UNITED NATIONS ENVIRONMENT PROGRAMME
NAIROBI CONVENTION

WIOSAP FULL PROPOSALS TEMPLATE

Call title: Implementation of the Strategic Action Programme for the protection of the Western Indian Ocean from land-based sources and activities (WIO-SAP)

Participating countries: Comoros, Kenya, Madagascar, Mauritius, Mozambique, Seychelles, Somalia, South Africa, Tanzania [and France (not project beneficiary)]

Executing organization: Nairobi Convention Secretariat

Duration of demo projects: 2 years

Stage of the call: Full proposals

Submission dateline: 15th July 2019

INSTRUCTIONS

Organisation Name	Sokoine University of Agriculture and National Environmental Management Council
Project Title	Sustainable Catchment Management through Enhanced Environmental Flow Assessment and Implementation for the protection of the Western Indian Ocean from land-based sources and activities in Tanzania
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Registration Details	**For NEMC**: Type of organisation: Public, Country: Tanzania Registration Number: Established under the National Environment Management Act No. 19 of 1983 NEMC came into being in 1983. The enactment of EMA No. 20 of 2004 (EMA, 2004) by Parliament in October 2004, repealed the National EMA No.19 of 1983 and re-established NEMC. **Year: 1983** **For SUA**: Type of organisation: Public, Country: Tanzania Registration Number: Established under the Sokoine University of Agriculture Act, 1984, which has been repealed by the Universities Act, 2005 (Cap 195, Act No. 7 of 2005) and the Universities (Chartering, Registration and Accreditation Procedures) Regulations, 2006, G.N. No. 39 of 2006; **Year: 1984**

Executive Summary: Water is essential to all kinds of human development and livelihood support systems including ecosystems management, sustaining both aquatic and terrestrial ecosystems. However, water resources are now under pressure due to increased competing demands and global warming, which have led to complex water management challenges. Poor management of river basins has resulted into degradation of water catchments consequently affecting river flows in both quantity and quality with devastating impacts on the downstream including the coastal and marine ecosystems which suffer from increased inflow of nutrients carried by rivers to the seas and sediment deposits on the sea bottom, and variation of flow regimes. The extensive land based rural activities in the upstream catchment areas play a significant role on the coastal and marine ecology by altering flow regimes and sediment deposition. The proposed project focuses on addressing poor management of river catchments and basins which results into changes to river flows and degradation of water quality and changes in sediment loads for provisioning of sustainable environmental flow. The project will assess the environmental flows in the upper catchment of the Mbarali River catchment and pilot the implementation with the involvement of Rufiji Basin Water Board and the beneficiary communities.

I. BACKGROUND AND JUSTIFICATION

a. Context and the problem or critical issue which the proposal seeks to resolve

Tanzania recognizes the importance of its coastal and marine areas as essential resource which supports livelihoods of about25% of country's population living in the coastal communities and 75% of the country's industries located in the area. The rapidly expanding coastal population and land-based activities exert ever-increasing pressure that degrades coastal and marine habitats and resources. The negative impacts on the coastal communities, developments and marine ecosystem are of considerable significance. Degradation occurs at different and variable scales and restoration efforts are required in both streams and catchments to improve conditions and manage flows. However, efforts to protect, restore and sustain environmental flows have mainly been hampered by lack of awareness, data and information on environmental flows among stakeholders. The government of Tanzania recognizes the provision of environmental flow and through its policies and laws (i.e. National Water Policy (2002), Water Resources Management Act (2009), Environmental Policy (1997), Environmental Act (2004)), calls for protection of reserve flows in all aquatic ecosystems, and has formulated regulations and guidelines which although complete have not been fully operationalized. The operationalization and implementation in catchments connected to the Western Indian Ocean and other areas in Tanzania has not been done, mainly due to lack of capacity and resources, lack of awareness on the importance of EFA, lack of stakeholders' support, institutional roadblocks and conflicts of interest, lack of ecological monitoring systems to evaluate changes in their functioning or status to identify appropriate measures and lack of tools to support proper integration of environmental flow and natural resources management. The proposed project focuses on addressing poor management of river catchments and basins which results into changes to river flows and degradation of water quality and changes in sediment loads for provisioning of sustainable environmental flow.

b. How the need for the project was determined

The need for interventions was determined from previous initiatives which include; WIO-Lab demonstrations; implementation of district Integrated Coastal Zone Management (ICZM) Action Plans, TDA/SAP process as well as Tanzania Coastal Management Partnership (TCMP) and WIOSAP projects and recommendations. Stakeholders working in the water basins, environmental protection and natural resources management sectors recognize the need to protect and sustain reserve flows and have expressed their desires to work towards finding a lasting and sustainable solution.

c. How the proposed action relates to other relevant national development strategies and policies; WIOSAP priorities and relevant global commitments

The proposed actions are relevant and align with the existing sectoral policies such as the National Water Policy (NAWAPO, 2002), National Environmental Policy, (NEP, 1997), National Integrated Coastal Environment Management Strategy (NICEMS), ICZM action plans, and WIOSAP priorities in particular the sustainable management of river flows through assessment of environmental flows in the pilot river basin and the implementation of flow assessment recommendations using participatory river basin management approaches. The proposed actions are also expected to be complemented by existing programs such as ICZM and Coral Reef activities which currently address illegal fishing, coral reef and mangrove restoration and sea wall construction for climate change adaptation. The expected outcome will contribute toward realization of the global sustainable development goals (SDGs), in particular Goal 14 (Life below water) which advocates for conservation and

sustainable use of the oceans, seas and marine resources. Furthermore, the project outcomes will contribute to the protection of life on land (Goal 15) by preserving biodiversity of forest and other ecosystems and restoration of degraded forests and provision of flow. It is expected that management of environmental flows and conservation of land-based activities will contribute to the availability of clean water and improve sanitation which will be a contribution of SDGs 6, 1, 2 and 3. Beneficiaries of the proposed project include: The coastal communities, industrial establishments, government (all sectors of the economy) and the public at large as well as the global community.

