United States Agency for International Development (USAID) under the Resilient Waters Program (RWP) and the CGIAR (Consultative Group on International Agricultural Research) Research Program on Water, Land and Ecosystems (WLE), led by IWMI. The project runs over two years from **January 18, 2021 to December 31, 2022**. This Inception Report documents the proceedings of the Inception Workshop held on February 05 and 08, 2021 and sets out the project work plan and activities based on stakeholder engagement.

1.1 Preamble

The USAID RWP (2018-2023) seeks to build more resilient and water secure Southern African communities and ecosystems through improved management of transboundary natural resources and increased access to safe drinking water and sanitation services. To achieve this objective, the program collaborates with regional institutions, including river basin organizations (RBOs) and Transfrontier Conservation Areas (TFCAs), national governments, and communities to enhance cooperation, capacity, partnership opportunities, and monitoring, evaluation and learning.

The RWP has four integrated results areas, and associated objectives, which are intended to reinforce each other to improve overall transboundary natural resources management and increase water security and the resilience of communities and ecosystems:

1. The conservation of biodiversity and ecosystem services in key areas in Southern Africa improved
2. Management and security of transboundary water resources in selected river basins improved
3. Access to safe, sustainable drinking water and sanitation services in selected areas increased
4. The ability of key institutions and targeted communities to adapt to the impacts of change strengthened

The primary geographic focus of RWP is the Okavango River Basin and the Limpopo River Basin, building on engagement from previous programs in the region, e.g. the Resilience in the Limpopo Program (RESILIM), which focused on the Limpopo Region, and the Southern Africa Regional Environmental Program (SAREP), which focused on the Okavango River Basin. The scope of the RWP expands the geographic focus to areas closely linked to the Okavango and Limpopo river basins, as they present an opportunity to make major impact with low-entry costs, e.g.: a) the Kavango Zambezi Transfrontier Conservation Area (KAZA TFCA) straddling the Okavango and the Zambezi River Basins; b) the Great Limpopo TFCA (GLTFCA), straddling the Limpopo River Basin and the BuPuSa River Basin.

Transboundary aquifers (TBAs), and groundwater resources more broadly, are progressively receiving more attention from the regional development partners and donors. The Southern African Development Community (SADC) currently has a Regional Strategic Action Plan (RSAP IV, 2016-2020), which explicitly mentions Program P6.2 on ***Groundwater Development and Management***, and a component under this on P6.2.3 ***Advancing Knowledge on Transboundary Water and***

National Groundwater[1]. SADC, with support from the World Bank, has a regional Groundwater Management Institute (SADC-GMI) at the Institute for Groundwater Studies at the University of the Free State in Bloemfontein, South Africa. This institute coordinates and supports regional research and management on groundwater and in particular transboundary aquifers.

SADC counts on 30 identified TBAs.[2] Integrated work on these resources so far encompasses significant efforts on the following systems: a) The Ramotswa Aquifer[3]; b) The Tuli Karoo Aquifer[3]; c) The Shire Baisn[3]; d) The Stampriet Aquifer[4]; and e) the Eastern Kalahari Karoo[5].

As part of this larger scope, RWP is increasingly engaging with the KAZA TFCA on freshwater and natural resources. Addressing the less well understood, but critical groundwater resources, including five TBAs in the TFCA (Figure 1), has been seen as a critical step towards water security and resilience.[6]

1.2 Project Background and Rationale

The Kavango Zambezi Transfrontier Conservation Area (KAZA TFCA) (Figures 1 and 2) was formally established in 2011 with a vision to establish a world-class transfrontier conservation and tourism destination area in the Okavango and Zambezi River Basin regions of Angola, Botswana, Namibia, Zambia and Zimbabwe within the context of sustainable development.[7] Broadly, the KAZA TFCA aims to secure natural resources for the good of people, economic growth and the intrinsic value of nature. It is the largest TFCA globally, covering 520,000 km^2 and counting on unique natural systems, interlinked supporting water systems, and immense biodiversity. All Partner States sharing the TFCA (Angola, Botswana, Namibia, Zambia and Zimbabwe) are undergoing rapid economic growth as well as significant population growth, especially in the upstream countries like Angola with an annual population growth rate of 2.7%. Climate change trends indicate a warmer and drier climate with larger variability in water availability and higher risks of floods and longer droughts. While expansive natural areas persist and a large impetus of the TFCA is to strengthen the connectivity between individual conservation areas and parks in order to re-establish and/or conserve large-scale ecological processes, wildlife mobility, and integrity across the region, it is also clear that the KAZA TFCA is under growing threats from broad drivers, requiring close cooperation between the Partner States and stronger coordinated measures.

Water insecurity, extreme climate events (droughts and floods), inadequate water infrastructure, growing human-wildlife and landuse conflicts, call for more pro-active natural and water resources management and transboundary cooperation to ensure the resilience of communities, wildlife and the ecosystems on which they rely. Communities are mostly reliant on water from rivers and shallow groundwater resources for domestic and small-scale livelihood purposes, with few formal reticulation systems in place outside major settlements. While surface waters constitute critical interconnected river/riparian, wetland and internal drainage/delta systems, (prominently the iconic Okavango Delta) across the region, groundwater and TBAs increasingly play a role in supplying reliable, climate-resilient, and widely available water to dispersed communities and wildlife.

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[1] SADC, Regional Strategic Action Plan on Integrated Water Resources Development and Management, Phase IV, RSAP IV (2016-2020), Gaborone, Botswana, 2016.
[2] https://www.iwlearn.net/resolveuid/e4b60187-31b7-4bb9-a557-7f1c087979ae
[3] https://conjunctivecooperation.iwmi.org/systems/
[4] https://unesdoc.unesco.org/ark:/48223/pf0000245265
[5] https://sadc-gmi.org/projects/water-resources-management-research-in-the-eastern-kalahari-karoo-basin-transboundary-aquifer/
[6] USAID Resilient Waters Program. Annual Wok Plan, FY 2019, 22 June 2018 - 30 September 2019.
[7] https://www.kavangozambezi.org/en/about/about-kaza

However, addressing the needs and existing gaps in the management of groundwater resources is an increasingly acknowledged key to supporting biodiversity, economic development, and resilience to climate change in the KAZA TFCA.[8]

The institutional basis for regional cooperation on natural resources and economic development in the TFCAs at the SADC level, supporting regional integration, hinges on various treaties and commitments, under which critical ones are: the SADC Protocol on Wildlife Conservation and Law Enforcement (1999), the SADC Protocol on Forestry (2002), the SADC Protocol on Shared Water Courses (2002), and the SADC Regional Biodiversity Strategy (2006).[9] The SADC Regional Indicative Strategic Development Plan (RISDP, 2020-2030) (2020) has identified sustainable development, conservation of wildlife and transboundary natural resources as a priority for SADC.[9] SADC supports TFCA work across the region through a the SADC TFCA Program (2013), a SADC TFCA Network (2013) and a Financing Facility, which is supported by e.g. KfW.[10] SADC subscribes to a nexus approach at the water-energy-food level and increasingly including an ecosystems nexus, and while the Regional Strategic Action Plan on Integrated Water Resources Development and Management (RSAP IV, 2016-2020) of SADC[11] does not mention transfrontier conservation areas explicitly, it does address transboundary water resources, fragile ecosystems, as well as climate change adaption, which creates critical cornerstones for collaborative work on the TFCAs of SADC and KAZA TFCA more specifically. The RSAP is spearheaded by the SADC Water Division under the Directorate for Infrastructure and Services, while the Food, Agriculture and Natural Resources Directorate oversees the SADC TFCA Program.

[8] Kavango Zambezi Transfrontier Conservation Area. KAZA's Freshwater Systems - Regional Stakeholder Meeting. 22-23 January 2019, Travel Lodge, Kasane, Botswana, March 2019.
[9] SADC TFCA Brochure, https://www.sadc.int/files/1415/8868/6263/SADC_TFCA_Brochure.pdf
[10] Kavango Zambezi Transfrontier Conservation Area. KAZA's Freshwater Systems – NGO & Development Partners Stakeholder Meeting, 24-25 January 2019, Mowana Safari Lodge, Kasane, Botswana.
[11] SADC, Regional Strategic Action Plan on Integrated Water Resources Development and Management, Phase IV, RSAP IV (2016-2020), Gaborone, Botswana, 2016.

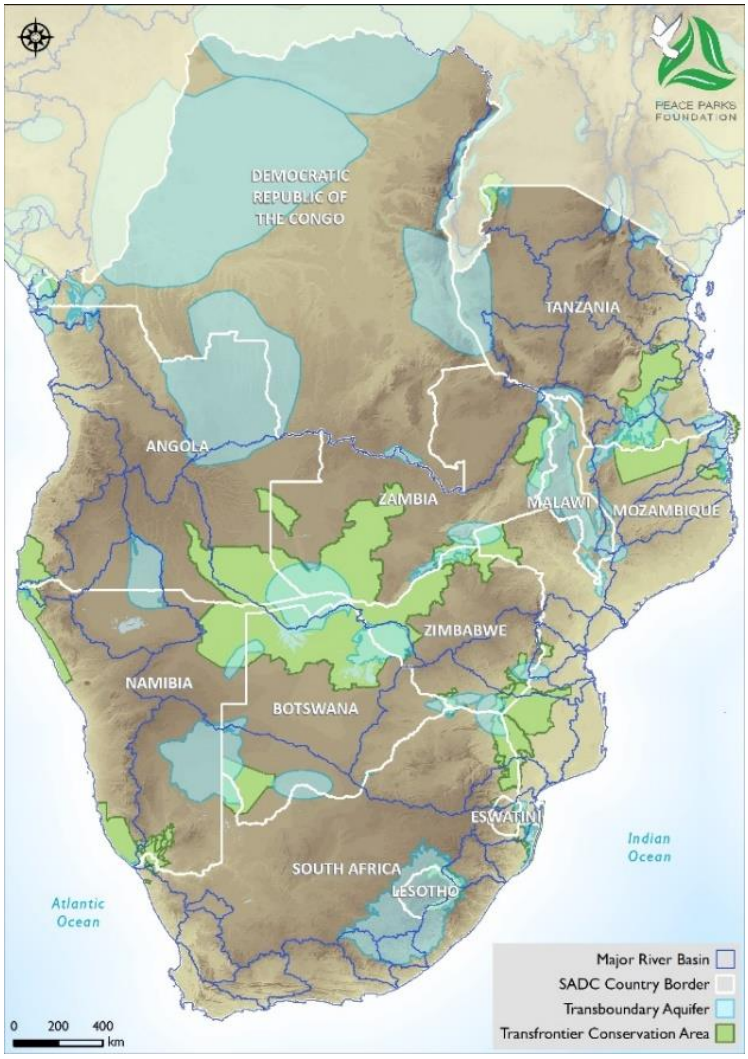


Figure 1. Map of transboundary aquifers (blue) and TFCAs (green) in SADC. The KAZA TFCA is the large green area in central SADC cutting across Angola, Botswana, Namibia, Zambia, and Zimbabwe.

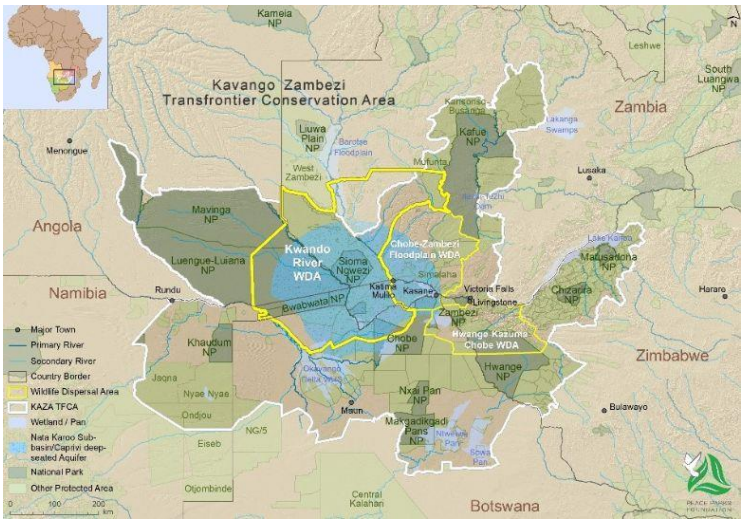


Figure 2. The KAZA TFCA and the Kwando River Wildlife Dispersal Area (KRWDA) (the western-most area marked in yellow). The Nata Karoo transboundary aquifer (TBA), the relevant TBA for the KRWDA, is marked in blue, while exact delineation is uncertain.

Against this backdrop, the KAZA-GROW project was conceptualized in partnership with the KAZA TFCA and PPF, as key stakeholders, to prioritize the management and conservation of freshwater, and in particular groundwater, resources in the KAZA TFCA. Groundwater knowledge across the TFCA is limited, with disparity and limited coordination between Partner States. There is a need to co-develop the knowledge base, the capacity and decision support tools, and policy guidelines as well as management frameworks around groundwater at the most appropriate integrated scales from local to transboundary for the TFCA. The RBOs, the Permanent Okavango River Basin Water Commission (OKACOM) and the Zambezi Watercourse Commission (ZAMCOM) with complementary mandates of parts of the KAZA TFCA in terms of water resources, are playing a key role in coordinating activities across the relevant Member States in their basins (OKACOM: Angola, Botswana, and Namibia, and ZAMCOM: Angola, Botswana, Namibia, Zambia and Zimbabwe), but increasingly also in coordinating issues of trans-basin character and in context of the KAZA TFCA.

