10 April 2017

Essential Services Commission
Level 37/2 Lonsdale Street
Melbourne Victoria 3000

RE: ESC's DRAFT DECISION – 2017 Quiet Lakes Bore Flushing Tariff Proposal

Thank you for the opportunity to respond with my concerns about the ESC's Draft Decision as discussed in our meeting at your office on the 20th March 2017.

As you are aware from our meeting, the ESC has been misled by its subsequent private unpublished consultations with Melbourne Water, which has caused the ESC to blindly follow Melbourne Water's disregard for protecting human health in one of its regional public drainage systems that freely discharges into other publicly accessible waterways.
As a consequence, the ESC has based its draft decision on many factual errors leading to a fundamentally factually inaccurate draft decision approving Melbourne Water's bore flushing tariff.

The ESC's decision on whether the residents or Melbourne Water become financially responsible to run the bore to maintain secondary contact water quality is not a decision by the ESC to be basing on a willingness to pay. Of course, the Quiet Lakes residents are willing to pay when presented with Melbourne Water's black mail style consultation of vote 'Yes' or 'the bore will be turned off for ever'. Quiet Lakes residents have seen and lived with unsafe levels of Blue Green Algae and given the chance would of course choose to pay to save their health and wellbeing to avoid being subjected to unsafe levels of Hazardous Blue Green Algae again. However, managing safe levels of Blue Green Algae is one of the functions that the Melbourne Metropolitan Waterways and Drainage Charge (MMWDC) cover as part of Melbourne Water requirement to improve waterway health and protect public health, which the Quiet Lakes residents already pay.

Melbourne Water claim that it is running the bore as a result of requests by residents for a higher level of water quality over and above secondary contact is factually incorrect. It was only by accessing the original and renewal ground water licences through 'Freedom of Information' that uncovered Melbourne Water's dastardly deed in 1991 when Melbourne Water unilaterally decided to reduce the bore licence from 730ML/yr at 2ML/day to just 20ML/yr at 2ML/day without any consultation with residents essentially starving the Quiet Lakes of any flow through or water renewal from that moment forward. Eventually this situation in conjunction with the drought lead to over a decade of unsafe levels of Blue Green Algae. Only by 'Freedom of Information' was this situation discovered which Melbourne Water was hiding from the residents. With the assistance of Donna Bauer, the former local member for Carrum, a meeting was arranged with the Hon. Peter Walsh, the former State Water Minister. Despite Melbourne Water's objections to running the bore, thankfully the Hon. Peter Walsh ordered Melbourne Water to increase the ground water licence and evaluate the effect of running the bore on

managing safe levels of Blue Green Algae. Alleluia! As soon as the bore began to run on the 01/10/12 the Blue Green Algae dropped to safe levels in Lakes Legana and Illawong from that moment onwards. The residents request of the Hon. Peter Walsh, not Melbourne Water, was in the desperate hope that running the Quiet Lakes as they were originally designed would transition the Quiet Lakes from a persistent health hazard effected by unsafe levels of Blue Green Algae to a healthy waterway with consistent safe levels of Blue Green Algae below 10mm3/L.

The Quiet Lakes resident's willingness to pay should not overshadow the resident's belief that Melbourne Water is financially responsible to run the bore to maintain safe levels of Blue Green Algae to protect human health that is substantiated by the 581 signature petition.

The ESC wants to ignore the resident's 581 signature petition that calls upon the Water Minister to compel Melbourne Water to fulfil its obligation to implement Recommendations 3 & 6 of the Independent Review, claiming that the 581 signature petition is unrelated to the bore tariff proposal. This position stated by the ESC in its Draft Decision is just one of many examples of the ESC's distinct lack of understanding of the Blue Green Algae water quality health issues and how pertinent information that has been presented to the ESC from various submitters connects with an expectation of the ESC to conduct an honest assessment and decision on the management of safe levels of Blue Green Algae that improves waterway health and ensures the protection of human health is managed by a responsible Water Authority.