d. Other programmes and activities which will complement the proposal

The "Uncertainty Reduction in Models for Understanding Development Applications (UMFULA)" project which works in the Rufiji Basin and may help to provide climate projections for modelling scenarios useful in assessing the sustainability of environmental flows in a changing climate. Links and contacts for learning and knowledge exchange with the "Resilient Natural Resource Management for Tourism and Growth (REGROW) Project will be established. The REGROW project seeks to strengthen the management of protected areas and promote nature-based tourism in Southern Tanzania and contribute to the diversification of livelihoods in selected communities. However, these projects are not currently complementary to the proposed project, but will seek to establish links and synergies.

II. PARTNERSHIPS

a. The mandate and role of each partner

The National Environment Management Council (NEMC) will be the project lead institution. Its main role will be the overall coordination of the project and maintaining linkages among the partners and the government. It will also oversee the overall implementation of the project and provide key inputs on issues pertaining to environmental regulatory framework, standards and monitoring system.

The Sokoine University of Agriculture (SUA) will coordinate the on-ground project implementation following its experiences and competence in carrying out EFA projects in Tanzania. SUA will among other and in collaboration with the lead institution design the tools, field instrumentation and experiments, and ensure stakeholder engagements at different levels of project implementation. SUA will lead the EFA processes, restoration activities and design the implementation monitoring network system including the capacity building.

The Rufiji Basin Water Board will be responsible for hydrometric data provisioning and engagement with the Water User Associations. They will provide technical backstopping on Integrated Water Resources Management and participate in identification and design of appropriate catchment interventions.

Communities are the direct beneficiaries of the planned interventions. They will be fully engaged in the piloting of the research activities.

b. Kind of resources the Lead Agency and partners will provide

Partner Name	***Mandate***	***Role in the project***	***Resources partner will provide***
1. NEMC	Project Lead institution	Coordination & execution	In-kind and human resources
2. SUA	Coordination of technical aspects & Capacity building	Supervision & capacity building	In-kind, human resources, expertise & training materials
3. Other institutions /organisations (RBWB, Ministry of Agriculture through LGAs, Ministry of Natural Resources and Tourism, etc.)	Partners	Monitoring & backstopping	Human resources
4. Communities	Partners	On-ground project implementation	Space for piloting research activities, casual labour

III. OBJECTIVES

A. Overall objective

To reduce impacts/stress from land-based sources and activities and sustainably manage critical coastal-riverine ecosystems through Environmental Flow Assessment and implementation with the support of partnerships at national and regional levels.

B. Immediate/specific objectives

Water is a key resource to human life and important for natural landscapes, sustaining both aquatic and terrestrial ecosystems. Rising demands for water and other natural resources as a result of increased population, compounded by the inappropriate use and poor management of land and water resources have increased negative effects on economic growth, on social welfare and on the world's systems such as coastal and marine environment. Despite the benefits accrued from the environment and the ecosystems, provision of flows (availability and quality) has often been overlooked and calls for a paradigm shift. Poor management of river basins has resulted into degradation of water catchments consequently affecting river flows in both quantity and quality with devastating impacts on the downstream including the coastal and marine ecosystems which suffer from increased inflow of nutrients carried by rivers to the seas and sediment deposits on the sea bottom, and variation of flow regimes. It has been realized that deforestation, overgrazing, ad extensive land based rural activities in the upstream catchment areas play a significant role on the coastal and marine ecology by altering flow regimes and sediment deposition (Mwalyosi, 2002; MA, 2005). Notably, the government is currently striving to promote effective management of water and watersheds in order to meet anticipated requirements in the near and distant futures. Environmental Flow Assessments (EFAs) which have gained attention and scientifically accepted method can be used for determining the quantity, quality, and timing of flows needed to sustain ecosystems and ecosystem services (King *et al*., 2008).

Objective 1: To enhance Capacity for Environmental Flow Assessment and Restoration for Sustainable Water Flows

EFA concept has been adopted in Tanzania with operational guidelines and procedures prepared but are yet to be operationalized. This entails building capacity and creates awareness of stakeholders in the pilot basins to fully embrace and operationalize EFA. The proposal aims to build capacity of basin staff, other practitioners and regulators through trainings, workshops and meetings. Awareness of stakeholders on environmental flow and assessment will be raised and capacity building on tools for catchment management and their significance on the sustainability of ecosystems services for which humans depends on for survival.

Objective 2*: *To conduct Environmental Flow Assessments in pilot river catchments to guide sustainable management of water flows

In view of the challenges in watershed management, Environmental Flows Assessments in selected river catchments in the Rufiji Basin are proposed with the major focus of advocating the significance of enhancing knowledge of flows required for the environment and involvement of stakeholders in the process to instil sustainability and environmental protection of the West Indian Ocean.

Objective 3: Implementation of recommended flows for sustainable water resources management

It is now widely realized that sound catchment management includes multiple objectives, such as ecosystem integrity, social well-being and economic security, and is fundamental to helping reduce poverty by providing income, clean water, sanitation and sustaining the environment that provides many direct and indirect benefits.

