



2019 On Site Review Report

by Rahel Shawl

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Warka Water

Dorze, Ethiopia



Architect

Architecture and Vision

Client

Emergency Programme, Italian Development Cooperation

Design & Research

2012-2015

Completed

2015

Warka Water

Dorze, Ethiopia

I. Introduction

In Ethiopia, according to a 2013 UNICEF annual report based on WASH (water, sanitation and hygiene) studies, only around 62% of the population has access to potable water. For many people living in remote parts of the country, access to clean and unpolluted water from pipelines, wells and streams is a daily challenge. The Italian architect Arturo Vittori noticed this during his travels to the Ethiopian highlands, when he saw people struggling up into the hills burdened with heavy loads and carrying water from far-off streams and wells. Upon his return home he started studying and researching possibilities for alternative methods of water collection; harvesting water from the atmosphere.

His ideas were inspired by the local vernacular construction systems in the villages of Ethiopia and water dew collection from nature's resources. After three years of research work and building various prototypes, in May 2015 the architect, with his collaborative team in Ethiopia, developed the Warka Water tower, an alternative water-source prototype project in the highlands of Dorze village in south-west Ethiopia. The prototype tower estimated to collect 100 litres of potable water per day was designed to harvest water from rain, fog and dew.

II. Brief historical background

While travelling the highlands of Lalibela in the northern part of Ethiopia in 2012, architect Arturo Vittori noticed women and young children carrying water up the difficult slopes to bring it home for their use. The water wells and streams are often located very far away or in the lower landscapes, mostly contaminated and often not fit for drinking. Even though this is the case, these communities carry heavy loads of water for long distances, in locally made clay pots or reused plastic containers. Although people live in beautiful natural environments, the associated challenges of living with lack of clean water are huge, directly and indirectly affecting the health and wellbeing of the inhabitants.

Perturbed by these realities and determined to alleviate the lack of water for these communities, the architect came home to Italy and started design work on an alternative water-source system. Through his office "Architecture and Vision" and collaborative partners from EiABC (Ethiopian Institute of Architecture, Building Construction and City Development), the architect and his team started researching ideas of extracting water directly from the atmosphere.

The tall and elegant triangular structure that came to be called 'Warka Water' was made out of a structure of split and woven bamboo, with polystyrene net for water harvesting and a plastic container for collecting the water. Using ideas from vernacular sources and cutting-edge computer technology, the group spent the next three years designing, experimenting, researching and building around ten scale models and prototypes. In May 2015, the group reached an important milestone with the construction of the first pilot prototype V3.2 on a chosen site in the Dorze highlands, a rural community living in the south-western part of Ethiopia.

III. Project development

A. *Geography and climate*

The design of the Warka Water tower was inspired by the lifestyles and cultures of the Dorze people. These communities live at 2,600 metres above sea level in a beautiful location 45 kilometres from Arba Minch, the nearest city in the Great Rift Valley of Ethiopia. The highlands of Dorze receive dew and moisture from the lakes of Arba Minch (Abaya and Chamo) located in the lower lands at 1,250 metres above sea level. The climate of this region is mostly warm and temperate with annual average temperatures of around 16°C.

B. *Structure*

The design and construction of the Warka Water tower was ingeniously adapted from local knowledge, vernacular architecture and the beautiful craftsmanship of Dorze huts, which are constructed from split bamboo interwoven into upright stands. The Warka Water prototype V3.2 built in Dorze was 9.5 metres tall and weighed 80 kilograms. The elegant triangulated frame design was initially inspired by the masero, a type of clay pot used by local women to carry water from streams and wells in rural Ethiopia.

The structure itself was constructed from split local bamboo canes woven into a lattice pattern, optimised for lightness and strength while offering stability and robustness. It is modular and quick to assemble, making it easy to transport and manoeuvre. There are five modules layered from top to bottom, securely connected to each other using natural fibre ropes. The structure sits on a circular foundation of easily assembled local stone blocks and is further strengthened by using a circular form with eight fixing points placed radially around it. These points are securely anchored to the frame, while different-size triangulated ropes are fixed around the structure, stabilising the tower and helping against strong winds.