Melbourne Water wants the ESC to believe that running the bore is about achieving swimmable water but its not. Running the bore is about managing safe levels of Blue Green Algae to maintain secondary contact water quality suitable for secondary contact activities. The simple fact is that the resident's 581 signature petition applies to the core of Melbourne Water's obligation to implement the Design Flow Water Quality Management Plan (DFWQMP) by running the bore to manage safe levels of Blue Green Algae (IR Rec 3) funded by the MMWDC funds (IR - Rec 6) supported by the identity and signatures of 581 residents. A petition of magnitude far greater than Melbourne Water's survey, that unquestionably calls for Melbourne Water to fulfil its obligation to implement Recommendations 3 & 6 of the Independent Review, which include:

- Implementation of the Design Flow Water Quality Management Plan (IR – Rec 3).
  The DFWQMP was commissioned for the sole purpose of: *"The primary objective of this strategy is to provide water quality improvement option that will help prevent cyanobacterial (blue-green algal) blooms developing and improve the overall water quality within the Quiet Lakes. The water quality management strategy seeks to provide a balance between the expectations of residents in terms of costs and enhancing the lakes system's recreational* (i.e. includes secondary contact activities such as boating, fishing and wading) *and amenity value,* ***mitigating public health risks and achieving a healthy lake ecosystem.***
  (DFWQMP, section 1.3 Purpose, page 8)

  The DFWQMP includes the implementation of:
  - Removing carp populations (MW is agreeable to)
  - **Continuing to run the bore at 1.5ML/day (MW objects to)**

- Aquatic planting (MW is agreeable to)
- Removal of the nutrient rich sediments (MW objects to)

(DFWQMP, section 1.3 Purpose, page 8 & section 7.1, figure 10, page 32 – Appendix A)

- *That the system of interconnecting water flows between the three Quiet Lakes be **managed, funded, and operated** by Melbourne Water to deliver the outcomes of this Review. These are to be funded from the MMWDC.* (IR – Rec 6)

The ESC is out of order to dismiss and disregard a 581 signature petition calling for Melbourne Water to fulfil its obligation to implement Recommendations 3 & 6 of the Independent Review, which is clearly directed at Melbourne Water's obligation to use *"groundwater to flush a minimum of 1.5ML/day over the summer period to reduce lake residence time and remove algal biomass from the lake system"* (DFQWMP, page 4). The DFWQMP recommendation to run the bore is a key element *"to provide water quality improvement options that will help prevent cyanobacterial (blue-green algal) blooms developing"* (DFQWMP, page 8) "*with the interconnecting water flows between the three lakes be **managed, funded and operated** by Melbourne Water to deliver the outcomes of the review* (i.e. to deliver IR Recommendations 2, 3, 4 & 5 as detailed on page ix.) *These are to be funded from the Melbourne Metropolitan Waterways and Drainage Charge funds"* (IR Rec 6, page x)

The ESC is also out of order to dismiss and disregard the PLQLOR community bulletin advising residents to vote 'Yes', which had the effect of influencing a 75% Yes vote result and consequently forced Melbourne Water to make a price submission that could then be contested. By the residents. Alternatively, Melbourne Water would have gladly turned off the bore and walked away to leave the residents with unsafe levels of Blue Green Algae as is the current situation on Lake Carramar. Never would one have imagined that Melbourne Water would stoop so low as to promote misleading and factually incorrect information to support its pricing submission with a win at all costs mentality. As a consequence, Melbourne Water has demonstrated no intention to fulfilling its core values to improve waterway health and protect human health.

Following PLQLOR's meeting with the ESC last year on the Thursday 26/05/2016 to discuss the ESC's 2016/17 Draft Decision and subsequent phone conversations to discuss the ESC's Final Decision to reject Melbourne Water's pricing proposal, Angeline Bilas (ESC) advised me in an email received Friday, 21 October 2016 that "*our expectation is that Melbourne Water consults widely. We are meeting with Melbourne Water late next week to discuss the bore tariff, including our expectations"*
In this regard the ESC has failed the Pricing Submission Process by allowing Melbourne Water to avoid its obligation to consult widely with the residents. In fact the ESC has accepted Melbourne Water's refusal to consult widely, by dressing up Melbourne Water's two "communications" distributed to residents during 2016 as being "consultation"

Definition of Consultation: a process by which the public's input on matters affecting them is sort.