Relatively little is known about the five TBAs in the KAZA TFCA (Figure 1) and their potential in terms of supporting water security and resilience in the area. The project's main focus is the Kwando River Wildlife Dispersal Area (KRWDA), shared between Angola, Botswana, Namibia, and Zambia, with a view of scaling out outcomes and lessons learned to the KAZA TFCA, in collaboration with major stakeholders, like SADC, OKACOM, and ZAMCOM.

1.3 Goal and Objectives

The overall aim of the KAZA-GROW project is to support water security and resilience in the KAZA TFCA through the sustainable development and management of groundwater resources. This overall goal will be achieved through meeting the following objectives:

- With focus on the Kwando River Wildlife Dispersal Area (KRWDA), the KAZA-GROW project will enhance the knowledge base on the water resources of the KAZA TFCA through a joint and interdisciplinary **Transboundary Diagnostic Analysis (TDA)**, including identifying **hotspot transboundary areas for groundwater development** to improve water security, livelihoods, resilience, and human-wildlife coexistence.
- It will also strengthen the policy attention to groundwater through **a TFCA Groundwater Management Framework (TGMF)** for the KAZA TFCA, piloted for the KRWDA, and as a pre-cursor for a joint Strategic Action Plan on freshwater for the KAZA TFCA and a Southern African Development Community (SADC)-wide TFCA Policy for Groundwater for continued benefits for humans and biodiversity and sustainable economic development.

1.4 Project Partners, Collaborating Partners and Beneficiaries

1.4.1 USAID Resilient Waters Program

The KAZA-GROW project is supported by a grant from the USAID through the RWP. The overarching aims of the RWP, which runs through to May 2023, are to build resilient communities and ecosystems in Southern Africa, through the improved management of transboundary natural resources and increased access to safe drinking water and improved sanitation services.

1.4.2 KAZA TFCA Secretariat

On 18 August 2011 at the SADC Summit in Luanda, Angola, the Presidents of the Republics of Angola, Botswana, Namibia, Zambia and Zimbabwe signed a Treaty, which formally and legally established the Kavango Zambezi Transfrontier Conservation Area (KAZA TFCA). This built on a long anterior process and an interim agreement in the form of a Memorandum of Understanding (MoU) between

the Partner States signed on December 07, 2006. The goal of the KAZA TFCA is to sustainably manage the Kavango Zambezi ecosystem, its heritage and cultural resources based on best conservation and tourism models for the socio economic wellbeing of the communities and other stakeholders in and around the ecoregion through harmonization policies and practices.[12]

The KAZA TFCA Secretariat represents the interest of the five Partner States in terms of the development and management of the TFCA. It plays a crucial role in supporting and facilitating the implementation of the projects outlined in the 2014 Master Integrated Development Plan (MIDP).[13] Specifically, the KAZA TFCA Secretariat provides support in the following areas:

- Securing financing
- Promoting transboundary cooperation and communication
- Encouraging partnerships with existing structures
- Integrating climate change planning into project design
- Promoting good quality monitoring and evaluation

1.4.3 Peace Parks Foundation

Peace Parks Foundation, as a key KAZA TFCA supporting international Non-governmental Organization (NGO), recognizes the importance of conserving and developing core areas, corridors and keystone species, irrespective of political boundaries, to secure biodiversity conservation, which in turn is the most important foundation to ensure maintained, healthy and functional ecosystems, also acknowledging the rights of human beings to join other species in responsibly using the natural resources present in these ecosystems.[14]

1.4.4 Boundary Partners

Key boundary partners to the KAZA-GROW project are the two RBOs OKACOM and ZAMCOM, with mandates in the Okavango River Basin and the Zambezi River Basin, respectively, the SADC Water Division, Directorate for Infrastructure and Services, and its subsidiary on groundwater, the SADC-Groundwater Management Institute (SADC-GMI). At national level, the project will collaborate closely with the authorities responsible for water resources management as well as environment, biodiversity and tourism. The KAZA TFCA Secretariat has an MoU with OKACOM, and is in the process of establishing one with ZAMCOM. These MoUs are deemed central to a formalized and close collaboration between the two RBOs and the KAZA TFCA Secretariat, with particular focus on shared freshwater resources.

As part of the project inception phase, a large number of implementing partners (research, NGOs, private sector, etc.) working on freshwater projects and initiatives relevant to KAZA-GROW were identified, and the Inception Workshop provided an opportunity to closely interact with many of these (Table 1).

1.4.5 Beneficiaries

The project will benefit stakeholders at various levels. Ultimately, the project will enhance access to safe and reliable water for multiple uses through multiple use water systems (MUS) for smaller

[12] https://www.kavangozambezi.org/en/about/about-kaza
[13] Kavango Zambezi Transfrontier Conservation Area - Master Integrated Development Plan (MIDP), 2015 – 2020.
[14] https://www.peaceparks.org/what/

communities in the KRWDA. The project also targets wildlife through identification of viable options for climate-resilient water supply, reducing risk of human-wildlife conflicts (HWC). Besides these primary beneficiaries, the project partners mentioned above will also benefit from the tools, frameworks and interactive processes produced and derived from the project.

2. SYNOPSIS OF INCEPTION WORKSHOP

As part of the project inception phase, an Inception Workshop was convened, bringing together key stakeholders in the KAZA TFCA. The objective of the meeting was to deliberate on project implementation, forge partnerships and identify areas of collaboration and synergy across ongoing projects. The specific objectives were to:

- Enhance the transnational network of partners engaged in freshwater, and in particular groundwater, resources in the KAZA TFCA
- Foster awareness of the importance and role of groundwater in the KAZA TFCA for humans, wildlife and nature
- Identify key issues related to groundwater development and management in the KAZA TFCA
- Identify key data sources for the Transboundary Diagnostic Analysis
- Identify coalitions for collaboration in order to take the KAZA-GROW forward

The meeting took place virtually, over two half days. The first session, held on February 05, 2021, provided a strategic overview of international, regional and national perspectives on freshwater for TFCAs, and KAZA TFCA in particular. It sought to generate high-level buy-in to the project, while creating critical linkages to key stakeholders. Technical details and project implementation specifics were discussed in the technical-level meeting held on February 08, 2021. Appendix 1 provides the proceedings of the Inception Workshop, while Appendix 2 provides the program. Over 50 participants participated in each session. Details of participants and their affiliations are provided in Appendix 3.

2.1 Stakeholder Representation

Participants were drawn from a cross-section of organizations to give a holistic perceptive of the nature of the challenges in the KAZA TFCA, as well as to develop potential collaboration opportunities central to successful project implementation (Table 1 and Appendix 3).

Table 1. Cross section of stakeholder representation at the inception meeting

International Organisations	*United States Agency for International Development (***USAID***),* **RAMSAR**
Regional and Transboundary Organisations	*Southern African Development Community (***SADC***), SADC Groundwater Management Institute (***SADC-GMI***), the Permanent Okavango River Basin Water Commission (***OKACOM***), Zambezi Watercourse Commission (***ZAMCOM***)*
National Government Departments	**Angola***: Ministry of Energy and Water - National Institute of Water Resources* **Botswana:** *Department of Water and Sanitation; Ministry of Environment, Natural Resources Conservation and Tourism* **Namibia:** *Ministry of Environment, Forestry and Tourism* **Zambia***: Ministry of Water Development, Sanitation and Environmental Protection* **Zimbabwe***: Zimbabwe Parks and Wildlife Management Authority*
Implementing Partners	*International Water Management Institute (***IWMI***), USAID Resilient Waters Program (***RWP***),* **KAZA TFCA Secretariat,** *Peace Parks Foundation (***PPF***)*

Collaborating Partners	*The Nature Conservancy (***TNC***), World Wild Fund for Nature (***WWF Zambia***), Climate Resilient Infrastructure Development Facility* (**CRIDF***), World Bank (***WB***), Sustainable Water Partnership (***SWP***), Southern African Science Service Centre for Climate Change and Adaptive Land Management (***SASSCAL***)*
Academic Institutions	**University of Zambia, Universidade Agostinho Neto (Angola)**

2.2 Key Outcomes - Strategic-level Meeting

Representatives from the funding agency, USAID, and implementing partners delivered opening remarks in support of the project and its objectives. Remarks from USAID (Graham Paul), KAZA TFCA Secretariat (Nyambe Nyambe) and PPF (Andrew Nambota) all reiterated the timeliness and relevance of the project in the KAZA TFCA region, further expounding on critical areas of interest in the project being supporting (i) human livelihoods; (ii) ecosystem and wildlife conservation; and (iii) groundwater management for water security and resilience. Groundwater was highlighted as a critical resource with the potential to sustain livelihoods and provide water security and resilience for both humans and wildlife. Remarks and presentation from IWMI Project Leader, Karen Villholth, provided the project rationale and scope in addressing the key challenges as related to groundwater development and management in the KAZA TFCA. She expressed high appreciation for the attendance and the opportunity provided to initiate a platform on groundwater in TFCAs as part of the inception phase.

Key messages coming out of the strategic-level meeting were:

- The KAZA-GROW project is a timely and welcome initiative
- There is a strong need to cooperate and set up collaboration mechanisms across multiple scales and institutions involved to create the necessary synergies related to groundwater management in the KAZA TFCA
- Groundwater is the missing component in many of the freshwater assessments that are taking or have taken place in the region
- There is limited knowledge of groundwater potential including its role in environmental flows and ecosystem services
- There is a good foundation for the KAZA-GROW project to advance its objectives on how groundwater management and development best can be integrated within TFCAs
- There is strong buy-in to the KAZA-GROW project and opportunities exist to link ongoing activities with geographic or thematic overlap

2.3 Key Outcomes - Technical-level Meeting

Collaborating partners drawn from various organizations and working in different areas and aspects of the KAZA TFCA presented their insights and experiences from working in the area and specifically the KRWDA and the Kwando River Basin. The session was structured around key focal areas for the project:

1. Data
2. Assessment
3. WASH and MUS opportunities
4. Policy frameworks

The level of participation highlighted the broad stakeholder interest in the KAZA-GROW and the importance of collaboration for building synergies across partners and institutions to strengthen the understanding and management of groundwater resources in the KAZA TFCA, and in the KRWDA.

Key messages coming out of the technical-level meeting were:

- There are fragmented data repositories on the KAZA TFCA and especially the KRWDA
- It is important to build on past and ongoing initiatives towards a stronger data and knowledge base for the KAZA TFCA
- Assessing the KRWDA water resources as part of the Kwando River Basin as well as the basins of the northern tributaries of the Zambezi River is key
- Groundwater, and more broadly, water quality is an emerging issue, which requires more attention regarding groundwater development and protection
- Issues identified for the KRWDA as part of the MIDP, need to be looked into, e.g. on missing land use information, HWCs, and limited water infrastructure[15]

2.4 Concluding Remarks on the Inception Workshop

The Inception Workshop was highly successful in brining key stakeholders on water resources and conservation in the KAZA FCA together in the context of identifying key issues around groundwater knowledge, use, development and management. There was broad consensus around the need for efforts to enhance the understanding of the resource base, the links to environmental flows and more broadly ecosystem services, and options to enhance water security and livelihoods for small communities through groundwater-based solutions. Addressing these needs may help inform and shape a shared rational, understanding and vision(s) for the KAZA TFCA's freshwater systems.[16]

While there is clear recognition of the multiple, potentially overlapping, mandates on transboundary water resources management in the KAZA TFCA, shared among the KAZA FFCA Secretariat, the RBOs, and individual states, a general perception and appreciation were evident around the growing cooperation platform to address water issues of transboundary nature.

3. PROJECT IMPLEMENTATION PLAN

3.1 Deliverables and Deliverable Schedule

Over the two-year duration of the project (January 18, 2021 - December 31, 2022), a number of incremental milestone activities will be undertaken towards meeting project objectives (Table 2).

[15] Kavango Zambezi Transfrontier Conservation Area - Master Integrated Development Plan (MIDP), 2015 – 2020.

[16] Kavango Zambezi Transfrontier Conservation Area. KAZA's Freshwater Systems - Regional Stakeholder Meeting. 22-23 January 2019, Travel Lodge, Kasane, Botswana, March 2019.

Table 2. Deliverables and milestones over the project life cycle (2021-2022)

	Year 1												Year 2											
Deliverable	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
Inception Report cum Inception Workshop Report (IR)																								
Draft TDA Report (dTDAR)																								
KRWDA Database (KDB) Report																								
Water scarcity vulnerability map of KRWDA (VM)																								
Draft TFCA GW Management Framework Report (dTGMF)																								
Final TDA Report (fTDAR)																								
Report on GW quality (GQR)																								
Draft Hotspot for GW Development in KRWDA Report (dHGDR)																								
Final Hotspot for GW Development in KRWDA Report (fHGDR)																								
High-level Concluding Workshop report (HLWR)																								
Final TFCA GW Management Framework Report (fTGMF)																								
Final Project Report																								

A more detailed milestone and activity schedule with deliverables is provided in Appendix 4.

3.2 Milestone Specification

3.2.1 Transboundary Diagnostic Analysis

The purpose of a Transboundary Diagnostic Analysis (TDA) is to serve as a basis for joint understanding and consensus among Partner States around transboundary water resources issues of concern.[17] This concept has developed into an internationally recognized tool for transboundary water management, facilitated and supported by the Global Environment Facility (GEF). In order to achieve this, broad datasets must be gathered and harmonized that include both biophysical and socio-economic dimensions. The process of developing the TDA, which is highly participatory and consultative, helps pinpoint particular issues of a transboundary nature, whilst building confidence and trust among the international partners and various stakeholders working together. The conclusions derived in this consensus-driven approach are often taken forward in a more prioritized and action-oriented Strategic Action Plan (SAP), which may serve define actual investments to address the key issues identified.

