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Committee Environment Committee

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Toxic cyanobacteria ‘blooms’ in Wellington’s rivers during 2005/06 – causal factors and management actions and implications

1. Purpose

To provide a summary of:

- the environmental conditions that contributed to toxic cyanobacteria proliferations in Wellington rivers during spring and summer 2005/06; and
- actions and initiatives undertaken since 2005/06 to assist with early detection and management of potential cyanobacteria problems in the future.

2. Background¹

During spring 2005, thick mats of benthic² cyanobacteria (blue-green algae) established in several of the region’s rivers commonly used for contact recreation. The Hutt River was affected for much of the spring and summer, with thick, dark brown-black mats of cyanobacteria (*Phormidium* sp.) found in the channel and exposed along the river margins in the Boulcott-Avalon area in early November 2005 (Figure 1). Significant cyanobacteria growth was also observed in the Otaki, Waikanae, Mangaroa and Wainuiomata rivers around the same time, and in the lower Waipoua River in March 2006.

At least five dogs were reported to have died after coming into contact with cyanobacteria mats in the Hutt River catchment during November and December 2005. Analytical tests confirmed the presence of cyanotoxins in samples from the mats and the stomach contents of one of the dead dogs. An inter-agency response team was immediately established comprising Greater Wellington Regional Council (Greater Wellington), Regional Public Health and local councils. River monitoring was stepped up, media releases issued and

¹ See also Report 06.12, 23 February 2006

² attached, bottom-dwelling

health warning signs erected restricting access to affected rivers. Restrictions remained in place for most of the 2005/06 summer.



(PHOTO COURTESY OF CAWTHRON INSTITUTE)

Figure 1: Exposed mats of cyanobacteria in the Hutt River, November 2005.

3. Causal factors

Environmental conditions experienced during spring 2005 were highly favourable to the establishment and growth of periphyton (filamentous algae and benthic mat-forming cyanobacteria) in the region's rivers. The weather during spring was more stable, warmer and drier than usual, particularly in the west of the Wellington region (Figure 2). These conditions resulted in below average river flows in all of the rivers subsequently affected by cyanobacteria proliferations.

During late August to mid-September, and in November 2005, the affected rivers experienced extremely low flows for the time of the year. Major water abstractions for public water supply (all of which are authorised by resource consents) during spring exacerbated the low flow conditions in the Waikanae, Hutt and Wainuiomata rivers. The extended dry spells in spring 2005 also meant that there were fewer 'freshes' through the rivers, particularly in August, September and November. For example, the Otaki, Waikanae, Hutt (Figure 3) and Wainuiomata rivers all had periods of at least 40 days with no significant fresh, which is highly unusual for the time of year.