Melbourne Water has not consulted widely as was required by the ESC. In fact Melbourne Water did not consult at all between its March 2016 Draft response and submitting its 2017/18 Pricing Proposal. Melbourne Water did nothing more than communicate the ESC's 2016/17 Final Decision and its intention to submit a 2017/18 Pricing Proposal to the ESC before the 01/12/2016. Melbourne Water hasn't even attended or initiated a Independent Review Steering Committee meeting to consult with the resident's representatives since August 2015. Yet consultation is supposed to be a key component of any ESC Pricing submission

At this years meeting with the ESC on the 20th March 2017, Marcus Crudden (Director ESC) took great offense to being advised that the resident's perception of the Draft Decision is that the ESC is working collaboratively with Melbourne Water to approve a Melbourne Water favoured outcome. Marcus was not only offended by the comment but adamant that the ESC, without question, operates as an unbiased independent regulator. I am confident this is a true position for Marcus and the ESC, however I request that Marcus ensures that his team is adopting the same unbiased integrity in making its Final Decision, which is not apparent by virtue of the numerous factual errors that distinctly reflect the views of Melbourne Water that have been presented in the ESC's Draft Decision.

THE KEY ISSUES

1. MELBOURNE WATER'S OBLIGATIONS ON WATER QUALITY IN THE QUIET LAKES AREA.

In regard to Melbourne Water's obligation to maintain secondary contact water quality in the Quiet Lakes I will demonstrate to the ESC that in fact Melbourne Water is not meeting its obligation.
To assist in establishing Melbourne Water's obligation it is important for the ESC to take note of its own stated background information from Melbourne Water's Proposal.

The ESC Draft Decision states (ESC Draft, 1.2, page 1):
"In 2012, the Victorian Minister for Water requested the establishment of the Patterson Lakes Independent Review (Independent Review). ***The aim of the Independent Review was to assess existing management arrangements for the Patterson Lakes waterways, and provide future management strategies based on a fair and equitable funding model that addressed the interests of beneficiaries of the Quiet Lakes****. Melbourne Water and the Patterson Lakes Residents Association selected the panel of reviewers from Planning Panels Victoria's group of independent panel members."*

The ESC has acknowledged that the Independent Review was commissioned by the former Water Minister specifically **to assess the management arrangements for the Patterson Lakes waterways**. As such the Independent Review is not about how Melbourne Water manages other waterways, that may not be classified as a secondary contact water body, that may not be located in such close proximity to residential housing, that may not have inappropriate residence time

due to the absence of sufficient inflows from a waterway or local drainage system or water pumps. Unless those other waterways that Melbourne Water refers to are the related Patterson Lakes Tidal Waterway and the interconnected Kananook Creek.

The Independent Review advises that Melbourne Water does operate and maintain a pump to provide flows and minimise retention times in the Tidal Waterways and the same pump to maintain environmental flows in the Kananook Creek that is funded by the MMWDC.
(IR, section 6.1 current service provision, page 79)

According to the Melbourne Water's Kananook Creek Corridor Management Plan the Kananook Creek Pump Station provides reliable flushing flows to manage poor water quality in Kananook Creek due to high nutrient levels and the high algal content that is funded by the MMWDC. This is the exact same purpose the Gladesville Boulevard pump station has to manage the exact same water quality issues in the interconnected Quiet Lakes.
(MW's Kananook Creek Management Plan - Section 6.2.1 page 18)

The ESC Draft Decision also states (ESC Draft, page 11 & 12):
"Melbourne Water is required to comply with the SEPP and NHMRC Guidelines in managing water quality within its waterways management district.
Water quality standards for waterways are defined in the NHMRC Guidelines according to the degree of contact with water during recreational activities, consistent with guidelines set by the World Health Organisation.[18] The NHMRC Guidelines classify recreational water contact according to the following three categories:

- *Primary Contact e.g. swimming*
- ***Secondary Contact e.g. boating, fishing, wading***
- *Non Contact e.g. sun bathing*

It is noted that the Independent Review recommended that minimum water quality standards in the Quiet Lakes ***be maintained to comply with the secondary contact criteria*** *as defined in the Australian and New Zealand Environment Conservation Council Guidelines (ANZECC Guidelines) and the SEPP.[20] The ANZECC Guidelines for recreational water quality in Australia rely on the NHMRC Guideline values.[21]*

For levels of Cyanobacteria the NHMRC Guidelines outline a primary contact standard limit of 10mm3 bio volume of Cyanobacteria per litre of water. There are currently no secondary contact limits for levels Cyanobacteria within the NHMRC Guidelines (or the ANZECC Guidelines, or the SEPP), as it is considered that the impact of secondary contact with Cyanobacteria is so low as not to warrant a limit.[22]"

The ESC has 'correctly' acknowledged that Melbourne Water is **required to maintain secondary contact water quality** as defined by the NHMRC Guidelines.

