Understanding and managing cyanobacteria blooms in Lake Hood – Residents briefing

February 2024

Prevalence of cyanobacterial blooms world-wide

- Global warming has led to an increase in occurrences of cyanobacterial blooms world wide
- NZ has not been isolated from this trend with the list here being Public Health notifications for the summer of 2023/24 for Canterbury, Southland and Otago alone
- 26 locations with 11 of these in South Canterbury

Kauru River, North Otago, Lake Tuakitoto, South Otago, Manuherekia River at Ophir, Waianakarua River, Ashley River/Rakahuri at State Highway 1 Bridge, Ashley River/Rakahuri above Rangiora-Loburn Bridge Swimming Hole, Te Moana River at Te Moana Gorge, Opihi River at Saleyards Bridge, Opihi River at Grassy Banks, Opihi River at Raincliff Bridge, Opihi River at SH1 Bridge, Pareora River at Pareora Huts, Pareora River/Pureora at SH1, Selwyn River/Waikirikiri at Glentunnel, Selwyn River/Waikirikiri at Whitecliffs, Selwyn River/Waikirikiri at Upper Huts, South Bank Tributary of the Waiau/Uwha River above the Waiau Bridge, Temuka River at SH1 Bridge, Waihao River at Bradshaw Bridge, Waihao River at Gum Tree Flat Road (Don's Hole), Te Roto o Wairewa/ Lake Forsyth, Lake Hood, Lake Pegasus, Lake Ellesmere, St Anne's Lagoon, Hakataramea River at SH82

Water Quality Task Force

- The Task Force was assembled in May 2023 following the first cyanobacterial bloom in Lake Hood
- Objective:

  Investigate and report on how to reduce the risk of further cyanobacteria blooms and how best to manage blooms should they occur in the future

- Members:

