Biomanipulating Diatom Growth Ammonia and Cyanobacteria Reduction in Wastewater Treatment

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Two Key Aims of Water Management

Reduce Nutrients and Reduce Algae

https://blog.nus.edu.sg/underthesurface/files/2016/11/Algal-Bloom-Lake-Erie-2500ft-Tom-Archer-23tg6u0.jpg

Eutrophication = Issues

High Nitrogen and Phosphorus (N and P) cause algae blooms, choking weeds and loss of biodiversity

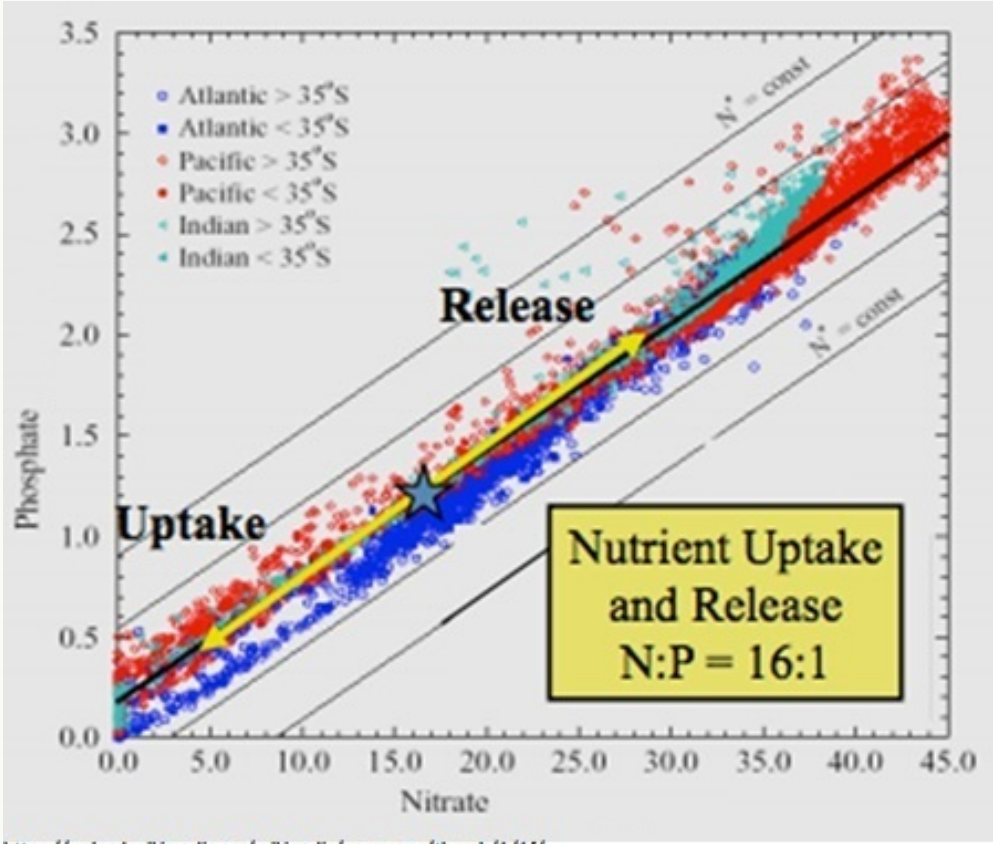
https://resources.stuff.co.nz/content/dam/images/1/e/x/v/v/p/image.related.StuffLandscapeSixteenByNine.620x349.1ewm0m.png/1477376878618.jpg

Why Do Polluting Levels of N and P Reduce the Health of a Biological System?

In ocean systems there is a ratio of N and P uptake for photosynthesis (Redfield Ratio).

Similar ratios apply for photosynthesis in freshwater systems.