Previous TDA experience

The International Water Management Institute (IWMI) has ample experience from TDA/SAP work in multiple transboundary settings within the SADC region. These include the Ramotswa-Ngotwane

[17] GEF Transboundary Diagnostic Analysis/Strategic Action Programme. Manual, Volume 1, Introduction to the TDA/SAP Process, https://iwlearn.net/resolveuid/396ac773-f663-4a07-b9d2-d9f0b4cdfe7a.

Aquifer system, the Tuli Karoo - Upper Limpopo system, and the Shire River Aquifer system. Information and outputs, including TDAs and SAPs, on each of these can be found online[18]. Each transboundary setting and TDA process poses its own unique set of circumstances and challenges, yet overarching lessons learnt are transferable to the KAZA TFCA context. These include the need to harmonize data before they can be compared (as in tables) or joined (as in maps). Furthermore, terminology is critical, and can be sensitive, e.g. related to names of systems, names of geological formations, and units of measurements to be used. The need for transparent and consultative processes is critical.

In addition, a range of TDA reports can be accessed via the GEF International Waters Learning Exchange and Resource Network (IW:LEARN) page[19]. This knowledge database draws on a number of examples and includes a TDA of the Botswana portion of the Okavango delta (2006).

Approach towards the KAZA-GROW TDA

The TDA acts as a primary knowledge base and framework for the project. However, the content of any particular TDA is highly dependent on the objectives and needs of the stakeholders involved. The highly successful Inception Workshop has already addressed some of the knowledge gaps for humans, wildlife and economic growth in the KAZA TFCA. The points raised in both the strategic and technical sessions have helped guide the initial outline of the TDA structure. We see this as the first step in an ongoing iterative approach to the formation of the TDA. As a result, we expect to remain fully engaged with our project partners and stakeholders throughout this process and will continually welcome any feedback on ideas, suggestions and topics that should be addressed in the final report.

Themes within the TDA

The overarching themes of the TDA relate to ongoing challenges faced not only by Member States in the KAZA TFCA but more broadly in the SADC region. The onset of climate change, water scarcity and land use conflicts are transboundary issues that rely on international cooperation regarding regional mitigation strategies. Within the KAZA TFCA, the TDA will analyze the relationship between humans, wildlife and economic growth and the ensuing role of groundwater development and management. The nuances within these topics will be brought forward by the project partners and stakeholders as discussions continue.

Areas to address in the TDA based on outcomes of the Inception Workshop

Given the wide-ranging representation and discussions in the Inception Workshop, a number of key outcomes were underscored:

1) *There is an unknown development potential of groundwater within the region and its contribution to a number of ecosystem services.* With the characterization of transboundary aquifers, and groundwater at large, the TDA will lay out the advantages of groundwater development and the resource's potential contribution to river flows and wetlands.

2) *How can groundwater be used to alleviate some of the ongoing challenges, such as water insecurity, poverty, and HWCs?* This question was highlighted by ongoing CRIDF research, which emphasizes that climate change is likely to exacerbate competition for water

[18] https://conjunctivecooperation.iwmi.org/
[19] https://www.iwlearn.net/documents/tda

resources for domestic and productive uses. The TDA will aim to set out how groundwater can address these multifaceted issues whilst supporting future development strategies.

3) *In terms of sustainable development, how can transboundary management frameworks and investments related to groundwater be put forward that leverage the potential of the resource?* This discussion was initiated based on the recognized current gaps in management frameworks and aimed to be aligned with future conservation strategies. Following the legal and institutional review, the TDA will be used as reference material for high-level decision making on transboundary water management frameworks and investments.

A draft outline of the TBA is provided in Appendix 5.

3.2.2 Kwando River Wildlife Dispersal Area Database

The KRWDA project database aims to synthesize existing sources and create an inventory of available quantitative and qualitative data sets regarding groundwater in the area. This collation will allow project partners and stakeholders to access the information available within the KRWDA, and within the wider KAZA TFCA. We expect that the database will present an excellent starting point for future projects centered on groundwater-related topics, complemented by other established institutional databases within the region (Table 3).

The project will further build on and leverage on existing data sets as identified during the inception meeting.

Table 3. Databases relevant to the KAZA-GROW project

Databases/-sets and repositories	Organization (Ownership)
Climate data - Weathernet	SASSCAL[a]
Groundwater Literature Archive	SADC-GMI
SADC Groundwater Information Portal (GIP)	SADC-GMI and IGRAC[b]
Hydrological and other data on the Kwando	WWF Zambia
Hydrological modelling data	TNC
KAZA M&E[c] tool	PPF
ZAMWIS[20]	ZAMCOM
Decision Support System[21]	OKACOM

[a] Southern African Science Service Centre for Climate Change and Adaptive Land Management
[b] International Groundwater Resources Assessment Centre
[c] Monitoring and evaluation
[d] Zambezi Water Resources Information System

3.2.3 Hotspot Mapping for Groundwater Development

The objective of this component is to identify suitable areas for groundwater development in the KAZA TFCA landscape that coincide with location of vulnerable communities in need of improved water access for multiple purposes. Several methods have been used for mapping of physical groundwater potential zones (GWPZs) including geologic, geophysical, and hydrogeologic approaches.[22] In this study, a combination of GWPZs and socio-economic modelling/mapping of

[20] http://zamwis.zambezicommission.org/INFO
[21] https://www.okacom.org/okacom-decision-support-system-dss
[22] https://link.springer.com/article/10.1007/s12517-020-06166-0#ref-CR8

vulnerable communities and HWCs, analyzed through multi-criteria decision making (MCDM)[23] will be used to map hotspot areas for groundwater development.

Groundwater is a component of water resources that saturates soil pore spaces, joints, and voids within geologic structures and strata. Groundwater availability and rate of groundwater flow is controlled by the hydraulic characteristics of lithologic materials, such as rock porosity and permeability. Groundwater is a dynamic and replenishable resource. The main sources of groundwater replenishment/recharge are precipitation, effluent discharge, and seepage from streams and lakes. Groundwater depletion and drought can be due to natural discharge, evaporation and pumping.

The exploitation and exploration of groundwater resources need an understanding of geology, hydrogeology and geomorphology of the area in question in order to identify areas with high physical groundwater potential. Identification of the water-bearing structures and stratigraphic layers with significant water storage and hydraulic conductivity and good water quality is therefore considered crucial to groundwater development. These areas holding high groundwater resources of considerable and economically exploitable quantity and quality are referred to as GWPZs.

Data and thematic maps/satellite images on e.g. soil type, geology, lineament density, depth to groundwater, groundwater storage, landuse\land cover, geomorphology, distance from surface water bodies, rainfall, slope, water quality, and borehole yield, will be sourced from project partners and freely available databases and data sources, and used to identify the GWPZs in the KRWDA. Focus will be on shallow replenishable groundwater resources. Primary and secondary data on groundwater quality, especially salinity and fluoride, known to be limiting for domestic uses[24], will be collected during both the dry and wet season and integrated into the analysis. Expert knowledge on the weighting of the importance of different thematic layers of groundwater potential will be used to support the analysis.

Socio-economic data will include information on e.g. water provision, distance to water sources and other infrastructure, livelihoods, health, and HWCs.

The final analysis of hotspot mapping of groundwater development will combine information on GWPZs and socio-economics. The results from this study provide information useful for guiding the effective identification and selection of appropriate locations for groundwater development to meet water needs in the KRWDA for vulnerable communities and avoiding HWCs. The results will be of benefit to decision-makers, NGOs, and investors, and ultimately to fragile communities in the KRWDA.

3.2.4 TFCA Groundwater Management Framework

Groundwater in Southern Africa is an important source of freshwater for large populations in rural communities. Nonetheless, the levels of use for domestic and small-scale demands are generally low compared to available resources. With increasing demand and pollution of surface water resources, groundwater can provide a complementary source of freshwater needed to sustain human and wildlife populations. Critical to this increased use and development of groundwater is its sustainable management to ensure that abstractions and associated environmental impacts are maintained

[23] Stoldt, M., T. Göttert, C. Mann, and U. Zeller (2020). Transfrontier Conservation Areas and Human Wildlife Conflict: The Case of the Namibian Component of the Kavango Zambezi (KAZA) TFCA. Nature, 10:7964.
[24] Bäumle, R., T. Himmelsbach, and U. Noell (2018). Hydrogeology and geochemistry of a tectonically controlled, deep-seated and semi-fossil aquifer in the Zambezi Region (Namibia). Hydrogeol. J., https://doi.org/10.1007/s10040-018-1896-x.

within acceptable limits, i.e. that groundwater resources are not depleted faster than they can be replenished and contamination is prevented. Groundwater management frameworks are generally lacking and fragmented across different institutions. While groundwater knowledge is growing, there is limited guidance to inform how best to manage and develop groundwater sustainably taking into account its unique attributes. Further, conjunctive use of surface and groundwater, which is often advantageous from a sustainability perspective, requires coordinated actions that ensures the sustainability of the integrated water system. Policy guidance gets even scarcer at transboundary level, particularly related to TFCAs. Through the KAZA-GROW project, the first steps towards a transboundary groundwater management framework for the KAZA TFCA will be developed in consultation with key stakeholders with the aim of establishing a framework that guides the use and development of groundwater resources to meet the needs of all users – domestic water uses, wildlife, livelihoods and ecosystems. This TFCA Groundwater Management Framework (TGMF) is foreseen to support a broader TFCA freshwater strategy and vision at KAZA TFCA level and a community of practice at SADC TFCA Network level.[25]

4. ANTICIPATED OUTCOMES

The KAZA-GROW project is envisaged to critically support ongoing freshwater initiatives in the KAZA TFCA, through increased focus on and understanding of the groundwater resources. The project will enhance the knowledge base as well as the institutional and management framework around groundwater in the KAZA TFCA, in collaboration with multi-stakeholders at multiple levels and scales to enhance a more integrated and holistic management of the freshwater resources across the area, supporting the water security of poor and vulnerable communities in the area, while enhancing resilience, livelihoods and conflict-free co-existence of humans and wildlife in the area (Section 5.2).

5. PROJECT ADMINISTRATION

5.1 Governance and IWMI Team

5.1.1 Governance

The project is led by IWMI, from its regional office in Pretoria, South Africa. IWMI provides standard internal structures and procedures to assure quality control as required for project implementation related to scientific approaches and rigor as well as established project financial and reporting procedures. In addition, the project will adhere to USAID requirements for project implementation, reporting, branding, etc. based on extensive previous experience from collaboration with USAID.

There is a need for an institutional structure (like a Project Steering Committee (PSC)) to oversee KAZA-GROW, and discussions around this have started. As an interim solution, a Project Partners meeting structure has been set up to follow initial implementation. The Project Steering Committee will consist of key project partners and will meet periodically to discuss pertinent project implementation issues and specific activities and outcomes, and possible upscaling, policy development, and lesson-sharing.

The KAZA TFCA Groundwater Platform, established as part of the Inception Workshop and taking advantage of the engagement of critical stakeholders at regional, RBO and national levels, provides a strong foundation for this platform going forward. This platform holds a potential to contribute to the Freshwater Working Group and the development of a freshwater strategy for the KAZA TFCA.

[25] Kavango Zambezi Transfrontier Conservation Area. KAZA's Freshwater Systems – NGO & Development Partners Stakeholder Meeting, 24-25 January 2019, Mowana Safari Lodge, Kasane, Botswana.

5.1.2 IWMI Team

IWMI has allocated resources for a core team of internal staff to support the implementation of the project In addition, a consultant is subcontracted by IWMI to work on the project. Students and interns will be attracted to work on specific technical tasks on the project. Table 4 presents the team.

Table 4. IWMI staff and Specialist Team (Consultants/Interns)

Role/expertise	Name	Country	Orgnizatopm
Project Manager	Karen G. Villholth	South Africa	IWMI
Hydrogeological studies and database development	John R. Lindle	Denmark	Consultant
Vulnerability and water quality assessments	Manuel Magombeyi	South Africa	IWMI
Legal and institutional assessments, TGMF	Patience Mukuyu	South Africa	IWMI
Landuse mapping and hysrological assessments	Svea Bertolatus (tbc)	Germany/Sweden	Lund University

5.2 Performance Targets

The RWP is evaluated against a theory of change and a monitoring, evaluation and learning (MEL) framework (Figure 3).