  David West, Chairman - AACPT

  Leandra Fitzgibbon - AAPCT

  Les McCracken, Mark Christensen - LHEP

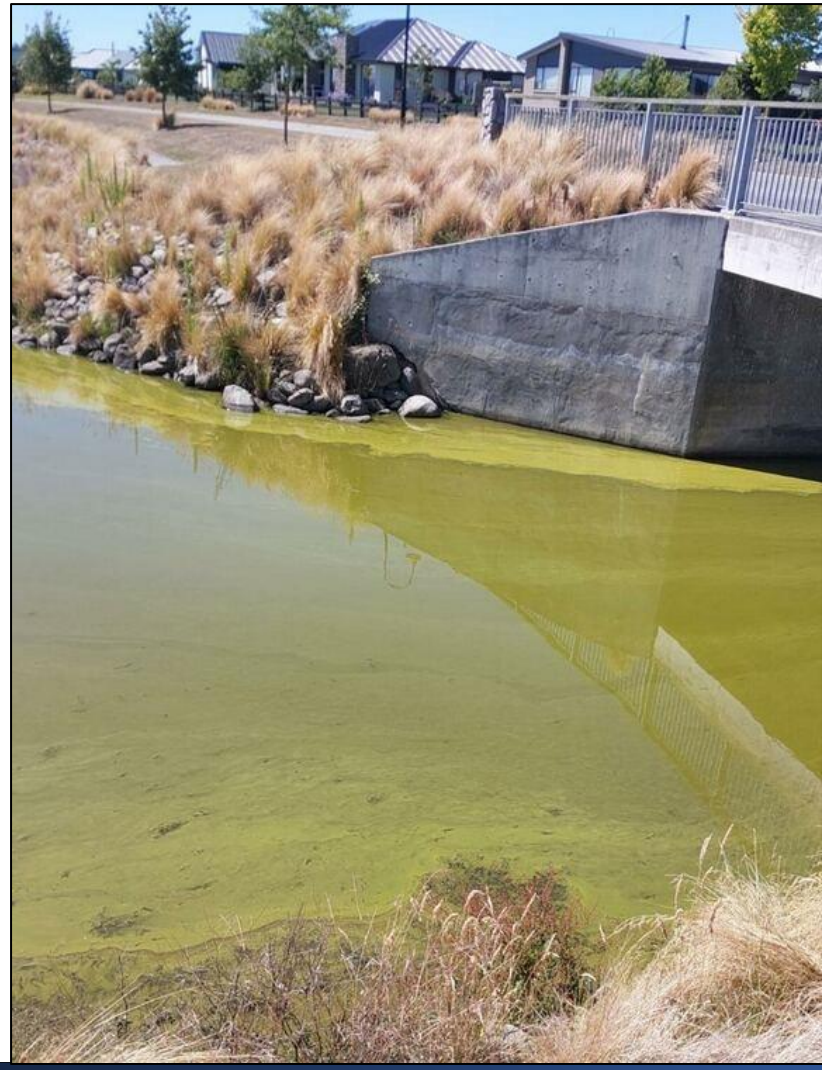
  Jeremy Savage - Residents

  Tania Paddock, Neil McCann - ADC

  Donna Sutherland - Scientific advisor

What are cyanobacteria

- A group of bacteria that are present in most inland waterways that obtain energy through photosynthesis and some of which produce toxins harmful to humans and animals
- They are often called blue-green algae



