

BACKGROUND

Since 2007, ChildVoice's Lukome Center in northern Uganda has provided a therapeutic community for adolescent girls including former child soldiers and sex slaves, war orphans, child mothers, and other, highly vulnerable girls from Uganda and South Sudan.



At the Center, girls can recover from the trauma of war and receive the educational and vocational training to help rebuild their lives.

EXISTING CONDITIONS

EcoSan composting stalls/toilets...

- require regular shoveling of solids and
- generate unpleasant odors, which is
- time consuming and laborious to maintain;
- especially, during monsoon season, the clayey subsurface becomes oversaturated.



GOAL



...To restore the dignity of the mothers, staff, and image of the ChildVoice Lukome Center by designing a new wastewater system that is, effective, low maintenance, and low cultural or environmental impact.

WW DESIGN FLOWS

Source <i>*including meals</i>	Water Usage Rate (gpcd)	# of People	Total Flow (gpcd)
Toilets	25	150	3,750
Residents*	6	100	600
Staff & Visitors*	9	20	180
Total Flow (gpcd)			4,530

WW DESIGN DECISION MATRIX

Alternative Design <i>*1 = worst, 2 = fair, 3 = best</i>	O&M*	Construction Costs*	Seasonal Flexibility*	Total
Partially Mixed Aerated Lagoons (PMAL)	2	2	2	6
(Non-Aerated) Facultative Lagoon	3	2	3	8
Constructed Wetlands	1	1	2	4
Septic Tank & Leach Field	2	1	1	4

SEWER PIPELINE DESIGN



KEY:

- The pipeline branches are shown in **yellow**,
- the **black/gray** box in the northwest corner shows the location of the two (2) Facultative Lagoon cells,
- 2% slope towards the northwest corner is shown in **blue**,
- **[1]** is the primary discharge option: Fishponds, &
- **[2]** is the secondary discharge option: Overland.

FACULTATIVE LAGOON DESIGN

Inlets that assure inflow distribution, vegetation to prevent erosion, and clay liners to prevent seepage;

- Total lagoon depth (bottom to berm) = 10 ft,
- Water level \leq 6 ft,
- Biological Oxygen Demand (BOD) concentration \approx 200 mg/L,
- BOD loading rate \approx 70 lb/acre-day,
- Two (2) cells in parallel:
 - use second cell when BOD loading rate of first cell exceeds 90 lb/acre-day (i.e., monsoon season),
- Area required \approx 0.108 acres, &
- Detention time \approx 46.583 days.



O&M

- Establish and maintain ground cover,
- Remove any trees and additional vegetation,
- Avoid herbicide usage,
- Prevent undesirable materials from entering WW system, maintain desirable water depth of less than 6ft;
- Repair berm damage (as needed), evaluate WW lagoon conditions, maintain essential lagoon features, pay attention to odors, measure and record sludge, &
- Regularly cleanout distribution boxes (as needed).



MATERIALS

- 4" PVC pipe \approx 1600 m (5249.3 ft); including various shapes, fittings, segments, etc.
- Four (4) concrete distribution boxes (aka. "d-boxes" or "manholes") for each point that pipe branches meet and/or change direction,
- Ten (10) flushable toilets (3.0 L) [0.8 gal] to replace EcoSans,
- Vegetation for erosion control, fencing, & adequate signage to prevent hazards (i.e., drowning).

SUMMARY & CONCLUSION

- Replacement of existing wastewater system,
- Addition of an on-site treatment system that could be easily maintained and operated,
- Installation of sewer pipeline that connects the six (6) WW collection sources to the new treatment system:
 - 2% existing slopes allow for easy flow by gravity, &
- Discharge treated effluent to the three (3) fishponds-in-series that connects to the local stream.

REFERENCES

NHDES: New Hampshire Code of Administrative Rules, Kansas Environmental Health Handbook (2020), & Lecture/Class Notes (provided by Professor M.R. Collins).

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