C. *Water harvesting*

The architect's inspiration for using polyester nets to harvest water was from his observing water condensation on the nets left hanging overnight on olive trees in Italy. He also researched examples from nature of plants and animals that have developed singular "skills" to enable them to collect water from the air and survive in the most hostile environments. These include the Namib beetle's shell, lotus leaves, spiders' webs and the fog collection and water storage system in cactuses. Water collected from rain, fog and dew rolls down over this net into a polyester sandwich membrane used as a funnel and filtration channel and on into a 3,000-litre water-collection PVC tank.

D. *Socially responsive design*

In addition, Warka Water derives its name from a huge fig tree found in Ethiopia that is loved and used by communities as a space for gathering and hosting of social activities. The Warka Water project not only uses this as a name but also has translated the concept into an architectural product, creating a canopied space where communities gather. Women and children come together under the canopies and engage in productive and educational activities rather than wasting 2–3 hours per day on carrying water from remote areas.

In addition, while the main aim of the Warka Water project is to alleviate the scarcity of potable water for people, it is also envisaged to provide water for livestock, small-scale irrigation and vegetable gardens. This can help alleviate poverty and create self-sufficiency in this village. Manufacturing the Warka Water tower locally and sourcing indigenous materials creates jobs and a further boost to the local economy.

E. Sustainability

Warka Water mainly uses local natural and biodegradable materials and is considered to be a zero-waste construction. Apart from the tank and polyester net (which are still undergoing study to make them more applicable to the idea of sustainability), it is a flexible, portable and temporary structure designed to leave no trace on the environment after removal.

F. Scaling and cost

The construction of the Warka Water tower takes about four weeks for fabrication plus one day of assembly time by a team of ten people. It is configured and designed so that the local communities could build it repeatedly without extra scaffolding or special tools. The prototype built in Dorze was estimated to have cost 1,500 USD for materials, although some parts like the bamboo were donations from local industries and not accounted for in the cost.

IV. On-site assessment

It is difficult to make a real assessment of the Warka Water prototype built in Dorze in 2015 as upon visiting the site, one could only see the ruins of this once spectacular project. The observation rather was to see how this project continued to serve the people in water collection, had fared structurally, and had impacted the community in the months and years following its erection:

- From information collected from the architect, Arturo Vittori, he himself had not been able to visit the site due to turbulent political times in Ethiopia. Students from EiABC who had been involved in the research and production of the Warka Water tower had been to the site thereafter to monitor the project (July and September 2015).
- The level of performance and water collection from the Warka Water prototype was around 100 litres of water per day, according to architect Vittori.
- Residents in the area reported that water was being collected from the tap from June through to October; while in November it slowly trickled down and dried as the rainy season came to an end.
- Today the Warka Water prototype in Dorze sits in a small heap on the site, long abandoned by the research team and the people. From what could be seen, the remaining items on site are the polyester net and the 3,000-litre water tank, while most of the bamboo had collapsed due to weathering.
- According to residents, the structure remained in place for almost 11 months after the inauguration. Unfortunately it finally collapsed mainly due to general neglect and absence of ownership. Though a fence had been added after monitoring activities, animals and children venturing into the fenced area and tampering with the structures and ropes continued.
- No further data could be collected from local student collaborators at the EiABC as they could not be found during this review. Architect Tadesse Girmay who was the local representative was not involved in the aftercare of the Warka Water project.

The communities of Dorze tell stories of hope that was promised and not fulfilled through the Warka Water project. They were excited and hopeful that their some of their water problem would be solved as explained to them by the architect and his team, and today are rather disappointed that this did not come about and the project was abandoned. Water still remains a scarce commodity to the residents of Dorze.

