**AQUEDUCT**
Technologies: **atmospheric- and rainwater harvesting, water purification (UV, nanotechnologies), algal generator**

Annual Capacity: 18250m³/4821140gallons of Water (prototyping area)

**SUPPORTING**

Water supply is an essential life provision and a vital element of life quality. The Aqueduct is an **advanced multifunctional structure** serving remote community as transmitter, storage, pressure generator or canopy but also as an atmospheric and rainwater collector and its purification processor.

Water is experienced throughout the Aqueduct and can be easily led to housing and other development areas. The designed structure is adjustable and scalable, while the aesthetic of Aqueduct responds to the surrounding and matches the natural environment around it.

Bringing it to the simplest, two spatial definitions of Aqueduct are notable. The bottom part is designed as bearing elements with limit to a minimum footprint designed as 4 anchoring points. Created with a way the ground level is barrier-free and allows on land usage. Proposed here can be a wide range of activities starting from greening, through smooth and free from obstacles transport to gathering arrangements. The upper part, which should be raised above potential roofs, allows water collection as an alternative method. The whole structure is made up of three different modules that are rotated and reassembled for a more economical and faster construction. The designed structure is flexible and adjustable to future dorp extensions and growth. Organizing available on-site water sources, the Aqueduct offers direct treatment that is suitable for each water class and transmits water to further target points. As a target assumed is either 1st class potable water or 2nd class industrial water.

**TECHNOLOGY**

The aqueduct uses various modern technologies dedicated to collection and purification. Lo-tech facilities for **atmospheric and rainwater collection** are an alternative, passive water source to drills. The upper part of the structure stretching across Fly Ranch is organized as system of membranes and meshes.

A hydrophobic PTFE membrane is used for rain collection and simultaneous weather protection. For the atmospheric water collection, a lightweight PE mesh is designed as fog catchers. Considering its further purification, collecting water overhead is highly profitable. The purification of such water can be done with a mere **hardening** (adding minerals). Before storing, the water is exposed to UV-C rays, in order to be sure, it is the most clean and healthy one.

Benefiting from such a vertical arrangement is a barrier-free ground level preserved for controlled transfer of people or goods along Fly Ranch.

**DEMANDED INPUT**
The aqueduct supports a close/tight cycle of water flow on site, but equally, it requires additional sources of electricity to run and work. The demand of water is strictly bounded with the size of the dorp.

Economical water use in a dorp (with 500 – 1 000 habitants) predicts 50-100 liters per person and day. This defines the capacity of the water tank which should reserve approx. 50m3. The most effective system is composed of the rain- and atmospheric (R+A) collection working closely with supportive ground water sourcing.

For both of the water generation systems important is energy provision. Significant is the power for the water pumps in the Flower Tower. The distances depend on the water mirror level in the water-bearing ground (underground pump) and the relative height of the water tank (on-ground pump).

The working time of the pump is calculated for 12h of continues work. Critical is the equation defining the demanded power of the pump: **P= (Q\*H\*g\*q) y**

Considering the underground pump and the water mirror depth as 100m we need energy of 1,2 kW.

Considering on-ground water pumps and the maximal relative height as 15m the energy demand for a single pump is 155W.
The membrane and fog catcher could need seasonal maintenance, what has been thought of while designing the Aqueduct. The textiles are attached to steel elements with eyelets at the end of timber elements and can simply be clicked-in and out. The maintenance can be easily done from a bridge structure.

**GENERATED OUTPUT**

The gain of water with use of atmospheric and rainwater collecting systems is based on surface generation. The proposed prototype of the Aqueduct structure is 330m-long. This span stands for over 1650m2 of membrane and over 3100m2 of fog harvesting surface. Collected rainwater is estimated as 300.000l annually while daily earn of atmospheric water varies from 12 450l to 31 125l.

Their output is linked with the weather conditions, but considering the analyzed data it is possible to collect 4-10l/m2 of atmospheric water with the designed atmospheric water collecting system.

In order to meet the assumed demand of 50m3 designed within Water Flower Tower is a drilled well which provides from 19-38 m³ per day.

In the entire water flow the additional substances are produced and used in different areas: biogas and sediment (biomass) from the wastewater station are translated into the algal reactor input and take part in the power production, nitrate and phosphate become fertilizers while renewed water can be used once again in industrial cycle. Grey water from residential units is reused at the spot and managed by the users. Thoughtfully managed closed water loop is enhancing the dorps’ life flow.

**PRIMARY MATERIALS + DIMENSIONS**

The bearing elements are proposed to be shaped as a wooden skeleton with the shrank to minimum ground work and foundation demand. The aqueduct is designed with all the connections being detachable or using press-in/-on with a third steel element. Wood can be sourced in the surrounding area, processed, crafted and easily assembled skipping heavy equipment. For the main construction are used 28cm⌀ lumbers and 12cm⌀ - 20cm⌀ for the supporting structure.

**PROTOTYPING STRATEGY**

The Aqueduct is the vein of Fly Ranch and will be developed together with the site development.

Important in the prototyping phase would be optimizing systems and structure balancing their effectiveness. First test area is focusing on atmospheric and rainwater harvesting and its upgrade possibilities in order to find suitable design solution for the specifics of the climate. Further development of Aqueduct is linked with its structural design and a shift from standard mechanical connections towards monomaterial connections will be encouraged.

In the prototyping phase a small, but fully developed Aqueduct will be built-up together with Flower Tower in the south and wastewater treatment station in the north. In this phase the Flower Tower should generate pressure and equal accessibility to water with its simultaneous purifying process and storage.

After the evaluation of an Aqueduct prototype, the first part connecting 1-st and 2-nd development area should be build-up. In the end, the Aqueduct will zip the site in north-south direction.

**ENVIRONMENTAL IMPACT**

To minimize impact on the site and to protect its natural ecosystem was the starting point for the design of a modern aqueduct. The aqueduct is located at the primary site boundary and not only enables the transfer of water, but also saves capacity for passenger connections and freight transport (pedestrians, mutated vehicles or others). So it is a leading structure that also shows the way through the entire Fly Ranch and protects the nature around it from uncontrolled transfer. Integrated in the upper part of the Aqueduct the water collection is an alternative measure to drilling wells. Due to casting shadow the Aqueduct turns the microclimate milder equally as by absorbing humidity biodiversity in the area enriches.

**COST ESTIMATE**

Cost estimation based on materials and does not include labor, working hours and wastewater treatment station.

