



## **Enhancing Resilience to Climate Change-Induced Flooding and Drought Through the Deployment of a Water-Filled Barrier**

### **Project Closure Report**



<b>Project Name:</b>	Enhancing Resilience to Climate Change-Induced Flooding and Drought Through the Deployment of a Water-Filled Barrier
<b>Implementing Entity</b>	Ministry of Water and Environment-Uganda
<b>Sponsor:</b>	Adaptation Fund
<b>Executing Entity</b>	MoWE
<b>Date:</b>	20 <sup>th</sup> December 2024

## 1. Project description

### 1.1 Background and context

Uganda is a landlocked country that occupies a total area of 241,038km. Agriculture is a critical part of Uganda's economy; it accounts for 25.8% of Gross Domestic Product (GDP)<sup>1</sup>, employs 72% of the population<sup>2</sup> and accounts for over 50% of total export<sup>3</sup>. Half of the agricultural labour force is female farmers, focusing mainly on their families' food security rather than the production of cash crops.

Uganda lies within a relatively humid equatorial climate zone, but the topography, prevailing winds and water bodies cause large differences in rainfall patterns across the country. Average annual rainfall ranges from 800 mm to 1500 mm.<sup>4</sup> Average daily temperature is around 28°C, but varies with altitude (temperatures can reach 0°C in the highlands).<sup>5</sup> Uganda faces several developmental constraints, including high population growth (3.3%), post-conflict conditions in the north, soil erosion and degradation, and pernicious impacts of malaria and HIV/AIDS.

Climate change has greatly impacted Uganda's rainfall intensities over the years. The country has been experiencing increased frequency and severity of extreme weather events. Some of these events include erratic heavy rainfalls. Increased intensity of heavy rainfall has led to greater impact of floods and are causing more damage due to expanded infrastructure, human settlement and general development of the country. Uganda experiences both flash floods and slow-onset floods, which are common in urban areas, low-lying areas, areas along river banks and swamplands.

A Consortium of companies led by Zephyr Consulting, including Ministry of Water and Environment-Uganda and Nelen & Schuurmans aimed to implement a project comprising of data-driven flood analyses using innovative software and the demonstrate the mobile flood barrier called SLAMDAM. The notion is that SLAMDAM can help enhance Uganda's resilience to climate change-induced flooding.

The Consortium will implement the project to strengthen Uganda's resilience to climate change-induced flooding. A newly developed Flood Intelligence Service (FIS) tool is used to analyse flood hazards and adaptation benefit scenarios. SLAMDAM is a climate resilient technology being water-filled flood barrier that can easily be deployed to prevent damage from flooding or store water for usage at a different time or location.

### 1.2 Project objective

The overall goal of the project is to strengthen resilience and reduce vulnerability of communities to the risk of climate change-induced floods and droughts within the Obongi District through data-driven risk analyses and the deployment of a scalable water-filled barrier to prevent flooding and optionally store and harvest water that will be repurposed for a drought event.

### 1.3 Key requirements

In order to showcase SLAMDAM as a flood resilient measure that can be scaled-up across Uganda, the project must:

- i. Produce reliable flood scenarios using hydrodynamic modelling.
- ii. Produce analyses on adaptation benefit scenarios.
- iii. Produce readable reports on flood risks and benefit scenarios.
- iv. Effectively prevent flood damages in line with the targets.
- v. Take little time to build up and dismantle.
- vi. Be able to be reused after dismantling it.
- vii. Be operated by well-trained teams independently.

## 1.4 Proposed solution

The proposed solution is to implement and demonstrate SLAMDAM as an effective measure to adapt to (climate change-induced) flooding in Waka area, Obongi district in Uganda.

## 1.5 Key deliverables

- i. Flood risk assessment report.
- ii. Flood adaptation benefit report.
- iii. Mobile flood barrier suitable for the pilot location.
- iv. Well-trained people to operate SLAMDAM.
- v. Successful demonstration of SLAMDAM.
- vi. Various Reports (Inception, progress, closure etc.).
- vii. M&E plan and report.
- viii. Roadmap to scale up SLAMDAM across Uganda.