The ESC has also 'correctly' acknowledged that the NHMRC Guidelines define 'recreational water' as being the three categories of primary, **secondary** and non-contact classifications of varying degrees of water contact.

The ESC has further 'correctly' acknowledged that secondary contact **includes** activities such as **boating, fishing & wading.**

Unfortunately, the ESC has **incorrectly** stated that *"that the impact of secondary contact with Cyanobacteria is so low as not to warrant a limit"*

At our recent meeting with the ESC, Jess Young (ESC) read the particular ESC Draft Decision reference [22], which was taken from the NHMRC Guidelines.
*"The difference between this two level guideline and the three levels suggested by WHO is that the **lowest level** recommend by WHO (of 20000 cyanobacterial cells/mL) for **protection of health outcomes due to irritative or allergenic effects'** is here not considered sufficiently significant to warrant a specific warning'……."* (NHMRC page 103, ESC Draft page 12)

It was brought to the ESC's attention that this statement actually applies to the **WHO's lowest level** (i.e. non hazardous water – WHO Green level Surveillance mode). That WHO's lowest level has nothing to do with hazardous or unsafe levels of Blue Green Algae, which is why it doesn't warrant a specific warning at that particular safe level.
The ESC was made aware that the Australian two level Guideline applies to **WHO's highest level** (i.e. hazardous water – WHO Red level Action mode).
The ESC's use of its reference as a key component of its Draft Decision is a fundamental factual error that has caused the ESC to derive a factually incorrect conclusion in its Draft Decision that "*secondary contact* (i.e. **irritative and allergenic** health outcomes that arise from secondary contact exposure) *with Cyanobacteria is so low as not to warrant a limit"*

As discussed in our meeting the correct location within the NHMRC Guidelines for establishing the adverse health outcomes for secondary contact (i.e. **irritative and allergenic** health outcomes that arise from secondary contact exposure) is under the heading 'Action mode – Red level' on page 114.
It is 'Action mode – Red level' (>50000 cyanobacterial cells/mL) that relates directly to the protection of human health for secondary contact water quality under the Australian two level Guideline.

The NHMRC Guidelines state:
***"Australian Level 1** – Toxic BGA >50000 cells/mL or biovolume equivalent of >4mm3/L for TOXIC Blue Green Algae."* (NHMRC, section 6.5.2. page 114)
This level relates to ingestion from primary contact or inadvertent immersion through slipping or falling into the water whilst participating in secondary contact activities e.g. boating, fishing or wading.
It should also be noted that the NHMRC Guidelines state on page 16: *"In water sports, the skill of the participant will also be important in determining the extent of involuntary exposure, particularly ingestion"* (NHMRC, section 1.5 page 16)
"To reiterate the definition of the potential health risks the Level 1 guideline is developed to protect against short term health effects of exposure to cyanobacterial toxins ingested during recreational activity" (NHMRC, section 6.5.2 page 114)

Australian Level 2 *– Non Toxic BGA >50000 cells/mL or biovolume equivalent of >10mm3/L for NON TOXIC Blue Green Algae* (NHMRC, section 6.5.2. page 114)
This level relates to direct contact with the skin during primary contact & secondary contact activities and/or inhalation from BGA airborne particulates on windy days during primary contact, secondary contact or non-contact activities when in close proximity to the water. This could be exposure to inhalation of unsafe levels of hazardous Blue Green Algae affected water by residents in their own gardens or inside their homes with the windows open.
"the Level 2 guideline applies to the circumstance where there is a probability of increased likelihood of non-specific ***adverse health outcomes, principally respiratory, irritation and allergy symptons*** (i.e. secondary contact health affects as highlighted by Jess Young's incorrect reference taken from NHMRC, page 103) *from exposure to very high cell densities of cyanobacterial material irrespective of the presence of toxicity or known toxins"*
(NHMRC, section 6.5.2. page 114).

