**World Bank – Tanzania Country Office**

**Short-Term Consultant (STC) – Geospatial Programming Specialist**

**(SAEW3)**

**Terms of Reference (TOR)**

**Ocean Health and Sanitation Nexus in Zanzibar**

**Background**

Zanzibar is a semi-autonomous archipelago within the United Republic of Tanzania. With a total land area of 2,461 km2, the Zanzibar archipelago has an estimated population of 1.89 million (as per 2022 census) mostly residing on the two major islands of Unguja and Pemba. The population has increased almost five times since the 1967 census where 354,815 people were recorded by then. The current population growth rate is averaged at 3.8 percent.

The Zanzibar Development Strategy (2021-2026) focuses on “Blue Economy for Inclusive Growth and Sustainable Development.” The access to safely managed Water Supply, Sanitation and Hygiene (WASH) play a key role in achieving this strategy. Access to water for many areas in urban and rural areas has significantly improved in the last few years after a concerted effort of the government. For instance, according to the Household Budget Survey 2019/20 access to an improved source of drinking water is 70.4% (urban areas 70.7%; rural areas 70.2%). However, the quality of potable water remains a big challenge, as is the reliance on fragile groundwater reserves. Accessibility to sanitation and hygiene facilities for many areas is still challenging, with only 66% of households accessing improved sanitation (MIS 2017), and 11.7% still practicing open defecation. Only 5% of the island is served by a centralized sewerage system which adequately treats the wastewater. Many households rely on onsite sanitation facilities (septic tanks/pit latrines).

Coastal marine ecosystems face a myriad of human pressures, including those from climate change and land-based activities such as agriculture. Land-based stressors, such as nutrient and chemical pollution run-off, link coastal marine systems to terrestrial human activities and they also amplify risks from other anthropogenic stressors such as climate change. Unsafely managed sanitation (from both industrial and municipal sources) is causing the further pollution of Zanzibar’s ocean environment and of its groundwater reserves. The lack of access to safely managed sanitation services in Zanzibar also has public health implications and puts its blue economy at risk, particularly its booming fisheries and tourism industry. In addition, the quality of groundwater, which is a major source of water supply in Zanzibar, is also at risk. This pollution from inadequate sanitation is a major contributor to coastal eutrophication and harmful algal blooms from the high levels of nitrogen and phosphorus entering the ocean environments as a result of wastewater pollution. This in turn results in substantial marine habitat degradation and loss including of critical coral reefs, seagrasses and mangroves, as well as impacting fish breeding and fish behavior. Wastewater pollution in the ocean also makes coastal marine ecosystems and coastal human populations more vulnerable to climate change through the degradation or loss of these critical habitats. Wastewater pollution negatively affects the viability of mangroves and seagrasses and impacts their ability to store carbon, leading to increased emissions and undermining blue carbon initiatives. Zanzibar is extremely vulnerable to future sea level rise from climate change. The potential impacts of sea-level rise include flooding and loss of low-lying areas, shoreline (coastal) erosion, saltwater intrusion and increased salinity in aquifers and water supplies. Mangrove swamps provide resilience against storms, coastal erosion and sea level rise, but their resilience is negatively affected by the presence of wastewater in coastal waters, causing their roots to be shallower and therefore their own resilience to be jeopardized.

In May 2023, the Government of Zanzibar (GoZ), through the First Vice President’s office, requested World Bank Support to conduct a detailed feasibility study (FS) of sanitation management in Zanzibar (on Unguja Island) and specifically to support them to better understand the implications of poor sanitation management on their groundwater and marine environments.

The World Bank has successfully received a 20-month USD 350,000 sponsored grant to support this request. The secured grant is linked to the proposed Tanzania Scaling-up Sustainable Marine Fisheries and Aquaculture Management Project (TASFAM) (P179969) (a FY25 deliverable). The objective of TASFAM is to enhance the sustainability of Tanzania's coastal and marine fisheries and aquaculture for strengthened livelihoods via enhancing the environmental sustainability of Tanzania's coastal resources with particular emphasis on the transformation and modernization of marine fisheries management (including reducing post-harvest losses) and aquaculture development in the context of strengthening and expanding the livelihoods of targeted coastal communities. This includes investments in critical coastal and marine biodiversity and habitat protection and conservation, promoting access to formal financial services, gender equity in employment opportunities within the sector, and aquaculture investments in anticipation of projected adverse climate change impacts to coastal areas. The transformation and modernization of marine fisheries (including reducing post-harvest losses) and the development of commercial aquaculture through increased productivity for the improved resilience of livelihood in coastal communities are key aspects of the project.