IV. PROJECT IMPLEMENTATION AND MANAGEMENT PLAN (See definitions in Annex 3)

A. Expected project results and indicators

The expected project results comprise the outputs and outcomes that are generated from the proposed intervention. These include: sustainable management of river flows using EFA and Decision Support Tools (DST) coupled with appropriate methodologies have been developed and used to manage river basins and river flows upstream and downstream. The outputs from the planned project activities include; (i) suitable EFA methods for use by specific catchments and DST guidelines customized for use; (ii) EFA guidelines effectively operationalized, monitored and evaluated. The unintended benefits of the project include the generated information from EFA/DST arrangement is useful input in the determination of fair compensation for the land managers (Ecosystem service sellers) based on

the data from field assessment of the water flows. The indicators to be used in measuring the results above are: the methods recommended for EFA will be known and used, customized DST guidelines will be available and used and a team of trained experts in EFA and selected DST will also be available and accessible.

Notably, the proposed project activities have potential for generating unintended and negative results, hence the project will be interested in tracking them so as to mitigate as appropriate.

B. Project activities and work plan

The summary of the project activities and work plan is presented in "*Annex A"* - Work Plan for the Implementation of the project on "*Sustainable Catchment Management through Enhanced Environmental Flow Assessment and Implementation for the protection of the Western Indian Ocean from land-based sources and activities in Tanzania".*

C. Project Beneficiaries

Direct project beneficiaries of this project will include communities and households living in the catchments/ basin. The benefits from the project results include; improved environmental conditions such as land and marine productivity, and resilience to climate change impacts. Other benefits include increased reliability of water flows (both quality and quantity) in near shore areas. Also, government institutions (extension & regulatory agencies) responsible for watershed management will benefit directly from improved river basin planning using EFA tool & PESDES guidelines for enhanced watershed management. Indirect beneficiaries of the project will include the government at large and the global community through SDG. The intended beneficiaries were involved in the design process at different stages and processes which includes; stakeholders' consultation which involved the VPO, MoWI, Rufiji Basin Water Board and LGAs in the ICZM participating districts. The other stakeholders were engaged in the project design stage which include; NEMC and LGAs (Mbeya, Iringa, Njombe and Morogoro – location of the project sites). Issues raised include degraded land in the upper catchments, high sedimentation rates, poor farming practices (on-farm water management), poor irrigation and water conveyance infrastructures and calls for efforts to restore the degraded catchments. The initial consultations enabled identification of local partners at catchment level that includes the WUAs such as Mbarali, Mpando, MbukwaMtitatu in the Mbarali catchment.
Stakeholders are expected to be involved in project approval, these include; Nairobi Convention Focal Point (the Vice President's Office -VPO), project implementation in the field (LGA, WBO, WUAs, NGO Water Utilities and LGA), project monitoring and evaluation (VPO, NEMC, LGAs, SUA and UNEP). The project design will effectively mainstream gender and human rights considerations of involved constituencies.

D. Implementing agency management of project

The overall implementation of the project will be under the two Organizations; NEMC and SUA. NEMC will be the lead institution and SUA will co-lead and co-ordinate all field experiments and activities. With its main mandate to provide advice on all matters pertaining to environmental conservation and management, NEMC will lead a technical advisory and co-ordinate other government agencies responsible for environmental and sustainable use of the natural resources. SUA will be responsible for leading the on-ground project implementation following its experiences and competence in carrying out EFA projects in Tanzania. SUA will lead the design of tools, field instrumentation, and experiments and ensure stakeholder engagement at different levels of project implementations and will lead the EFA processes and design the implementation monitoring network system including the capacity building.

NEMC has experience in coordination implementation of environmental management projects including working in the water basins as well as ICZM action plan for more than 20 years. NEMC will coordinate the project through the directorate responsible for research and management (DEPM) and will be headed by a Project Coordinator (PC). NEMC in collaboration with SUA will form a working group for the implementation of the project. A structure might be put in place in the future for strengthening complementariness with any relevant and related programmes and activities.

V. PROJECT METHODOLOGY

Objective 1: To enhance Capacity for Environmental Flow Assessment and Restoration for Sustainable Water Flows

As it is now understood that without careful flow management, water impoundment by dams, reservoirs and abstraction for various purposes including irrigation can deprive the ecosystems and livelihoods downstream and eventually affecting the oceans. It is important that flow management be integrated into river basin development which will help to provide the means to make consensus-based decision on how to manage trade-offs between infrastructure development, livelihoods and ecosystems. Integrating environmental flows into water management policy and practice requires communication, stakeholder participation, awareness raising, adaptive management and demonstration of the benefits of flows for people and nature. To do this the project will:

i) Literature review

Conduct a literature review to understand the level of knowledge and draw lessons from elsewhere around the world on successful flow restoration projects considering integrated flow management which will be important in planning and managing of landscapes and the entire catchments. The literature review will also be used to understand the local environment. This will mainly be a desk work and the project team will produce a comprehensive literature review that will narrate the scientific understanding of environmental flow assessments methods as well as river/catchment restoration and the linkages between hydrological processes and components and various ecological variables with relevance to the study area and applicable in understanding the land-based activities impacts to flows and sediments. The literature review will be complemented by characterizing analysis of biophysical features of the catchments to give insights to what state they are in and the associated drivers and pressures as well as impacts which will be accomplished through the integration of GIS and remote sensing.

ii) Awareness raising to stakeholders and baseline data collection

Raise awareness on ecosystems services, environmental Flow Assessments (EFAs) and Decision support tools (DST) and their value on/usefulness for water resources and landscape management. This will be done through first carrying out a baseline survey to understand the level of awareness among communities, practitioners and managers as well as other environmental experts in the Rufiji basin and prioritize learning needs and gaps. As human preferences are well acknowledged to be critical component of setting environmental objectives (Acreman *et al.*, 2014; Poff *et al*., 2010), inclusion of what is perceived as a solution in the local context will be important.