The Warka Water project however has become quite an internationally acclaimed project. Its beautiful and elegant structure coupled with the innovative ideas and social character of the project have made it a huge success. It has received many international awards and been presented in various exhibitions and filmed and photographed extensively. Since the Dorze prototype V3.2 in 2015 and from the learning taken from it, architect Vittori and his team have gone on to further experimentation and research on various prototypes and modifications of the Warka Water concept around the world in places like Togo, Cameroon and Haiti.

V. Project data

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VI. Bibliography

The project has been published, documented and featured extensively. For full details of awards, workshops, documentaries and publications, please refer to ‘Warka Water 20.04.2019’ for recent updated information:

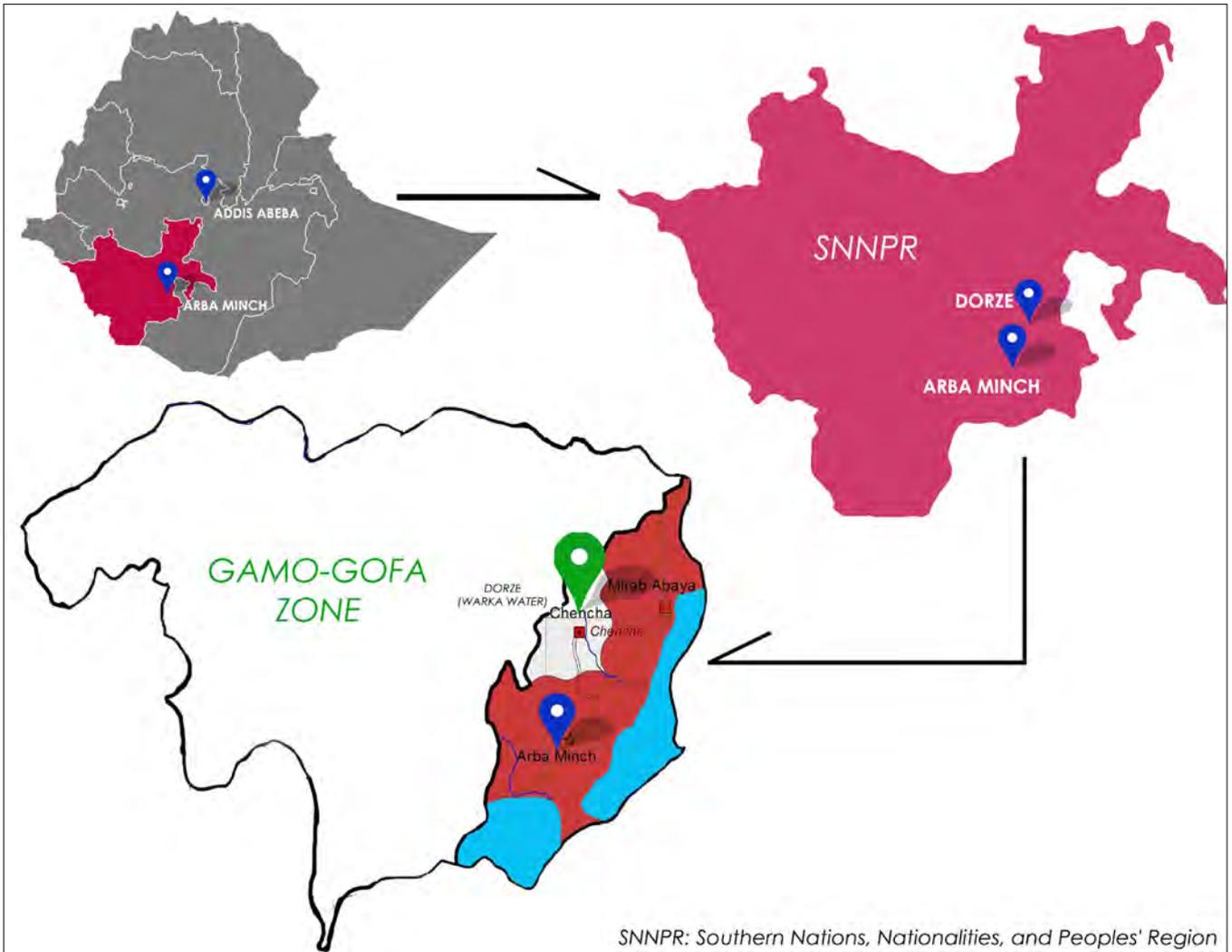
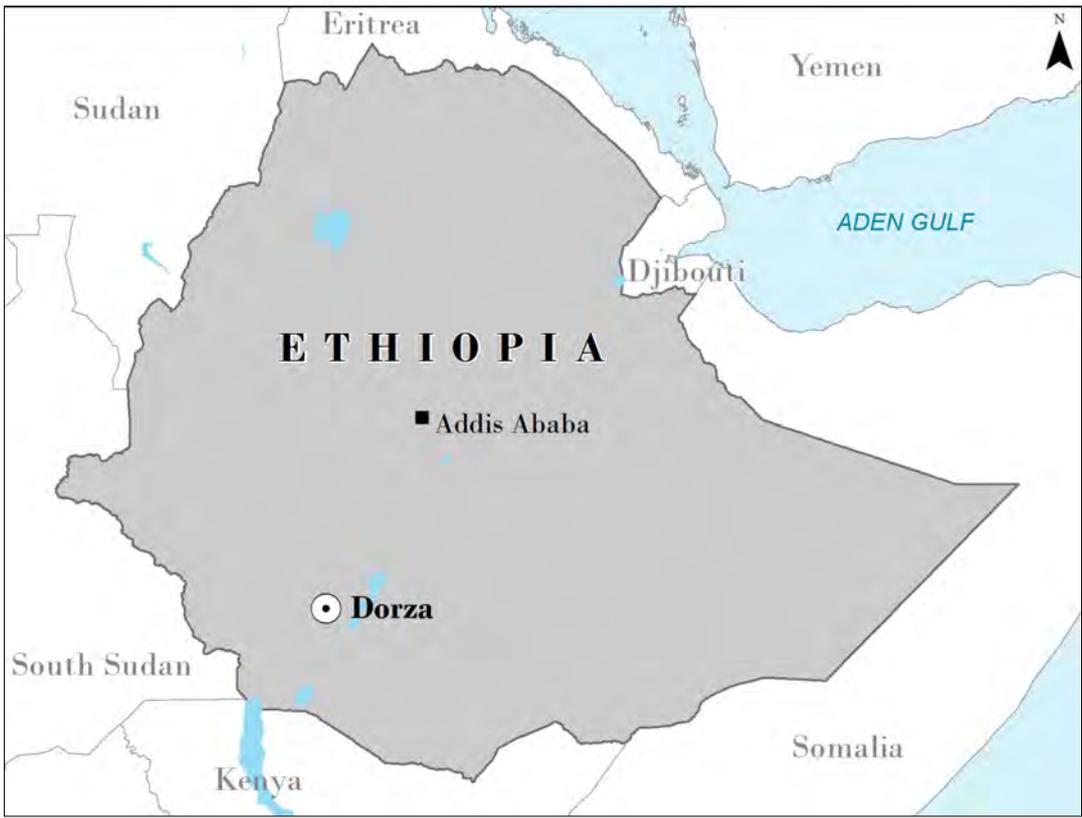
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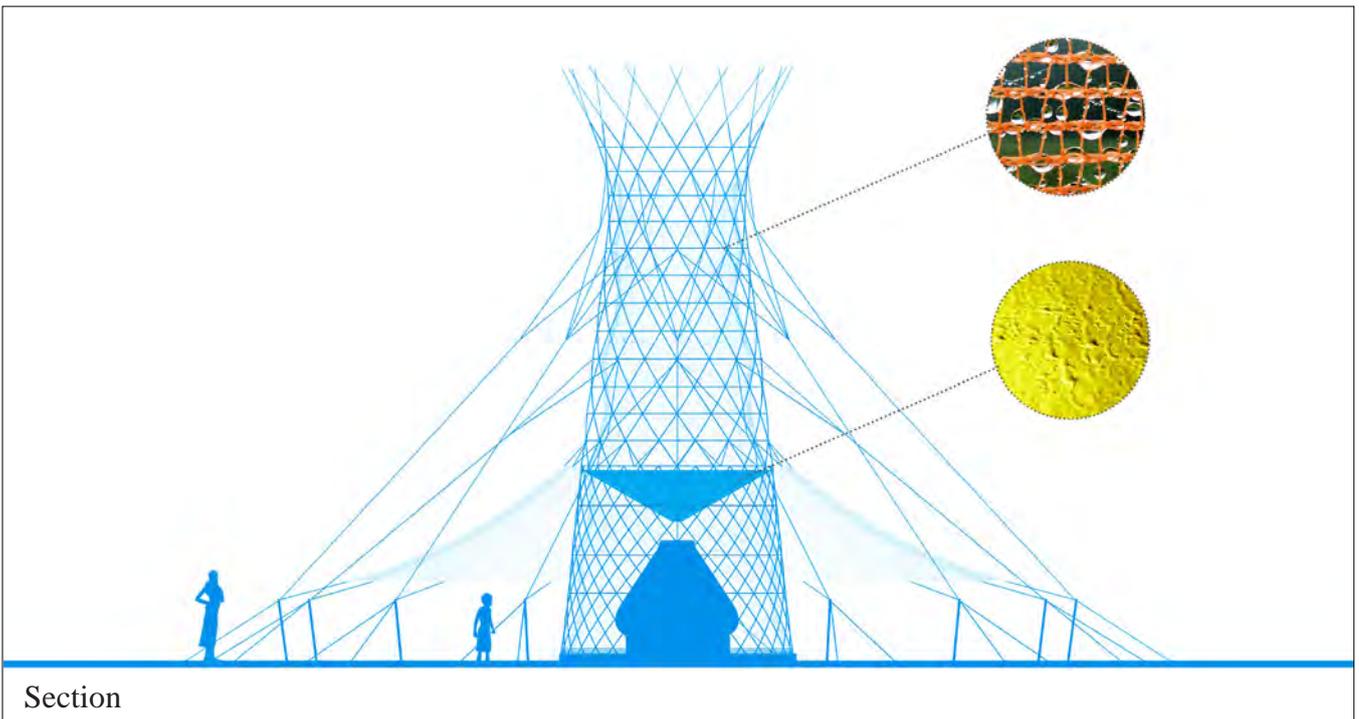
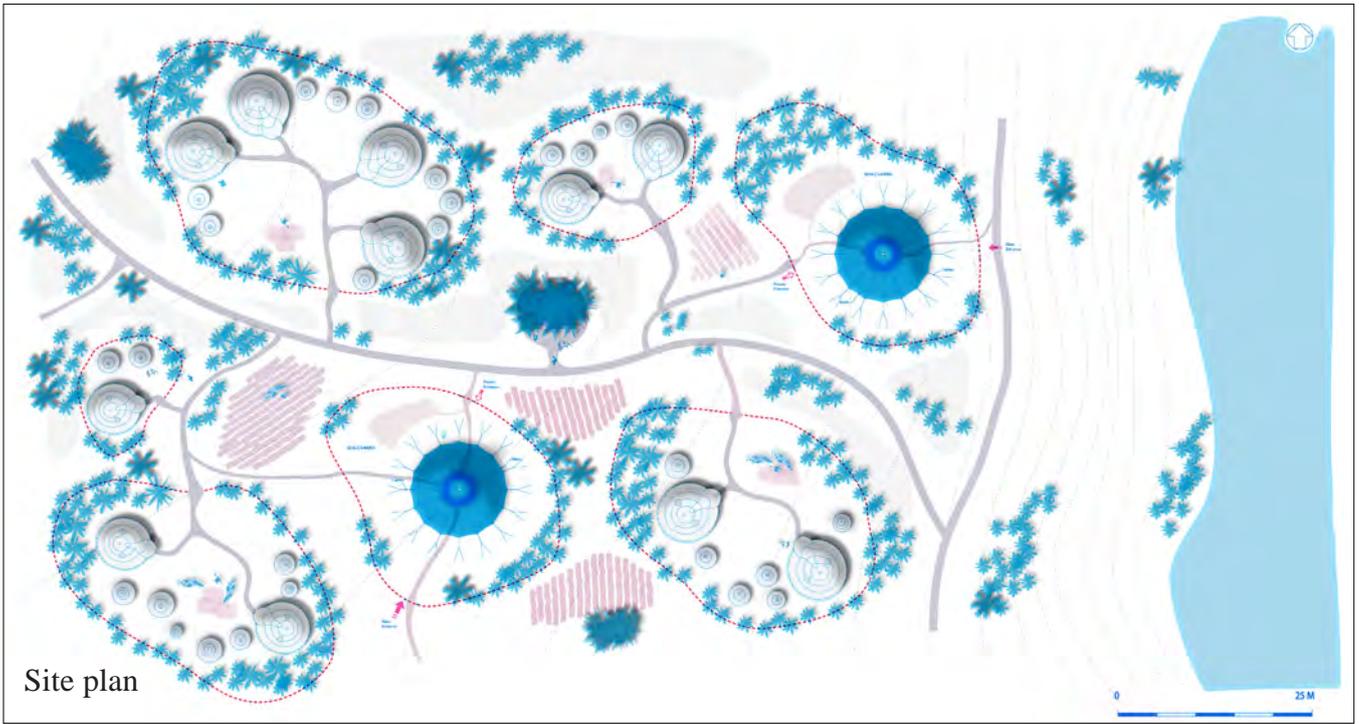
Biography