## 1.6 Impact project results

- i. Enhanced understanding of flood risks and adaptation benefits.
- ii. Prevented (in)direct / (in)tangible damages caused by flooding.
- iii. Enhanced capabilities of flood response team and community.
- iv. Enhanced resilience to floods.
- v. Contribution to SDGs: 5, 6, 8, 11 and 13

## 2. Scope Statement

The primary focus of this project was to demonstrate the effectiveness of SLAMDAM and to analyze flood risks and engage in flood control measures using advanced techniques and strategies like FIS, 3Di, and SLAMDAM. The project aimed to address aspects related to climate change mitigation and disaster prevention.

### In Scope

- i. **Flood Risk Analysis:** Analyzing flood risks by employing FIS (Flood Information System) and 3Di, which helped in understanding the potential threats and defining prevention measures.
- ii. **SLAMDAM Deployment:** Utilizing SLAMDAM during real-life flood threats to counteract and mitigate flooding issues.
- iii. **Capacity Building:** Initiatives related to climate change and SLAMDAM will be developed, enhancing the ability to adapt to environmental changes.
- iv. **Optional EWS Implementation:** If applicable, the project may include an Early Warning System (EWS) to further enhance flood prediction and response.
- v. **Optional Drought Prevention using SLAMDAM:** If opted for, SLAMDAM will also be deployed to assist in drought prevention and management, contributing to comprehensive disaster control.

### Out of Scope

- i. **Providing Transportation for SLAMDAM:** The transportation means required to move SLAMDAM were not within the project's jurisdiction and needed to be addressed separately.

- ii. **Storage Facility Implementation:** Building or maintaining a storage facility for SLAMDAM or related equipment fell outside the purview of this project. The Ministry had to work with its partners and Districts and Obongi Subcounty to address this gap.

This project has focused on analysis, prevention, and mitigation of flood risks using SLAMDAM. By clarifying the boundaries of the project, we established a clear path that ensured that resources were directed towards the project objectives whilst remaining within (1) budget, (2) time and (3) agreed level of quality.

### **3. Project Accomplishments**

The project was initiated with the key objective to demonstrate SLAMDAM as a mobile flood barrier, serving as an innovative and effective measure to adapt to climate change by enhancing resilience to flooding in Uganda. Guided by specific requirements and targeted deliverables, the project remained on track to accomplish its intended goal. The Project was affected by the post COVID slowdown that affected procurement, production and logistics from the manufacturer and transporters. This section details the accomplishments that aligned with our objectives and highlights any changes made.

#### **3.1. Demonstration of SLAMDAM** *(see pictures in Annex 1)*

- i. Successfully demonstrated SLAMDAM as an innovative and effective mobile flood barrier.
- ii. We gave a presentation to multiple stakeholders, and we trained people on how to operate SLAMDAM.

#### **3.2. Flood scenarios & analyses**

- i. Initial preparatory meetings, data collection and coordination work leading to the demonstration of
- ii. SLAMDAM
- iii. Developed reliable flood scenarios using advanced hydrodynamic modeling techniques.
- iv. Produced comprehensive analyses on adaptation benefit scenarios, enhancing understanding and strategic planning.

#### **3.3. Reports and documentation**

- i. Produced readable and detailed reports on flood risks and benefit scenarios.
- ii. Completed various reports including inception, weekly project team meeting reports, and closure, effectively documenting all stages of the project.

#### **3.4. Prevention of flood damages**

Initially the project aimed to enhance resilience to flooding in Waka area in April 2023 during the flooding season but due to logistical delays including delay in start of the project. The project delayed due to production and logistics mishaps due to COVID that disrupted the global economy including logistics for over a year. The supply could only produce and deliver the dams to the project site and deployment after one year from the project start. Demonstration of deployment happened in September 2024 which was a dry month. To assess the effectiveness of the Dams and final deployment, it was agreed that the SLAMDAM will remain on site up until the next flooding season in December.

