

1st July 2020
The Natural Resource Commission
GPO Box 5341,
Sydney NSW 2001

Dear Sir/Madam

Re: Submission Review of the Tweed Water Sharing Plan

I wish to make a submission in regards to the above matter.

The NSW Natural Resources Commission (NRC) is undertaking a Review, including submissions from the public, of the existing Tweed Water Sharing Plan (WSP), which expires next year.

Background

There is in the current plan a Clause 48 (1) which prohibits the building of a dam at Byrrill Creek.

As a member of the Tweed Shire Council's Water Strategies Project Review Group (PRG), I wish to support Tweed Shire's Council affirmation for the prohibition for a Byrrill Creek Dam until 2032.

Prohibition of a Byrrill Creek Dam should remain in perpetuity for the following reasons:

Review of the Tweed Water Sharing Plan - Clause 48(1) Byrrill Creek Dam

The benefits of retaining Clause 48(1) for the Tweed Shire are:

- The current prohibition of a Dam within Byrrill Creek water source has been a positive environmental outcome and it is recommended that this prohibition remains within the Tweed Water Sharing Plan.
- This clause has helped preserve the Byrrill Creek catchment area with its high riparian conservation status, numerous threatened species, 26 Aboriginal cultural heritage sites, and the wildlife and climate change corridor linking Mt Warning and Mebbin National Parks.
- Water Supply Augmentation – Council resolved in 10th December 2015: “Based on the information currently available, Council adopts the raising of the Clarrie Hall Dam as the preferred option for future water security and proceeds with the planning approval and acquisition phase for the project”.

(Council advice to PRG members on the 15th June 2020).

Concerns about future water augmentation from the Tweed River

Council advised PRG members on the 15th June 2020 that:

“Tweed water source is run of river “topped up” from stored water. All things being equal it does not matter where that storage is. All things being equal having 10,000 ML at Byrrill Creek has the same impact as having an extra 10,000 ML at Clarrie Hall Dam.”

On the 11th August 2020, the Water Strategies Review Project Group will review the consultancy Report of Hydrology and Risk Consulting Pty Ltd (HARC), who have been engaged to carry out Part B - Water Supply Augmentation for the period beyond 2026 – 2046.

The HARC review has not been received by the PRG, but advice from Council is that this review will be discussed at a PRG workshop meeting on 11th August 2020.

Responding to the Tweed Water Sharing Plan, I consider that the council submission to the NSW Natural Resources Commission (NRC) could be further influenced by the recommendations of the PRG workshop after their consideration of this report has been presented to Council.

Submission on Environmental Water Flows

Consideration is being given by council to stopping environmental flows, only at criteria, which matches the natural flow rate of the Doon Doon Creek.

At present the plan requires a flow of 3ML/day even at the height of drought when the creek would normally be dry.

This is of considerable concern to the Tweed community for the following reasons:

1. From Clarrie Hall Dam - Environmental Water flow releases from Clarrie Hall Dam to supply Doon Doon Creek and the Tweed River should remain. It has proved to be an important aquatic refuge particularly during the recent drought, when the majority of all creeks and the upper reaches of the Tweed River ran dry.

2. Fish ladder flows at Bray Park Weir - The flow releases for the Fish Ladder at Bray Park Weir should continue to remain and be improved so as to allow the migration of native fish species upstream and downstream. The environmental flow is required particularly in drought periods of the Tweed River, which at times sees the Lower Tweed River far below the surface water of the Bray Park Weir.

3. Community concern is raised, when council has recently stated that: ***“Requirements for fish passage / environmental flows are also impacting the long-term secure yield of Tweed’s water supply system e.g. Bray Park Weir fish ladder passes 25ML/day even when the weir is not spilling”.***

(Far North Coast Regional Water Meeting – Tweed Shire Council - Notes, 7th May 2020.)

Comment

This environmental flow over Bray Park Weir appears far beyond the requirements of Licence 30SL06619.

It is of interest to note that environmental flow and conditions under Licence 30SL06619 are:

- The environmental flow requirement is 8ML/day when the Clarrie Hall Dam is > 75%; 5ML/day and the dam is > 50%; 3ML/day and the dam is < 50%.
- The licence conditions for Clarrie Hall Dam are that there must be a release from Clarrie Hall Dam of; 1ML/day when the Palmers Rd gauge is at the 95th percentile or less; 2ML/day when the Palmers Rd gauge is between the 80th and 95th percentile; 4ML/day when the Palmers Rd gauge is at the 80th percentile or greater

4. Bray Park Weir water stressors that require environmental consideration

At the Far North Coast Regional Water Meeting on the 7th May 2020 – Tweed Shire Council noted as follows:

Rural water user extraction of water transfers can also risk town water supply security	• Releases from Clarrie Hall Dam to Bray Park Weir were extracted for rural landholders during recent drought period. For example, approx. 15ML/day released additional to Tweed’s water supply requirements. This placed substantial strain on the supply. • Compliance and enforcement of water sharing plan rules is a consideration in this instance
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(Council Notes, 7th May 2020.)