The Australian two level Guideline for establishing the safe limits of Blue Green Algae in **recreational water** (i.e. primary, secondary and non-contact classifications for **'recreation water'** – ESC Draft, page 11 & NHMRC, page 7 & 91) are clearly detailed in the NHMRC Guidelines
"Guidelines
Fresh ***recreational water*** *bodies should not contain:*

- *≥ 10 ug/L total microcystins; or ≥ 50000 cells/mL toxic Microcystis aeruginosa; or biovolume equivalent of ≥ 4 mm3/L for the combined total of all cyanobacteria where a known toxin producer is dominant in the total biovolume; or*
- *≥ 10mm3/L for the total biovolume of all cyanobacterial material where known toxins are not present; or*
- *Cyanobacterial scums consistently present."*

(NHMRC Executive Summary Table A & page 7; Section 6, page 91).

The NHMRC Guidelines are clearly related to fresh **recreational water**. The ESC stated in its Draft Decision that **recreation water** is classified into the three categories of primary, **secondary** and non-contact levels of contact with the water. (ESC Draft, page 11)
The NHMRC Guideline limits for unsafe levels of Blue Green Algae and the unquestionable association with secondary contact water quality and requirement for preventive action is further supported by the various documents published by the various Authorities:

1. The BGA warning signs displayed by Melbourne Water when Blue Green algae exceeds 10mm3/L, which includes images warning against secondary contact activities such as no fishing, no boating and no exposure to pets
   (MW, Appendix B)
2. The Blue Green Algae community information distributed to resident's letter boxes when Blue Green Algae exceeds 10mm3/L, which includes warnings by Melbourne Water of *"increased risk to people and pets that come in contact with the water. This is because of the increased volume of a toxic form of blue green algae above the level to be determined" Skin contact with either toxic or non toxic forms of blue-green algae when participating in water-based activities can cause problems such as skin rashes, swollen lips, blisters, eye irritation and redness, ear ache and itchiness, sore throat, hay fever symptoms, asthma and possibly promotion of skin tumors. The risk is likely to increase with repeated exposure to the water and especially if the water is swallowed."*

Melbourne Water's classification that canoeing, sailing, rowing are medium risk of adverse health outcomes, assuming avoidance with any contact with the water, is absolutely ridiculous in a waterway that has no jetties and involves participants of varying skill levels. The ESC's conclusion that *there are currently no secondary contact limits for levels Cyanobacteria within the NHMRC Guidelines"* (ESC Draft page 12) is not only factually incorrect and absurd, it is totally irresponsible against the protection of human health for the ESC to hold this belief and publish such a statement.
(MW, Appendix C)

3. The various highlighted pages from the NHMRC Guidelines:
    a. Executive Summary (NHMRC, page 1).
    b. Executive Summary (NHMRC, Table A, page 4).
    c. Cyanobacteria and algae in fresh water Guidelines (NHMRC, page 7 & 8)
    d. Aim of these Guidelines (NHMRC, page 11)
    e. Designation of Recreational Activities (NHMRC, p16)
    f. Algae and cyanobacteria (NHMRC, page 17)
    g. Potential adverse health outcomes (NHMRC, page 18)
    h. Hazards and Measures for reducing risks with Cyanobacteria – Table 1.2 (Primary) is exactly the same as Table 1.3 (Secondary). (NHMRC, pg20 Vs. 21)
    i. Guidelines and Guideline Values (NHMRC, page 23)
    j. Summary of the guidelines for recreational water (NHMRC, page 24)
    k. Design of monitoring programs (NHMRC, page 27)
    l. Cyanobacteria and Algae in fresh water (NHMRC, p91)
    m. WHO Level 1 (NHMRC, page 102)
    n. Australian guideline (NHMRC, page 103)
    o. Interpretation of cyanobacterial alert levels (NHMRC, page 107)
    p. Recommended action at different alert levels (NHMRC, pg112)
    q. Action mode – red level (NHMRC, page 114)

    (NHMRC, Appendix D)
4. DEPI letter to Melbourne Water to follow the BGA Circular
    (DEPI - 04/09/2013, Appendix E)
5. Department of Health letter to Melbourne Water advising to follow the NHMRC Guidelines
    (DoH – 04/09/2013, Appendix F)
6. Blue Green Algae Circular 2016-17
    (DEPI, pg1, Appendix G)

Beyond all doubt, the referenced documents connect unsafe levels of Blue Green Algae ≥ 10mm3/L as having the probability of increased likelihood of non-specific secondary contact adverse health outcomes of respiratory, irritation and allergy symptoms in association with the secondary contact activities of rowing, sailing, canoeing, boating, fishing, wading and paddling.

