Small Scale Irrigation Project at Abba Samuel River Watershed, Ethiopia

Kelsey Reeves, Alexander Curry, Lori Fomenko, Yamil Roman
Department of Civil and Environmental Engineering

Project Overview

Objectives
- To build a sustainable irrigation system for a rural community in Ethiopia

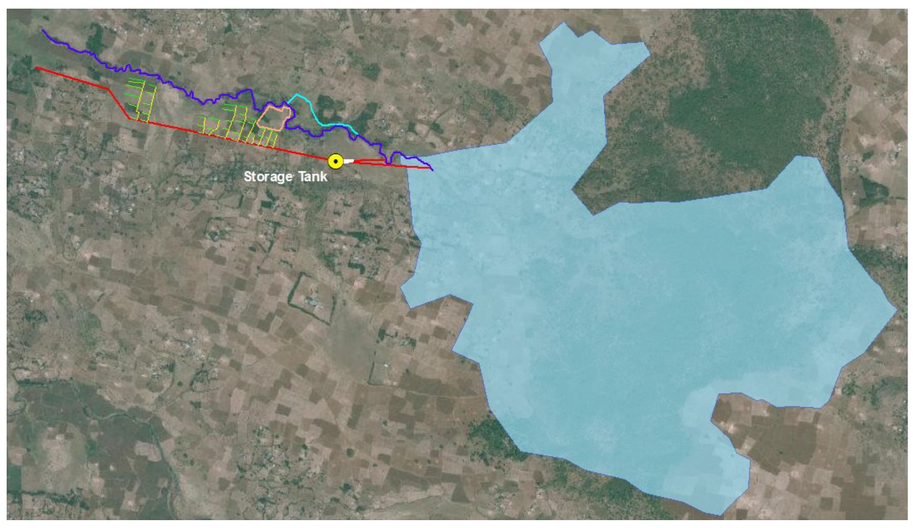
Background
- Community faces food insecurity and economic stability challenges
- The farming dependent community is located near to Woreta in the Fogera District of Northern Ethiopia

Constraints
- System must be culturally appropriate, maintainable by the community, and built of local materials
- Limited data on the project site in regards to topography, soil types, and the water cycle

Goals
- To reduce poverty for a community located in Ethiopia by means of irrigation

Conceptual Site Design and Existing Conditions

Water Resource Collection, Storage, and Management

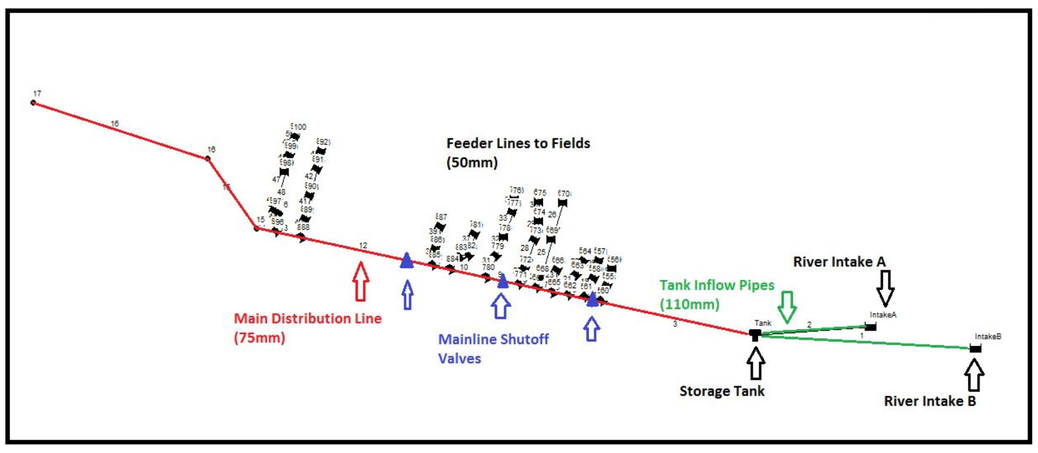


Key:
Light Blue Polygon = Watershed
Yellow Point = Location of Proposed Storage Tank
Dark Blue Line = Existing River/Waterway
Orange Polygon = Fields currently irrigated by existing waterway
Light Blue Line = Existing Distribution System
Red Line = Distribution System: Main Line
Yellow Line(s) = Distribution System: Feeder Line(s)
Green Line(s) = Irrigation: Furrows

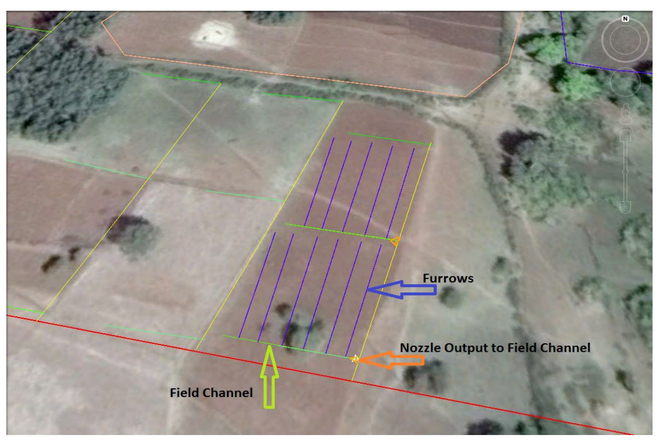
- The shown watershed, with an area ~2.75 km^2, provided an estimate of anticipated flow direction and accumulation based on the topography of the area.
- Precipitation data was used to determine the expected annual volume of water that could be stored.
- The existing river bed will be the main source of water for irrigation. A dam currently in place on the river is near the outlet of the watershed, which serves as a major point for water accumulation.
- The distribution system has two inflow lines coming from points of highest accumulation near the beginning of the existing waterway. The ferrocement storage tank is placed where these two inflows converge. The distribution main line system extends from the tank. Branches off of the main line connect with furrows for irrigation.
- The entire system is gravity-fed and made of PVC piping