Comment

Clarrie Hall Dam discharge at the Tweed River Uki NSW Water gauge for the period 26.11.2019 to 26.12.2019 to Bray Park Weir at the Tweed River was as follows:



The releases of 100 ML water per day from Clarrie Hall Dam in times of drought is of great community concern, particularly, when approximately 32 ML per day including water treatment loss is generally required for drinking water purposes.

5. Blue- Green algae most prone at Bray Park Weir

At the Far North Coast Regional Water Meeting on the 7th May 2020 – Tweed Shire Council noted that the increasing presence of toxic algal species in storages in both dry and wet is a big issue.

Blue-green algae in storages	• Blue-green algae events in storages in both dry and wet periods – big issue. • Most prone at Bray Park Weir • TSC now have good treatment and in-house testing capability • Fortunate to date that while toxic algae species have been detected, toxins have not been detected in the water supply.
	• Only have one water supply, so no viable alternative if toxins were to be detected. • Lack of diversity of supply source is acknowledged as a major risk for Tweed • Releases from Clarrie Hall Dam to flush the Weir pool waste a lot of water

Comment

The Tweed Shire Council water laboratory has advised the PRG that strains of these algal species at Bray Park Weir impoundment have the potential to become toxic and pose another challenge for the processing.

The \$75 million Bray Park Water Treatment Plant cannot process salt water affected by salt water intrusion from the downstream of the Tweed River as the plant would require an upgrade to higher water filtration of reverse osmosis.

6. Review of raw drinking water source within the Clarrie Hall Dam/Bray Park system.

Water Quality

The Hydrosphere Consulting (2011) Six Year IWCM Review Background Paper reports that:

- “The review of raw water drinking quality, collected 1997-2011 was undertaken to examine raw water within the Clarrie Hall Dam/Bray Park system. (HWA 2011) and showed that: “Cyanobacteria are a primary health concern in dams and waterways as they have the potential to produce toxins. Cyanobacteria typically occur in the still or slow flowing parts of Clarrie Hall Dam and river systems (HWA2011)”.
- “The nutrient source that reservoir managers have the ability to control is the internal nutrient load. The internal load is the release of phosphorus and nitrogen from the sediments in reservoirs that become stratified, particularly if the bottom waters adjacent to the sediments become anoxic as a result of reduced mixing and intense biological activity.”

Please find attached a summary of potentially toxic algae species above 50,000 cells found at Bray Park Weir.

The increasing presence of toxic algal species in storages in both dry and wet is a big issue affecting water quality and the processing of quality drinking water.

Comment

If fish, frog and turtle along with water quality measurements, aimed to quantify the diversity and potential movement of these species in response to bulk water deliveries from the dam are to be protected at Bray Park weir, then the current environmental flows should be maintained at Bray Park Weir.

Indeed there is a community opinion that environmental flows at Bray Park Weir should be increased during times of drought to protect the diversity and potential movement of these aquatic species.

7. Clause 43. Access rules for the taking of surface water

At the Far North Coast Regional Water Meeting on the 7th May 2020 - Tweed Shire Council noted the following:

Groundwater and bottled water	• Chief Scientist report – fractured rock aquifer means drawdown from one bore can substantially affect neighbouring bores, but no noticeable impact across a region. Improvement required in licencing requirements to avoid impact on neighbouring bores • Report does not really address community perceptions regarding the bottled water industry itself and use of groundwater for this purpose
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Comment

- Irrigators need to be utilising best-practice water efficiency measures, and *accountable and monitored* metered use of water extracted, if not a cease pump restriction, during drought times and extremely low flows.
- The Tweed community considers that there is a lack of scientific data of both above ground and groundwater sources in the Tweed which means the current Water Sharing Plan is ineffective in making any future decisions on water licensing.
- This needs to be remedied (and funded) as soon as possible with the evidence of climate change being visible in Tweed River with increased salt-water tidal ‘anomalies’ topping Bray Park Weir and repeating droughts and increasing algal bloom species.
- Lack of compliance by many of water users in the Tweed is inadequate to effectively manage and put the current Water Sharing Plan into operation. The self-regulation of water licenses is open to abuse and has proved to be not accountable within the Water Sharing Plan or regulatory bodies.