There is NO document that I am aware of that states that unsafe levels of Blue Green Algae ≥ 10mm3/L pose NO Risk of non-specific adverse health outcomes of respiratory, irritation and allergy symptoms in association with the secondary contact activities of rowing, sailing, canoeing, boating, fishing, wading and paddling.
Consequently, the ESC has made a factually incorrect conclusion due to the misreading of the reference *"the impact of secondary contact with Cyanobacteria is so low as not to warrant a limit"*[22]

2. Beneficial Use of the Quiet Lakes

The ESC Draft Decision states that the Quiet Lakes residents are the 'primary beneficiary' of water quality without any qualification as to how the ESC came to that conclusion or from where that conclusion is referenced within the Independent Review.

The ESC also advises that Melbourne Water has agreed to the findings of the Independent Review and that ESC decisions for Patterson Lakes Waterways are to be consistent with the findings of the Independent Review.

The Independent Review states:

"Both the Quiet Lakes and the Tidal Waterways also outflow into neighbouring drains leading to Kananook Creek, which outflows into Port Phillip Bay at Frankston
This demonstrates the Patterson Lakes Waterways were designed, situated and created to perform a floodplain management and drainage retention function. The Review also acknowledges that the interconnectedness of the Patterson Lakes Waterways reflects high reliance upon the broader catchment as a source of water. They also play an important role in the primary treatment of stormwater before it is discharged into Port Phillip Bay"
(IR, Current Situation 5.2, p.64)

"The water quality of Patterson Lakes Waterways affects those who live there, use them, and those downstream abutting drainage and watercourse areas (via outflows). This includes not only human activity but also flora and fauna species and broader ecosystems."
(IR, Water Quality 5.3, p.64)

"The practical function that the Quiet Lakes and Tidal Waterways play in the regional drainage network is not insignificant. The review concludes from the literature and submissions that Melbourne Water operates the drainage system components of Patterson Lakes to e broader catchment, and that this is consistent with the Authority's metropolitan waterways role"
(IR, Conclusion 5.5, p.74)

"Whilst the pipeline and pumping system operation does directly benefit the water quality in the Patterson Lakes, it also provides benefit to the Patterson River, Kananook Creek, and Port Phillip Bay water health and associated recreational uses"
(IR, Conclusion 5.5, p.74)

"The review concludes that Melbourne Water should manage, operate and maintain these functions from the Melbourne Metropolitan Waterways and Drainage Charge funds."
(IR, Conclusion 5.5, p.74)

The ESC's Draft decision has NO basis for assigning the Quiet Lakes residents as being the 'primary beneficiary' of water quality. The Quiet Lakes residents are either the 'sole beneficiary' or a 'joint beneficiary' with the broader community.

Clearly the Independent Review considers Quiet Lakes to be provide benefit to the broader catchment area in meeting the requirement to discharge healthy secondary contact water quality

to the interconnected downstream waterways in conjunction with the Quiet Lakes drainage retention function for flood mitigation.

As the Quiet Lakes residents are identified by the Independent Review as being 'joint beneficiaries' with the broader community providing secondary contact water quality and a flood mitigation drainage function the ESC's 'user pays' methodology does not permit the ESC to apply a special tariff to a single group amongst the many benefitting groups for the cost of improving waterway health, protecting human health and the drainage retention flood mitigation function that is already being paid for by Quiet Lakes residents from the MMWDC funds.

The ESC's Draft decision to approve a special tariff to run the bore to manage safe levels of BGA on the basis of an unqualified and inappropriate classification of 'primary beneficiary' is inconsistent with the Independent Review and is inconsistent with the ESC's former Final Pricing Decision to reject Melbourne Water's proposal to charge the Marina for the cost and ongoing maintenance of the Tidal Gates as the sole beneficiary of the Tidal Gates when a benefit is also received by the 900 other households within the Tidal Waterways system.

3. Use of the Bore to Manage Safe Levels $\leq$ 10mm3/L of Blue Green Algae

(IR – Rec 3 Implement Design Flows Water Quality Management Plan)

The ESC Decision states:
"While the impact of the bore flushing trial on the frequency of algal-blooms is unclear"

At our recent meeting with the ESC, the ESC's Technical expert expressed concerns that the outcome of the bore trial was unclear due to spikes of Blue Green Algae that continued to occur while the bore was running.

It was brought to the ESC's attention that the view held by their Technical expert actually relates to unsafe levels of Blue Green Algae that were experienced in Lake Carramar, which is not currently considered a beneficiary of the bore flushing program or pricing proposal.