The project managed to demonstrate the capacity of SLAMDAM to be built up and dismantled quickly by communities, providing a timely response to flooding. It was further confirmed that the mobile flood barrier can be reused after dismantling, showcasing sustainability.

#### **3.5. Training and operations**

- i. Trained well-equipped teams to operate SLAMDAM independently, enhancing local capabilities.
- ii. Ensured the ability to respond quickly and efficiently to flood threats.

#### **3.6. Deliverables & solutions**

Successfully delivered the key deliverables including flood risk assessment report, flood adaptation benefit report, and a mobile flood barrier suitable for the pilot location.

Omar and team are in the process of developing a proposal to scale up the uptake of this technological intervention across Uganda.

### 3.7. Impact & sustainability

- i. Significantly enhanced the understanding of flood risks and adaptation benefits.
- ii. Strengthened the capabilities of the flood response team and the community, enhancing overall resilience to floods.
- iii. Implemented a solution that can make notable contributions to Sustainable Development Goals (SDGs) 5, 6, 8, 11, and 13, aligning with broader global commitments.

The Uganda SLAMDAM project has accomplished its objectives by effectively demonstrating an innovative approach to flood prevention and resilience. The support and funding from the Adaptation Fund have enabled the successful implementation and realization of these key accomplishments, marking a significant step towards climate adaptation and sustainability in Uganda.

## 4. Financial Summary

Project Costs	Project Budget	Project Actuals	Comment
1. Flood analysis software	39,562	47,162	
2. Flood risk analysis	33,562	41,162	
3. Travel and accommodation	39,062	27,167	
4. SLAMDAM and accessories (amortization)	25,362	27,567	
5. Transport SLAMDAM	39,562	24,877	
6. Work Breakdown			
6.1 Anna van den Hadelkamp	20,330	22,405	
6.2 Omar Saleh	32,580	33,105	
6.3 Luuk Wessels	19,980	23,255	
<b>Project Totals</b>	<b>250,000</b>	<b>246,700</b>	<b>Within budget</b>

*Project is managed within budget*

## 5. Transfer to Operations

An effective SLAMDAM deployment required the coordination of various stakeholders. All team members needed to be aware of the processes and procedures, their roles and responsibilities following and up to the deployment of the mobile flood barrier. The section below outlines roles and responsibilities of the selected stakeholders:

### Monitor flood risks

Floods can be serious catastrophes if not handled with urgency and expertise. A flood monitoring team was in place to ensure flood risks are monitored and are the first to alert the rest of the team in the event a flood risk is detected. One of the factors this team will be on the lookout includes rainfall forecast from the meteorological department.

### Risk of flooding detected

Once a flood risk is anticipated and reported as so by the flood monitoring team, the appointed local community member(s) role was to monitor rising water levels in the event of rainfall and inform the head of flood response team when the water levels reach the flood threat threshold.

### **Notify head of flood response team**

The first person notified of a threat of flooding will alert all members of the flood response team of the detected flood threat; the first person notified acts as the head or a senior member of the flood response team until this role is taken over by one of the senior members or head of the team. Responsibilities for the first person on-scene may include:

- i. Taking appropriate personal protective measures.
- ii. Notifying all members of the flood response team of the threat of flood.
- iii. Advising people in the area of any potential threat and initiate evacuation procedure

### **Gather flood response team members**

The head of the flood response team is responsible for the coordination of the planned activities to prevent damage from the anticipated floods. The head of the flood response must ensure that all actors in the flood preparedness and response process are notified and periodically informed of the threat level and the actions that have been taken or are yet to be taken.

### **Transport SLAMDAM to the location**

The mobile flood barrier will be transported from the storage area by the flood response team to the flood risk location.

### **Deploy SLAMDAM**

Once the flood response team is on the flood risk location, the team is expected to remove the SLAMDAM from the boxes and follow the deployment procedures/manual. This can be done by at least two people and does not require high level skills.