- As the Tweed Council relies on flow releases from the Dam for the urban Tweed Water Supply, it is considered that there should be a reduced access/cease to pump to water from the river to properties with self-regulated water licences drawing from the Tweed/Oxley Rivers during drought times.
- During droughts, restrictions to reduce access/cease and to pump, should also apply to all five water extraction and water bottling plants within Tweed Shire who are taking water from aquifers, when there are low flows in nearby creeks and rivers.

8. Climate Change

A Water Sharing Plan is required to address climate change more effectively.

The Tweed has experienced its worst flooding event during Cyclone Debbie, March 2017, and its worst drought in 2019, and also the overtopping of the Bray Park Weir with salt water inundation at increasing levels.

Occurrences of salt water intrusion into the Bray Park impoundment are predicted to become more extreme with a changing climate.

The records which council has provided is that over 15 years there have been 65 events (i.e. more than 4 per year), covering 201 days (approx. average of 3 days per event), when an intrusion of salt-water high tide has exceeded weir height, with a significant increase in the number of days since 2010.

Tyalgum Village

Clause 14 of the existing Water Sharing Plan has provisions to manage the sharing of water based on long-term averages; however this plan needs to reflect these changes, particularly when there are low flows.

During the 2019 drought the water supply to Tyalgum village was severely affected, with no flows into the weir and high levels of algal bloom. Council did not have sufficient water for the village supplies and water was trucked in. An increased allocation, depending on river health is suggested.

Unless an alternate future water supply can be provided for Tyalgum in times of drought the community should have water security with the provision of a public bore by the NSW Government.

Bores are being funded by government in other drought areas at the present time.

Using reclaimed water for non-drinking use would be another option to manage water security.

I request that you consider the above submission and acknowledge receipt of this document.

Regards

Richard W Murray

A member of the Tweed Shire Council's Water Strategies Project Review Group



Summary of potentially toxic algae species above 50,000 cells at Bray Park Weir and CHD 2002 to 2019

Bray Park Weir and Sydney Catchment Authority Cyanobacteria Risk Profile 2010

Items 2 to 2543 - Sampled from 4 m depth prior Feb 2012

[Items 2544 to 3219] - See Offtake for surface samples - Post Feb 2012 - 2/4/ 2002

Family Coleofasciculaceae – **Species** - *Anagnostidinema amphibium* (Cyanophyta) (28/2/2019)

Family Nostocaceae - **Species** - Phormidiaceae - *Anthrospira* + (Cyanophyta) – 2/5/2018

Family Nostocaceae - **Species** - *Aphanizomenon gracile* +

Family Nostocaceae - **Species** - *Aphanocapsa deliicatissima* +

Family Nostocaceae - **Species** - *Cuspidothrix issatschenkoi* (Cyanophyta) Formerly *Aphanizomenon issatschenkoi*

Family Nostocaceae – **Species** - *Aphanocapsa holsatica* +

Family Aphanothece – (Cyanophyta) - (15/5/2017)(29/5/2017)(12/2/2018)

Aphanocapsa, *Aphanothece*, *Cyanonephron* and *Cyanodictyon*. These organisms are not known to produce toxins in freshwater. [SCA Cyanobacteria Risk Profile 2010 - P.99]

Family Chroococcaceae – **Species** - *Chroococcus minimus* +

Family Nostocaceae- **Species** - *Dolichospermum circinale* + *(Cyanophyta)

Family Nostocaceae- **Species** - *Dolichospermum flos-aquae* [Formerly *Anabaena flos-aquae*] (Cyanophyta)

Family Nostocaceae - **Species** - *Chrysosporum ovalisporum* (Cyanophyta) (11/2/2019)(27/3/2017)(5/2/2018)
(NEW to CHD & BPW since 2007-2008)

Family Nostocaceae - **Species** - *Chrysosporum sp.* (Known toxic-Cyanophyta) – 15/1/2018; 30/1/2018 & others

Family Merismopedia - **Species** - *Aphanocapsa delicatissima* + (Cyanophyta) - 2/1/2018 & others

Family Merismopedia - **Species** – *Aphanocapsa holsatica* + (Cyanophyta) - 2/1/2018 & others

Family Microsystaceae – **Species** - *Microc. Aeruginosa* – 20/2/2017;27/12/2017;22/1/2018;30/1/2018;27/8/2018;
Microcystins are known to be produced only by *Microcystis sp.*, primarily *Microcystis aeruginosa*. Relative potency of various strains of microcystin can be found elsewhere (Deere, 2009). [SCA Cyanobacteria Risk Profile 2010 - P.99]

***Items marked in red indicate potentially toxic species**

Family Oscillatoriaceae – **Species** – *Oscillatoria princeps* + *(Cyanophyta)

Family Phormidiaceae – **Species** - *Phormidium ambiguum* + *(Cyanophyta) [2002]