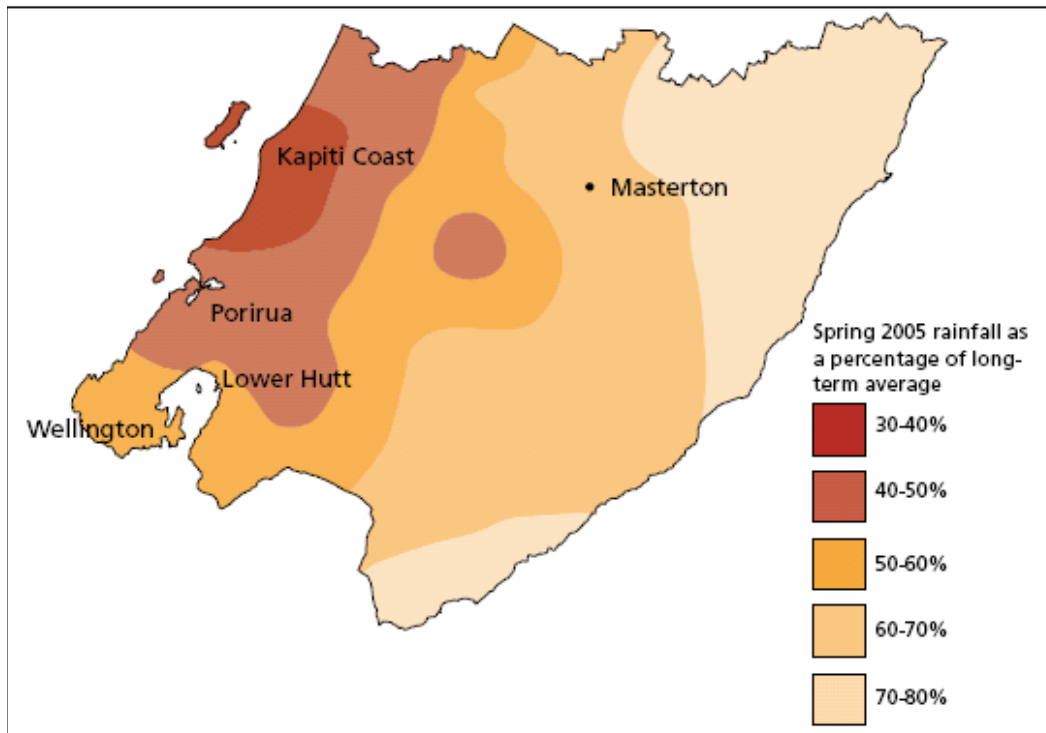


Figure 2: Rainfall during spring 2005 as a percentage of the long-term average spring rainfall.

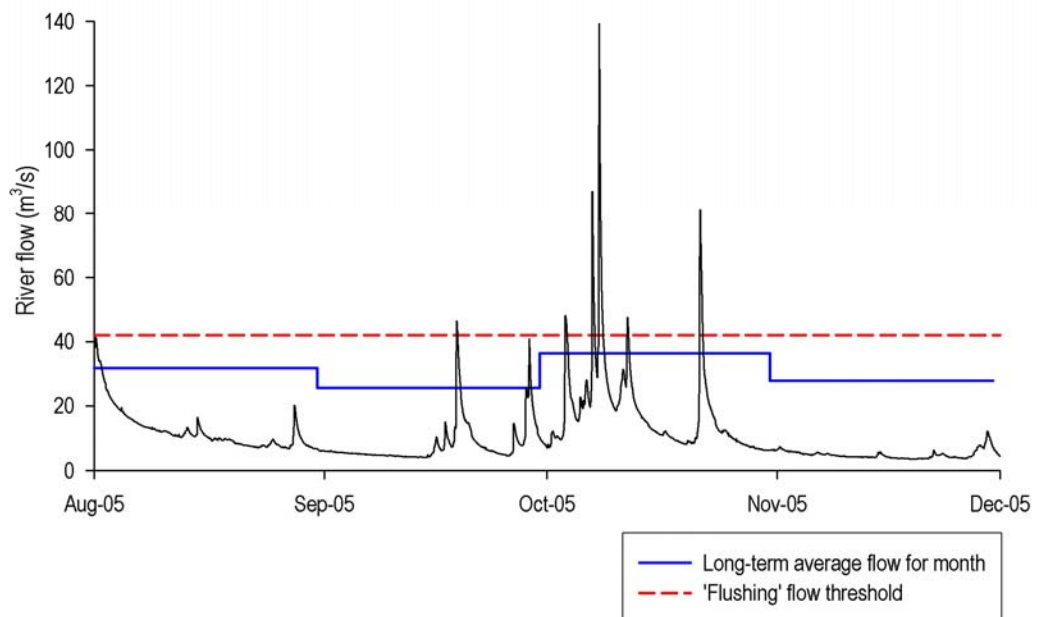


Figure 3: Flow in Hutt River at Taita Gorge, August to December 2005, with long-term average monthly flows and a 'flushing' flow threshold (indicative) shown.

Greater Wellington's water quality monitoring records from the Hutt River at Manor Park indicate water temperatures were above average, reflecting above average sunshine hours and air temperatures during this period. In addition, several visual clarity measurements made at Manor Park during spring were above the long-term 90th percentile value, suggesting that low rainfall and associated stable river flows provided for high water clarity at this time.

Warm water temperatures and good clarity (light supply) are both conducive to periphyton growth.

Other than above average spring water temperatures, and possibly water clarity, there is nothing unusual in Greater Wellington's water quality monitoring records for spring 2005. Unauthorised nutrient discharges to water were identified in the lower Mangaroa catchment but were unlikely to have been a major contributor to the benthic cyanobacteria proliferations in the Hutt River.

The presence of extensive mats of *Phormidium* sp. in multiple rivers of varying nutrient status, including the relatively pristine upper reaches of the Otaki and Wainuiomata rivers, is consistent with its widespread distribution reported in the literature. Overall, it is concluded that the climatic and hydrological conditions experienced during spring had the most significant influence on the proliferations of *Phormidium* sp. in 2005/06; in particular, the lack of 'flushing' flow events and extended period of stable, low flows.