Arturo Vittori (born in Viterbo, 1 October 1971) is an Italian architect, designer and artist. He is co-founder and director of the research and design studio Architecture and Vision, CEO of the American nonprofit Warka Water Inc., and founder of the fashion brand Culture à Porter. After graduating from the Faculty of Architecture at the University of Florence, he gained experience collaborating with architects such as Santiago Calatrava and Jean Nouvel. From 2002 to 2004 he was Manager of Cabin Design at Airbus, in Toulouse (France), taking part in the cabin design for the first A380 aircraft; from 2004 to 2006 he worked with Future Systems, collaborating with Anish Kapoor in the design of the Monte Sant’ Angelo underground station in Naples (Italy), while in 2006 he practised yacht design at the London-based studio Francis Design. He has spoken at numerous international conferences on the topics of aerospace architecture, technology transfer and sustainability, and also taught and led workshops on a variety of related themes. Vittori has taught Industrial Design at the First Faculty of Architecture “L. Quaroni”, University of Rome La Sapienza; Product Design at the Faculty of Arts and Design at the IUAV University of Venice; and Architecture at the Illinois Institute of Technology in Chicago.

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May 2019







The structure sits on a circular foundation made of stone blocks.



Five modules are layered from top to bottom and connected to each other using natural fiber ropes.



Several ropes stabilised the tower against strong winds.



The tower structure is made of local bamboo, polyester



Water is collected from rain, fog and dew. The polyester net membrane captures water, filters and channels it into a 3,000 litres water collection PVC tanker.





The canopied space, inspired by a local fig tree named “warka”, is also used for community gathering.





The structure remained for around 11 months before it collapsed. It is mainly due to a lack of maintenance.



Warka Water is meant to be biodegradable and is considered to be a zero waste construction, apart from the tanker and polyester net.



After the construction of different prototypes based on Warka Concept have been implemented in different countries, the architect and his team conducted further researches and several projects have been implemented in Togo, Cameroon and Haiti.