There are also ratios between N, P and C (Carbon) and all the micronutrients that are needed for photosynthesis (e.g. Fe, Zn, Mn, Mg, B, K, Ca, Cu).



https://upload.wikimedia.org/wikipedia/commons/thumb/1/1f/PhosphatetoNitrate.png/200px-PhosphatetoNitrate.png Edited

Correcting the Ratio of Elements to Create a Healthy System

A healthy waterway is assumed to have the right ratio of elements to encourage photosynthesis;

N 16: P 1: Fe 0.001

The ratio in wastewater and polluted systems;

N 16,000: P 1,000: Fe 0.001

Correcting the ratio with uncontrolled micronutrient addition won’t fix the problem.

Targeted micronutrient addition does fix the problem.

Targeted Micronutrient Addition

Diatomix - a nano-Silica based micronutrient solution.

Contains: Nano-Silica and ten micronutrients: Iron, Manganese, Cobalt, Molybdenum, Calcium, Boron, Copper, Magnesium, Zinc and Potassium.

The use of nanotechnology ensures that the micronutrients are only bio-available to algae that take up Silica (i.e. diatoms).

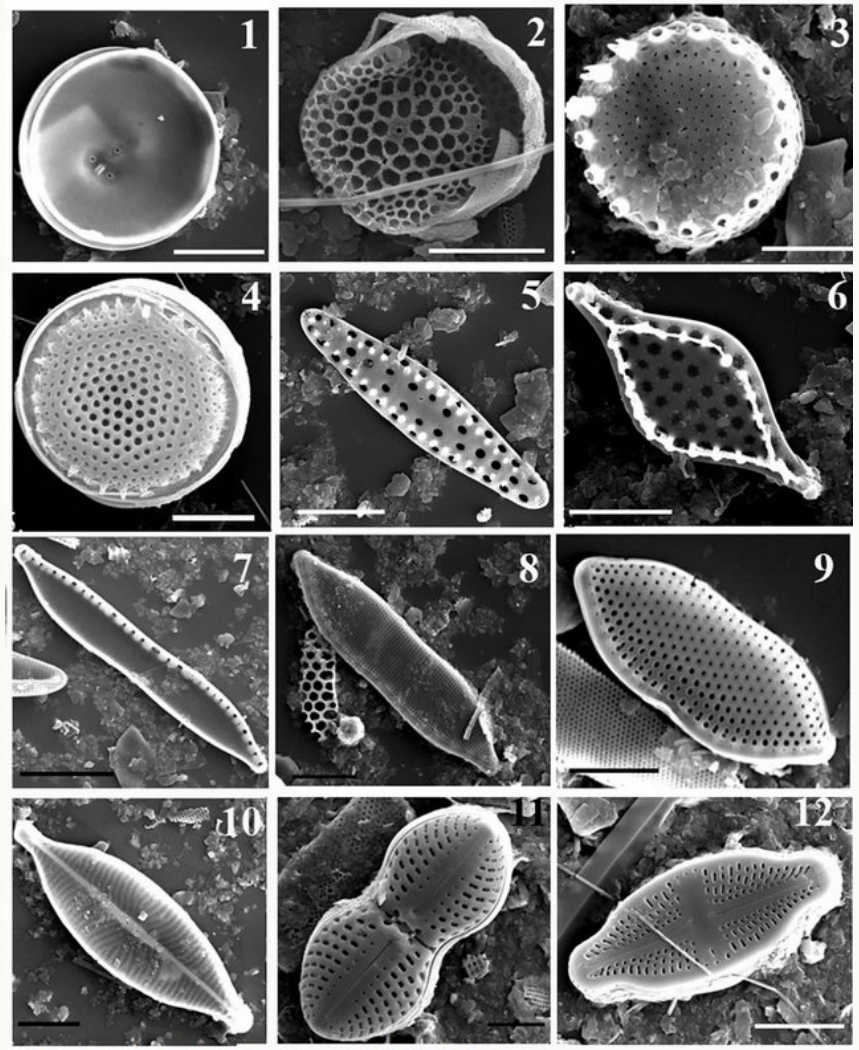
Diatoms target the Silica as a nutrient for growth and the added micronutrients boost their growth compared to other classes of algae.

What are Diatoms?