It was further brought to the ESC's attention that there have been NO instances of unsafe levels of Blue Green Algae experienced in Lakes Legana and Illawong during the times when the bore has been running over the past 5 summer periods. That this outcome is in distinct contrast to the spikes of unsafe levels of Blue Green Algae that have been adversely affecting Lake Carramar during the past 5 summer periods and is also in distinct contrast from the unsafe levels of Blue Green Algae that were adversely affecting all three Quiet Lakes in the years preceding the running of the bore.

The success of the bore in maintaining safe levels of Blue Green Algae is actually the only issue that all parties agree on.

Please refer to the attached documents confirming the success of the bore trial.

- Minutes to MW's Bore Trial review with Jason Sonneman – 30/04/2015
- Melbourne Water 2016 Price Submission – 26 April 2016
- Melbourne Water's 'Water Quality Results Charts' for the period 2007-2015

(MW, Appendix H)

4. Weekly water quality testing of Blue Green Algae

The ESC Draft Decision states that:
"Melbourne Water is required to comply with the SEPP and NHMRC Guidelines in managing water quality within its waterways management district.

"The services proposed to be carried out by Melbourne Water and recovered via the bore flushing tariff include:
Weekly blue-green algae monitoring (visual inspections) during October and November each year, extending the existing monitoring regime funded by the general waterways and drainage tariff by two months (to allow it to cover the bore flushing period each year)."

The Independent Review states:
"Melbourne Water commissions weekly water quality testing, to ascertain the conditions for recreational use, and any warnings that need to be disseminated regarding algal blooms"
(Independent Review – Water Quality 5.3, p.68)

The ESC's 2014/15 Final Pricing Decision approved Melbourne Waters Pricing submission stating
"Melbourne Water accepts the findings of the Independent Review Recommendations. Adoption of the key recommendations has lead Melbourne Water to develop the Patterson Lakes management strategy, consisting of:……
*-For all other services considered to have a **regional and community benefit**, these will continue to be **funded through the Waterways & Drainage Charge**.*
These services and capital works in the Tidal Waterways include: ……
These services and capital works in the Tidal Waterways include: ……
***In the Quiet Lakes**, these include:*

- *carp removal*
- ***water quality testing***
- *general civil assets monitoring & works*
- *community communications/consultations"*

(MW's ESC 2013 pricing submission, Proposal p.4)

Please refer to attached documents produced by Melbourne Water and the ESC that have previously approved weekly water quality testing on the basis of providing a regional and community benefit:

- Melbourne Water Pricing Proposal – 19 Dec 2013
- ESC Final Decision to MW Pricing Proposal – May 2014
- Melbourne Water Community Bulletin ESC Approved Pricing Proposal – June 2014

(MW, Appendix I)

The ESC's Draft decision to approve a reduction in water quality testing is inconsistent with the ESC's former Approved Final Decision issued in May 2014 that *"water quality testing provides a regional and community benefit" and would continue to be funded by the Metropolitan Waterways and Drainage Charge.*

5. Meeting the NHMRC Guidelines for Water Quality Testing

The ESC's Draft Decision states:
The NHMRC Guidelines outline activities for the management of Cyanobacteria at the primary contact standard level, which include regular visual inspections, sampling where known species of cyanobacteria are present, monitoring blooms and notification of health authorities and warning the public of the potential health risks

The NHMRC Guidelines Table 6.2 point c. on page 107:
"Note that it is not likely that scums are always present and visible when there is a high population, as the cells may mix down with the wind and turbulence and then reform later when conditions becomes stable"
(NHMRC Guidelines Table 6.2, page 107- Appendix J)

The NHMRC Guidelines Table 6.6. on page 112 detail that BGA testing should be as follows:
Surveillance mode level (safe water) – Green level
-weekly sampling in waterways where known toxic species are present ***(≤ 0.4mm3/L)***
-fortnightly where non-toxic species are known to be present ***(≤ 0.4mm3/L)***
-fortnightly visual inspections of water for surface scums
Alert (increasing presence - cause for concern) – Amber level
-twice weekly sampling where toxic species are dominant ***(≤ 0.4mm3/L – ≤ 4.0mm3/L)****; and*
-weekly or fortnightly sampling where non-toxic species are known to be present ***(≤ 0.4mm3/L – ≤ 10.0mm3/L)***
-make regular visual inspections of water for surface scums
Action Mode (hazardous water) – Red Level
-twice weekly sampling where toxic species are dominant ***(≥ 4.0mm3/L);*** *and*
-weekly or fortnightly where non-toxic species are known to be present ***(≥ 10.0mm3/L)***
-make regular visual inspections of water for surface scums.
(NHMRC Guidelines Table 6.6. on page 112- Appendix K)

