Executive summary

This project was aimed at addressing the potential for algae harvesting within some of Bay of Plenty Regional Council's eutrophic lakes.

Aquaflow have developed a technology for algae harvesting and this trial is the first opportunity to test this technology on wild algae within a lake environment with the objective of improving water quality by removing algae and its associated nutrients.

This project focuses primarily on harvesting of algae and the removal of nitrogen from the lake.

The Ōhau Channel was identified as an ideal location to test this equipment. This is because of a consistent flow of water from Lake Rotorua where water and algae can be taken and delivered to the harvesting system.

The aim of the project was threefold:

- To undertake a "proof of concept" trial to test the capacity for wild algae harvest in a water quality improvement project;
- To test the technology for algae harvesting within some of Environment Bay of Plenty's eutrophic lakes; and
- To fulfil one of the key recommendations from the Proposed Rotorua and Rotoiti Action Plan to investigate the role of biomass harvesting within the Lakes Protection and Restoration Programme.

The project was undertaken for a period of three months commencing April 2010. A suitable site was located on land adjacent to the Ōhau Channel for an intake structure and the associated pumping and harvesting equipment. The take and discharge of water was minimal at 25 cubic metres per hour from the Ōhau Channel flowing at 17 cubic metres per second. Water was returned to the Ōhau Channel in a somewhat cleaner state with algae removed.

Examination of the specific poly-electrolyte used identified no eco toxicological risks. A well mixed representative grab sample of the harvested algal slurry was taken from 1 m^3 containers approximately every two days and analysed for:

- Total solids (g/m^3)
- TN (g/m^3)

A C3 submersible fluorescence/temperature logger was deployed upstream of the inflow to the harvester in the Ōhau Channel. The logger was programmed to give five minute readings for relative chlorophyll-a concentrations, relative phycocyanin concentrations, turbidity and temperature.

Influent grab samples were taken from Ōhau Channel upstream of the intake to the harvester weekly. Effluent grab samples were also taken weekly from a sample tap in the exit line before effluent was discharged into the Ōhau Channel oxbow, downstream of the intake.

Results

Algal laden water was drawn from the Ōhau Channel at approximately 25 m^3/hour from 29 April to 29 July 2010, a period of 92 days. Over this period approximately 94,000 litres of concentrated algal laden slurry had been drawn off the harvesting plant.

The weight of solids extracted from harvested effluent over the trial period was approximately 1,000 kilograms in 92 days.

Based on the difference between the suspended solids (SS) load in the influent and the effluent, the harvester removed on average around 30% of the SS load from the influent.

Removal of organic material showed that over 90% of chlorophyll-a has been removed from the influent. Phosphorous concentrations were lower in the effluent than the influent with on average 59% TP removal achieved, indicating that most of the phosphorous is associated with the suspended solids material.

The resultant 1,000 kilograms of algal concentrate harvested from the Ōhau Channel over the trial period indicates that the harvesting of wild algae from a water body can be successfully achieved by the Aquaflow harvest method.

Over the three month trial period the harvester managed to extract approximately 14.0 kilograms of nitrogen. An estimated 60% nitrogen has been recovered which is on average approximately the same percentage of phosphorus recovered, based on the difference in phosphorous concentrations in the influent and effluent.

To meet half of the nitrogen target for Lake Rotorua of 175 tonnes per annum would require approximately 131,000 m^3 of water to be processed per day. This presents a significant challenge as the test equipment was only capable of 0.02% of the flow. Smaller abstraction rates targeted at algae hot spots may have long term benefits for lake health by helping to break the cycle of algal bloom, algal deposition and sediment nutrient release, by using the Aquaflow system. Identifying these hot spots could be difficult as algae tend to move rapidly in response to wind conditions.

The Aquaflow Harvester is proficient at removal of algae from a water body with fluctuating algal concentrations and species. Any analysis must also consider the costs of deployment (capital and operational) and potential cost recovery from the recovered algae or algae derived product. There is also an aesthetic improvement of the water quality with the removal of toxin producing algae from the water body to facilitate increased recreational use, particularly swimming.