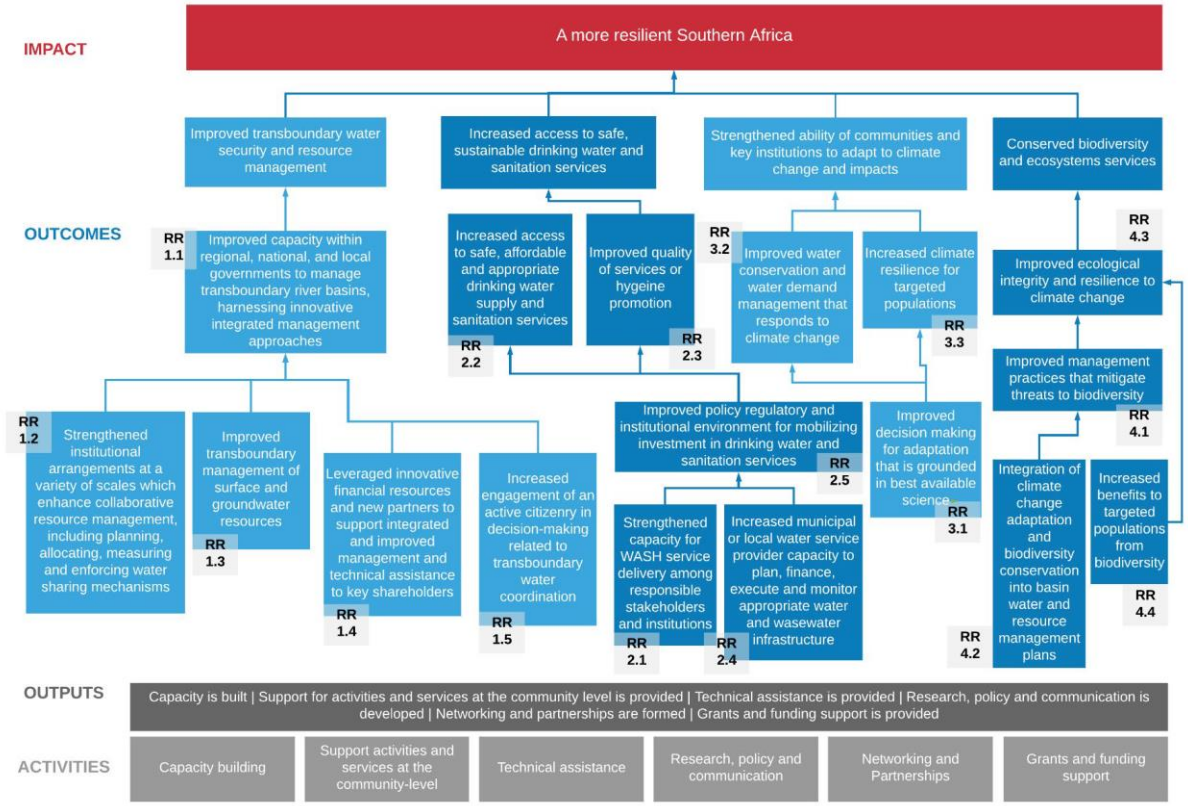


Figure 3. Indicative overarching theory of change of the RWP, indicating overarching objectives and performance targets (RR) used in the MEL framework

The KAZA-GROW project will feed into several of the RWP objectives and performance targets (Table 5).

Table 5. RWP objectives and performance targets that KAZA-GROW contributes to

Objective	Performance target	Indicator	Rationale
Objective 1: Improved Transboundary Water Security and Resource Management	**RR 1.1:** Improved capacity within regional, national, and local governments to manage transboundary river basins; harnessing innovative integrated management approaches to address complex transboundary water challenges	4. Number of people educated on tools, approaches, or methods for water security, integrated water resource management, or water source protection as a result of U.S. government assistance	The project will enhance technical and human capacity in transboundary water resources management
	RR1.3: Improved transboundary management of surface and groundwater resources	1. Number of tools and strategies promoting conjunctive use and management of surface and groundwater resources that are proposed, adopted, or implemented as a result of Resilient Waters' assistance	The project will provide improved tools and frameworks to improve management of surface and groundwater resources
	RR 1.4: Leveraged innovative financial resources and new partners to support integrated and improved management and technical assistance to key stakeholders	2. Resources leveraged for improved management and technical assistance to key stakeholders as a result of Resilient Waters' support	The project strives to leverage additional resources and partnerships to enhance uptake of processes and methodologies developed
Objective 2: Increased Access to Safe, Sustainable Drinking Water and Sanitation Services	**RR 2.4:** Increased municipal or local water service provider capacity to plan, finance, execute, and monitor appropriate water and wastewater infrastructure	14. Number of municipal or local water service providers supported to plan, finance, execute, and monitor appropriate water and wastewater infrastructure (custom)	The project will target NGOs and other water providers in terms of identifying and planning groundwater resources for appropriate water supplies
Objective 3: Strengthened Ability of Communities and Key Institutions to Adapt to Change, Particularly the Impacts of Climate Change	**RR 3.1:** Improved decision-making for adaptation that is grounded in the best available science	15. Number of evidence-based knowledge products on adaptation produced and disseminated to improve decision-making	The project will develop knowledge products that enhances the water security and livelihoods of small communities while reducing HWCs

5.3 Engagement and Communication

5.3.1 Engagement

TDA consultation

The TDA will be developed in consultation with key stakeholders with three primary objectives:

1. Ensure best representation of existing knowledge around the conditions in the KRWDA
2. Participatory development of key issues around water-related developmental issues in the KRWDA

3. Ownership and uptake of the TDA for information and co-development of a future joint SAP

Thematic Working Groups

Thematic working groups will be invited and developed around the key project outcomes – the TDA, Hotspot for Groundwater Development Mapping, the TGMF, and capacity development. Interested organizations and institutions, primarily based on the inception phase engagement, will be invited to form part of these thematic groups whose focus areas may include hydrology, hydrogeology, modelling, water security from groundwater, policies and institutions, and collaboration around student engagement.

5.3.2 Communication

Branding

For all branding and partner recognition, the project will follow the USAID branding strategy.

Communication channels

The project counts on a project flyer.

Outlets for project outcomes and outputs are as follows:

- Meeting presentations and recordings as relevant will be made available for stakeholders through a OneDrive shared folder.
- Updates and reports will be provided on the project website: kaza-grow.iwmi.org

The project aims for wide dissemination of project outputs and outcomes, both via scientific research publications, the project website, as well as the media. Media communication and outputs will be coordinated across the project partners.

6. PROJECT CONSTRAINT CONSIDERATIONS AND RISK MANAGEMENT

6.1 Opportunities for expansion of project scope

Since the KAZA-GROW project is implemented with a significantly reduced scope relative to original conceptualization, it is realized that the project will lay an important foundation for a stronger accounting and consideration of the importance and role of groundwater resources in TFCA areas, with respect to water security and resilience of human and wild-life communities, and ecosystems, while providing the knowledge base and strengthened institutional structures to enhance sustainability of groundwater resources – but also that detailed investigations of the resource base will not be feasible, e.g. in terms of airborne geophysics[26] to delimit transboundary aquifers as put forward as part of the original scope.

Hence, it is recognized that relatively little progress in terms of **understanding deeper, and often transboundary larger aquifer systems** will be possible under this project. Hence, the project, in

[26] https://chemonics.com/impact-story/taking-flight/

collaboration with the project partners (KAZA TFCA Secretariat and PPF) will actively seek expansion on the scope in these areas with a view to close the knowledge gaps.

Another area that the project may be relatively constrained in terms of addressing relates to **capacity development**. The project will involve students as possible, and use project meetings to transfer knowledge, but more designated training will not be possible. The project will expand the understanding of present capabilities, as well as capacity constraints, within present institutions, to identify critical bottlenecks and key investment areas for expanding the capacity in the field of groundwater for sustainable development in the KAZA TFCA and TFCAs in SADC more broadly.

6.2 Risks associated with project implementation and mitigation measures

The Project Lead foresees a couple of risks associated with the project (Table 6). They are all considered of an intermediate character in terms of possibly affecting the outcome of the project, but not considered as major constraints for the successful implementation of the project (Table 6).

Table 6. Project risks and mitigation measures

Risk	Mitigation measure
A. **Continuation of Covid-19 lockdowns preventing/constraining field visits**	1. Early planning, to circumvent issues related to lockdown and strict adherence to current national regulations 2. Planning to avoid significant interaction with local communities to avoid infection risk 3. Considering support from citizen scientists and students to help doing the field sampling in their local areas, ensuring this activity would not increase risk of these groups
B. Limited data availability for the TDA	1. Application of remote sensing data as relevant and possible 2. Providing guidance and recommendations on priority data gaps to be filled going forward 3. Involving students, including from national universities, to collect critical data as identified early in the project
C. Transboundary conflicts or disputes around TDA development	1. Clear consultative processes around the TDA development 2. Translation of TDA documents (to Portuguese) to ensure all countries have equal insights to knowledge generated and opportunity to provide feedback 3. Providing incentives in terms of a future collaborative SAP process, which may led to concrete investments to address the developmental issues identified during the TDA process

APPENDIX 1: INCEPTION WORKSHOP PROCEEDINGS

1. STRATEGIC-LEVEL MEETING, FEBRUARY 05, 2021

1.1 Partner Perspectives

United States Agency for International Development (USAID), *Graham Paul, Climate Change and Environment Advisor*

USAID has been involved in the KAZA TFCA for more than 10 years through the Southern African Regional Environment Program (2010-2016) and the current Resilient Waters Program (RWP) among other initiatives in the region. Specific objectives of the RWP Program are to build a more resilient Southern Africa, its communities as well as ecosystems through improved management of transboundary resources and increased access to safe drinking water and sanitation services. Through the KAZA TFCA Secretariat as the beneficiary partner, USAID has extended its support to numerous other partnerships within the region including IWMI. The main objectives of these partnerships being to build more resilient institutions, developing more robust information systems, and promote innovative practices that enhance sustainable natural resource management across the region at multiple levels.

KAZA-GROW will be instrumental in advancing sustainable conjunctive water use, addressing two main regional challenges (i) minimal groundwater use across the countries suggesting it is an untapped natural resource with significant potential for building resilience particularly against climate change impacts and providing water security for humans and wildlife (ii) groundwater governance systems are state centered with limited integration coupled by inadequate capacity. However multilevel governance, particularly in transboundary aquifers is required for decisions to be delegated at the lowest local level necessary for sustainable groundwater management. Further, water quality data is lacking and ineffective for decision making and river system management. Lack of real time water quality data threatens the health of water bodies. The KAZA-GROW project will therefore enhance knowledge on water resources on hotspot transboundary areas for groundwater development, creating an enabling environment through strengthened groundwater management, securing water for wildlife and humans, and a more organized and planned approach to conjunctive use of surface and groundwater.

KAZA TFCA Secretariat, *Nyambe Nyambe, Executive Director*

The KAZA Secretariat represents the KAZA partner States of Angola, Botswana, Namibia, Zambia and Zimbabwe. Water and conservation development in the KAZA TFCA took off in 2018 with the Conservation Working Group directing attention to the management and development of water Resources in the KAZA. Since then, an MoU has been signed with OKACOM in addition to several stakeholder engagements discussing shared risks faced by KAZA States particularly due to climate change and the need to build resilience. One of the resolutions during the workshops was the need to understand the risk to groundwater resources and draw more attention to it, similar to surface water to enable a hotitich system understanding. There is therefore collective will towards addressing challenges in the KAZA TFCA as well as of the initiatives currently taking place – including the KAZA-GROW project. Due to resource constraints, the project will be a pilot focusing on the Kwando WDA with the hope of scaling up to other transboundary aquifers in the KAZA TFCA.

Peace Parks Foundation (PPF), *Andrew Nambota, Regional Manager*

As one of the KAZA-GROW project partners the PPF recognizes the importance of water for both humans and wildlife. Humans often indiscriminately use resources to the detriment of other uses and users. PPF aims to enable an equilibrium and harmony between conservation and consumption and between man and nature. Supporting the development of TFCAs and strengthening the resilience of communities in TFCA landscapes is a critical action. Key to this is the sustainable management of water resources. Groundwater was identified as an important source of water for the Kwando WDA and that climate change would leave lasting impacts on people and wildlife, therefore a practical and functional decision system is needed for the long-term sustainable provision of water.

International Water Management Institute (IWMI), *Karen Villholth, Principal Researcher and Project Lead*

There are three partners collaborating with IWMI in the implementation of the KAZA-GROW project, namely USAID/RWP, KAZA TFCA Secretariat and PPF. The IWMI project team consists of Karen Villholth as Project Lead and Principal Researcher; Manuel Magombeyi, a Researcher in hydrology, hydrogeology and water resources management; Patience Mukuyu, a Researcher in transboundary water management, and John Lindle, an Independent Consultant on multidisciplinary groundwater assessment. The stressors of the KAZA TFCA include climate change, induced water scarcity, population growth, and infrastructure development. The project wants to identify how groundwater and transboundary aquifers can be integrated into a water management framework to support the KAZA TFCA, and particularly in the KRWDA. IWMI has been involved in three transboundary water systems (both surface and groundwater) – Ramotswa, Shire and Tuli Karoo. Transboundary diagnostic analysis has been conducted in all these systems and similar work will be conducted in the KRWDA. However, not all activities that were carried out in other systems, e.g., the airborne geophysics will be possible in the KAZA-GROW due to resource constraints. In response to the project goal and objectives, a TDA, hotspot mapping for groundwater development, as well as developing a TFCA groundwater management framework will be carried out.

Discussion items

- Salty groundwater e.g. in the Sesheke areas in Zambia towards the Caprivi strip, where boreholes are limited to shallow depths
- Development of groundwater has to be linked to regional water development. If WDAs are to remain functional, regional planning should take such into consideration
- Project outcomes were selected to lay foundation for potential out scaling with the hope to look beyond the project's two years and institutionalizing some of the outcomes and lessons. The scope of the project had to be reduced extensively in view of available resources
- If relevant partnerships are established through this project, opportunities may arise for scale up

1.2 National Perspectives - Freshwater for TFCAs

Representatives from national water departments or TFCA national coordinators or both, provided national perspectives on freshwater and TFCAs as well as expressed their expectations of the KAZA-GROW project.

Angola, *Manuel Quintino, Director General, National Institute of Water Resources, Ministry of Energy and Water*

Angola is part of the Kunene, Cuvali, Cubango, Congo and the Zambezi transboundary basins. The Angola National Water Master Plan has three main objectives for the Angola portion the Zambezi basin (i) to secure water supply for the entire population in the basin (ii) to prevent and mitigate the effects of floods droughts as well as accidents caused by pollution (iii) to secure water availability for the different socio economic activities. The Kwando River which falls within the KAZA TFCA is a key water resource in the country referred to as the "S*ource of life*".