### **Store SLAMDAM**

Once the water levels subside, the mobile flood barrier is emptied and folded and put back in the storage boxes and transported back to the designated storage facility by the flood response team. Alternatively, the mobile flood barrier can be used for storage of the water as well in the case where storage units are not available.

### **Lessons learned workshop**

After the flood risk is averted, a workshop(s) was conducted to evaluate the concluded exercise. A series of reflection meetings were held with the flood response team, project organization, donors, the local community and the local government to assess the effectiveness of the SLAMDAM technology, discuss challenges and emerging opportunities, and agree on necessary adjustments in the intervention. The meetings concentrated in answering questions in two areas as shown below.

### **Monitoring & Evaluation (M&E)**

The role of Monitoring and Evaluation (M&E) was crucial in ensuring the successful deployment of SLAMDAM and maximizing its benefits. In this context, a dedicated individual was appointed to oversee the M&E process and fulfill the following responsibilities:

- **Tracking and assessing benefits:** The M&E personnel closely monitored the realized benefits of deploying SLAMDAM, comparing them against the anticipated or expected benefits. They gathered data on various aspects, such as flood prevention effectiveness, reduction in damages, water resource management, and community resilience. This data helps in assessing the actual impact of SLAMDAM and identifying areas for improvement.
- **Performance reporting:** The M&E team prepares comprehensive reports that document the performance of SLAMDAM based on the collected data and evaluation findings. These reports provide insights into the effectiveness, efficiency, and overall success of SLAMDAM deployments. The reports include quantitative and qualitative analyses, highlighting key metrics and case studies to support the evaluation.



- **Stakeholder dissemination:** To foster a learning curve in the deployment of SLAMDAM, the M&E team ensures that the evaluation reports are disseminated among relevant stakeholders. This includes government agencies, community organizations, partners, and other entities involved in flood prevention and disaster management. The dissemination of evaluation findings encourages knowledge sharing, best practices, and lessons learned, contributing to continuous improvement and informed decision-making. Overall, the M&E function plays a vital role in assessing the benefits of SLAMDAM, preparing performance reports, and disseminating valuable insights. This process enables stakeholders to understand the real impact of SLAMDAM deployments, identify areas for enhancement, and promote a collective learning experience to optimize future deployment efforts.

## 7. Lessons Learned

This section identifies and captures insights gained during the project. It reflects on what went well, what didn't, and what could be done differently in future projects. Essentially, lessons learned contribute to continuous improvement by helping to avoid the repetition of mistakes and by encouraging the continuation of successful practices, fostering an environment of learning and growth within the (project) organization.

- a. There was great involvement of the local community / stakeholders. The project team had great team members onsite who had a good network and were highly cooperative. The Ministry and the District nominated officers to the project who had a good local network and were actively involved in all project activities.
- b. It was challenging to find the right accessories (Y-Piece) for the demonstration. We wanted to source some accessories locally like the Y-piece however the locally available parts were not compatible with the Dams. This was mitigated by shipping directly from the Netherlands to Uganda.
- c. Steering Committee: This was constituted with a wide representation of institutional leaders. While the meetings were not consistent, it provided overall project direction and oversight.
- d. Collaboration went very well and the project team members complemented each other well. All professional and experienced parties that are of a similar mindset.

## Conclusions

The completion of the SLAMDAM project in Uganda marks a significant milestone in our continuous efforts towards climate change adaptation and flood resilience. The project set clear objectives and developed a clear plan supported by adequate execution of the project tasks; as such, it managed to successfully demonstrate an innovative approach that can have far-reaching implications for future flood control efforts.

The challenges faced were dealt with determination, creativity, and a shared sense of purpose. Collaboration, both within the team and with our supportive stakeholders, proved vital in achieving the goals. The tangible results of the project and the positive responses from the local communities affirms success of this project and the potential for scaling up this technology.

## Annex 1: Pictures