Family Phormidiaceae – **Species** – *Arthrospira maxima* +

Family Pseudanabaenaceae - **Species** *Geitlerinema amphibium* + (Cyanophyta)

Family Pseudanabaenaceae - **Species** *Pseudanabaena limnetica* (Cyanophyta)

Family Pseudanabaenaceae – **Species** - *Spirulina latissimi* + (Cyanophyta)

Family Synechococcaceae – **Species** - *Synechococcus?* (Cyanophyta)

Family Synechococcaceae - **Species** – *Cyanogranis libera* (Cyanophyta)

Other Cyanophyta

Cyanodictyon planktonicum (Cyanophyta) [2002]

Cryptomonas (Cyanophyta)

Family Leptolyngbyaceae **Species** - *Planktolyngbya* (Species type?) (Cyanophyta)

Planktothrix (Species type?) (Cyanophyta)

Rhabdoderma (Species type?) (Cyanophyta)

Romeria (Species type?) (Cyanophyta)

Sphaerospermopsis (Species type?) (Cyanophyta)

Spirulina (Species type? *sp*) (Cyanophyta)

Chlamydomonas (Chlorophyta)

Dinobryon (Chrysophyta)

Synura (Chrysophyta)

MIXED ALGAE - No Cyanophyta - [Family and Species not provided]

4 Metre depth

(Items 356 -363) [27/11/16 to 15/1/2007]; (382 – 411) (10/4/2007 to 22/10/2007); (484 -569) (27/10/2008 to 569); (595 to 654) (29/12/2009 to 31/1/2011); (701-723) (29/12/2019 to 31/11/2019) [Total Items 202]

See Offtake for surface samples post Feb 2012

[Items 2947- 3140]{ (23/4/2007 to 9/11/2009); Items 3163-3179) - (1/4/2010 to 19/4/2010. [Total Items 209]

Algal Red Alert for Recreational use - 50,000 cell counts and SCA Risk management

Data provided by Tweed Shire Council Water Unit (Colours show different depths)