Key areas of concern and limitations noted in the Kwando Basin include

- The remoteness of the Sub-Basin in relation to centres of political decisions
- The need for creation of an Office for Management of the Zambezi River Basin, within the Angolan territory;
- Insufficient hydrological and meteorological coverage of the Kwando Sub-Basin
- The need for a Transboundary Diagnostic Analysis – for the Kwando Sub-Basin
- The need for establishing environmental flow (E-flow) for the Kwando River
- Joint monitoring of Water Resources / Joint campaigns for Flow Measurements of Kwando River
- Sharing of tangible benefits

Initiatives that have taken place in the Kwando basin include:

- A Master Plan in the Angolan portion of the Zambezi River Basin and the Zambezi River Basin-wide Strategic Plan
- Transboundary Cooperation between Angola and Zambia through the Rehabilitation of the Fluvial Canal "Rivungo – Shangombo"
- Existence of the National Stakeholders Committee (NASC-Angola) which interacts with communities living in the basin area.

Botswana, *Thato Setloboko, Hydrogeologist, Department of Water and Sanitation, and Michael Cranwell Molaodi, TFCA Coordinator, Ministry of Environment, Natural Resources Conservation and Tourism*

Botswana is heavily reliant on groundwater as it experiences frequent episodes of drought. Future projections also show continued reliance on groundwater for various sectors including humans and wildlife. The Chobe enclave in the Northern part of Botswana falls within the KAZA TFCA. Water quality concerns along the Chobe River floodplain prompted the conjunctive use of surface and groundwater for rural communities' water supply. Several institutions including the Water Utilities Corporation, Botswana Geoscience and the Kalahari Conservation Society play a role in wildlife management and groundwater development issues. Data availability and reliability is a huge concern and groundwater modelling could be an important tool to addressing some of these challenges. The KAZA-GROW project outcomes would be key in informing the TFCA planning process for more targeted interventions, such as where boreholes should be placed in supporting humans and wildlife. Additionally, outcomes may also benefit other TFCA such as the Kgalagadi Transfrontier Park where groundwater is the main source of water.

Namibia, *Naambo Josephine Iipinge, TFCA Coordinator, Ministry of Environment, Forestry Tourism*

The Water Resources Management Act (No. 11 of 2013) provides for the management and conservation of all water resources in Namibia and those shared with other countries. The main objectives are ensuring sustainable management for development, use and conservation of water

resources. The Ministry of Environment, Forestry and Tourism is responsible for coordinating all Namibian TFCAs in collaboration with the ministries of agriculture and water.

Strategies and programs for water and TFCA management in Namibia include

- Integrated Water Resources Management (IWRM) plan for sustainable water resources use and management in Namibia, ensuring holistic management at the National level
- Strategic Action Plan to manage the Okavango River Basin in a sustainable manner for improved livelihoods, socio-economic development and environmental protection.
- ZAMCOM Regional Development Plan
- Basin Development Management Framework – establishment of Basin Management Committees to manage water along hydrological boundaries and to involve local communities more actively in the planning, operation and management of their water supplies and resources
- Groundwater mapping for the Kavango Regions, Joint monitoring and surveys and Livelihoods demonstration projects (OKACOM EU & UNDP GEF)
- KAZA Treaty – Master IDP - KAZA IDP - demonstrate how the Government of the Republic of Namibia (GRN), through MET, intends managing and developing the Namibian component towards addressing the issues, gaps and challenges identified through a situational analysis of the delineated area and meeting its obligations in respect of the KAZA TFCA.
- Water provision in the context of HWC mitigation (KFW Phase III Support to KAZA - Kwando and Chobe WDA)

Structures for management of the KAZA TFCA within a coordinated mechanism are established in Namibia for example through the National Steering Committees.

Zambia, *Stanley Hantambo, Acting Principal Water Officer, Ministry Water Development, Sanitation and Environmental Protection*

Within the KAZA TFCA there are two major basins - the Zambezi, Kafue and Ruanga in which three main national parks are found including the Siomangwezi. People living within these Parks rely on water from rivers. To avoid human animal conflict, national parks authorities have developed separate water sources for animals such as boreholes. The Zambia 7th National Development Plan contains both national and transboundary water management actions e.g. for transboundary aquifers, to ensure regional integration. Government is promoting partnerships in the management of transboundary aquifers by developing a framework for data collection and information exchange with other member states. Climate change has impacted TFCAs through the loss of natural environment and destruction of biodiversity. Climate change adaptation and mitigation measures have been mainstreamed to promote social wellbeing and economic growth thereby reducing environmental risk such as water pollution and shortage. The Department of Water Resources Development is responsible for water resource infrastructure development and transboundary water resource management, including groundwater exploration and mapping. The Water Resources Management Authority (WARMA) is the regulator responsible for development of catchment management plans, water resource allocation and ecosystem protection. Collaborations with a number of partners to ensure TFCAs are protected include partnership with the WWF Zambia who are working in the Kwando Basin and involved in the Sesheke Forest Restoration Program. Prospects of hydropower development in the Zambezi basin are important to Zambia which generates about 80% of power from hydroelectricity.

Zimbabwe, *Stanley Nyamayedenga, KAZA TFCA Program Officer, ZimParks*

TFCAs are central to wildlife and human livelihoods. People and communities are at the heart of TFCA establishment to improve socio economic conditions and to foster climate resilience and water security. Through ZimParks, international cooperation is facilitated through MoUs, treaties, joint action plans and multilateral environment agreement and protocols. The aim is to develop Zimbabwe TFCA programs into a functional and integrated network of stakeholders and improving stakeholder livelihoods by enabling their full participation in TFCA programs. The Zimbabwe National Water Authority (ZINWA) is responsible for water resource planning and development while ZimParks is responsible for conservation activities. The importance of freshwater management in TFCA management is critical for both humans and wildlife and at the transboundary scale Zimbabwe is party to the Ramsar Convention, Convention on Migratory Species and the SADC Protocol on Shared Watercourses. Good water governance will ensure the sustainability of TFCAs through recognizing equitable use and benefit sharing to enable TFCA conservation.

Discussions items

- Inadequate data on groundwater, however studies have been conducted by WWF which the KAZA-GROW Project can draw from
- The KAZA Conservation Working Group meets about twice a year and there are several other subgroups such as the Fisheries sub-working group. In November 2018 the KAZA Joint Management Committee endorsed the Freshwater Working Group. Meetings have not been held as would be desired due to Covid19 limitations. The 2021 calendar is in the process of being finalized
- The link of conservation and health e.g. in the case of zoonosis, is a form of human- wildlife conflict from using the same source of water
- The importance of data and information sharing across initiatives in the region to strengthen understanding of the system
- In Namibia, some institutions have revised their policies to include the groundwater component
- Potential to contribute to training and empowering students from the Universidade Agostinho Neto in the area of ecology and fauna, namely to encourage the integration of Angolans students in areas of the project.

1.3 Regional Perspectives - Drivers and networking for freshwater for TFCA in SADC

SADC Secretariat, *Tawanda Gotosa, Technical Advisor TFCAs*

The SADC Transfrontier Conservation Areas (TFCAs) Program strategic focus is to develop SADC into a functional and integrated network of transfrontier conservation areas where shared natural resources are sustainably co-managed and conserved to foster socioeconomic development and regional integration for the benefit of those living within and around TFCAs. This program was developed in recognition of the many benefits of TFCAs including ecosystem services, investment opportunities through tourism and community livelihoods when communities are empowerment to take a more active role and participate in local initiatives. There are seven key components in the SADC TFCA Program, which include reducing vulnerability to climate change, enhancement of local livelihoods and establishing data and knowledge managements systems among others. The SADC strategic focus on TFCAs recognizes that connectivity matters, highlighting the importance of landscape conservation across boundaries including shared surface and groundwater resources. This allows for strengthening collaboration and linkages in support of regional integration. In that regard,

TCFAs are a combination of biodiversity development and cooperation where countries come together to discuss the development and benefits of shared resources. The KAZA-GROW groundwater contribution will be critical for adding knowledge on TFCAs in SADC.

SADC Groundwater Management Institute (SADC-GMI), *James Sauramba, Executive Director*

Groundwater is important particularly in the SADC region where 70% of local communities depend on this resource for meeting their domestic and productive needs. The promotion of conjunctive use is enshrined in the 2000 SADC Protocol on Shared Watercourses and through the Regional Strategic Action Plan. SADC-GMI envisions extending the knowledge base of transboundary aquifers in the region developing TDAs and SAPs that can inform future investments. There is potential for data generated though this project to feed into the Groundwater Information Portal which can be a one stop shop for groundwater information. Further, the SADC Drought Risk Map has been updated showing areas that are at risk, forecasting the need for conjunctive use to promote sustainable use of groundwater around the hotspots identified. Groundwater dependent ecosystems are critical for fish, plant and wildlife populations but have not received much attention in terms of mapping and conservation. In addition, valuation of groundwater and how it contributes to socio-economic development in TFCAs would be an important area to consider. TFCAs straddle existing water governance structures opening opportunities for synergies for such structures to coordinate before new structures can be developed, these include RBOs, joint technical committees as well as SADC-GMI. In addition, capacity building and knowledge products would be invaluable outputs from the KAZA-GROW Project, which is a starting point for long term efforts of advancing integrated knowledge in TFCAs.

The Permanent Okavango River Basin Water Commission (OKACOM), *Phera Ramoeli, Executive Secretary*

Groundwater is a key component of the water balance central to supporting livelihoods. As such there is an ongoing groundwater assessment program in the Okavango Basin. Linkages between the Okavango and Zambezi systems are being established through the studies and the Kwando work will add to this knowledge. However, there are serious challenges with data availability particularly in the upper reaches of the Okavango Basin. There are other opportunities to gain more data through collaboration between ongoing assessments in the Okavango Basin. Importance to consider also is that the jurisdiction of TFCAs and RBOs do overlap, as such institutional issues need to be carefully considered so that there is collaboration not competition. Currently there is a joint MoU between the KAZA TFCA Secretariat and OKACOM.

Zambezi Watercourse Commission (ZAMCOM), *Evans Kaseke, Program Manager*

Among the key objectives of ZAMCOM is promoting the equitable and reasonable utilization of the Zambezi Watercourse. The watercourse refers to the overall ground and surface water system. The KAZA-GROW initiative is coming at a critical time to address groundwater, when most attention has been given to surface water, despite the fact that many communities rely on groundwater resources. The KAZA-GROW project will generate information and data that can be used for groundwater management for the dependent humans, wildlife and vegetation, particularly during drought periods when there is an increased reliance on groundwater. Other ZAMCOM initiatives with WWF Zambia in the Kwando are to ensure that human stakeholders are afforded a platform to communicate and to discuss about decisions on ecosystem management. KAZA-GROW outputs will also inform initiatives such as the upcoming groundwater strategy for the Zambezi Watercourse to be developed in partnership with SADC-GMI.

RAMSAR Secretariat, *Njisuh Zebedee Feka, Senior Adviser*

Water use has increased six-fold and demand continues to increase with humans using more water than can be replenished. Ecosystems, particularly wetlands have been negatively impacted as a result. One of the drivers of this are deficient governance structures and climate variability. Further, more food and water will be required in the future to sustain life. Nonetheless, there has been a concerning loss of wetlands exacerbated by climate change. Biodiversity faces extinction due to the loss of wetlands. Deficient governance policies and institutional frameworks are some of the direct drivers of freshwater decline and wetlands conversion. The complex interaction of socioecological drivers for this loss are not well understood and are compounded by lack of political will to enable effective freshwater governance. The Ramser Convention on Wetlands calls for collective action to address wetland loss and degradation. The KAZA-GROW project is a strategically timed initiative to address pressing challenges related to freshwater management and identifying hotspots for development.

Discussion items

- Conventions such as the RAMSAR Convention on Wetlands recognize the importance of water and water resources collaborations and how these can be further developed and used to guide future developments.
- In the KAZA-GROW various aspects of groundwater management and groundwater development will be addressed, distilling data from existing information research and provide broad scale recommendations. More investments are required to further understand the resource due the project's limited scope.
- Collaboration with academic institutions are welcome through student capacitation and will be further explored.

1.4 Collaborating Partners - Freshwater initiatives in KAZA TFCA

The Nature Conservancy (TNC), *Sekgowa Motsum, Okavango Basin Program Director*

TNC is an international NGO currently working on the Okavango Basin across three main thematic areas (i) community based freshwater conservation (ii) sustainable finance to continuously support activities to move from project cycle funding (iii) smart development to generate knowledge and science to support decision making. The major gaps that has been identified in their work is groundwater data availability. The KAZA-GROW initiative would be useful in plugging some of these data gaps. One of the products coming out of TNC led initiatives is the Freshwater Map for the KAZA landscape. Integrated approached are needed outside of the KAZA and the conservation community boundaries reaching so less obvious partnerships. Development needs in Angola are acute and as such a strong dependence on conjunctive ground and surface water use is foreseen.

World Wild Fund for Nature (WWF), *Michael Knight, KAZA Lead; Faith Chivava, Water Resources Management Specialist*

WWF has been operating in the KAZA landscape with a focus on wildlife and community based conservation and has recently started to focus on freshwater, food, forests, climate change and energy. Protecting biodiversity, building trust with communities and building the economic case are at the core of WWF functions. The KAZA has an unparalleled economic advantage over other TFCAs with the Kwando being the most critical link across the KAZA landscape. From a wildlife and water perspective, the Kwando is the least transformed river and most important. WEF works with local partner NGOs in implementing projects. The WWF Zambia project portfolio spans across different scales. However, groundwater has been a missing link which is key to understanding the hydrology

of a system. WWF is also involved in the understanding of environmental flows to inform holistic water allocation. The Okavango has benefited from significant research efforts unlike the Kwando Basin. Technical discussions and information sharing between projects would be an important step forward to develop a common understanding of the Kwando for both surface and groundwater.