Final Design

Irrigation Site Layout

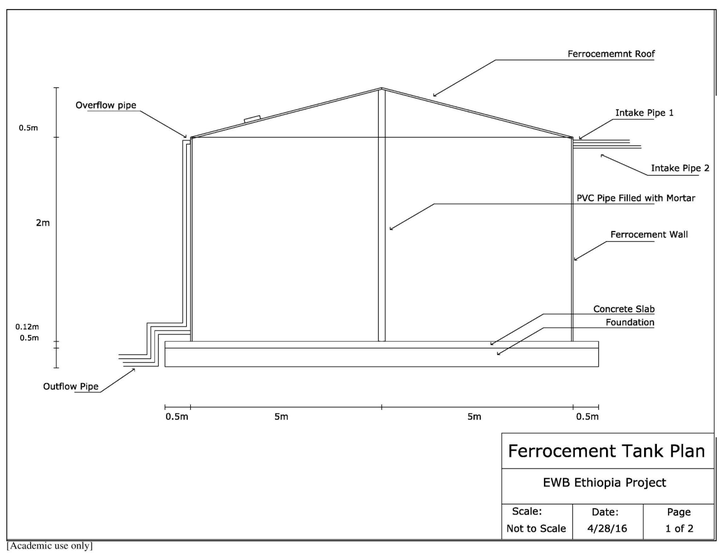


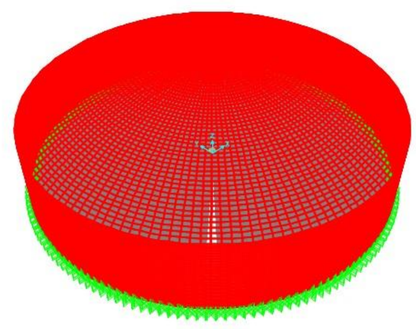
- EPANET was used to determine appropriate pipe sizes and the placement of valves
- Pressure calculations from EPANET were used to determine how valves along the mainline should be regulated in order to compensate for a lack of pressure in the tank as the water level drops over the duration of the dry season[4]

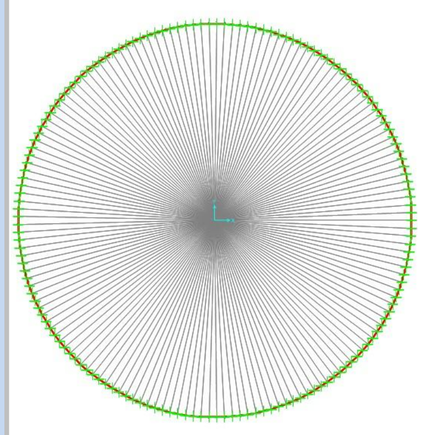


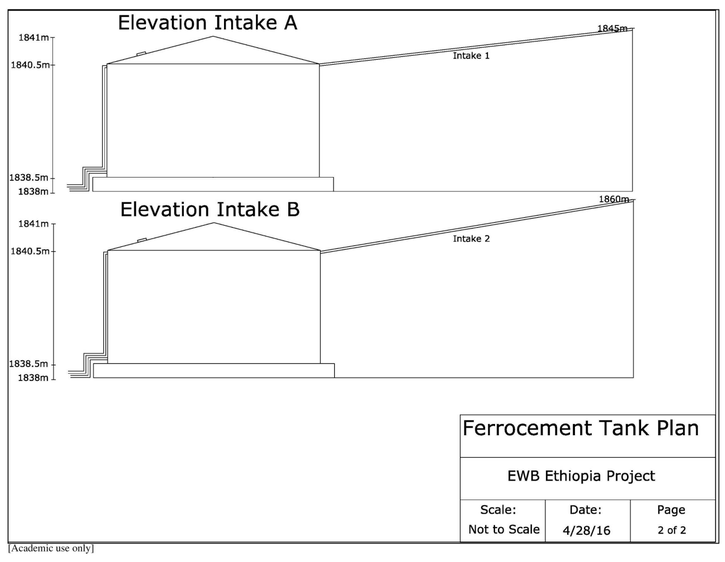
- Pressure from the tank and pipes allow water to exit the feeder pipes into field channels
- Man-made furrows continue water flow downhill and deliver to crop roots through infiltration

Ferrocement Storage Tank









Additional Data Required

- Additional precipitation data for increased accuracy in expected water volumes
- Soil samples throughout the area for infiltration rates and foundation design
- Evaporation data
- Wet season conditions i.e. where and when flooding is likely to occur, height of the water in the existing waterway, the extent of overflow, if any, from the river, and runoff rates
- Full survey with proper equipment of the area, especially the area in which the storage tank will be placed before the design is implemented in the community

Cost Analysis

Section	Cost (USD)
Inflow Lines	3,416
Mainline	3,219
Branches	2,366
Storage Tank	4,923
Total Cost:	$13,924

References

[1]United Nations High Commissioner for Refugees (UNHCR)
[2]Building Code Recommendations for Ferro-cement (IFS-10-01)
[3] ITACA Appropriate Technology Specialists
[4] EPANET National Risk Management Research Laboratory

Acknowledgments

- University of Connecticut Engineers Without Borders
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