- 25.3.2019 - Planktolyngbya sp - 106,000 cell counts (CHD - 2m)
- 18.3.2019 - Planktolyngbya sp - 190,000 cell counts (CHD - 2m)
- 11.3.2019 - Planktolyngbya sp - 172,500 cell counts (CHD - 2m)
- 4.3.2019 - Planktolyngbya sp - 86,000 cell counts (CHD - 2m)
- 25.2.2019 - Planktolyngbya sp - 138,666 cell counts (CHD - 2m)
- 18.2.2019 - Planktolyngbya sp - 106,000 cell counts (CHD - 2m)
- 11.2.2019 - Planktolyngbya sp - 53,000 cell counts (CHD - 2m)
- 31/1/2019 – Total Cyanophyta – 58980 cell counts Surface B/Park 10.33 Bio Vol
- 15.12.2014 - Cyanogranis libera - 120,000 cell counts (CHD - 2m)
- 8/12/2014 - Chlorophyta - 58300 cell counts Surface B/Park 7.62.44 Bio Vol
- 1/12/2014 - Chlorophyta - 101115 cell counts Surface B/Park 5.44 Bio Vol
- 30/10/2014 - Chlorophyta – 155390 Total cell counts Surface B/Park 4.51 Bio Vol
- 27/10/2014 - Chlorophyta - 49840 cell counts Surface B/Park 9.55 Bio Vol
- 2.12.2013 – Aphanocapsa - 52,200 cell counts (CHD - 2m)
- 4.11.2013 - Cyanogranis libera - 104,000 cell counts (CHD - 2m)
- 28.10.2013 - Cyanogranis libera – 58,570 cell counts (CHD - 2m)
- 21.10.2013 - Cyanogranis libera - 210,000 cell counts (CHD - 2m)
- 14.10.2013 - Cyanogranis libera - 57,200 cell counts (CHD - 2m)
- 8.10.2013 - Cyanogranis libera - 290,000 cell counts (CHD - 2m)
- 2.4.2013 - Dolichospermum circinale -332,850 cell counts (CHD - 2m)
- 2.4.2013 - Aphanocapsa – 52,400 cell counts (CHD - 2m)
- 21/1/2013 – Total Chlorophyta - 84100 cell counts Surface B/Park 30.2 Bio Vol
- 14/1/2013 – Total Chlorophyta - 39600 cell counts Surface B/Park 11.2 Bio Vol
- 10.12.2012- Cyanogranis libera - 52,000 cell counts (CHD - 2m)
- 25/10/2012 - Chlorophyta -51800 cell counts Surface B/Park
- 1/11/2012 - Chlorophyta - 43990 cell counts Surface B/Park 14.99 Bio Vol
- 1/11/2012 - Chlorophyta - 57850 cell counts Surface B/Park 8.78 Bio Vol
- 26/11/2012 - Chlorophyta - 132365 cell counts Surface B/Park 2.18 Bio Vol
- 29/11/2012 – Total Chlorophyta - 312700 cell counts Surface B/Park 8.13 Bio Vol
- 3/12/2012 – Total Chlorophyta - 402200 cell counts Surface B/Park 9.94 Bio Vol
- 6/12/2012 – Total Chlorophyta - 659005 cell counts Surface B/Park 29.59 Bio Vol
- 10/12/2012 – Total Chlorophyta - 214000 cell counts Surface B/Park 9.17 Bio Vol
- 17/12/2012 – Total Chlorophyta - 224300 cell counts Surface B/Park 8.17 Bio Vol
- 20/12/2012 – Total Chlorophyta - 272425 cell counts Surface B/Park 14.23 Bio Vol
- 13/12/2012 - Total Cyanophyta– 103 ,900 cell counts (CHD – Surface)
- 23.4.2012 - Cyanogranis libera - 64,000 cell counts (CHD - 2m)
- 23/2/2011 Dolichospermum c – 52,900 cell counts (CHD – Surface) Bio/Vol 9.22
- 2/3/2011 Dolichospermum c – 64,500 cell counts (CHD – Surface) Bio/Vol 14.25
- 28.12.2011- Cyanogranis libera - 66,000 cell counts (CHD - 2m)
- 19.12.2011- Cyanogranis libera - 77,000 cell counts (CHD - 2m)
- 15/12/2011 - Total Cyanophyta– 57,710 cell counts (CHD – Surface)
- 12.12.2011- Cyanogranis libera -105,000 cell counts (CHD - 2m)
- 12.5.2011 - Aphanocapsa – 73,000 cell counts (CHD - 2m)
- 7.3.2011 - Aphanocapsa – 51,200 cell counts (CHD - 2m)
- 10.1.2011- Cyanogranis libera - 150,000 cell counts (CHD - 2m)
- 10.1.2011- Cyanogranis libera - 63,000 cell counts (CHD - 2m)
- 1st February 2011 - A Red Alert for the Clarrie Hall Dam was reported by the ‘The Tweed Link.
- 19/2/2010?
- 12.1.2009 - Aphanocapsa – 53,200 cell counts (CHD - 2m)
- 12.7 2009 – Dolichospermum Total 59,300 cell count surface B/Park 10.51Bio-Vol
- 17th October 2009 - A Red Alert for the Clarrie Hall Dam was reported by the ‘The Echo’.
- 14/12 /2009 Total Total Chlorophyta - 103510 cell counts Surface B/Park

- 26/10/2009 - Dolichospermum.cTotal 81,500 cell count surface B/Park 11.8 Bio-Vol
- 12/10/2009 Dolichospermum c – 456,000 cell counts (CHD – Surface) Bio/Vol 100.73
- 19/10/2009 Dolichospermum c – 53,100 cell counts (CHD – Surface) Bio/Vol 11.73
- 23/5/2008 - Aphanocapsa – 58,800 cell counts (CHD - 2m)
- 8.3.2005 Microsystis – 570,000 cell counts (CHD – Surface)
- **7th October 2002 - A warning on Algal Bloom** was issued by the Department of Land and Water Conservation.
- 27/12/2002 Total Chlorophyta - 122843 cell counts Surface B/Park
- 13/12/2002 Total Chlorophyta - 355542 cell counts Surface B/Park
- 30/10/2002 Total Chlorophyta - 840600 cell counts Surface B/Park
- 25/10/2002 Total Chlorophyta - 59020 cell counts Surface B/Park
- 23/10/2002 Total Chlorophyta - 78693 cell counts Surface B/Park
- 21.10.2002 - Aphanocapsa –56,500 cell counts (CHD - 2m)
- 21/10/2002 Total Total Chlorophyta - 57580 cell counts Surface B/Park
- 18/10/2002 - Cyanodictyon - (B/Park - surface) 128980 cell counts
- 16/10/2002 - Cyanodictyon - (B/Park - surface) 148000 cell counts
- 4/10/2002 - Cyanodictyon - (B/Park - surface) 61,660 cell counts
- 27/9/2002 - Cyanodictyon - (B/Park - surface) 52143 cell counts
- 20/9/2002 - Cyanodictyon - (B/Park - surface) 96000 cell counts
- 25/9/2002 - Cyanodictyon - (B/Park - surface) 263300 cell counts
- 18/9/2002 - Cyanodictyon - (B/Park - surface) 173000 cell counts
- 12/6/2002 - Cyanodictyon - (B/Park - surface) 87,000 cell counts
- 30/1/2002 - Anabaena - (B/Park - surface) 61000 cell counts
- 25/1/2002 - Anabaena - (B/Park - surface) 88600 cell counts
- 23/1/2002 - Anabaena - (B/Park - surface) 56600 cell counts
- 18/1/2002 - Anabaena - (B/Park - surface) 51000 cell counts
- 17/1/2002 - Anabaena - (B/Park - surface) 68500 cell counts
- 16/1/2002 - Anabaena - (B/Park - surface) 63000 cell counts
- 10/1/2002 - Anabaena - (B/Park - surface) 52500 cell counts
- 8/1/2002 – Total Cyanophyta - (B/Park - surface) 51700 cell counts

