

## Hybrid material technology supplies simple solution to water storage challenges

Development of the DEPLOY water storage tank represents one of those Eureka moments, where decades of experience in a field of work deliver a truly innovative solution through the discovery of a new material with which to overcome a variety of practical challenges.

Paul Mendieta's father and grandfather had worked on water storage and irrigation projects in Ecuador for decades when the engineer decided to undertake an MA and MSC course at London's Royal College of Arts and Imperial College and learned about the revolutionary Concrete Canvas which had already been created by two RCA students; primarily to help provide emergency shelters in disaster areas.

Sound engineering logic and some lateral thinking have since seen the cement impregnated canvas employed in forming circular tanks, which can be shipped in a crate and inflated on a prepared area of ground to provide long term storage capacity. These can



be utilised for holding potable water supplies, rainwater harvesting, irrigation and even enable firefighting.

Originally conceived in 2005 by students, and now co-Directors William Crawford and Peter Brewin, for a university design competition, Concrete Canvas comprises a cement filled geosynthetic – initially used for the outer layer of an inflatable emergency shelter – which has the potential to revolutionise different civil engineering works across the globe. Crucially, the material gains strength very quickly as the cement hardens once it has been hydrated in-situ after inflation.

To counter the rise in pressure with increasing depth – a fundamental principle identified by Archimedes more than two millennia ago – the walls of the two metre high Deploy tanks utilise a lower layer of 8mm thick Concrete Canvas Hydro (CCH8), with a second ring of 5mm thick (CCH5) above that. Importantly, the sections of Concrete Canvas feature an edge strip which permits them to be successfully heat-welded, while the walls also have a PVC-U inlet and outlet as well as a vent bolted into holes cut through the fabric. The latter of these then doubling as the inflation point where a compressor is connected.

### SITE PREPARATION

Most farmers and smallholders are well used to digging ditches or setting up heavy equipment on their land, so should find the minimal ground preparation required for the installation of Deploy a straightforward task. Basically, saturated soil is not a suitable base substrate and the soil needs to be graded and compacted to achieve a bearing capacity of 100 kPa (100 kN/m<sup>2</sup>): to prevent the weight of the tank, when filled, from causing any settlement.



A layer of sand, three to five centimetres in depth is then spread across the surface; on top of which a square sheet of the Concrete Canvas is spread out and hydrated to form a solid plinth on which the tank can be inflated. This also takes place on day one with the inflated Deploy tank being hydrated using a hose and left to harden. Work on the second day then continues with the detachable lid being 'unzipped' from the top of the walls and a lightweight support cage of glass-fibre tubes rapidly being assembled inside.

There will be three sizes in the range – all designated 'R' for Rural – and two metres in height. The entry level 14R is three metres in diameter and has a capacity of 14,000 litres. The 25R is four metres across and has a capacity of 25,000 litres while the largest, 40R is five metres in diameter and will hold 40,000 litres.

Weighing in at 365, 450 and 600 kg respectively, all three units are delivered in a sturdy wooden crate which measures 2,500 mm by 1,200 mm and stands 700 mm high.

As described by the inventors of Concrete Canvas, the hydrated material has a 'hard armour' surface which protects the geotextile from being punctured in service. It is also resistant to abrasion, UV radiation, weathering and attack from insects or burrowing animals. Importantly it has also proved robust enough to withstand the attentions of cattle who are notoriously inquisitive about water tanks and tend to rub against them. They are also resistant to most chemicals and can be repaired if damage does occur; say from farm machinery.

Paul Mendieta comments: "The combination of the Concrete Canvas material and the manufacturing process my co-founder Beren Kayali and I have developed for Deploy has enabled us to totally transform the pre-conception that concrete infrastructure needs to be bulky, heavy and expensive."

One of the most significant advantages to Deploy tanks is that they can be transported to remote areas and installed far more easily in many cases than rigid plastic tanks. And although these offer good tensile strength, the Concrete Canvas has superior compressive strength and offers all round durability.

Paul Mendieta sums up: "We accompany and guide our customers throughout the entire journey, to ensure that they get the size of tank with the correct fittings which are suited to their requirements; then we supervise the delivery, unloading, inflation and hydration of the tank over a two-day period.

"We ensure that from the beginning to the end of the process that they are comfortable with the product and how to get the best from it: whether that is for straightforward water storage, rainwater harvesting or even emergency applications as might be required by the military or emergency services."

As well as fulfilling a growing number of orders for the smaller tanks, Deploy is in the process of establishing a semi-automated production line to speed the manufacture of more units and thereby increase capacity. The company is also involved with facilitating sports clubs to make much more use of rainwater harvesting for irrigation, in particular keeping turf watered in dry weather when the strain on reservoirs is most severe.

