

# DEVELOPMENT AND TRIALLING A LAMELLA CLARIFIER KIT FOR BULK WATER TREATMENT.

Location: Kyaka II refugee settlement, Uganda.

Timeframe: 2020 – 2022

Project Status: Completed

## 1. PROBLEM/GAP BEING ADDRESSED:

The method of surface water treatment during a first phase emergency response has not changed in 30+ years. Assisted sedimentation through adding a coagulant such as aluminium sulphate (alum) to water has been, and remains, a highly effective and simple treatment process to remove suspended matter and reduce turbidity to enable effective chlorination of water. Batch treatment set-ups work effectively but are labour intensive, require a relatively high level of oversight, a large volume of storage and associated space, and can therefore be costly to operate. Consequently, they are not desirable medium to long term durable solutions.

Oxfam operates such a system in Kyaka II refugee camp. It comprises 6 T70 sedimentation tanks, each of which takes 4-5 hours for a complete cycle (filling, settlement, discharge to clear tanks for chlorination). Whilst these can happen in parallel (so two cycles per tank per day is possible), limiting factors are the pumping rate and capacity of the aerator which reducing the throughput to 40m<sup>3</sup>/hr (400m<sup>3</sup> total daily production per 10 hour day)..

## 2. SOLUTION:

Oxfam has previously undertaken R&D on [Lamella clarifiers](#) with the aim of transferring a technology which is already proven within the Water Industry and demonstrating its relevance for the emergency aid sector. Unlike batch dosing which requires water to be left for up to several hours for sedimentation to occur, Lamella tubes (or plates) operate on a continuous flow basis enabling higher treatment volumes and because less storage is required, they require less space. The "[inclined plate settler](#)" trialled in Juba between 2015 and 2018 was a prototype small capacity (5-6m<sup>3</sup>/hr) lamella treatment unit. Field trials were a partial success but due to high staff turnover and the complex political and security environment which restricted close monitoring and set up of equipment in an optimal configuration - it left many questions unanswered. The need therefore remains to complete the research to evaluate the applicability and potential advantages of a lamella clarifier, but in a more controlled environment.

GHT WASH team has identified a supplier specialising in lamella settler treatment systems for the municipal water supply and wastewater industry. The specific advantage of their lamella tubes (a form of inclined plates) is the modular "trapezoidal gutter shaped" construction made from lightweight polypropylene which fit together through tongue and groove joints to form a larger honeycomb structure. Components are also able to nest and stack, so already in a kit form suitable for efficient transportation and assembly on site.

## 3. RESULTS:

The kit is time consuming but straightforward to set up taking several days from start to finish due to the time it takes for welding individual plastic tube profiles together.

Continuous suction side dosing was used with 10kg of Alum per 70m<sup>3</sup> of raw water (70-80NTU). Initial trials experienced "short circuiting" of water around rather than through the lamella tubes. Different inlet configurations and flow rates were trialled to optimise conditions for floc formation. At reduced inflow of 20m<sup>3</sup>/hr, the measured outlet turbidity ranged between 20-30 NTU.

A second field trial was undertaken after improving the precision of alum dosing and modifying the inlet and outlet in the Lamella tank. These adaptations were intended to improve mixing and floc formation, ensure only the top layer of water is drawn off and short circuiting is avoided. This resulted in slight improvements to turbidity (14 NTU) at flow rate of upto 25m<sup>3</sup>/hr. It was not possible to achieve the target of <5 NTU, required to ensure effective chlorination.

## 4. LEARNING/APPLICABILITY ELSEWHERE:

Ultimately success is benchmarked against the lamella outperforming the existing batch treatment system against any of the following parameters i) producing a greater volume of treated water in a given time within a

smaller land footprint, ii) Requiring less inputs (labour/chemicals) and perceived to be simpler, iii) lower set up and operational cost for comparable water output and quality. Unfortunately none of these benchmarks were achieved during the Uganda Kyaka trial. Similar issues were experienced in a parallel pilot in Cox's Bazar funded by Bangladesh team.

The prototype lamella is not operationally efficient as to clean and desludge the tank requires emptying and manual cleaning. Even if better results had been forthcoming, further design improvements would still have been necessary to make it fit for purpose i.e. desludging by opening a gate valve.

Since the Uganda trials Oxfam has consulted with Prof. Caetano Dorea (University of Victoria, Canada), a long term collaborator, water treatment expert and designer of the inclined plate settler. His advice was that efforts should focus on improved stirring to facilitate better floc formation is the most likely weakness of the system. This could be explored through post graduate research but that will require more time and funding.

In parallel Oxfam approached Enxio, a German based company that produces commercial lamella equipment in circular tanks which are potentially compatible with Oxfam T11 tanks. This company had the initial patent on the lamella profiles used by Aqua Equip technologies (which was founded by a former Enxio employee) in Uganda. In the event that they can propose a proven solution or an adaption of something already tried and tested, which addresses the observed weaknesses of the T70 Lamella prototype, it may still be worth once last trial.

## 5. ADDITIONAL INFORMATION:

Project documents ([Box link](#)), [Installation of the lamella system](#); [Initial test \(2021\)](#); [Further testing \(2022\)](#). A HSP and GHT Advisor was deployed to manage the field trials. This ensured we had confidence in the process and the results of the tests were reliable, even if they were not what we'd hoped for.

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