The baseline will also be used to understand the landscape characteristics, including levels of degradation, drivers, pressures, states and impacts at the catchment based on the perception of the local communities. The use of participatory rural appraisal (PRA) techniques will be explored on understanding the local knowledge, attitudes and perceptions on ecosystems and restoration programs which are crucial in environmental flow management. The project will use the Contingent Valuation (CV) Method which assesses people's willingness to accept (WTA) to give up a good and their willingness to pay (Arrow *et al.*, 1993). This will enable the project to evaluate the knowledge, attitudes and perceptions of public towards environmental flows and restoration programs to restore the degraded watersheds for the sustainability of ecosystems services as used by (Alam, 2008).

Primary and secondary data will be gathered and analysed to gauge the awareness as well as understand indigenous knowledge on the ecosystem's services and existing techniques for restoration of degraded landscapes, pressures, state and impacts on the flow regimes. The gaps and state of the watersheds and ecosystems will be synthesized and summarized and disseminated in different forms such as brochures, leaflets, meetings and publications to the audiences in the target area, in the country and in the entire region. Dissemination will target different stakeholders in the basin.

Collection of biophysical data to establish current status of the river watershed (socio-economic setting, institutional arrangement, degradation hotspot areas, bio-indicators present, river health) and bio-physical assessments such as land use and land cover, species or vegetation (including rare and threatened species), and farming practices and other activities will be done and synthesized.

iii) Conduct capacity building to practitioners and regulators on scientific EFA methods and DST for management of flows

The capacity building will target water and natural resources managers including the Basin Water Boards (Rufiji River Basin), water catchment committees, WUAs and LGAs to accurately carry out water monitoring and ensure quality of data for informed decision making. As it is widely understood that proper planning and management requires presence of good data, therefore capacity building will involve training basin staff on significance of

accurate flow measurements for both dry and wet periods as well as well as carrying out water quality measurements in pollution hot spots. The engagements will be necessary for instilling sustainability and create a sense of ownership of the process. Field campaigns to measure flows and sediments will be conducted to the Basin Water Board (BWB) staff for developing flow and sediment rating curves. The project will conduct trainings, workshops, and meetings to BWB staff. On the other hand, the project will seek to document and prioritize technologies through consultations with stakeholders for improving watershed management and widely disseminate the selected technologies in the target areas with a long-term goal of sustainability and buy-in by local people

iv) Foster multi-stakeholder engagement and participation

The project will seek to build understanding between multiple stakeholders and determine optimal allocation strategies based on a balanced, benefit-sharing approach. This will involve fostering collaboration and multi-stakeholder platforms that will act as catalysts for further engagements of multiple sectors to achieve a common good. The engagement will not only involve state actors but also non-state actors such as NGOs and the private sectors who in one way or another are concerned with improving or restoration of environmental flows and reduce impacts of land-based activities on the flow regimes. As one of the areas that are earmarked for growth in the agricultural sector through the Southern Agricultural Growth Corridor of Tanzania (SAGCOT), the Mbarali Catchment hosts several growing enterprises which will focusing on increasing productivity may inadvertently affect the environment and ecosystems not only in the upstream, but cascading down to the Indian Ocean. The involvement of planners, policy makers, decision makers, practitioners and the private sector will be crucial. Face-to-face, meetings, workshops and different fora will be used to bring together the different actors and encourage their participation.

v) ***Document, evaluate and disseminate technologies for sustainable management of flows in the selected landscapes***

Integration of flow management into river basin development provides the means to make consensus-based decisions on how to manage trade-offs between development, livelihoods and ecosystems. As highlighted earlier, Communities' understanding of the benefits and the trade-offs between decisions for development and desire to restore or sustain flows need to be improved. The documentation of existing technologies and prioritization of the technologies will be done through consultation with stakeholders for improving watershed management. The dissemination of the selected technologies in the target areas will be done with a long term. On the other hand, the project will seek to document and prioritize technologies through consultations with stakeholders for improving watershed management and widely disseminate the selected technologies in the target areas with a long-term goal of sustainability and buy-in by local people. Integrating flow management into river basin development provides the means to make consensus-based decisions on how to manage trade-offs between development (including for agriculture and hydropower), livelihoods and ecosystems. As highlighted in Activities i & ii on the documentation of existing technologies for sustainable flows, the project will document and evaluate technologies that will be crucial for managing flows in the study area(s).

vi) A database for storing catchment data will be set up to facilitate manipulation, access and sharing of collected data both biophysical and socio-economic data.

Objective 2*: *To conduct Environmental Flow Assessments in pilot river catchments to guide sustainable management of water flows

Tharme (2003), reports the presence a number of methods used for determining flows around the world. However, in recent years, the trend has been towards approaches that consider water needs for ecosystems in a holistic manner. The project proposes the use of a holistic or multidisciplinary framework using a Building Block Methodology (BBM) (King et al, 2008). The BBM relies on the formation of multidisciplinary team of scientific experts of diverse disciplines. The process involves i) carrying out selection of significant catchments in the Rufiji Basin (earmarked basin for the pilot) and critical sites within river catchments where flow-ecology or flow-ecosystem services relationships are critical and sites where management interventions are needed by prioritizing issues related to levels of degradation, where interventions such as dams are to be developed, competing uses of water, location and its connectivity to the estuary/Indian Ocean. The choice of the sites will be done following the Tanzania EFA guidelines (URT, 2018) ii) the team of experts (Hydrology, hydraulics, fish and invertebrates, geomorphology, socio-economic, water quality and ecology (vegetation and riparian) will carry out preliminary assessments as indicated in the BBM protocol which will be followed by:

i) Environmental flow assessment at selected sites

The determination of the Environmental Flow for specific sites in the selected river watersheds which will involve carrying out field sampling campaigns during both the dry and wet seasons, following which data from the field studies and information from the scientific literature will be used to develop flow requirement for a specific sites in the river system.

