



Phosphorus loads to Lake Rotorua

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A dedication...



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Anthropogenic Phosphorus Loads to Lake Rotorua



2015

ERI Report 66

Client report prepared for Bay of Plenty Regional Council By Grant Tempero¹, Chris McBride¹, Jonathan Abell² & David Hamilton¹

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The Waikato River Photo credit: Waikato Regional Council

Phosphate-based fertilizers have helped spur agricultural gains in the past century, but the world may soon run out of them. Natasha Gilbert investigates the potential phosphate crisis.

en years ago, Don Mavinic was working on a way to get rid of a pesky precipitate that plugs up the works of waste-water treatment plants, Known as struvite, the solid crud forms in pipes and pumps when bacteria are used to clean up sewerage sludge.

Mavinic, a civil engineer at the University of British Columbia in Vancouver, Canada, realized that struvite was more than just rubbish. A combination of phosphate, magnesium and ammonium, struvite contains many of the essential nutrients that plants need. Mavinic has developed a way to remove the precipitate during the water-treatment process and he is now selling it as a 'green' fertilizer. His technology was first used commercially in 2007 in a treatment plant in Edmonton, Alberta, tries. In the future it's going to become more and

phosphorus in the form of phosphate, which has an essential role in RNA and DNA and in cellular metabolism. Every year, China, the United States, Morocco and other countries mine millions of tonnes of phosphate from the ground (pictured above), the bulk of which is turned into fertilizer for food crops. But such deposits are a finite resource and could disappear within the century.

Experts disagree on how much phosphate is left and how quickly it will be exhausted. But many argue that a shortage is coming and that it will leave the world's future food supply hanging in the balance.

"I am starting to think phosphate rock is becoming a strategic material for many coun-

"It is a very curious thing that something so important is so poorly understood and so little talked about in the larger political arena," says Arno Rosemarin, a water-resources specialist at the Stockholm Environment Institute who has researched global phosphate use. Although international leaders have not tended to focus on the potential for phosphate shortages, the issue has been proposed for discussion next month at a United Nations meeting on global food security - an indication that it is starting to attract the attention of the international community.

Just decades left?

In many countries, phosphorus is a limiting plant nutrient in short supply in the soil. So farmers add phosphate-based fertilizers to

Chla vs. Total P in Lake Rotorua, 2002-2012

Chla vs. Total N in Lake Rotorua, 2002-2012

Cyanobacterial biomass in global and NZ lakes

Phosphorus loads to Lake Rotorua

Land use within the Lake Rotorua sub-catchments

Size of the pie charts is scaled to the area of the catchment

Total phosphorus loads by stream

*Ungauged refers to minor and ungauged streams within the Rotorua sub-catchment.

Dissolved phosphorus loads by stream

*Ungauged refers to minor and ungauged streams within the Rotorua sub-catchment.

Particulate phosphorus loads by stream

*Ungauged refers to minor and ungauged streams within the Rotorua sub-catchment.

Summary of annual phosphorus loading to Lake Rotorua

	Annual loading t P y ⁻¹		
	Total	Anthropogenic	Baseline
Dissolved reactive phosphorus	27.7	6.1	21.6
Particulate phosphorus	21.0	17.3	3.7
Total phosphorus	48.7	23.4 (43-64%)	25.3

- To achieve a TLI target of 4.2 would require an estimated reduction in TP of 10–15 t y⁻¹
- Anthropogenic TP loading would need to decrease from c. 23.4 t y⁻¹ to 8–13 t y⁻¹.

Let's get to work!