Diatoms are the only class of algae that require the element Silica to help them grow.

Diatoms are a diverse group of algae, one of the most common types of organism found in oceans, lakes and freshwater ecosystems.

Diatoms make up a large proportion of the food chain for higher trophic levels e.g. zooplankton, insects, snails, fish.



http://file.scirp.org/Html/2-6701730/39f338cc-1f6e-4f16-ba12-505afdbdfdfb.jpg

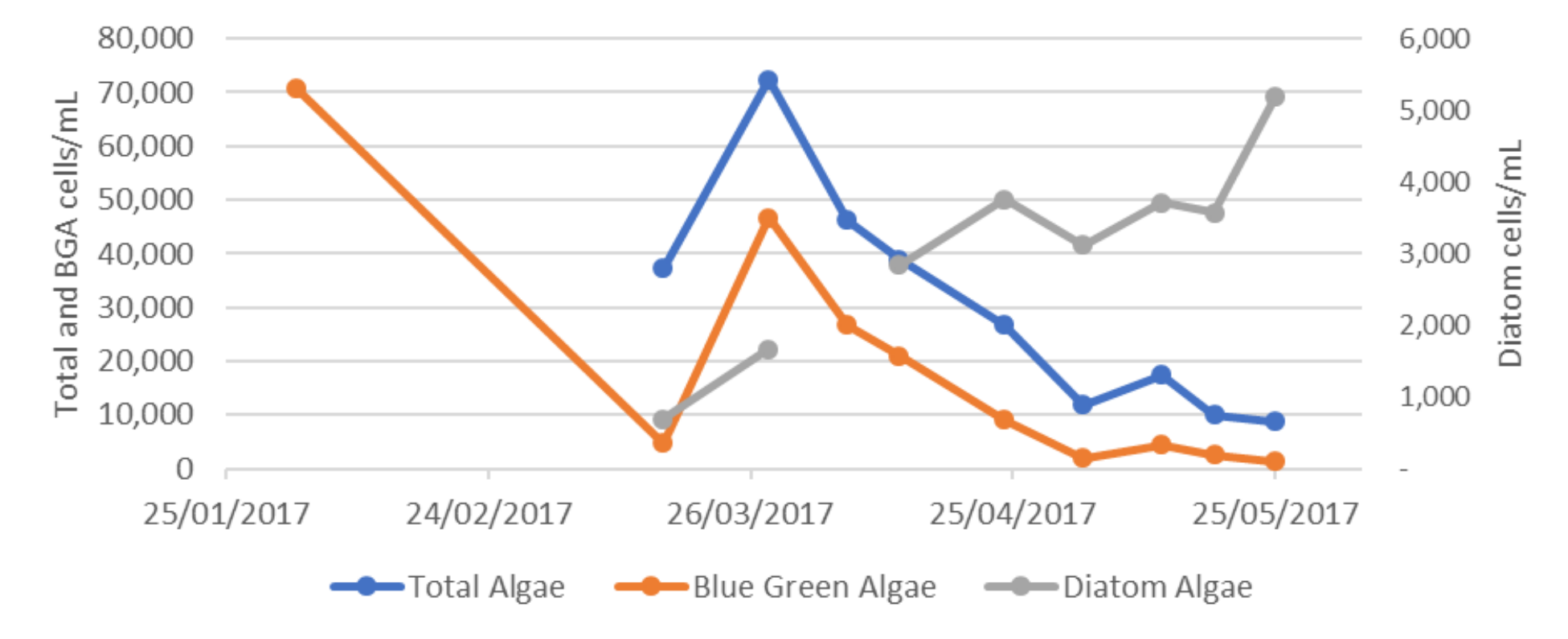
How Does It Work?

Diatoms out-compete Cyanobacteria (blue-green algae) and other large water plants (Water net, Salvinia) for the Nitrogen and Phosphorus in the water.

N and P becomes living animals, taking the nutrients out of the plant cycle, and healthy balance is restored to the water body.