ii) Ecohydrological modeling, hydraulic modeling, hydraulic simulations (1-D and 2-D river models) and connectivity assessment

The assessment requires understanding of the processes at catchment scale and within the river reach. However, data are usually limited, a modeling approach will be used to fill the data gap and evaluate scenarios for understanding connectivity of the land-based activities to flow regime and sediment. To better represent and understand the process, the project proposes to use an eco-hydrological model for which the Soil and Water Assessment Tool (SWAT) is preferred and will be used for depicting the flow regime and erosion processes controlled by land-based activities and climate on the catchment scale. The discharge and sediment time series resulting from the hydrologic modeling will be used for hydraulic simulations on the reach scale. The Hydrologic Engineering Center River Analysis System (HEC-RAS) - a one dimensional model will be used along with the Adaptive Hydraulics Modeling System (AdH) - a two-dimensional model to simulate water depth, flow velocity, substrate changes and sediment transport. Different scenarios will be considered in the modeling approach, including land use scenario for development and restoration options and their impacts on not only quantity of flows but also on water quality.

iii) Monitoring of hydro-meteorological parameters and water quality using low-cost sensors

This proposal plans to carry out installation of low-cost sensors to monitor hydro-meteorological data. Low-cost sensing has the potential to broaden the scale of environmental measurements and will help as input in hydrological modeling and for validating remotely sensed data. This study will create a low-cost Wireless Sensor Network for hydro-meteorological network in the selected Arduino Platform/other platforms to monitor water quantity (water level) and water quality (turbidity, dissolved oxygen etc), meteorological parameters (precipitation, minimum and maximum temperature, relative humidity, solar radiation and wind. The low-cost sensors will be deployed to various hillslopes within the landscape and information will be transmitted directly to the base station at SUA and shared directly, in real time and also transmitted to the internet through the Internet of Things (IoT) platform, which will be public and other people can access the data for various uses.

iv) Mapping of water abstraction and hotspot areas for sediment and erosion

A GIS approach will be used to map water abstraction and to identify areas with significant alterations both legal and illegal which will consider the water permits as compared to the available water resources. Areas of significant pressures to the resources will be mapped and interventions targeted based on their perceived impacts as simulated in the ecohydrological models. Output of the activity will include understanding of the present abstraction pressures and provide guidelines for issuing permits. The project proposes to calculate water resources availability for different flows, low flow (e.g. Q_{95}), below moderate flows (Q_{70}), moderate flows (Q_{50}) and higher flow and will use statistical analysis to make interpretation of long-term scenarios. This will enable drawing out lessons that will assist the BWB to make decisions on the issuing of water use permits for different nodes in the catchment. An example for resource availability and implication for issuing permits is shown In Table 1.

Table 1. Water Resource availability color.

Water Resource availability color	Implication for issuing permits
High hydrological regime	There is more water than required to meet the needs of the environment. However, due to the need to maintain the near pristine nature of the water body, further abstraction is severely restricted
Water available for issuing permits	There is more water than required to meet the needs of the environment. New permits can be considered depending on the local and downstream impacts
Restricted water available for licensing	Full licensed flow fall below EF. If all licensed water is abstracted, there will not be enough water left for the needs of the environment.
Water not available for licensed	Recent actual flows are below the EF. No further consumptive licenses will be granted.
Heavily Modified Water Bodies (and/or discharge rich water	These water bodies have a modified flow that is influenced by

bodies)	reservoir compensation releases or they have flows that are augmented.

It is worth noting that, stakeholder's involvement is a significant requirement and the project will work with key stakeholders include the Basin Water Boards, Water User Associations (WUAs) including the Irrigators Organizations (IOs), Local Government Authorities (LGAs), natural resources managers, conservationists and other key stakeholders for determination and validation of recommended flows.

Objective 3: Implementation of recommended flows for sustainable water resources management

Water demands are often in conflict and consequently river basins and the livelihoods and the biodiversity they support are increasingly under pressure (Overton *et al*., 2014). Environmental flows can help to achieve the wise use of catchments and natural resources and contribute to all SDGs, particularly SDG 6, 14 and 15. However, realizing the full benefit requires coordination of stakeholders at the different levels including the grassroots level. It requires paradigm shift from traditional systems based on command and control to an incentive-based system with major drivers on maintaining environmental flows, stakeholders' participation and use of modern and emerging technologies in water and catchment management. The project will evaluate decision support tools (DST) or suite of ecosystem service models for the valuation of benefits derived from the ecosystems in the context of catchment or landscape restoration and for their ability to be used in conjunction with EFA to enhance stakeholder's participation and catchment management resulting into increased quantity and quality of river flows and guide water allocation process. Such models will be able to provide evidence for viability of incorporating natural capital into decision making, offer replicable methods for widespread use and dissemination of methodology and capacity building. These models will be evaluated for creating and testing incentive-based scenarios for implementing flow recommendations and watershed restoration. Some models that will be evaluated include PESDES, InVEST, TESSA, Co$ting Nature, WHBET, ARIES, SOLVES in combination with eco-hydrological models such as the Soil Water Assessment Tool (SWAT) as described in Objective 2 to assess the viability of restoration options and the recommended flows will be evaluated.

Activities such as promotion of good agricultural practices, reforestation through planting of trees (including fruit and spice trees) and grasses with the ability to regulate flows, as well as protection of wetlands will be tested for the effectiveness in managing or improving environmental flows. The project will work with farmers and other stakeholders to promote restoration activities including preparation of tree nurseries, water use efficiency technologies in irrigated lands and efficient use of water.