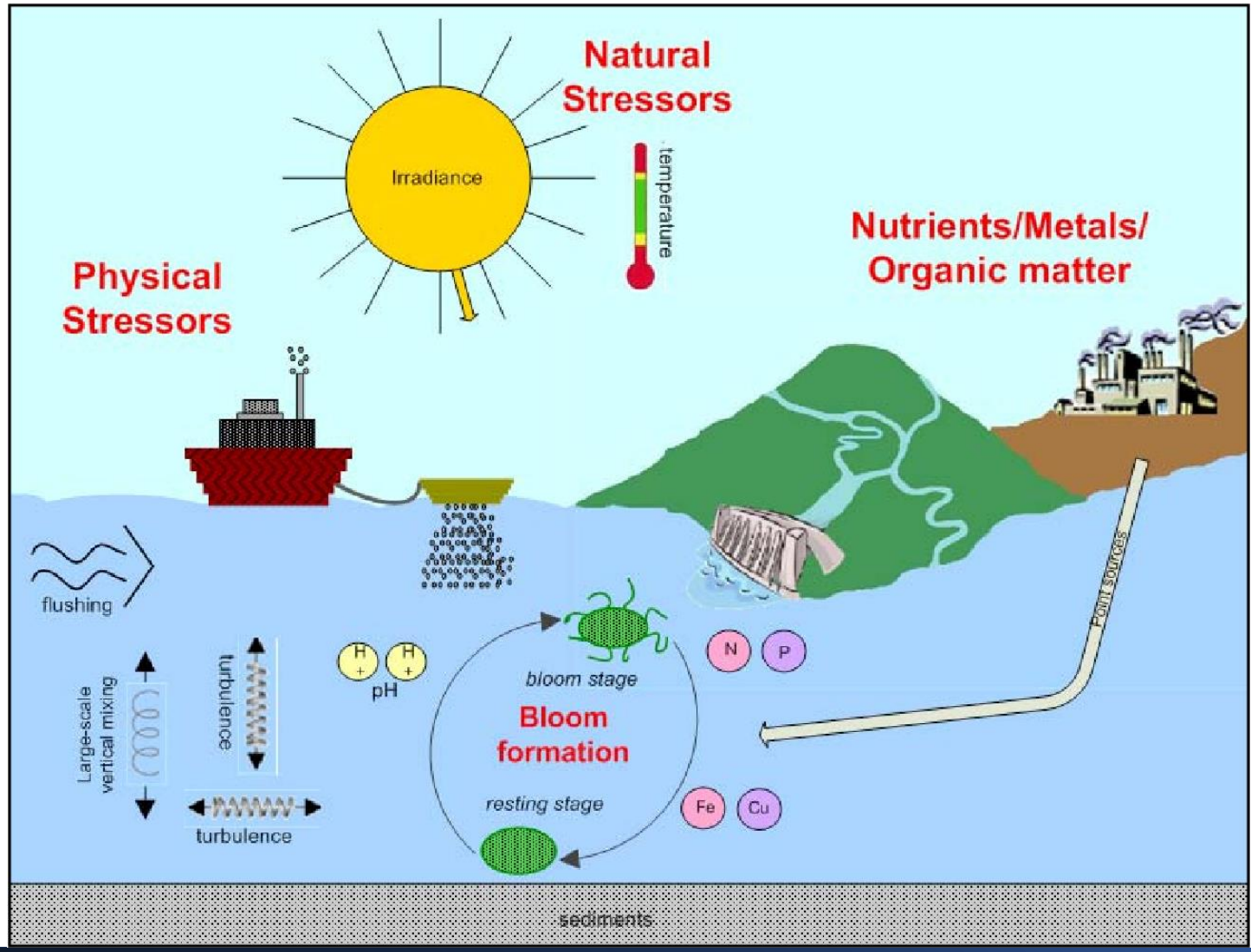
What leads to cyanobacteria blooms

Blooms form when environmental conditions allow for rapid growth of new cells:

- Sun light
- Nutrients
- Temperature
- pH

Therefore: to reduce blooms, we need to reduce the **causes of the blooms**.

The only one we can do something about is **NUTRIENTS**



Recent cyanobacteria blooms

- 28 Feb 2023 cyanobacteria detected in Lake Hood but below the action level
- 16 Mar 2023 cyanobacteria level exceeded action level – public notified, signs erected and lake closed to contact recreation
- 15 May 2023 cyanobacteria level dropped below action level – restrictions on lake use lifted
- 6 Jan 2024 cyanobacteria level exceeded action level – public notified, signs erected and public left to make informed decisions on contact recreation

Responsibilities in NZ Guideline for cyanobacteria control

- Ecan monitors local water quality through sampling programmes
- Te Whatu Ora advised if the Action Level in the Guideline is breached
- Te Whatu Ora advises public through media and requests Ashburton Council to erect warning signs
- Te Whatu Ora will decide when the public health warning is lifted, based on test results and visual assessments undertaken by ECan