On data presented there were 80 levels Cyanophyta with cells over 50,000.

Data had been requested for Bray Park/Surface - surface sample post 2012 for the period 28/11/2014 to the current date. (Email to TSC 24.8.2019)

- **1st January 2002 - A Blue Green Algae alert** for **Bray Park Weir** and upstream was reported by the Regional Algal Coordinating Committee.
- **2nd November 2001** - Tweed Shire Council issued Algal Bloom Alert on 2nd November 2001 after tests revealed the presence of potentially poisonous algae in the Tweed River at **Bray Park Weir**.
- **February 5, 2019 Blue-green algae red alert at Bray Park Weir** - by Echonetdaily
“The species of blue-green algae identified in the weir is potentially toxic and may cause gastroenteritis in humans if consumed and skin and eye irritations after contact.” “Mr Burnham told Echonetdaily that extra releases from the dam to flush out the algae had been tried in the past, without much success. ‘You can waste a lot of water very quickly that way,’ he said.” “Warning signs have been placed at key recreational areas and will remain in place while high levels of blue-green algae are present”.
<https://www.echo.net.au/2019/02/blue-green-algae-red-alert-bray-park-weir/>
- **2 Nov 2012 Red Alert in Tweed for blue-green algae** - Tweed residents are being reassured that drinking water supplies from the **Bray Park Weir** are still safe, despite a red alert for the presence of blue-green algae. Brian Dodd, from the New South Wales Office of Water, says animals can die if they drink affected water, and humans should avoid any seafood from the warning area
- **28th October 2014 - A Red Alert** for potentially toxic blue-green algae at the **Bray Park Weir** in Murwillumbah was issued on the 28th October 2014. The North Coast Regional Algal Coordinating Committee alert means a high health risk is posed by the current state of the water in the weir, which is part of the town’s drinking-water catchment.
- <https://www.echo.net.au/2014/10/red-alert-blue-green-algae-murwillumbah-weir/>

Review of raw drinking water source within the Clarrie Hall Dam/Bray Park system.

The Hydrosphere Consulting (2011) Six Year IWCM Review Background Paper reports that:

“The review of raw water drinking quality, collected 1997-2011 was undertaken to examine raw water within the Clarrie Hall Dam/Bray Park system. (HWA 2011) and showed that:

* “Cyanobacteria are a primary health concern in dams and waterways as they have the potential to produce toxins. Cyanobacteria typically occur in the still or slow flowing parts of Clarrie Hall Dam and river systems (HWA2011)”.

Comment

“The nutrient source that reservoir managers have the ability to control is the internal nutrient load. The internal load is the release of phosphorus and nitrogen from the sediments in reservoirs that become stratified, particularly if the bottom waters adjacent to the sediments become anoxic as a result of reduced mixing and intense biological activity.”

[2.6.2 Nutrient management – What can be done to control nutrient inputs?

[CRC For Water Quality and Treatment Research Report – 2010 74 Para.3 P.51]

* “Although there have been algal events in the weirs and Clarrie Hall Dam *there has not been a toxic event.*

* During the summer of 2001/2002 algal blooms of the genus *Anabaena*, (*now renamed as the saxitoxin, “Dolichospermum circinale”*) occurred in the Tweed River resulting in the cyanobacterial *Geosmin* being released in the river water”.

* A recommendation that the Tweed Shire Council should provide for a Drought Management Strategy that would develop a Blue Green Management Plan.

[Hydrosphere Consulting (2011) - Six Year IWCM Review Background Paper. (P. 36.)]

Extracts from Sydney Catchment Authority - Cyanobacteria Risk Profile 2010

6.4.2 Saxitoxins (Paralytic Shellfish Poisons)

Formal guideline concentrations for maximum contamination of drinking water by saxitoxins have not yet been determined in Australia or internationally due to the lack of adequate data, but are currently under development. Based on the relative molecular toxicities of saxitoxin and microcystin-LR and observations of acute exposure effects by Fitzgerald et al (1999), the South Australian Health Department nominally applies a provisional health guideline for total saxitoxins of 3 µg / L. The same value has been recommended for the revised ADWG (NHMRC, 2010).