In order to be able to monitor changes, it is proposed to pilot the installation of low-cost monitoring devices to measure flow and water quality parameters in selected sites which could later be replicated to other sites.
Rufiji Basin has been earmarked for the pilot projects as its catchments are pollution hotspot areas with significance influence on the coastal and marine ecosystems and where land-based activities have negative ramifications on ecosystems and biodiversity. The components for the demo projects have been presented in the work plan.

VI. SUSTAINABILITY AND REPLICABILITY

Sustainability of the project results is key aspect and hence measures have been incorporated in the project design which includes placing the project coordination role within NEMC whose regulatory functions address closely the scope of the project and river basin management activities is integral part of the institutional activities. The project will increase institutional and human resources capacity at the district level and sectoral levels. This will be complimented by capacity building on awareness and technical skills among stakeholders at all levels and promote sharing of best practices among implementers and stakeholders. In addition, the project will address barriers and constraints at all levels to ensure long-term environmental sustainability. Mainstreaming of the environmental impact assessment and auditing good practices into river basin planning and EFA practices will be supported via planning and implementation of river basin management plans. The project will encourage and facilitate full participation of communities, CBOs and NGOs within the catchments / districts, share benefits and observe gender issues / human rights in order to encourage participation and sustainability. The project will engage competent and experienced staff in RBM & IWRM issues to work in the project to accelerate achievements and outputs/outcomes. The government will seek further donor support to leverage the available funds and support project results and

enhance sustainability. Leveraging strategic partnerships will be a key requirement in the project for synergy and sustainability. The project seems to have potential for building a social enterprise or business case particularly at up-scaling phase, which will be pursued.

VII. PROJECT MONITORING AND EVALUATION

The coordinating institution (NEMC)'s Planning and Monitoring and Evaluation Unit (PMEU) will be responsible for monitoring and evaluation (M&E). The Project Coordinator (PC) will report on the project performance to the Technical Advisory Committee (TAC) through the Director of Environmental Research and Management (DERM) in NEMC. The project will establish a detailed result framework for individual components for this project based on the existing institutional guidelines on project M&E framework (NEMC, 2014) in collaboration with SUA. UNEP will monitor the implementation of the Grant Agreement through routine supervision missions and review of M&E data.

VIII. BUDGET

The budget indicating categories, sub-categories, quantities, unit cost and total cost for supporting the implementation of the proposed project activities is presented in "Annex B". These activities will co-finance in-kind contribution (i.e. staff time, office space, vehicles and utilities) to the tune of 5% of the total project budget.

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ANNEX A: WORK PLAN

Planned Task	Responsible Actor	Year 1												Year 2											
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
Overall Objectives: To reduce impacts/stress from land-based sources and activities and sustainably manage critical coastal-riverine ecosystems through Environmental Flow Assessment and implementation with the support of partnerships at national and regional levels.																									
Outcome 1.0: Capacity of water and natural resources managers to conduct EFA and restorations for sustainable river flows in the catchments enhanced.																									
Output 1.1	NEMC, SUA																								
Activity 1.1.1	SUA, NEMC																								
Activity 1.1.2	SUA, NEMC																								
Activity 1.1.3:	NEMC, SUA, RBWB, WUAs & Other Stakeholders																								
Activity 1.1.4:	NEMC, SUA, RBWB, WUAs & Other Stakeholders																								
Outcome 2.0: Environmental Flow Assessments in pilot river catchment of Mbarali conducted and used to guide sustainable management of water flows																									
Output 2.1	SUA, NEMC																								
Activity 2.1.1	NEMC, SUA																								
Activity 2.1.2	SUA, NEMC																								
Activity 2.1.3	NEMC, SUA RBWB, WUAs & Other Stakeholders																								
Activity 2.1.4	SUA, NEMC, RBWB, WUAs & Other Stakeholders																								
Activity 2.1.5	NEMC, SUA RBWB, WUAs & Other Stakeholders																								
Outcome 3.0: Improved water resources condition (both quantity and quality), ecological condition and management through implementation of the recommended Eflows.																									

Output 3.1	NEMC, SUA RBWB, WUAs & Other Stakeholders																							
Activity 3.1.1	SUA, NEMC, RBWB, WUAs & Other Stakeholders																							
Activity 3.1.2	NEMC, SUA RBWB, WUAs & Other Stakeholders																							
Activity 3.1.3	SUA, NEMC, RBWB, WUAs & Other Stakeholders																							

Annex 2: Logical Framework

Project title: Sustainable Catchment Management through Enhanced Environmental Flow Assessment and Implementation for the protection of the Western Indian Ocean from land-based sources and activities in Tanzania.			
Project overall objective: To reduce impacts/stress from land-based sources and activities and sustainably manage critical coastal-riverine ecosystems through Environmental Flow Assessment and implementation with the support of partnerships at national and regional levels.			
Project Results	**Outputs**	**Activities**	**Costs /output (US$)**
Outcome 1.0: Capacity of water and natural resources managers to conduct EFA and restorations for sustainable river flows in the catchments enhanced.	O.1.1 Knowledge of water and natural resources managers on EFA and restoration improved	A.1.1.1 Awareness rising on EFA and DST and their value on/ usefulness for catchment management A.1.1.2 Conduct capacity building to practitioners and regulators on scientific EFA methods and DST for management of flows A.1.1.3 Conduct multi-stakeholder Engagement and participation meetings A.1.1.4 Document, evaluate and disseminate technologies for sustainable management of flows in the selected landscapes	**39,000**
Outcome 2.0: Environmental Flow Assessments in pilot river catchment of Mbarali conducted and used to guide sustainable management of water flows	O.2.1 EFA in pilot rivers conducted and process documented (various reports - site selection, catchment baseline description report, wet and dry season sampling report, experts' starter reports, EF report, Eflow recommendation workshop report produced).	A 2.1.1 Conduct literature review and baseline survey to establish the past and current conditions of the selected river catchments and river flows A 2.1.2 Carry out catchment/landscape and site selection for conducting environment flows using established criteria A 2.1.3 Conduct field sampling campaigns during both the dry and wet seasons to collect the necessary social, water quality, river health, ecological, hydrologic, hydraulic, climatic and geomorphologic data A 2.1.4 Conduct any necessary modeling and scenario analysis to identify trends in river flow, sediment yield, water quality and ecological parameters under the change in land use and climatic conditions for the study catchment, and prepare expert reports with suggested environmental flow recommendations and water allocation criteria A 2.1.6 Conduct a flow recommendation workshop and setting river management objectives including restoration activities with all stakeholders.	**86,000**