This 20-month grant will support the proposed TASFAM operation to specifically understand better the interactions and impacts of poor sanitation on ocean health and groundwater pollution on Unguja island both now and in the future, and its impact on climate resilience/mitigation. This will include: i) developing a locally developed, innovative GIS based model to better understand how poor sanitation management is interacting with coastal, marine and groundwater environments; ii) evaluating the possible impacts of climate change on this interaction; iii) identify high priority activities to reduce the negative impact of poor sanitation on coastal, marine and groundwater environments; iv) design high priority sanitation projects/livelihood investments to reduce this impact; and v) dissemination and communication of project results

**2. Description of Duties**

The Geospatial Programming Specialist will provide support to the task team in leveraging innovative geospatial programming solutions for data-driven decision-making, focusing on sanitation’s impact on Zanzibar’s groundwater and marine ecosystems, while utilizing advanced geospatial programming solutions to maximize data-driven insights. Specifically, the Geospatial Programming Specialist will:

1. Work closely with specialists on the Zanzibar TA, namely marine biologist, GIS mapping specialist, sanitation specialist and the coordination team to identify sanitation hot spot areas that are resulting in contamination of marine and ground water sources.
2. Assist in collecting, cleaning, and organizing all datasets, including sanitation infrastructure, biophysical, habitat and all other data sets.
3. Design and implement automated data processing pipelines for geospatial data (e.g., ETL workflows using Python or R).
4. Develop GIS-Based Models in collaboration with Geospatial Data Analyst to adapt high-resolution geospatial models for mapping nutrient and pathogen flows into marine and groundwater systems in Zanzibar.
5. Use the geospatial model to simulate baseline against other plausible scenarios under different boundary conditions including climate change, development trajectories, population dynamics among others
6. Develop interactive or static visualizations and reporting tools for communicating the analytics. This may include tools for exporting geospatial information and summaries for stakeholder presentations and reports.
7. Undertake Capacity Building endevours to ensure the optimal use of the model and geospatial tools developed in the project.

Other types of tasks related to this assignment may be asked of the consultant.

**3. Duration**

The STC assignment will be for XXX days between July 1, 2025 to February 28, 2026. Depending on performance and business needs, additional days may be added. The consultant may be expected to travel to Zanzibar, with all travel, accommodation and per-diem costs being provided as per World Bank rates and conditions. The consultant will be paid a daily rate as per World Bank STC rates - which is calculated based on the requirements of the assignment and selected consultant’s experience.

**4. Reporting and deliverables**

The consultant will report to the task team leader, Ruth Kennedy-Walker, and will work closely with other task team members. The following outputs are expected from the consultant:

1. Automated Geospatial Data Workflows including scripts for data cleaning, integration, and preprocessing.
2. Processed and ready-to-use geospatial and time series datasets
3. GIS-Based Model(s) written in Python or R scripts for mapping nutrient and pathogen flow analysis.
4. Well documented model scenarios with maps and other visualizations capturing the baseline as compared against scenario results.
5. Comprehensive final report documenting all the methodological approach, model development, scripts, and workflows for sharing with the bank, government agencies and other stakeholders.
6. Training materials (e.g manuals) for local stakeholders on use and application of the modeling tools.
7. An array of PowerPoint presentations covering both model development and application of the geospatial model.
8. Workshop/meeting report(s) (for any stakeholder engagement targeting modelling works). The workshop report(s) must be submitted within 48hours after the convening takes place.
9. Written responses on Team documents, project summary report (within 5 business days of receiving).
10. Contribute to the final project report and drafting of a joint journal article (to be decided).
11. Bi-weekly progress reports.
12. Timesheets when submitting monthly payment requests (template to be shared).

**5. Consultant profile**

* Minimum 4 years of experience in GIS programming (Python, R, or similar).
* Strong skills in automating geospatial workflows and model development.
* Familiarity with Zanzibar’s environmental context is a plus.
* Language proficiency in English; Kiswahili is advantageous.