For a highly potent toxin-producing bloom of *Anabaena circinalis* the **3µg / L level** currently used in South Australia is equivalent to a cell concentration of approximately **20,000 cells / mL in raw untreated water**.

An alert level of 6,500 cells/mL at 30% of the density equivalent has been adopted.

An advisory is therefore issued if *Anabaena circinalis* cell concentrations exceed 20,000 cells / mL.

Further details can be found in Appendix C. SCA Cyanobacteria Risk Profile 2010 P.56

8.3.1 Artificial destratification

Most of the harmful species of cyanobacteria, including all the known toxin-producing species in Australia, tend to proliferate in calm stable waters. Typically they occur in lakes and reservoirs, especially in summer when thermal stratification reduces vertical mixing. Artificial destratification has been used in attempts to remediate lakes and ponds suffering from bottom anoxia (no oxygen) and nutrient loading from the sediments causing cyanobacteria blooms.

The SCA currently employs mixing by compressed air bubbling technique in Prospect, Avon, Nepean and Woronora reservoirs. **Pressurised air** is percolated through perforations of a long polyethylene pipe. Tallowa Reservoir was also mixed at the dam wall by compressed air bubbling from 2005 to 2009. The reservoirs in the Blue Mountains are destratified by mechanical mixers. Mixing in the SCA reservoirs was done historically to manage metals (iron and manganese) and was not optimised for algal control.

Artificial mixing has frequently failed to prevent cyanobacteria blooms because the mixing principles for optimum performance were neglected (Chorus and Bartram, 1999). There are numerous cases in Australia where destratification has satisfied thermal design criteria but failed to meet chemical and biological criteria. Sherman et al (2000) found that although properly sized destratification systems such as bubble plumes were able to drastically reduce the internal nutrient load, they frequently failed to produce a deeper surface layer. This failure to deepen the surface layer arises when local climatic conditions are not energetic enough (eg mean daily wind speed < 2-3 m/s) to deepen the surface layer even though the stratification has been greatly weakened.

Destratification can be expected to reduce average annual algal biomass where internal nutrient loads are significant, but it cannot be expected to cause a shift away from dominance by cyanobacteria.

8.3.2 Control of seed sources

Most species of cyanobacteria have a distinct seasonal pattern in temperate zones, and blooms normally occur in late spring and summer. Some species may survive as resistant spores (akinetes) during winter, whereas others hibernate as a small number of vegetative cells. The akinetes and hibernating cells are essential for the year-to-year persistence of cyanobacteria. A recent study indicated that the vegetative cells and akinetes are found in higher densities in shallow backwaters and lagoons on the flood plains. The backwater may also serve as the nutrient source. Isolation of those backwaters, especially during cyanobacteria risk periods, could reduce the blooms in the main reach of the river (Steffensen et al, 1999).

There is another hypothesis that the cells hibernate at the bottom and resuspend later in certain reservoirs. Cyanobacteria blooms cannot be controlled in SCA reservoirs by controlling the seed sources, as most of the reservoirs do not have specific backwaters and cyanobacteria cells are present throughout the year in almost all SCA reservoirs. SCA Cyanobacteria Risk Profile 2010 **P.73**

8.3.5 Hypolimnetic aeration / oxygenation

Hypolimnetic aeration is used in reservoirs with a stable thermal stratification during summer months. The process results in aeration of the hypolimnion without destratification, thus warming of the lake is avoided. Hypolimnetic aeration may affect the buoyancy of cyanobacteria. Further, this process may indirectly influence phytoplankton population by increasing the aerobic volume, in which the phytoplankton-grazing zooplankton can thrive. However, several studies on hypolimnetic aeration resulted in conflicting outcomes, as some investigators reported reductions in chlorophyll-a while others reported increases, and still others have reported no effects of the process on either the level of phytoplankton production or phytoplankton community structure (Yoo et al, 1995).

8.4 Long-term approach

In the long term, actions to try to control the fundamental causes of cyanobacteria blooms are often recommended. The most common focus of these long term strategies is to minimise the input of essential nutrients to the water body. Approaches for the long-term management of cyanobacteria are outlined in Sections 8.4.1 to 8.4.3.

8.4.1 Controlling nutrient inputs

It is the concentration of the key nutrients, nitrogen and phosphorus that, along with light, most influence cyanobacteria numbers in water. Although light intensity cannot be readily controlled and is in fact increased by reducing turbidity of water, nutrient levels can be controlled.