4. Actions and initiatives taken

Following the 2005/06 summer, Greater Wellington, Regional Public Health and local councils agreed on a protocol for responding to future benthic cyanobacteria proliferations in rivers in the region. The protocol outlines the key roles and responsibilities of the various organisations during both 'normal' and 'response' conditions, with the aim of improving response speed and effectiveness.

Other actions taken to assist with early warning detection of and response to cyanobacteria proliferations include:

- the introduction of automated river flow alarms to act as an 'early warning system' of flow conditions that might lead to a problem with benthic periphyton growth at bathing sites;
- improved training of field staff in the identification of cyanobacteria mats, in particular, in recognising and reporting potentially problematic growths;
- a review of the periphyton assessments undertaken weekly at freshwater bathing sites over the summer months (1 November to 31 March) so that both filamentous and mat-forming periphyton cover is assessed at all sites;
- the provision of further information about cyanobacteria on Greater Wellington's *On the Beaches* bathing webpage, including a facility for regular updates on rivers where warnings are in place; and
- the development of standardised warning signs for use in the Wellington region.

Further public education and awareness initiatives will be investigated this year, including press releases prior to and during bathing season and the production of leaflets or posters that can be distributed to vets and displayed in

Greater Wellington and local council offices. Ongoing public education about the potential risks cyanobacteria pose to human and animal health is particularly important; it is not possible to monitor all of the river reaches where cyanobacteria may proliferate and people or animals may visit.

5. Management implications

Phormidium sp. are common and cosmopolitan, with extensive attached or detached mats documented in many countries. For example, in the Wellington region alone, *Phormidium* sp. was present (but not necessarily abundant) at 30 of 46 RSoE sites monitored by Greater Wellington for periphyton during summer and autumn 2006. Other potentially toxic species of benthic cyanobacteria are also present in the region, including *Oscillatoria* sp. and *Lyngbya* sp. Given the wide-ranging distribution of these cyanobacteria genera, it is perhaps surprising that more animal deaths have not been reported.

It is a reality for the Wellington region that environmental conditions conducive to cyanobacteria proliferations may occur again in the future. Already in 2007, warm, dry weather during February accelerated the growth of benthic cyanobacteria in a number of the rivers affected in 2005/06, prompting one local council to erect health warning signs as a precautionary measure. In the South Island, similar conditions have led to proliferations of *Phormidium* sp. in the lower Ashley River (North Canterbury). At the time this report was being finalised, at least two dogs had died after chewing on mats in the Ashley River and another had been seriously ill. Toxin analysis performed on samples of the mats confirmed the presence of cyanotoxins.

Until recently, cyanotoxin production has primarily been associated with planktonic cyanobacteria, typically in lake environments. The dog deaths in the Hutt River catchment in late 2005, coupled with the recent dog deaths in north Canterbury, have increased awareness of the potential toxicity of benthic cyanobacteria, including the presence of a specific cyanotoxin, homo-anatoxin-a, and its associated degradation product (previously unreported in New Zealand).

6. Current obstacles and knowledge 'gaps'

Despite implementing measures to assist with the early detection of benthic cyanobacteria problems in the region's rivers, there is currently a lack of national guidance. In addition, the extent, frequency, and causes of toxicity in benthic cyanobacteria are poorly understood.

Practical guidance is urgently required to manage the response to benthic cyanobacteria proliferations. Toxin analysis is expensive to conduct on a regular basis and testing other than to confirm the existence of a suspected problem is of limited value given the factors affecting cyanotoxin production are poorly understood. In lake environments affected by planktonic cyanobacteria blooms, cell counts are often used as a surrogate measure for toxicity. However, these monitoring methods and associated guidelines can not be transferred directly to benthic cyanobacteria in river environments.

Based on the findings of the limited toxin testing of benthic cyanobacteria samples from the Wellington and Canterbury regions, it would appear that the greatest risk to human and animal health is posed by thick mats that are 'stranded' exposed, or near exposed, at the river's edge. Such mats are easily accessible to animals, and attractive to dogs.

7. Communication

Copies of a technical report³ documenting the cyanobacteria proliferations of 2005/06 will be sent to all the territorial authorities in the region and to Regional Public Health. Copies of the report can be made available for councillors who wish to have a copy. A press release will be issued documenting the key findings of the report, with the report displayed on-line at www.gw.govt.nz/on-the-beaches.

8. Recommendations

It is recommended that the Committee:

1. **Receive the report; and**
2. **Note the contents.**

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³ Toxic benthic cyanobacteria proliferations in Wellington's rivers in 2005/06 (Report No. GW/EMI-T-07/72).