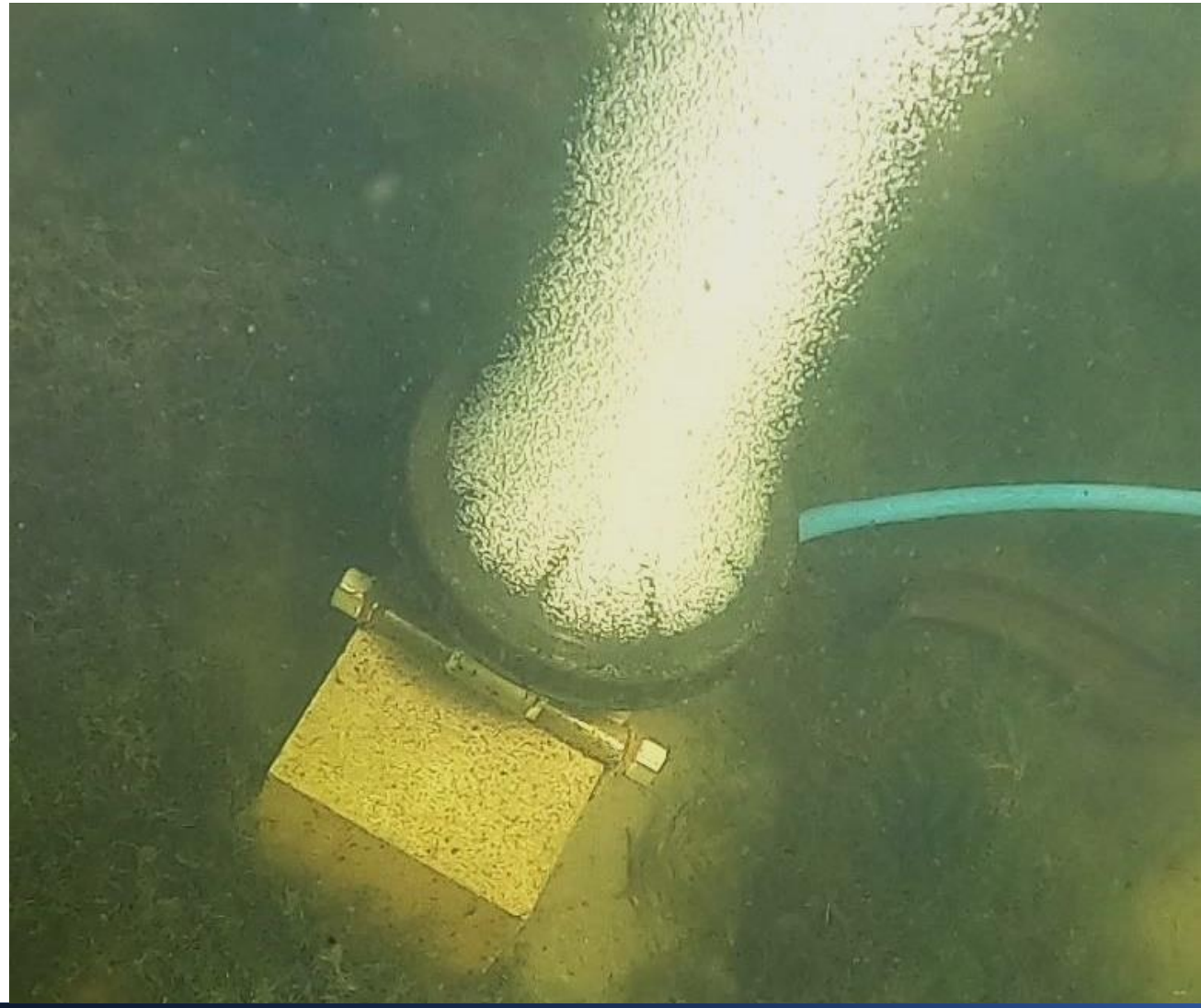
Alert Level	Timeframe	Response
Surveillance	Winter	Monthly visual assessment
	Spring (September and October)	Fortnightly cyanobacteria sampling
	Summer (November to April)	Weekly cyanobacteria sampling
Alert	Once alert trigger reached: 1. Biovolume ≥ 1.8 mm^3/L of potentially toxic cyanobacteria	Weekly cyanobacteria sampling Notify Public Health unit
Action	Once action level reached: 1. Biovolume 0.5 to <1.8 mm^3/L of potentially toxic cyanobacteria, or 2. Biovolume ≥ 10 mm^3/L total biovolume of all cyanobacterial material, or 3. cyanobacterial scums consistently present.	Weekly cyanobacteria sampling Notify Public

Task Force actions to date

- June 2023 review of historical lake water quality
- June/July 2023 research into options for managing cyanobacteria risk
- August 2023 completed briefing paper for Lake Hood stakeholders identifying options for managing cyanobacteria risk
- August 2023 completed business case to purchase weed harvester
- Sept 2023 discussions with various companies on aeration
- Oct 2023 commenced aeration trial in selected canal
- Oct 2023 commenced weekly monitoring of aeration trial water temperature and dissolved oxygen
- Nov 2023 weed harvester ordered by ACL with delivery Mar 2024
- Dec 2023 discussions with Australian and American companies on phosphorus removal from water
- Jan 2024 discussions with NZ companies on bacterial control of cyanobacteria
- Jan 2024 released brief to NIWA for proposal to offer scientific advice