Case Study 1 - Raw Water Storage Dams

Two farm dams (NSW) treated with the product to reduce and manage cyanobacteria (blue-green algae). Dam 1 cell counts.



Case Study 1 - Raw Water Storage Dams

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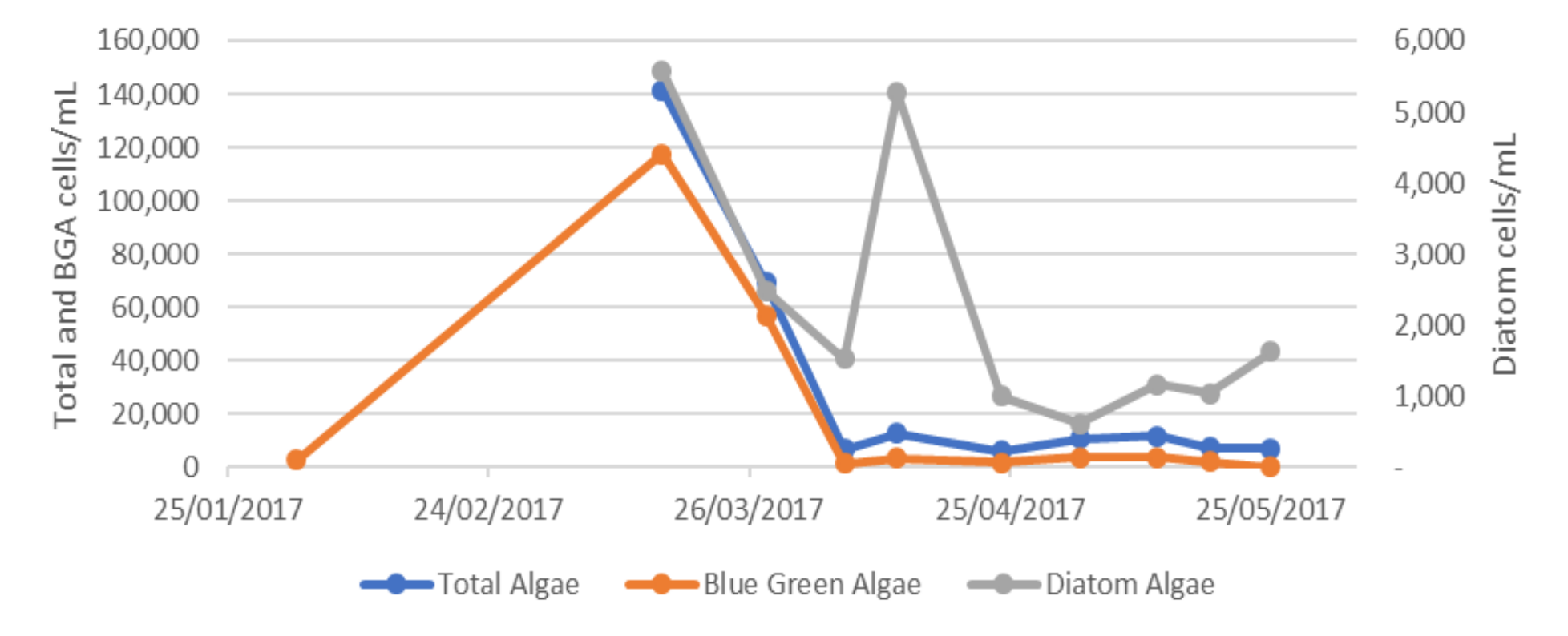
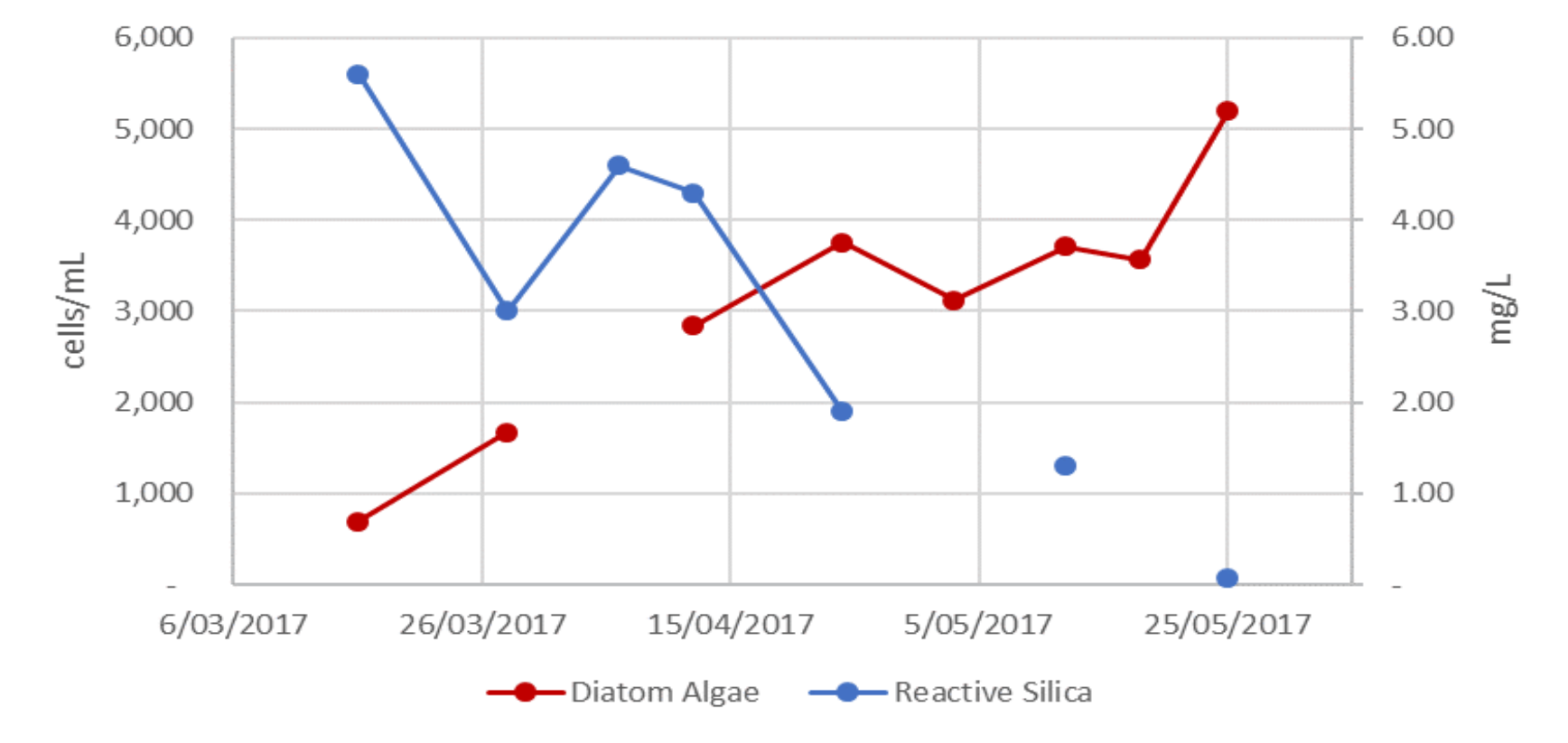