Reducing nutrient concentrations will reduce the algal carrying capacity of a storage without necessarily changing the species composition. The rate of growth of an algal species is dependent upon the available light, and cyanobacteria do not grow well in environments where the surface layer is deeper than three times the euphotic depth. The time scale of nutrient uptake is so much shorter than the time scale of photosynthesis that it is unlikely that nutrient concentrations alone will have a significant effect on growth rate. There is some evidence that the form of inorganic nitrogen (ammonium or nitrate) in the water column may influence competition between cyanobacteria species.

In the SCA's catchments the largest nutrient input originate from agricultural sources, including cropping land and livestock, particularly during large inflows. Although point source urban discharges such as STPs may dominate during low flow periods, the total volume at these times is very low and unlikely to be enough to trigger major cyanobacteria blooms. Overflows of untreated sewage were identified as a potentially significant source of nutrients in the past (eg the 2005 Catchment Audit report), however recent assessment suggests that the contribution of sewer overflows to the total annual nutrient inputs to the Warragamba Reservoir is insignificant (Water Futures, 2008; SCA, 2008d). SCA Cyanobacteria Risk Profile 2010. **P.73**

The following activities can be undertaken to control the nutrient addition caused by diffuse sources (Yoo et al, 1995):

□ control of runoff from developing and developed areas □ management (timing, quantity, etc.) of the application of phosphorous based fertilisers in line with soil requirements, climatic conditions and pasture types

□ control of overland runoff from feedlots, dairies, piggeries and other intensive animal farming operations by using holding dams, land application and reduced water use □ rehabilitation of riparian strips to provide a buffer strip between land uses and waterways □ reduction of soil loss from cropping lands through erosion control strategies □ control of stock and animal access to waterways (off-river watering, fencing, etc) □ limitation of phosphate based reagents □ careful siting, design and maintenance of on-site systems. SCA Cyanobacteria Risk Profile 2010 **P.76**

Table 6.1 SCA Alert Level Framework (SCA, 2010b) for cyanobacteria in drinking water sources with respect to public health

Alert level	Total Potentially toxin producing cyanobacteria Cells/mL	Total cyanobacteria biovolume equivalent	Total Microcystin-LR toxicity equivalents	Actions	Notifications
Alert	500 - <2000	N/A		Routine monitoring and surveillance for scum and odours	SWC and councils
Minor Incident	2000 - 6500	N/A		- Operations manager to raise incident and send notification forms to GM Water Supply - Implement weekly sampling for cell counts - Increase surveillance for scum and odours - Seek advice from NSW Health regarding toxicity monitoring - Obtain information on Water Filtration Plant performance	- NSW Health (cell count and toxin levels if monitored) - SWC and councils
Major Incident	>6500	N/A	1.3 µg/L	- Seek advice from NSW Health on actions/ warnings - Implement twice weekly sampling and surveillance	NSW Health (cell count & toxin levels), MSCRACC and affected customers
Emergency	Two or more consecutive instances of major incident levels	N/A		As per Major Incident and as agreed by NSW Health and affected customers	

SCA Cyanobacteria Risk Profile 2010 P.63.

SCA Cyanobacteria Risk Profile 2010

Table 6.2 SCA Monitoring and response framework (SCA, 2010b) for cyanobacteria in recreational water sources

Alert level	Total potentially toxin producing cyanobacteria cells/mL	Total cyanobacteria biovolume equivalent	Total Microcystin-LR toxicity equivalents OR Visible algal scum	Actions	Notifications
Green	500 – 5,000	0.04 – 0.4 mm ³ /L		Implement weekly sampling for cell counts and surveillance for scum & odours	Forward sample results to SCC and EE
Amber (Minor Incident)	5,000 – 50,000	0.4 – 4 mm ³ /L		- Operations Manager to raise incident and send notification forms to GMWS - Implement twice weekly sampling for cell counts and biovolume - Increase surveillance for scum and odours	- NSW Health (cell count and toxin levels if monitored) - SCC & EE (cell count) - Consult with EE on status of transfers, refer to operating protocols
Red (Major Incident)	>50,000	> 4 mm ³ /L	10 µg/L • Visible scums persist in the area	- Seek advice from NSW Health on actions/ warnings - Continue twice weekly monitoring including toxins - Erect signage in response to algal alerts issued by MSCRACC	- NSW Health (cell count and toxin levels) - NOW, MSRACC, EE - Direct customers - Stakeholders including downstream residents and recreational groups
Emergency	Two or more consecutive instances of major incident levels	Two or more consecutive instances of major incident levels		As per Major Incident and as agreed by NSW Health and affected customers	As per Major Incident and as agreed by NSW Health and affected customers

SCA Cyanobacteria Risk Profile 2010 P.55