Outcome 3.0: Improved water resources condition (both quantity and quality), ecological condition and management through implementation of the recommended Eflows.	O.3.1: Incentive-based decision support tool/technologies evaluated and applied to promote restoration activities and the implementation of the recommended environmental flows	A 3.1.1 Identify and evaluate incentive-based Decision Support Tools A 3.1.2 Promote and implement restoration activities/technologies recommended for EF management A 3.1.3 Install monitoring equipment to measure flow and water quality parameter and other indicator parameters	**65,000**

Annex 3: Project Monitoring Plan

Project Title: Sustainable Catchment Management through Environmental Flow Assessment and Implementation for the protection of the Western Indian Ocean from land-based sources and activities in Tanzania			
Project overall objective: To reduce impacts/stress from land-based sources and activities and sustainably manage critical coastal-riverine ecosystems through Environmental Flow Assessment and implementation with the support of partnerships at national and regional levels.			
Project Results	**Indicator**	**Target/baseline**	**Method**
Outcome 1.0: Capacity of water and natural resources managers to conduct EFA and restorations for sustainable river flows in the catchments enhanced.	**IND.1.1** Number of managers trained in EFA, and training report detailing on EFA and restoration techniques	**Target:** Capacity of water resources managers to conduct EFA and restoration activities enhanced over the project time frame. **Baseline:** Limited understanding of EFA and restorations techniques among water and natural resources managers	Through seminars, meetings and workshops
Outcome 2.0: Environmental Flow Assessments in pilot river catchment of Mbarali conducted and used to guide sustainable management of water flows.	**IND.2.1** Environmental Flows information generated and used for decisions on sustainable water resources management in the catchment	**Target:** Environmental flow estimates helping the restoration of modified river flow regimes and key ecological characteristics; and at least 10% of the degraded land restored, population of species in the river increased and sediment loading decreased. **Baseline**: Existing management of river flows is not sustainable and there is no EF quantities to guide compliance by the Rufiji Basin water Board and communities	Field monitoring and sampling for both wet and dry seasons; trend analysis; GIS and Remote Sensing analysis; Scenario modelling and simulations of future changes; EF assessment using holistic methods; development of PES scheme based on indicators for the implementation of EF and training for use.

Outcome 3.0: Improved water resources condition (both quantity and quality), ecological condition and management through implementation of the recommended Eflows.	**IND.3.1** Water quantity increased, and water quality achieved required standards; and ecological characteristics improved.	**Target:** Water quantity increased and of acceptable quality standards sustainably supporting riverine ecosystems with reduced sediment loading to the downstream and the marine environment. **Baseline:** Declining water quantities, degraded catchment and riverine environment, high sediment rates and poor ecological conditions.	Field monitoring and sampling at different times of the year; statistical analysis

Annex 4: Budget

Activity	Category	Year 1					Year 2					Total Cost for 2yrs	
		Quantity*	Unit Cost (US$)	Total Cost (US$)	WIOSAP Support	Co-financing	Quantity	Unit Cost (US$)	Total Cost (US$)	WIOSAP Support	Co-financing	WIOSAP Support	Co-financing
Output 1.1 Knowledge of water and natural resources managers on EFA and restoration improved													
A.1.1.1 Awareness rising on EFA and DST and their value on/ usefulness for catchment management	**Personnel**	2	100	200	200								
	Equipment			500	500	3,500							
	Operating costs			1,800	1,800	1,500							
	Contract Services			3,000	3,000								
	Travel			3,500	3,500								
	Sub-total			***9,000***	***9,000***	***5,000***						***9,000***	***5,000***
A.1.1.2 Conduct capacity building to practitioners and regulators on scientific EFA methods and DST for management of flows	**Personnel**	2	100	200	200								
	Equipment			500	500								
	Operating costs			2,400	2,400								
	Contract Services			2,500	2,500								
	Travel			2,500	2,500								
	Sub-total			***8,100***	***8,100***	***-***						***8,100***	***-***
A.1.1.3 Conduct multi-stakeholder Engagement and participation meetings	**Personnel**	2	100	200	200								
	Equipment			1,200	1,200								
	Operating costs			1,500	1,500								
	Contract Services			2,700	2,700								
	Travel			1,600	1,600								