Case Study 1 - Raw Water Storage Dams

The relationship between diatom growth and the reduction of Reactive Silica in Dam 1.



Case Study 2 - Wastewater Effluent Storage

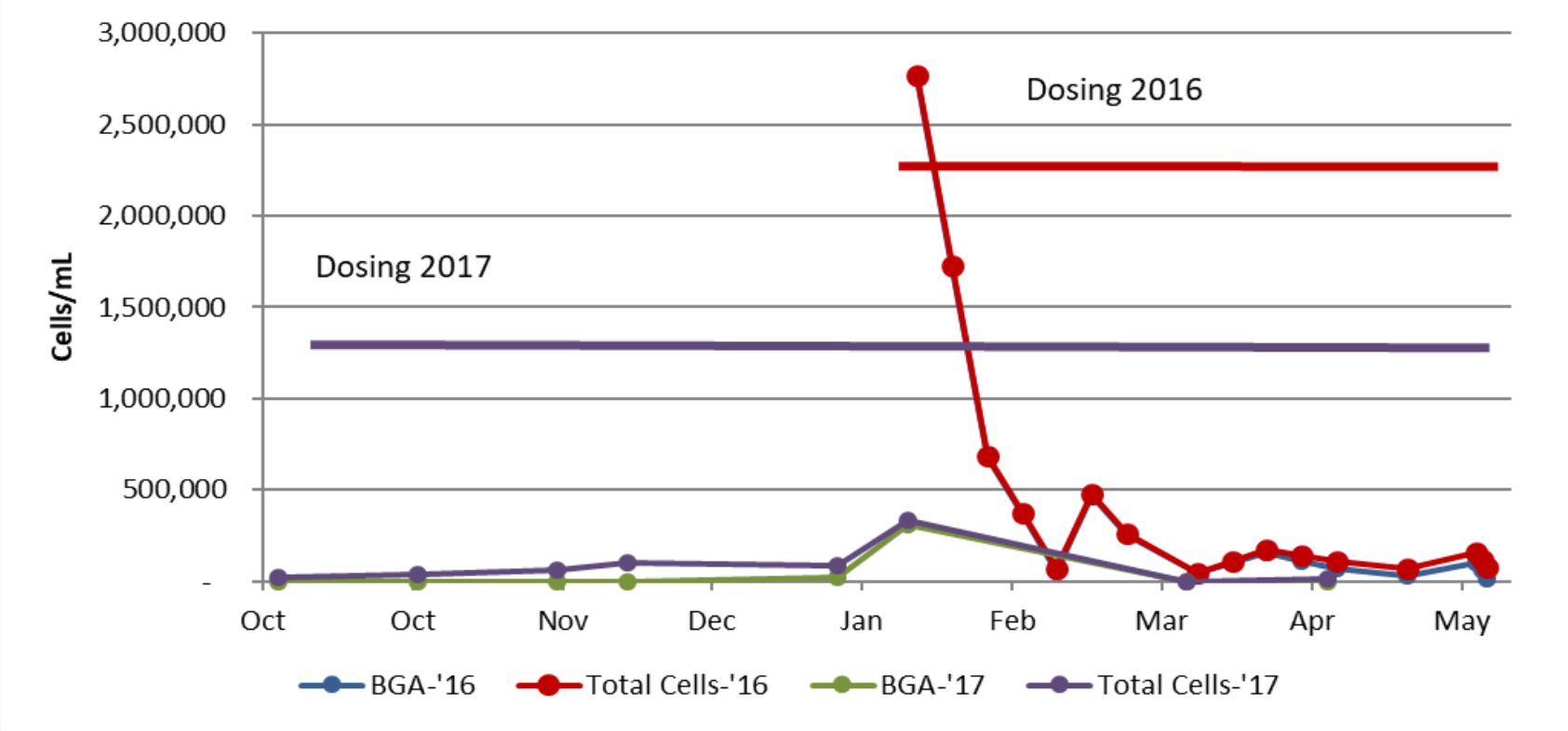
Treated wastewater often has sufficient N and P in it for Cyanobacteria to bloom to problematic levels.

Before Treatment (Jan-16)

Ongoing Treatment (May-17)

Case Study 2 - Wastewater Effluent Storage

Dosing of the product reduced Cyanobacteria populations by an average of 98%.



Case Study 3 - Wastewater Treatment Lagoon

Wastewater Treatment Lagoons use algal growth to reduce the N and P in the water.