2. TECHNICAL-LEVEL MEETING, FEBRUARY 08, 2021

The second session held on February 08 focused on technical discussion related to specific project outcomes and expectations. Various collaborating partners presented their experience with project implementation in the KAZA TFCA region across four main areas (i) data availability (ii) assessment Initiatives (iii) water, sanitation health and hygiene (WASH) and multiple use (MUS) opportunities (iv) regional policy frameworks. The following sections presents these discussions in more detail.

Opening Remarks, *Nyambe Nyambe, Executive Director, KAZA TFCA Secretariat*

Good momentum has been gained from the previous strategic level meeting and opportunities exist to leverage and build on the synergies among the organizations involved. The RBOs mandate over water resources management in KAZA is recognized and collaboration will be strengthened with the KAZA TFCA Secretariat to build on synergies. The interest showed by partners and the expertise available is appreciated, and the invitation is open for greater collaboration to better harness competencies and skills across institutional boundaries.

Project Implementation Plan, *Karen Villholth, Principal Researcher and Project Lead, IWMI*

The project has three main deliverables (i) Transboundary diagnostic analysis (TDA) (ii) Hotspot transboundary areas mapping for groundwater development (iii) Transboundary Groundwater Management Framework (TGMF). These deliverables will be developed in collaboration with various partners that will be identified as the project continues. Establishing the link between groundwater management and TFCAs will be a key focal area for the TGMF. There is room for refinement of these outputs based on stakeholder input. Expectations of this technical session are to achieve a common understanding of previous and ongoing activities in the region related to freshwater, identifying data sources and enhancing partnerships as well as identifying potential for collaboration on specific issues within and beyond the KAZA-GROW. Areas of joint interest will be actively sought and identified.

2.1 Data Sources and Availability

The Nature *Conservancy (TNC),* *Sekgowa Motsumi, Okavango Basin Director*

The TNC's footprint is mostly in the KAZA upper catchment of Angola focusing on the conservation of headwaters, smart development that balances the needs of people and nature and sustainable finance. Conservation activities include community based conservation initiatives and management of protected areas. Current efforts in the Okavango Basin are aimed at guiding new investment away from hydropower to land based renewables such as solar. Similarly, ecosystem sensitivity analysis for freshwater, biodiversity wildlife and protected areas in the Kwando system is important to direct development to areas of low impact, being cognizant of critical areas such as wildlife dispersal corridors. In developing the business case for OKACOM, TNC had to conduct instream modelling to ensure that there are no adverse impacts on the resource in the different development options, however, there was very limited groundwater data in Angola for a holistic assessment. There was no data to support scenarios where conjunctive use of surface and groundwater would be useful in meeting some of the development goals. Groundwater sustains base flows in the Okavango system

but there is no data to show the magnitude of these contributions. There is therefore a desperate need for groundwater data which the KAZA-GROW project can help in bridging.

Peace Parks Foundation, *Marina Faber, Information Systems Manager*

The PPF has a large spatial database with base mapping data, location and boundaries. Other areas may have more data than others. Most of the work has occurred in Southern Zambia where surface water data may be available at various resolutions. The KAZA M&E tools developed collaboratively under the Impact Monitoring group of the KAZA TFCA is spatial tool that contains a number of indicators and story maps. This spatial tool has potential to house data generated from the project in a single repository. Landover change data (maps) are currently being updated.

SADC Groundwater Management Institute (SADC-GMI), *Brighton Munyai, Hydrogeologist*

SADC-GMI hosts the SADC Groundwater Information portal (SADC GIP) which has been revamped and linked to ORASECOM and ZAMCOM databases. The portal is being updated with current project information. The portal contains borehole location information and was last updated in 2010. Current initiatives have been the Namibian updated hydrogeological map with ability to show real time data and in Botswana an integration of the country database. The SADC Groundwater Literature Archive is updated with 600+ records with interesting sources for OKACOM and ZAMCOM to provide input into the KAZA-GROW TDA. From the Eastern Kalahari Karoo (EKK) transboundary aquifer System are relevant project outputs for the KAZA-GROW. There are ongoing groundwater assessments in the Cubango-Okavango river basin, both quantitative and qualitative, outputs of which may be important for the KAZA-GROW project.

Resilient Waters Program *Mark Schapers, Groundwater Lead*

The USAID RWP is implementing groundwater related Interventions at community, national and transboundary levels particularly in the Limpopo and Okavango basins and aligned to LIMCOM and OKACOM strategic programs. The RWP expectations through the different initiatives are to improve data compatibility, consolidation, standardization as well as building capacity in beneficiary organizations. Potential to tap into exiting platforms such as SADC GIP to consolidate data exists including through other initiatives such as the UNESCO GGRETA 3, the Ramotswa and Tuli Karoo transboundary aquifers. Challenges of data inconsistencies persist due to differences between countries in how their databases are set up. To overcome some of these challenges including data sharing, would be important areas of focus to consider for the KAZA-GROW.

World Wide Fund for Nature (WWF) Zambia, *Faith Chivava, Hydrologist*

The WWF Zambia is currently implementing three projects in the Kwando Basin – the State of the Basin Report, Kwando Basin Health Scorecard and exploring hydrological modelling and virtual flow assessments. The Kwando Basin has a complex hydrology and therefore different boundary depictions may exist. The groundwater component is currently the missing link in the projects being implemented. The State of the Basin Report is a comprehensive characterization of the Kwando using a compilation of available information. The catchment is extremely flat and most of the flows originate outside of the KAZA TFCA boundaries. The aim of the basin report, currently at draft stage is to drive towards a common understanding of the Basin. There are opportunities for sharing data between projects to further strengthen outputs as limited groundwater data is a challenge in the Kwando Basin. WWF is looking to partner with Microsoft and UPSTEAM, applying machine learning to flow forecasting and developing virtual gauging stations which are linked to ground measurements but are not physical infrastructure.

Discussion items

- There is potential to strengthen and expand the M&E tool to reach different interest groups.
- ZAMCOM which is currently in a process to develop groundwater strategy for the Zambezi Basin to further strengthen the groundwater component. Partnership with SADC-GMI and KAZA TFCA Secretariat puts the basin authority in a position to establish a well-stocked portal which includes groundwater data.
- The Kwando Basin Scorecard is useful in promoting collective action to strengthen governance of shared water resources, where it forms the basis for dialogue with all stakeholders.
- strong stakeholder participation driving the process to come up with the scorecard to make significant contributions. In ZAMCOM emphasis on stakeholder participation. Tools are owned by stakeholders but also the counties involved looking at it as a pilot of 4/8 counties in the Zambezi. Lessons will be upscale Issue of the environment important
- The importance of groundwater modelling to understand an entire transboundary system. There are ongoing modelling initiatives from a surface water perspective where groundwater is missing necessitating the need for an integrated model. There is therefore need to join forces to enhance existing models with existing data. There are currently no funds in the KAZA-GROW project for dynamic modelling, however conceptual models will be developed and strengthened.

2.2 Assessment Initiatives

World Wild Fund for Nature (WWF), *Michael Knight, KAZA Lead*

WWF strategy for the KAZA TFCA cuts across three areas – building resilience, developing the economic case and protecting key biodiversity assets. Of importance is the specific focus on securing free flowing rivers and wetland habitats in the Kwando. Transboundary water governance and inclusive decision making are key to understanding water and food security. Focus is also on securing that WDAs and ensuring that wildlife moves northwards and freshwater moves southwards. In all this work, stakeholders are of key importance developing a shared narrative with stakeholders including the private sector which plays a role in investing in bankable opportunities. Alternative economic opportunities, bankable initiatives outside of the Kwando Basin,

The Dreamfund[27] project will work on the Kwando Basin developing a shared narrative with stakeholders, identifying bankable projects and promoting community water stewardship through small-scale irrigation for local farmers. Strategic environmental assessments will be conducted to understand what the environment can support in terms of development, a process which will include assessing surface and groundwater. In addition to the KAZA M&E framework, WWF is undertaking a socio economic study based on a study done in 2014 to understand what people are experiencing on the ground and how surface and groundwater play a role in local livelihoods.

University of Zambia, *Imasiku Nyambe, Professor*

In Zambia, the KAZA TFCA goes through Barotse Floodplain towards the Kafue Flats with variable groundwater productivity. The University of Zambia has undertaken a number of studies in the Kazungula, Namwala and Sesheke provinces. Boreholes drilled by the Zambian Ministry of Local Government showed that groundwater in these areas was quite saline, as such the Integrated

[27] https://www.peaceparks.org/about/ppf-international/the-netherlands/partners/

Resource Center at UNZA undertook a number of studies through PhD and Masters students to answer the salinity question. It was found that at below 30m depth there was risk of salinity and freshwater would only be accessed after a 100m depth in the Karoo rocks. Assessments of groundwater quality in shallow wells which support productive uses in the region have also been conducted. Selected publications that may have a direct bearing on the project, for example on how institutions can adapt to climate change, resource control and state intervention are available as a potential resource.

International Water Management Institute (IWMI), *Manuel Magombeyi, Researcher*

IWMI has conducted work in the Limpopo Basin in the Tuli Karoo transboundary aquifer. The data required in previous projects may also apply in The Kwando basin. This project inception engagement is key in identifying where and what data may be available. The gaps identified now and during the TDA will be highlighted for filled at a later stage as well as those that can be addressed during the course of the project. A cross section of data will be required to develop theTDA including demographic and socio-economics data. Similarly, hydrogeology, sectoral water uses and surface water assessments are some of the aspects that will form part of the TDA.

Southern African Science Service Centre for Climate Change and Adaptive Land Management (SASSCAL), *Jöerg Helmschrot, Director of Science and Technology & Capacity Development*

Under SASSCAL is the WeMast[28] project – Wetland monitoring and Assessment Service for Transboundary Basins in Southern Africa, whose main aim is to develop and implement an earth observation online assessment platform that's supports suitable wetlands assessment and monitoring services. Promote policy implementation and management practices in the SADC Region. This work covers mainly the Cuvelai, Zambezi and Limpopo Basins. The platform is still under development and should be available in April 2021. There are a number of water research activities in the TCFA through hydrological modelling and climate assessments. A database has been developed and is hosted by the Okavango Research Institute. SASSACAL has a data and information portal containing time series, hydrological and climate assessment data as well as a number of publications.

Discussion items

- It would be quite useful to consider opportunities to put the TDA to broader application given the broad range of data to be assessment. Opportunities for joint projects may be identified from the TDA outcomes
- Groundwater impacts and uses at different time scales, e.g. between short and long term effects. Timescale effects should be considered and reflected in the data sets.
- Good climatic data set with a lot of climate projections from South Africa through the CSIR and Wits University
- Planning initiatives maybe be useful to note e.g. in the Zambia- Siamangu some general management plans were recently completed as well as strategic business plans. Tourism detailed planning is underway. In Angola protected areas management planning to be undertaken in the near future including a biosphere initiative. This KAZA-GROW groundwater component may have a significant contribution to these processes
- Dreamfund project opportunity for 3 international NGO PPF, WWF, Africa Parks came together to raise funds on a bigger scale – how best to seize opportunities of going together

[28] https://www.sasscal.org/wemast/

- Consider linking with communities with ongoing activities RWP or on the radar of local ministries
- Data may be available with Weathernet in the Limpopo maintained by Piet Kienabatho climate projection available, Climate Change institute WITS, CSIR
- Involvement of students for PhD and Masters can be taken up in follow up discussion possibly for fieldwork and data collection although there are not a lot a funds available. The logistics would need to be further discussed.

2.3 WASH and MUS Opportunities

Resilient Waters Program (RWP), *Suvritha Ramphal, WASH Specialist*

In Zambia, RWP is working with PPF in Simalaha, training local communities in the management of borehole water points. In Botswana, RWP is working with the Department of Water Sanitation to drill boreholes in the Eretsa village, located in the SE pan handle of the Okavango Delta for a rural water supply and sanitation project. Still in development is the partnership with Development Workshop, Angola in the headwaters of the Okavango Delta which will include water governance training for community management in the Mucheka water services model. There has been support of Masters research student in the rural water supply sector of Namibia – looking at the potential of the Fundifix water services maintenance model. There is strong community based management in Namibia. Possible synergies with KAZA-GROW exist in water governance training in communities that will be identified in the KAZA-GROW.

Climate Resilient Infrastructure Delivery Facility (CRIDF), *Charles Reeve, Team Leader*

CRIDF funded by UK government, works extensively in SADC also in the KAZA, transforming the way which water infrastructure is used to build resilience. CRIDF has worked in the KAZA addressing the increased competition for water by humans and wildlife through facilitating socio-economic upliftment. Groundwater is available to support agriculture and create livelihoods for local communities and open up the WDA to reduce HWCs. Other initiatives include moving human activity out of the floodplains in direct conflict with wildlife and to support agriculture that feeds into the tourism value chain. Investments in solar powered boreholes have supported both livestock and domestic. There is good potential for groundwater to support livelihoods particularly when climate change is increasing competition for water.

International Water Management Institute (IWMI), *Manuel Magombeyi, Researcher*

Multiple Use Water Services (MUS) is a holistic participatory approach to planning and providing water services, that supports people's self-supply and their multiple water needs as identified by communities and coordinated across government departments as needed. Communities construct infrastructure to divest water to their villages for multiple uses as such single purpose infrastructure is an inefficient use of financial resources. IWMI has also successfully assisted farmers to use water more efficiently by applying water saving and nutrient management tools.