Phosphorus recycling within the lake - Aeration trial

- An organic silt layer has formed on the lakebed in the canals from decomposing lake weed
- This silt, and the inorganic silt it sits on, is high in nitrogen and phosphorus and supplies nutrients to weed and cyanobacteria
- As a result of stratification of the lake water the lower 0.5m of the lake can become anoxic – low in dissolved oxygen
- The aeration trial is testing our ability to upset the stratification and oxygenate the full water column to reduce the availability of phosphorus for weed and cyanobacteria



Phosphorus reduction in water inflows - Phoslock

- The CSIRO in Australia developed a compound that is able to chemically absorb phosphorus from water
- A company has commercialised a product called Phoslock that can be spread on to the water surface as a slurry and as it sinks it removes phosphate from the water and locks it up in a compound where it is not available to plants or cyanobacteria
- The disadvantage of this approach to removing phosphate is that surface and groundwater inflows continue to bring phosphorus into the lake requiring regular retreatment
- The use of Phoslock has been consented for use in an Auckland trial unfortunately disrupted by the 2023 floods and a trial will require ECan approval

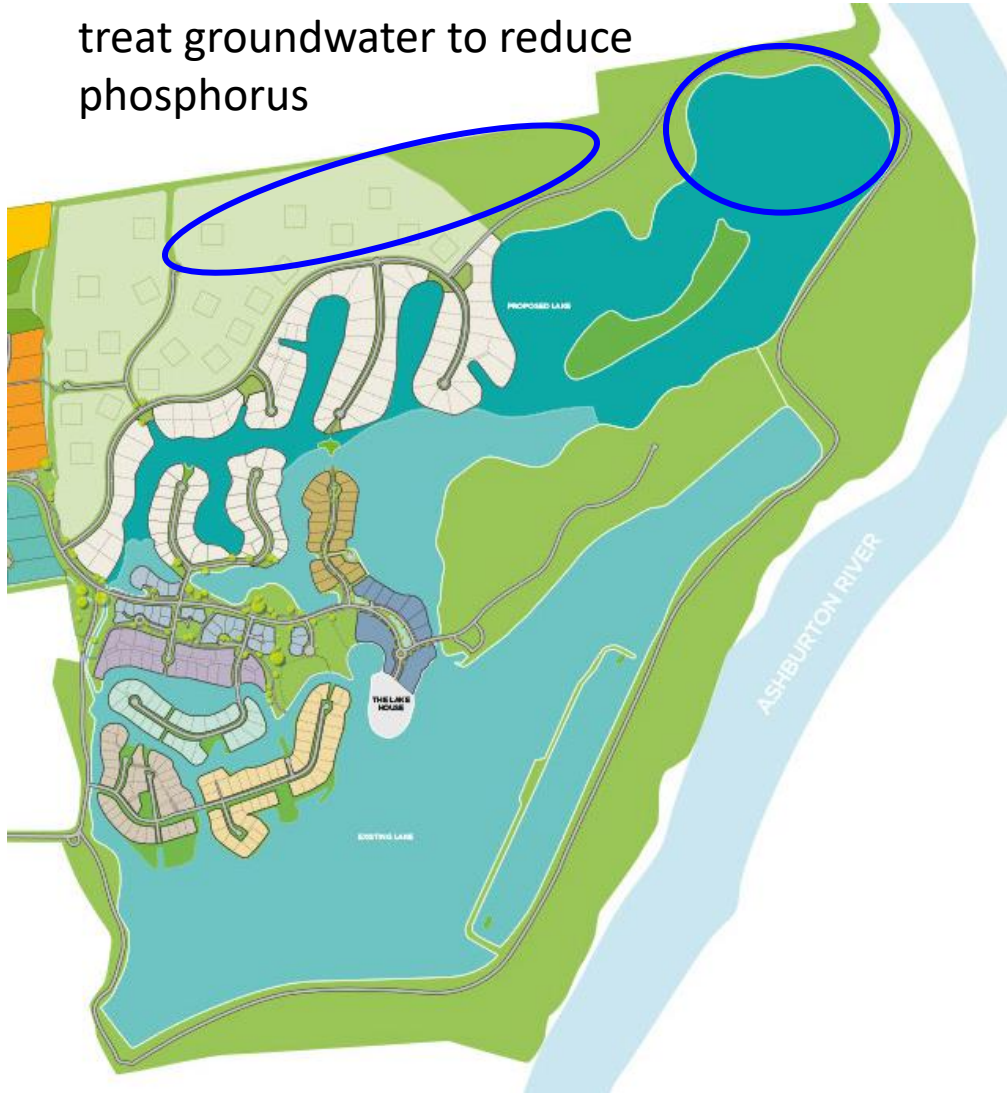
Phosphorus reduction in water inflows - Phosflow