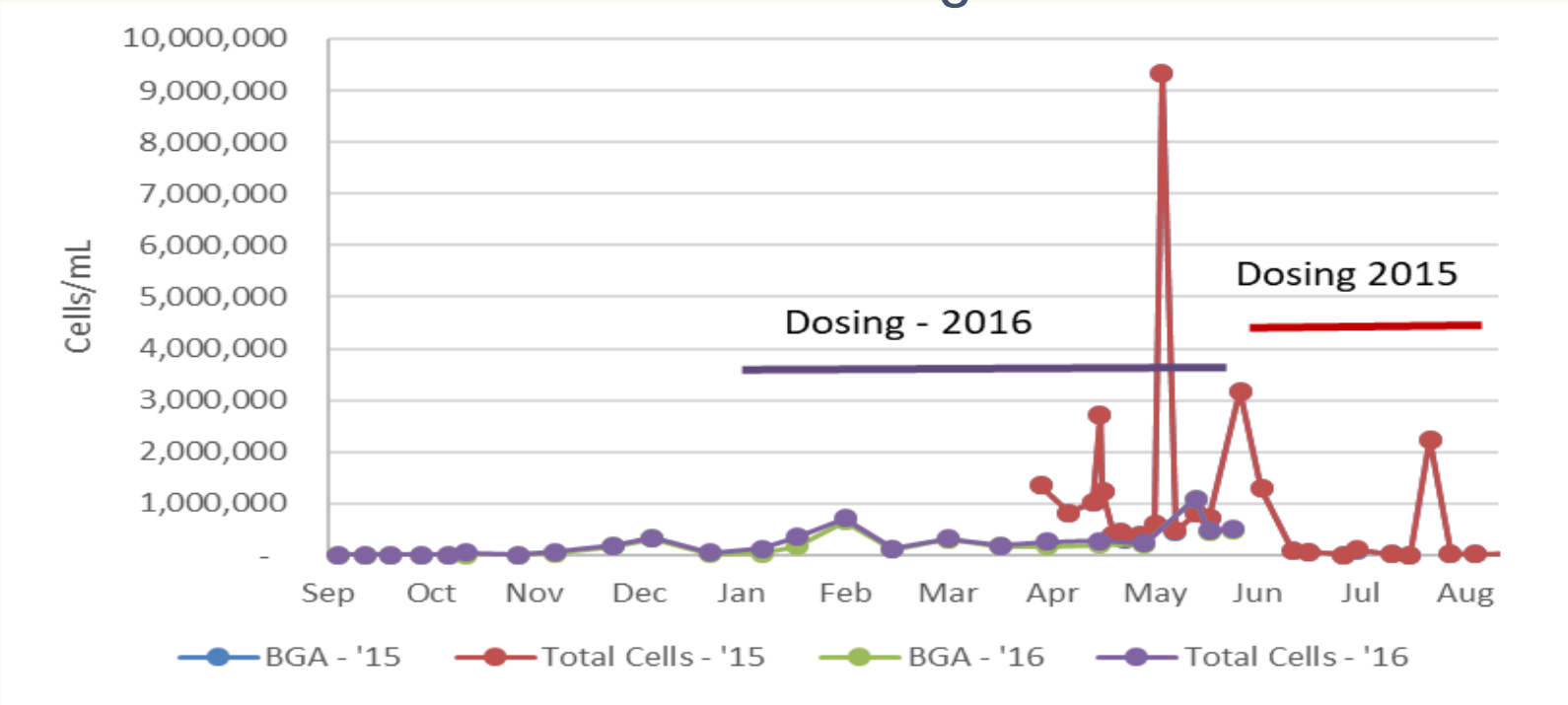
However, Cyanobacteria proliferate when micronutrients are depleted by the other algae.

