

## Protecting a National Treasure

### UPFLOW FILTERS PROVIDE RUNOFF TREATMENT ALONG NEW ZEALAND'S HAURAKI GULF

By Robert Y.G. Andoh



The Hauraki Gulf is an object of fiercely protected national pride in New Zealand. This coastal area along New Zealand's North Island is one of the country's most precious conservation icons due to its vast diversity of birds, plants and aquatic life. Concern about the Gulf has been mounting since the 1990s due to increasing pressures from population growth, an expanding port and international events.

Many companies had sought and failed to receive approval for

development projects at Okahu Landing in Auckland, which overlooks the Hauraki Gulf. Orakei Marina Development proposed 172 new berths and more than two acres of development including a parking lot and gardens. To receive approval for this project, the firm needed to comply with strict environmental requirements and overcome the challenges of working in tidal conditions.

#### RAIN ISSUES

The conversion of open space to impervious surfaces proposed by

Orakei Marina Development would increase the volume of storm water runoff and the risk of downstream flooding. Without proper storm water controls, oil and other materials coming from the cars would get swept directly into the marina when it rained. Multiple treatment processes are typically needed to address the highly variable composition and pollution loading of storm water runoff.

The marina also necessitated the use of a shallow drainage network across the site. During high tide, if the

top of the drainage pipe was equal to the level of the water, seawater backed up into the drainage system. Since the drainage pipe was already filled with seawater, rain water had no place to go at high tide, and this overflow could cause troublesome surface flooding. Therefore, the outfall pipe of the drainage system needed to be higher up in order to accommodate the tidal zone.

### DOWNFLOW FILTERS

Storm water filtration is known to be effective for controlling fine particulates and their associated pollutants. However, a common challenge with traditional surface filtration systems is a slow filtration rate (and hence a large footprint) and a tendency to clog.

With these conventional downflow filters, water flows down through a porous media filter that traps particles. If the particles are too large, they will block the filter and reduce the surface area available for water to flow through. Often developers try to overcome this

problem by increasing the footprint of the filter and thus the amount of water being filtered at one time, but this takes up expensive real estate and involves considerably higher maintenance costs.

Downflow filters are generally not cost-effective for managing runoff because of the relatively high flow rates that occur during wet-weather events. The average one-acre parking lot, for example, can generate approximately 450 gal per minute (gpm) with average rainfall, yet typical downflow filters can only handle 2 gpm to 5 gpm. This is of particular concern in a region such as Auckland, which experiences high levels of rainfall almost year round and receives an average of about 4 ft of rain annually.

Maintenance of such large systems is also a consideration. Having a downflow system the size of a baseball field, for example, could require removal and replacement of the top 3 in. of the sand filter three to four times a year. In addition, the capital expense for these



*Upflow technologies provide room for filter media to swell and circulate.*

enormous filters is cost-prohibitive, and the filter media tends to stay submerged in water, creating an environment ripe for bacteria growth.

### GOING UPFLOW

To tackle these challenges, Orakei Marina Development hired Hynds Environmental Systems Ltd. The company supplied three Up-Flo Filter units to treat

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runoff from the marina's northern, central and southern parking lots totaling 3.1 million gal. Hydro International of Portland, Maine, developed the filters.

The Up-Flo Filter has very low headloss—the difference in height between the top of the water level upstream of the filter and the top of the water level downstream of the filter—compared with other filtration devices.

Unlike traditional sand filters that can require 4 ft or more of headloss to operate efficiently, the Up-Flo Filter has approximately 29.5 in. of required headloss at peak operational capacity.

The Up-Flo Filters employ multiple methods to treat runoff from critical source areas such as parking lots. The sump eliminates coarse grit and gross debris; the chamber eliminates floatables and trash; the angled screen handles neutrally buoyant material; and the filter media screens out fine sediment, hydrocarbons, metals, organics, herbicides and nutrients.

In the new system, water flows upward, allowing particles to fall away from the filter to prevent clogging. During a storm event, water enters the chamber within the device via an inlet pipe or grate. Gross debris and sediment settle out in the sump, and as water fills the chamber, flow is directed up through an angled screen and flow distribution goes through media into the filter module. This way, the flow is distributed evenly across the media for maximum treatment. Treated flow exits the filter module via a conveyance channel to an outlet module.

In systems utilizing upflow technology, there is enough room inside for the filter media to swell and circulate through the device. The system is designed this way intentionally because the added room ensures a higher flow-through capacity. In addition, a drain-down system keeps the media from staying submerged between storms. This alternative approach has been vetted by the Auckland Regional

Council, which approved the Up-Flo Filter for storm water runoff treatment.

As a result of using this advanced filtration system, Orakei Marina Development was able to exceed the council's requirements for storm water treatment. The system removes more than 90 percent of particles, with a mean particle distribution of 20 microns. Based on the success of the Orakei Marina project, other areas of New Zealand now look to Auckland for guidance on the best treatment technologies for a particular job. **SWS**

**Robert Y.G. Andoh is director of innovation for Hydro International. Andoh can be reached at 207.756.6200.**

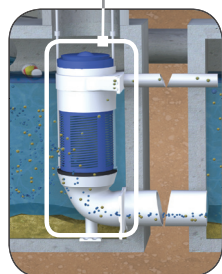
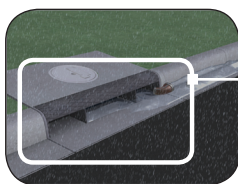
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