- An American company has developed a pelletised version of Phoslock called Phosflow which locks up the phosphorus in a pellet
- The pellets are exposed to the water by placing them in mesh bags and allowing running water to flow through the bag
- Results from actual applications have shown up to 96% phosphorus removal with the reduction directly proportional to the reaction time with the flowing water
- We are in talks with the American company to run a trial on the Carters Creek flow into the lake
- The trial will need ECan approval

Phosphorus reduction in groundwater inflows

- Consideration will be given to creating wetlands at the north-east area in the proposed lake expansion and immediately to the north of the expanded lake
- These wetlands would intercept groundwater at a higher level than the current lake surface
- The objective would be to drain treated water towards the western canal to improve flows in the canals
- The design could allow for use of Phosflow to remove phosphorus dependent on the results of proposed trials

Potential wetland areas to treat groundwater to reduce phosphorus

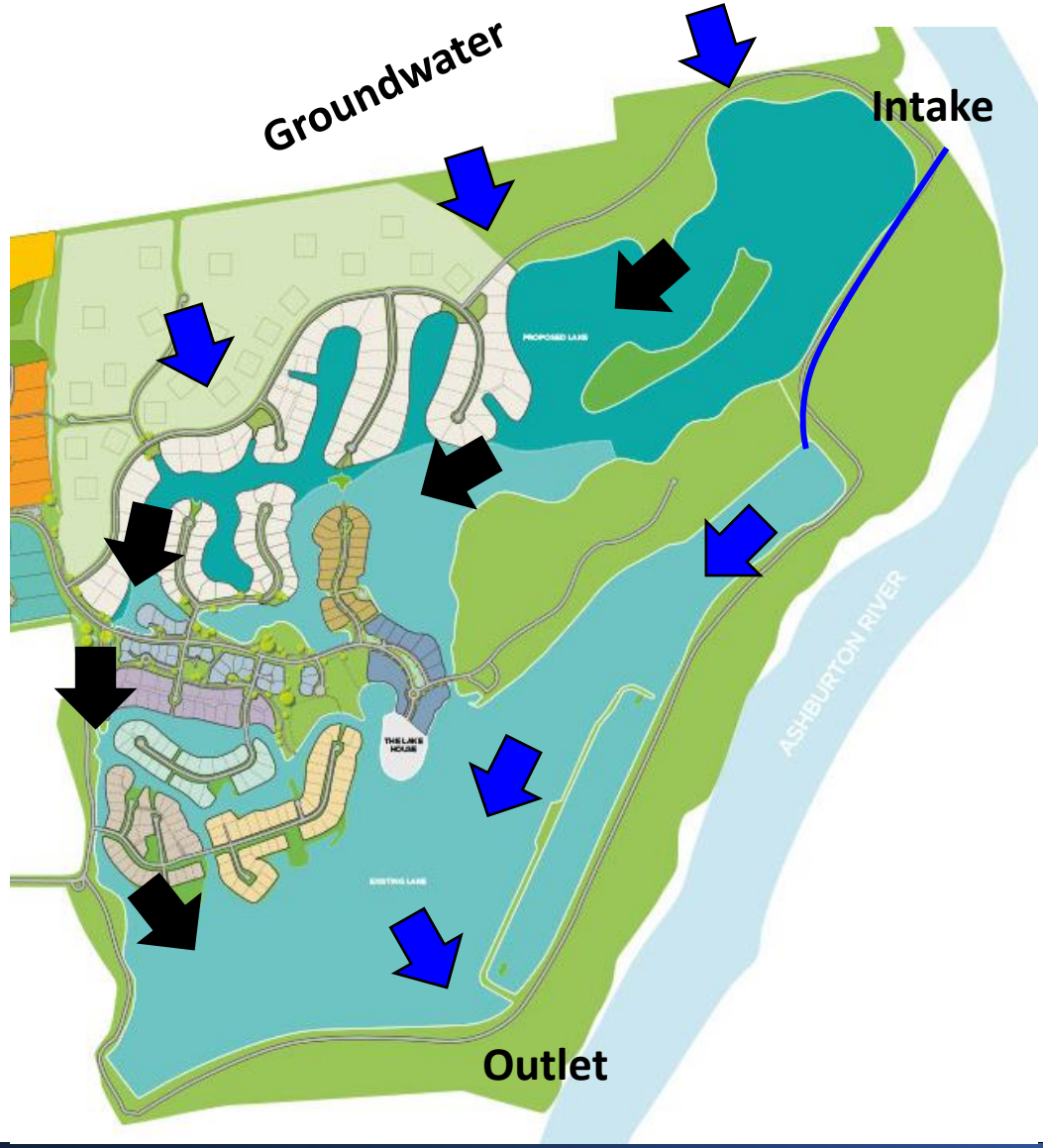


Phosphorus reduction in lake silt – Weed harvesting

- ACL have ordered a weed harvester that is currently on ship heading for New Zealand
- ADC has committed funding ACL to purchase and operate the harvester for at least 5 years
- The harvester is located on a self- propelled barge capable of holding 5m^3 of cut weed
- Harvested weed will be transported to a local farm composting operation

Improving water circulation

- Current river intake flow does not promote canal water flow
- Research has shown that most lake water flow is wind induced in the top 0.5m of the lake