Before Treatment (Apr ’15)

Ongoing Treatment (Jul ‘15)

Case Study 3 - Wastewater Treatment Lagoon

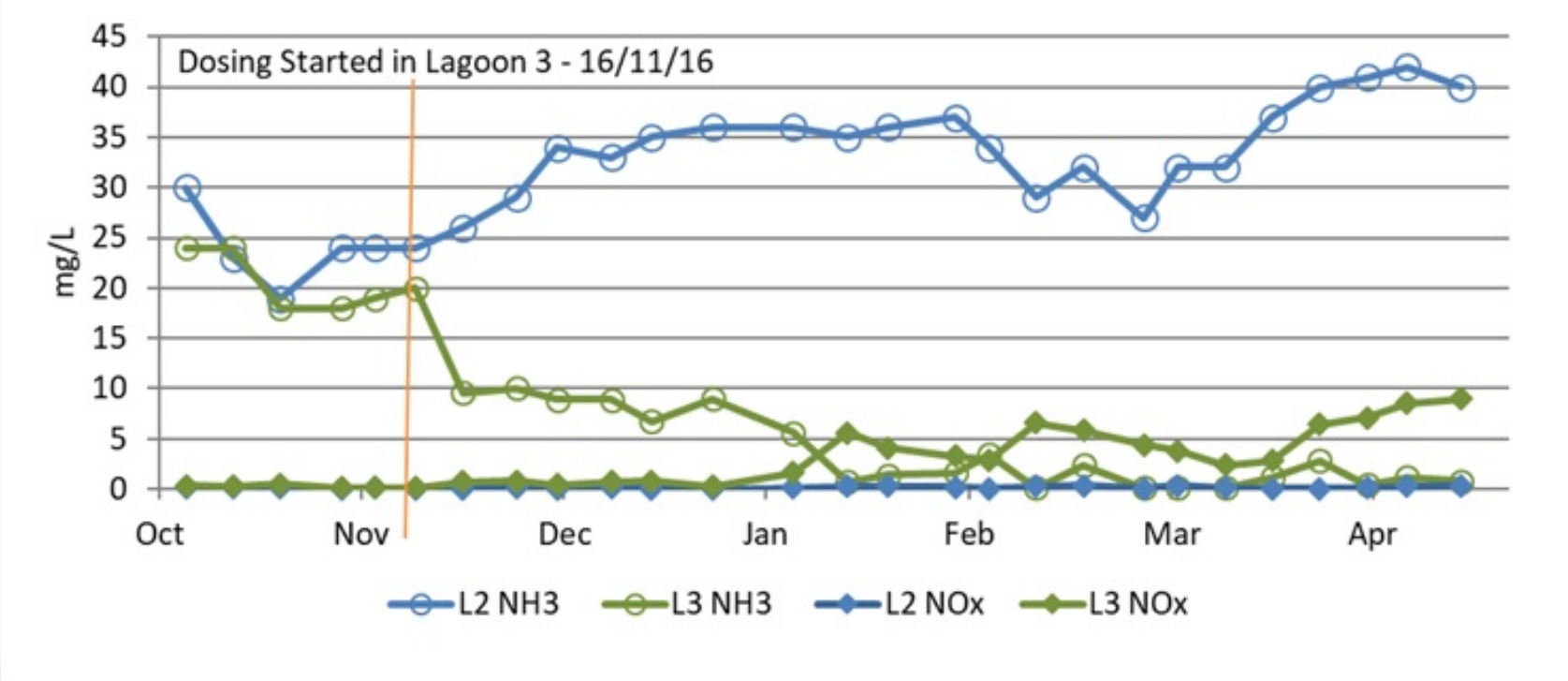
Cyanobacteria tend to have boom and bust cycles in lagoons. With healthier ecosystems algal populations are more resilient, and can return to stability after disturbances like large rain events.



Case Study 4 - Wastewater Ammonia Reduction

High concentrations of ammonia require additional aeration ($$) to treat and poor quality effluent has further costs associated.

Correcting the ratio reduced ammonia by 95% on average.



Summary

The product, *Diatomix*, is used to balance the concentration of Nitrogen and Phosphate with the necessary micronutrients needed by more desirable algae, such as diatoms.

Reductions in Cyanobacteria counts have been as high as 99.6%, with some samples having 0 BGA cells/mL.

Ammonia levels were reduced by 95% on average.

A biological solution to a biological problem.

Questions

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For more information please visit our website: www.algaenviro.com.au