Advances in slow sand filter skimming.

Case study – 2017/18.

Advances in slow sand filter skimming.

Slow sand filters are at the heart of London's largest treatment works which supply 70 per cent of our water each day. These sustainable biological filters clean raw water using low amounts of energy, but they need to be drained and cleaned every few weeks to keep them productive. We're working on an underwater skimming machine that cuts the time the filters are being drained and cleaned by around 80 per cent.

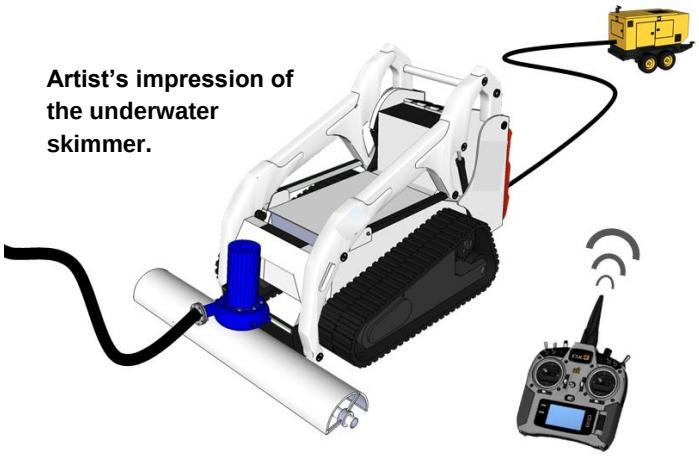
Daily filter skims.

We operate 102 slow sand filters in London to treat raw water biologically, with a total area of more than 3000m^2 for each filter. Almost every day, one of these filters needs us to remove around 250 tonnes of sand to be cleaned and recycled.

After a few weeks of filtering raw water, a green biological layer forms on the surface of the sand, and blocks the filter. This means we have to drain it to allow purpose-built skimming machines and dumper trucks to remove the top layer of sand for cleaning and recycling.

The filter is then slowly refilled and brought back into use, giving the microbiological community at the core of the treatment process time to re-establish. Each cleaning and refilling process takes four days, but we'd like to reduce this to half a day.

Current process: skimmer with dumper truck following behind.



Artist's impression of the underwater skimmer.

New skimmer design.

We're planning to build an innovative skimming machine which combines standard equipment in a unique and novel way.

Our new design of skimmer will travel underwater, collecting the surface layer of sand which will be pumped out of the filter for cleaning and recycling. It will be operated remotely by a technician in a mobile control centre using a laser guided control system, underwater cameras and GPS location equipment.

The machine will use a commercially available tracked excavator which has been stripped down to remove unwanted parts. A conventional cutting head from an existing skimmer will be fitted, together with a submersible slurry pump. The new skimmer will be serviced with food grade oils and powered remotely by a hydraulic power unit on the side of the filter.

Being able to clean slow sand filters while they're still operating will increase water production, minimise the disruption to the biology of the filter, and reduce health and safety risks for our people.

- **We operate 102 slow sand filters in London to treat water.**
- **We're planning to build an innovative underwater skimming machine.**

Thames Water

The project plan.

Last year, we conducted a market review which confirmed that no machine of this kind was commercially available at a scale that would let us clean our filters at the speed we require. So we decided to design and build our own innovative underwater skimmer.

Using a mathematical model, we demonstrated that a fleet of these new skimmers, working across London, could let us produce an extra 60 to 90 million litres of drinking water a day, compared to current skimming methods.

Over the next year, we'll be constructing a working prototype. Our research and development team will build and test the machine using pilot filter studies to establish how the slow sand filter should be operated while the underwater skimmer is in use.

After these tests, we'll put the new skimmer to work on full scale filters to monitor water quality and the performance of the skimmer. The full-scale sand filters will be close to our sand cleaning plant to allow the sand and water slurry to be pumped to the plant directly from the skimmer.

Alongside the tests of the skimmer machine, we'll be working with a supplier of solid and liquid separation technologies to develop a sand dewatering solution, to avoid pumping sand slurries over long distances.

- **Our innovative underwater skimming machine could cut the time taken to clean our filters.**
- **It could also help our people stay safe and make our maintenance more efficient and productive.**

Current process: skimmer in a slow sand filter.

The project team.

The working prototype will be built by a team led by a Thames Water research engineer in collaboration with Affinity Water who is providing an experienced mechanical and electrical craftsman. The team will also include two of our slow sand filter technicians who will eventually be using the new machine.

A promising future.

As one of the world's major users of slow sand filters, we appreciate their benefits but recognise that we need to do more with our existing assets. Our innovative approach should ensure that this technology remains at the heart of meeting our customers' needs well into the future.

This exciting new machine could save time for the whole skimming process – as well as helping our people stay safe - and make our maintenance work more efficient and productive.