Resilient Waters Program (RWP), *Kristi Maciejewski, Biodiversity Advisor*

The RWP's work in the KAZA TFCA towards building resilience in Southern Africa addresses the water sanitation and hygiene issues, protected areas management, reducing HWCs and improving livelihoods. Further consideration is given to transboundary management and integrated planning. The program works across different scales (i) transboundary – KAZA Livelihood Diversification Strategy, KAZA and OKACOM transboundary fisheries management plan

(ii) at national scale - to review and update management plans of protected areas e.g. in Botswana Chobe National Park and Moremi Game Reserve in order to build climate change resiliency into these plans (iii) at the local level – small grants programs support local level projects. Linked to the Kwando areas is setting up diversified livelihoods options for communities living in WDAs as access to water is a common theme for both people and wildlife. Working at the different scales holistically and systematically addresses challenges in TFCA landscapes.

Discussion items

- Acknowledging the reality of KAZA being a coexisting landscape therefore inevitably there will be HWCs. Accepting wildlife as a competitive stakeholder is important for supporting socio economic livelihoods.
- Expanding the value chain in view of the volatility of the tourism market
- Groundwater is a great but hidden resource and more should be done for it to be understood at all levels, and highlighted for its applicability and potential use
- Needs to think broadly to groundwater quality and how to leverage the mandate of public health authorities as related to water, as well as to expand consultations to include National Planning, Departments of Health and Ministries of Finances in the partner countries to understand different objectives and needs

2.4 Policy Frameworks

The Permanent Okavango River Basin Water Commission (OKACOM), *Phera Ramoeli, Executive Secretary*

There is an ongoing groundwater assessment program in the Okavango Basin with the specific objectives to determine the groundwater status both in quality and quantity This includes gathering critical information for the development of groundwater, collating existing data into a database compatible with the OKACOM Decision Support System and identifying data gaps as well the characterization of aquifers in the basin. Data challenges particularly in the upper reaches of the Basin are evident. Modelling efforts are underway to address some of these data challenges. A Transboundary Water Allocation Strategy developed by OKACOM was found to concentrate on surface water excluding the groundwater component necessitating the need for such an assessment. The draft assessment report should be available in the coming weeks. Groundwater modelling would also address groundwater quantification and to understand groundwater flow systems among others. Preliminary results point to potential interaction between transboundary systems.

Peace Parks Foundation (PPF) *Loraine Bewsher, Planner*

In developing the management framework, certain key aspects need to be considered to get a better understanding of the envisaged transboundary groundwater management framework. It would be important to understand how the framework would work particularly around screening projects as e.g. in relation to environmental safeguards to guide specific interventions. Questions around a standardized approach that can translate to a M&E reporting framework and what other innovative conservation finance mechanisms to explore need to be considered including how policy frameworks in the four countries can be harmonized to develop this framework and support livelihoods.

Sustainable Water Partnership (SWP), *Clara Bocchino, SADC TFCA Network Support Coordinator*

The Big Data and Transboundary Water Collaboration for Southern Africa is a project implemented to support innovation for water security. The objective being to determine how prepared the region

is to use big data analytics. Using the Ramotswa Transboundary Aquifer as a case study, the project sought to identify gaps for innovative water management initiatives. The project is currently in its final stages and the core partnership will continue to look at, for example, capacity building to bridge the gap between the water sector, big data and computer science in order to create new expertise. Of relevance to the KAZA-GROW project would be working with policy designers and implementers, an important step to enable access to data and policy impact. Data collection and sharing as well as how groundwater management can influence policy and decision making would potentially be important areas to further develop and explore.

Ramsar, *Njisuh Zebedee Feka, Senior Adviser*

Policy frameworks are common and can use either pull up or pull down approaches. Projects should be implemented to contribute to some policy change, therefore there is a need to understand what the current policies are or if they exist at all. A first step could be as analysis of stakeholders to determine who owns those policies and how they being implemented. Actual community practices are important to understand as they contribute to strengthening or weakening policies at national and subnational level as such, local practice should be documented and reviewed to see how it contributed to transforming the landscape. Ultimately, creating effective partnership at the local level is critical to the success of management frameworks. This is because national partnerships may not filter effectively to on-the-ground practice. Through data collection and motoring systems developed during and after the project, trust can be built at the local level and contribute to the success in the implementation of a management framework.

International Water Management Institute (IWMI), *Patience Mukuyu, Researcher*

Developing the Transboundary Groundwater Management Framework in the KAZA-GROW project will aim to review available national and transboundary polices with a bearing on surface and groundwater as well and conservation and livelihoods. Through a consultative process, the framework aims to include suitable interventions for the KAZA TFCA and how they can be absorbed. More thinking will have to take place around the target group for the framework looking at the higher structures as well as how the more operational and implementation issues can be supported through the framework.

Discussion items

- To gain a better understanding of where investments can best be made through the transboundary groundwater assessment framework
- To further investigate how policies and legislation complements or conflicts across national policies

2.5 Closing

In closing and in appreciation of all the inputs, this inception meeting provided a platform for establishing future collaboration and synergies, which can be further explored by partners. Inputs from stakeholders will be considered in refining the project implementation plan as it is clearer how the project will fit into exiting initiatives across the region.

APPENDIX 2: INCEPTION WORKSHOP PROGRAM

Sustainable Groundwater Development and Management for Humans, Wildlife, and Economic Growth in the Kavango Zambezi Transfrontier Conservation Area *(KAZA-GROW) - 2021-2022*

INCEPTION WORKSHOP (virtual)
5 and 8 FEBRUARY 2021

Background

Groundwater and transboundary aquifers in the Kavango Zambezi Transfrontier Conservation Area (KAZA TFCA) are increasingly playing a role in supplying reliable and widely available water to dispersed communities and wildlife. As such, addressing the needs and existing gaps in the management of groundwater resources is key to supporting biodiversity, economic development, and resilience to climate change in the transboundary area.

The **KAZA-GROW Project**, funded by USAID under the Resilient Waters Program, led by IWMI, International Water Management Institute, and in partnership with the KAZA TFCA Secretariat and the Peace Parks Foundation (PPF), seeks to support water security and resilience in the KAZA TFCA through the sustainable development and management of groundwater resources.

With focus on the Kwando River Wildlife Dispersal Area (KRWDA), the KAZA-GROW Project will enhance the knowledge base on the water resources of the KAZA TFCA through a joint and interdisciplinary **Transboundary Diagnostic Analysis**, including identifying hotspot transboundary areas for groundwater development to improve water security, livelihoods, resilience, and human-wildlife coexistence.

It will also strengthen the policy attention to groundwater through a **Transboundary Groundwater Management Framework** for the KAZA TFCA, piloted for the KRWDA, and as a pre-cursor for a joint Strategic Action Plan on freshwater for the KAZA TFCA and a Southern African Development Community (SADC)-wide TFCA Policy for Groundwater for continued benefits for humans and biodiversity and sustainable economic development.

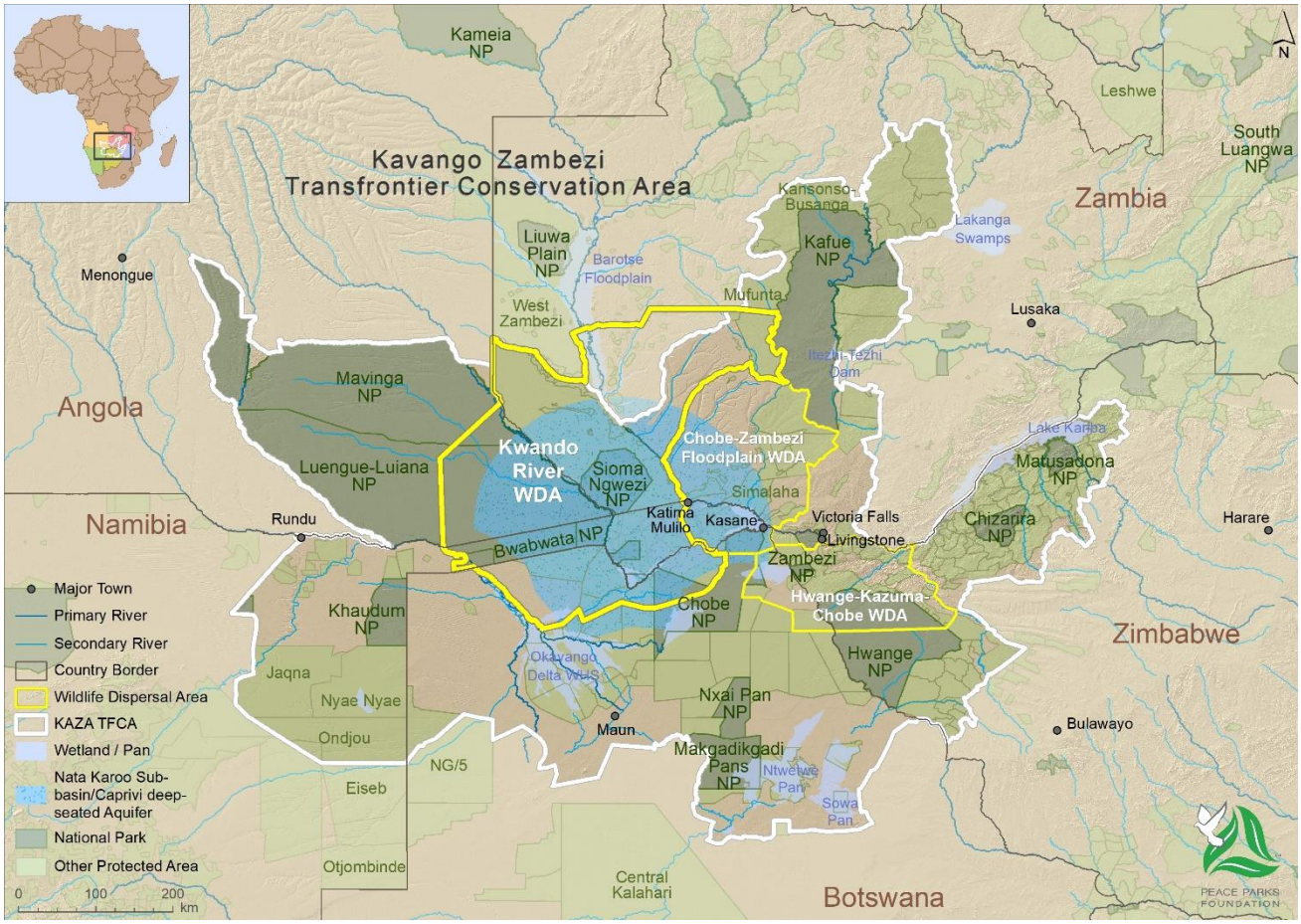
Workshop Format and Objectives

This Inception Workshop brings together project partners and key stakeholders to enhance the partnership and knowledge generation necessary to make KAZA-GROW a success. The workshop is divided into two days:

1. **Session 1** (5th Feb): **Strategic-level Meeting** to solicit high-level buy-in and support to KAZA-GROW
2. **Session 2** (8th Feb): **Technical-level Meeting** to discuss collaborative implementation

The specific objectives of this workshop are to:

- Enhance the transnational network of partners engaged in freshwater, and in particular groundwater, resources in the KAZA TFCA
- Foster awareness of the importance and role of groundwater in the KAZA TFCA for humans, wildlife and nature
- Identify key issues related to groundwater development and management in the KAZA TFCA
- Identify key data sources for the Transboundary Diagnostic Analysis
- Identify coalitions for collaboration in order to take the KAZA-GROW forward



The Kwando River Wildlife Dispersal Area (the western-most area marked in yellow). The Nata Karoo TBA, the relevant TBA for the KRWDA, is marked in blue, while exact delineation is still uncertain.