- Minimal flow from Carters Creek to western canal
- Long term objective is to increase flows from the intake towards the western canal to promote increased canal flows
- Solar powered pumps capable of pumping up to 100L/sec will be investigated as a tool to increasing canal flows and acting as a second lake outlet



ECan consultation

A high-level consultation process with ECan is planned to discuss a number of long-term initiatives that can contribute to reducing cyanobacteria bloom risk:

- Resubmitting the non-consumptive take application which will allow us to take more water from the river based on the fact that we discharge this water 2.8km downstream from the intake
- Pumping from canals to a second outlet
- Phosphorus reduction using Phoslock and Phosflow
- Beneficial bacteria treatments
- Upstream wetlands to treat ground water prior to it entering the lake

This current summer is the first we have faced with the revised Ashburton river minimum flows and, while the water loss was not significant, it occurs over the summer period when we most need flushing flows

Scientific advisors

We have requested a proposal from NIWA to provide scientific advice to the Task Force on:

1. Examine the 25-year historical water quality data and report on drivers to recent cyanobacteria blooms
2. Research the characteristics of the most prevalent cyanobacteria in the lake with a view to advising on mitigation measures
3. Research the relationship between water phosphorus level and cyanobacteria blooms to guide possible phosphorus removal proposals
4. Complete a literature survey on the science behind proposed cyanobacteria controls methods, including beneficial bacterial control, to guide the Task Force's assessment of these controls