	Sub-total			***7,200***	***7,200***	***-***						***7,200***	***-***
A.1.1.4 Document, evaluate and disseminate technologies for sustainable management of flows in the selected landscapes	**Personnel**	4	100	400	400								
	Equipment			1,600	1,600								
	Operating costs			1,500	1,500								
	Contract Services			3,000	3,000								
	Travel			4,300	4,300								
	Sub-total			***10,800***	***10,800***	***-***						***10,800***	***-***
	Total for Output 1.0			***35,100***	***35,100***	***5,000***						***35,100***	***5,000***
Output 2.0: EFA in pilot rivers conducted and process documented (various reports - site selection, catchment baseline description report, wet and dry season sampling report, experts' starter reports, EF report, Eflow recommendation workshop report produced).													
A 2.1.1 Conduct literature review and baseline survey to establish the past and current conditions of the selected river catchments and river flows	**Personnel**	10	100	1,000	1,000								
	Equipment			600	600								
	Operating costs			1,900	1,900				1,000	1,000	1500		
	Contract Services			3,000	3,000				1,000	1,000			
	Travel			11,000	11,000				3,000	3,000			
	Sub-total			***17,500***	***17,500***	***-***			***5,000***	***5,000***	***1,500***	***22,500***	***1,500***
A 2.1.2 Carry out catchment/landscape and site selection for conducting environment flows using established criteria	**Personnel**	8	100	800	800					-			
	Equipment			300	300					-			
	Operating costs			500	500					-			
	Contract Services			1,000	1,000				800	800			
	Travel			1,000	1,000				1,000	1,000			
	Sub-total			***3,600***	***3,600***	***-***			***1,800***	***1,800***	***-***	***5,400***	***-***
A 2.1.3 Conduct field sampling campaigns during both the dry and wet seasons to collect the necessary social, water quality, river health, ecological, hydrologic, hydraulic, climatic and geomorphologic data	**Personnel**	10	100	1,000	1,000		10	100	1,000	1,000			
	Equipment			600	600				600	600			
	Operating costs			2,000	2,000				2,500	2,500			
	Contract Services			3,000	3,000				3,400	3,400			
	Travel			8,300	8,300				10,000	10,000			
	Sub-total			***14,900***	***14,900***	***-***			***17,500***	***17,500***	***-***	***32,400***	***-***
A 2.1.4 Conduct any necessary modeling and scenario analysis to identify trends in river flow, sediment	**Personnel**	2	100	200	200		2	100	200	200			
	Equipment				-				100	100			
	Operating costs				-				1,000	1,000			

yield, water quality and ecological parameters under the change in land use and climatic conditions for the study catchment, and prepare expert reports with suggested environmental flow recommendations and water allocation criteria	**Contract Services**			500	500				1,100	1,100			
	Travel			1,000	1,000				4,900	4,900			
	Sub-total			***1,700***	***1,700***	***-***			***7,300***	***7,300***	***-***	***9,000***	***-***
A 2.1.5 Conduct a flow recommendation workshop and setting river management objectives including restoration activities with all stakeholders.	**Personnel**						10	100	1,000	1,000			
	Equipment								300	300	500		
	Operating costs								1,500	1,500			
	Contract Services								2,000	2,000			
	Travel								3,300	3,300			
	Sub-total					***-***			***8,100***	***8,100***	***500***	***8,100***	***500***
	Total for Output 2.0			***37,700***	***37,700***	***-***			***39,700***	***39,700***	***2,000***	***77,400***	***2,000***
Output 3.0: Improved water resources condition (both quantity and quality), ecological condition and management through implementation of the recommended Eflows													
A 3.1.1 Identify and evaluate incentive-based Decision Support Tools	**Personnel**	4	100	400	400		8	100	800	800			
	Equipment				-				100	100			
	Operating costs				-				1,000	1,000	1500		
	Contract Services			500	500				1,100	1,100			
	Travel			1,000	1,000				4,100	4,100			
	Sub-total			***1,900***	***1,900***	***-***			***7,100***	***7,100***	***1,500***	***9,000***	***1,500***
A 3.1.2 Promote and implement restoration activities/technologies recommended for EF management	**Personnel**						10	500	5,000	5,000			
	Equipment								1,000	1,000			
	Operating costs								5,000	5,000			
	Contract Services								7,727	7,727			
	Travel								10,000	10,000			
	Sub-total					***-***			***28,727***	***28,727***	***-***	***28,727***	***-***
A 3.1.3 Install monitoring equipment to measure flow and water quality parameter and other indicator	**Personnel**						6	500	3,000	3,000			
	Equipment								5,000	5,000	1000		
	Operating costs								5,000	5,000			

parameters	**Contract Services**								1,500	1,500			
	Travel								8,000	8,000			
	Sub-total					**-**			***22,500***	***22,500***	***1,000***	***22,500***	***1,000***
	Total for Output 3.0			***1,900***	***1,900***	**-**			***58,327***	***58,327***	***2,500***	***60,227***	***2,500***
	Total for Output 1.0-3.0			**74,700**	**74,700**	**5,000**			**98,027**	**98,027**	**4,500**	**172,727**	**9,500**
												Cost for administration (10% of total cost for outputs 1.0-3.0)	***17,273***
												Sub-Total	***190,000***
												Co-financing and in-kind contribution	***9,500***
												Grand total	***199,500***

Annex 4.1: Budget justification

	Category	Justification
1.	**Personnel**	Personnel will include coordination functioning and working members' participation during the implementation of the project activities.
2.	**Equipment**	Water quantity and quality measurement equipment and biological sampling tools need to be procured to support continued monitoring. Computers are required to store data. Also some equipment will have to be hired.
3.	**Operating costs**	Communication will enable constant engagement with our project partners and members as well as project management unit. Stationeries will be needed to print working tools and documents and fuel will be needed to support fieldwork activities.
4.	**Contract Services**	The project at different times will require engagement of experts with requisite knowledge in EFA. These will include the geomorphologist, hydraulic engineer and modeller, hydrologist, ecologists, water quality expert, and sediment expert. Engagement meetings will be conducted more regularly and will require hiring of venues through contracted conference packages.
5.	**Travel**	Project members, and engaged experts/ consultant will need transport for fieldwork and for attending meeting/workshop events. Transport costs and daily subsistence allowance will have to be paid.