Program

Session 1: *Strategic-level Session*

To join this session, please, register here: https://us02web.zoom.us/meeting/register/tZMtc-GqpjwqE9RZ-cwFk-HzH4r9_Oc6uOUp

Moderator: Patience Mukuyu, *IWMI*

08:45 – 09:00	***Meeting Opens***	
09:00 – 09:10	Welcome remarks *Facilitator/Chair*	Karen Villholth, *IWMI* / Clara Bocchino, SW*P*
09:10 – 09:30	Opening remarks *Project Partners*	Graham Paul, *USAID* Nyambe Nyambe, *KAZA TFCA Secretariat* Andrew Nambota, *PPF*
09:30 – 09:50	Project background - setting the scene, *Project Lead*	Karen Villholth, *IWMI*
09:50 – 10:00	***Discussion***	
10:00 – 10:50	National perspective - **'Freshwater for TFCAs'** *Representatives from National Water Departments / TFCA National Coordinators*	Angola: Manuel Quintino / Aristofanes Pontes Botswana: Bogadi Mathangwane / Michael Cranwell Molaodi Namibia: Maria Amakali / Naambo Josephine Senior Adviser, Zambia: Stanley Hantambo /Sydney Tembo Zimbabwe: Gerald Mundondwa / Stanley Nyamayedenga
10:50 – 11:00	***Discussion***	
11:00 – 11:30	***Comfort break***	
11:30 – 12:30	Regional perspective - **'Drivers and networking for freshwater for TFCAs in SADC'** *Regional Partners*	Patrice Kandolo Kabeya, *SADC Water Division* Tawanda Gotosa, *SADC FANR TFCA Unit* James Sauramba, *SADC-GMI* Phera Ramoeli, *OKACOM* Michael Mutale, *ZAMCOM* Njisuh Zebedee Feka, *RAMSAR*
12:30 – 12:40	***Discussion***	
12:40 – 12:50	Freshwater initiatives in KAZA TFCA *Collaborating partners*	Sekgowa Motsumi, *TNC* Michael Knight, *WWF*
12:40 – 12:50	***Discussion and brief intro to Session 2***	
12:50 – 13:00	***Wrap-up and closing remarks***	Karen Villholth / Clara Bocchino
END		

Session 2: *Technical-level Session*

To join this session, please, register here:
https://us02web.zoom.us/meeting/register/tZUocuGvrD0sGdD45EBQTWuQqo9P5bHyQqBH

Moderator: Patience Mukuyu, *IWMI*

08:45 – 09:00	***Meeting opens***	
09:00 – 09:15	Introduction *Project implementation plan*	Karen Villholth, *IWMI*
09:15 – 10:00	Component 1 *Data*	Tracey Baker, *TNC* Marina Faber, *PPF* Brighton Munyai, *SADC-GMI* Chris Brooks, *RWP* Steve Boyes, *Wild Bird Trust* Faith Chivava, *WWF* Marcus Wijnen, *independent*
10:00 – 10:15	**Discussion, Q&A**	
10:15 – 11:00	Component 2 *Assessment*	Michael Knight, *WWF* Sekgowa Motsumi, *TNC* Imasiku Anayawa Nyambe, *University of Zambia* Manuel Magombeyi, *IWMI*
11:00 – 11:15	***Discussion, Q&A***	
11:15 – 11:45	***Comfort Break***	
11:45 – 12:30	Component 3 *WASH opportunities*	Charles Reeve / Leonard Magara, *CRIDF* Suvritha Ramphal, *RWP* Manuel Magombeyi, *IWMI*
12:30 – 12:45	***Discussion, Q&A***	
12:45 – 13:30	Component 4: *Policy Frameworks*	Patience Mukuyu, *IWMI* Loraine Bewsher, *PPF* Khuthadzo Nethengwe, *PPF* Clara Bocchino, *SWP* Njisuh Zebedee Feka, *RAMSAR* Phera Ramoeli, *OKACOM*
13:30 – 13:45	***Discussion, and planning for smaller teams to take work forward***	
13:45 – 14:00	***Wrap-up and closing remarks***	Karen Villholth / Clara Bocchino
END		

APPENDIX 3: INCEPTION WORKSHOP ATTENDANCE REGISTER

	NAME	EMAIL ADDRESS	ORGANISATION
1.	Aleix Serrat-Capdevila	aserratcapdevila@worldbank.org	World Bank
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APPENDIX 4: MILESTONE SCHEDULE

No	Milestone Title	Activities	Outputs	Milestone Verification	Date
1	Inception Report, cum Inception Workshop proceedings	1. Draft participants list for Inception WS 2. Hold virtual workshop with relevant stakeholders identified[a]. 3. Present the TFCA GW Management Framework concept and expected results to stakeholders. 4. Conduct early needs assessment of national and transboundary GW management capacity 5. Co-identify key data sources 6. Pre-identify vulnerable areas 7. Establish KAZA TFCA GW Platform	1. Inception Workshop participant list drafted 2. Virtual workshop held with stakeholders 3. TFCA GW Management Framework concept presented 4. Early needs assessment of national and transboundary GW management capacity conducted 5. Key data source identified 6. Vulnerable areas pre-identified 7. KAZA TFCA GW Platform established	The grantee will submit to RWP an Inception Workshop Report detailing the following: 1. Proceedings and outcomes of the workshop 2. Results of national and transboundary GW management capacity early needs assessment 3. Establishment of KAZA TFCA GW Platform Annexes: 1. Inception Workshop agenda 2. Participants list	01 Mar 2021
1	Inception Report, cum Inception Workshop proceedings	1. Refine project methodology 2. Revise and update project implementation plan and timelines 3. Align project activities with RWP MEL framework 4. List and map out transboundary/regional and national stakeholder/institutions	1. Project methodology refined 2. Project implementation plan and timelines revised and updated 3. Project activities with MEL framework aligned 4. Transboundary/regional and national stakeholder/institutions mapped	The grantee will submit to RWP an Inception Report detailing the following: 1. Project methodology 2. Project implementation plan and timeline 3. Project activities and MEL framework Annexes: 1. List/map of transboundary/regional and national stakeholder/institutions	01 Mar 2021
2	Draft Transboundary Diagnostic Analysis (TDA) Report	1. Review previous and existing engagement, strategies and management commitments in KRWDA, with focus on water 2. Conduct baseline assessment of climate, water resources, landuse and key water-based environments in the KRWDA 1. Conduct assessment of socio-economics legal and institutional aspects of water and water use in KRWDA	1. Previous and existing water focused engagement, strategies and management commitments in KRWDA reviewed 2. Baseline desktop assessment of water resources and key water-based environments in the KRWDA conducted 1. Assessment of socio-economics, legal and institutional aspects of water and water use in KRWDA conducted	The grantee will submit to RWP a draft Transboundary Diagnostic Analysis Report detailing the following: 1. Existing water focused engagement, strategies and management commitments in KRWDA 2. Outcomes of baseline assessment of water resources and key water-based environments in the KRWDA 3. Outcomes of socio-economics, legal and institutional aspects of water and water use in KRWDA assessment	30 Jun 2021
3	KRWDA Database (KDB)	1. Data and information collation 2. Analysis and synthesis of data	1. Data and information collated 2. Data analyzed and synthesized	The grantee will submit to RWP a KRWDA Database (KDB) including the following: 1. Meta data 2. Structured folder system with primary and secondary data and maps	30 Jun 2021

No	Milestone Title	Activities	Outputs	Milestone Verification	Date
4	Water Scarcity Vulnerability Map	3. Develop an integrated water scarcity vulnerability map based on GW resources, climate/rainfall, expected good GW quality, community locations, water supply and road infrastructure, water demand for multiple purposes, gender aspects, conservation areas and wildlife corridors, and human-wildlife conflict areas. 4. Identify vulnerable human and wildlife communities 5. Hold consultations with key stakeholders	3. Integrated water scarcity vulnerability map developed 4. Vulnerable human and wildlife communities identified 5. Consultations with key stakeholders conducted	The grantee will submit to RWP a Water Scarcity Vulnerability Map detailing the following: 1. Process of the development of the Integrated water scarcity vulnerability map 2. Identified vulnerable human and wildlife communities 3. Outcomes of consultations with key stakeholders	31 Aug 2021
5	Draft TFCA GW Management Framework	1. Review previous and existing engagement, strategies and management commitments in TFCAs in SADC with focus on GW 2. Develop recommendations for the assessment of GW, vulnerability assessment, implementation of GW infrastructure, local sustainable management of GW and options for out-scaling to the larger KAZA TFCA and to SADC 3. Propose the consolidation of the KAZA TFCA GW Platform into a permanent Working Group under KAZA TFCA	1. Previous and existing engagement, strategies and management commitments in TFCAs in SADC with focus on GW reviewed 2. Recommendations for the assessment of GW, vulnerability assessment, implementation of GW infrastructure, local sustainable management of GW and options for out-scaling to the larger KAZA TFCA and to SADC developed 3. The consolidation of the KAZA TFCA GW Platform into a permanent Working Group under KAZA TFCA Secretariat	The grantee will submit to RWP a report detailing the following: 1. Previous and existing engagement, strategies and management commitments in TFCAs in SADC with focus on GW 2. Recommendations for the assessment of GW, vulnerability assessment, implementation of GW infrastructure, local sustainable management of GW and options for out-scaling to the larger KAZA TFCA and to SADC 3. The consolidation of the KAZA TFCA GW Platform into a permanent Working Group under KAZA TFCA Secretariat	31 Oct 2021
6	Final Transboundary Diagnostic Analysis (TDA) Report	1. Final TDA including key GW potentials, risks, knowledge and data gaps	1. Final TDA including key GW potentials, risks, knowledge and data gaps	The grantee will submit to RWP a Final Transboundary Diagnostic Analysis Report detailing the following: Identified key GW potentials, risks, knowledge and data gaps	31 Dec 2021
7	GW Quality Field Report	2. Identify 5 vulnerable communities for field survey 3. Conduct GW quality testing in wet and dry seasons	2. 5 communities identified for field survey 3. GW quality testing in wet and dry seasons conducted	The grantee will submit to RWP a GW Quality field report detailing the following: 1. List of 5 identified sites 2. Results of GW quality from each site from wet and dry seasons Annexes: 1. Photographs of field testing	31 Mar 2022

No	Milestone Title	Activities	Outputs	Milestone Verification	Date
8	Draft Hotspot for GW Development in KRWDA Report	1. Develop process of identifying hotspots from water scarcity vulnerability map and GW quality assessment 2. Select and describe 2 vulnerable (human/wildlife) communities 3. Investigate best (climate-resilient, animal-tamper-proof and cost-effective) GW development/ infrastructure options with sufficient and adequate water quality for selected communities	1. Process of identifying hotspots developed 2. Two vulnerable human/wildlife communities selected and described 3. Best GW development/ infrastructure options with sufficient and adequate water quality for 2 selected communities proposed	The grantee will submit to RWP a Draft Hotspot for GW Development in KRWDA Report detailing the following: 1. Process of identifying hotspots 2. Selected hotspots description 3. Review of best GW development/ infrastructure options with sufficient and adequate water quality for 2 selected communities	30 Apr 2022
9	Final Hotspots for GW Development in KRWDA Report	1. Final report including recommendations for the implementation of GW infrastructure, local management of GW and options for out-scaling to the larger KAZA TFCA	1. Final report including hotspots and recommendations	The grantee will submit to RWP a Final Hotspots for GW Development in KRWDA report detailing the following: 1. List of identified hotspots 2. Recommendations for the implementation of GW infrastructure, local management of GW and options for out-scaling to the larger KAZA TFCA	30 Jun 2022
10	High-level Concluding Workshop Report	1. Present the final TDA 2. Present draft TFCA GW management framework 3. Present and develop capacity on hotspot for GW development assessment in TFCA 4. Discuss opportunity for establishing a permanent GW Working Group under KAZA TFCA Secretariat	1. Final TDA presented 2. Draft TFCA GW management framework presented 3. Capacity on hotspot for GW development assessment presented and developed 4. Opportunity for establishing a permanent GW Working Group under KAZA TFCA Secretariat discussed	The grantee will submit to RWP a workshop report detailing the following: 1. Proceedings of workshop 2. Outcomes from workshop discussions Annexes: 1. Attendance registers 2. Workshop Agenda 3. Photographs from workshop	30 Sep 2022
11	Final TFCA GW Management Framework and Final Project Report	1. Develop final TFCA GW management framework. 2. Incorporate outcomes/recommendations from High-Level Concluding Workshop	1. Final management framework 2. Outcomes from High-Level Concluding Workshop Incorporated	The grantee will submit to RWP a Final TFCA +GW Management Framework detailing the following: 1. The final management framework 2. Incorporate outcomes of High- Level Concluding Workshop	30 Nov 2022

APPENDIX 5: DRAFT OUTLINE OF THE KWANDO RIVER WILDLIFE DISPERSAL AREA TRANSBOUNDARY DIAGNOSTIC ANALYSIS

1 Introduction
- 1.1 Background
- 1.2 Objectives
- 1.3 Key partners
- 1.4 Regional setting: KRWDA within the wider KAZA TFCA
- 1.5 Transboundary diagnostic analysis approach
- 1.6 Transboundary diagnostic consultative approach
- 1.7 Transboundary diagnostic analysis data sources

2 Physiography
- 2.1 Climate – present and historic
- 2.2 River basins
- 2.3 Land cover
- 2.4 Geology
  - 2.4.1 Geological history
  - 2.4.2 Overall stratigraphy
- 2.5 Soils

3 Socioeconomics
- 3.1 Demographics
- 3.2 Economics and livelihoods
- 3.3 Conservation in the KAZA TFCA
- 3.4 WASH Provisions
- 3.5 Population and economic growth and the SDGs
- 3.6 Future development plans: infrastructure, CC adaptation, conservation plans, legal/institutional, wildlife corridors, etc.

4 Water resources assessment
- 4.1 Surface water
  - 4.1.1 River catchments
  - 4.1.2 Wetlands
  - 4.1.3 Water quantity and quality
- 4.2 Groundwater
  - 4.2.1 Aquifer systems (shallow and deep)
  - 4.2.2 Geological features
  - 4.2.3 Conceptual model of groundwater flow and surface water-groundwater interaction
  - 4.2.4 Groundwater potential
    - 4.2.4.1 Development potential (quantity and quality)
    - 4.2.4.2 Climate change adaptation
    - 4.2.4.3 Reducing stress on human-wildlife conflicts
    - 4.2.4.4 Hotspot mapping (areas of resource potential and human/wildlife vulnerability)

5 Ecosystem services and environmental risks
- 5.1 Ecosystems, wildlife and biodiversity
- 5.2 Climate change projections
- 5.3 Changes in landuse and water usage
- 5.4 Human-wildlife conflicts
- 5.5 Health risks

6 Legal and institutional framework
- 6.1 Current international legal framework (international law & conventions – water and conservation)
- 6.2 Regional and transboundary frameworks
- 6.3 National water and conservation strategies and policies
- 6.4 Key institutions and stakeholders
- 6.5 Legal and institutional gap analysis

7 Transboundary aquifers
- 7.1 Current knowledge of transboundary aquifers
- 7.2 Data and knowledge gaps
- 7.3 Challenges and opportunities for transboundary aquifers in KRWDA / KAZA TFCA

8 Conclusions
- 8.1 Developmental issues within KRWDA
- 8.2 Links to broader developmental issues within KAZA TFCA
- 8.3 Groundwater role in sustainable development in KRWDA
- 8.4 Discussion regarding potential and necessity of a Strategic Action Plan
- 8.5 Key messages and recommendations