It has been observed on Lake Carramar that unsafe levels of Toxic Blue Green Algae have been first detected by the EPA in response to resident's complaints where Melbourne Water's bogus 'visual inspection' program inadequate in detecting unsafe levels of Blue Green Algae. Melbourne Water continually exhibits a complete lack of concern for its role as the Water Manager assigned the responsibility to improve waterway health and to protect human health.

The actions contained in Table 6.6 are not for Melbourne Water to pick and choose which tasks suit them to perform. The NHMRC Guidelines require all tasks of (i.e. sampling, cell counts and visual inspections) to be conducted at the appropriate frequency determined by toxicity and biovolume of the water samples.

Melbourne Water's proposal to only conduct visual monitoring is clearly NOT meeting the NHMRC Guidelines that firstly call for sampling and cell counts in a waterway that is known to contain

Blue Green Algae in order to protect Human Health from the adverse health effects of exposure to high cell densities.

The ESC's Draft decision that has approved Melbourne Water's proposal for weekly visual monitoring over the summer period is inconsistent with the NHMRC's testing protocol designed to provide a best-practice, hands-on, practical approach to protect human health to ensure freshwater environments and reneges on the fact that Melbourne Water has already received approval from the ESC in May 2014 to conduct weekly water quality testing funded by the MMWDC.

6. Lake Carramar Flow Through

The ESC Draft Decision states:
"Melbourne Water's obligations in relation to Lake Carramar (the third Quiet Lake which is not included in the bore flushing tariff)[68]: Following the Independent Review Final Report, Melbourne Water conducted a review of the Quiet Lakes headworks infrastructure which confirmed that nothing had been altered from the original engineering design.[69] A further investigation determined that water flow through to Lake Carramar is not feasible.[70] Accordingly, Lake Carramar residents are excluded from the proposed bore flushing tariff."
[69] *Water Technology, Quiet Lakes Headworks Review, August 2013.*
[70] *Melbourne Water, Memo: Patterson Lakes Management Plan Steering Committee - Lake Carramar southern pipe outlet & through flows, 15 January 2014.*

Please refer to attached documents

- Lake Carramar Residents Survey (March 2015)
- Memo from PLQLOR to Jarrod Mitchel, MW (24/04/2015)
- Memo from Mark Chicoine, MW to PLQLOR (14/05/2015)
- Lake Carramar through flow concept options (October 2014)
- Melbourne Water Drainage Map showing the drainage connection from the south end of Lake Carramar to the local drainage system further to the south, which ends up in discharging to the Tidal Waterways in Ibis Court.

(MW – Appendix L)

The ESC's Draft Decision to believe Melbourne Water on face value for their blatant lie that flow through Lake Carramar cannot be achieve is irresponsible participation by the ESC in Melbourne Water's intentional neglect to fulfil its core purposes to improve waterway health and to protect human health of Lake Carramar residents against repeated exposure to TOXIC Blue Green Algae.

7. ESC – Duty of Care

The ESC Approved for the Precept to be ceased which has been in affect snice the 1/07/3013.

In December 2013 Melbourne Water's Pricing Submission to the ESC stated that:
"Melbourne Water proposed that until the Commission rules on the price submission the existing precept rate would cease and services would continue to be provided as normal. Customers would also still pay the general waterways and drainage charge. The Commission accepted this proposal"
(MW's ESC 2013 pricing submission, Background p.3)

However, at no stage has the ESC placed a requirement on Melbourne Water to ensure that all maintenance activities that were once covered by the Precept are still covered by either the MMWDC or an ESC Price submission.
Whilst the ESC may expect that Melbourne Water would be working with the residents to ensure this outcome unfortunately that's not the case where certain activities Melbourne Water has not addressed as a requirement for a Price Submission and has also not continued to provide those services as normal.

To this end I feel the ESC has been neglectful in ensuring Melbourne Water has in fact exhibited a duty of care as the title owner to ensuring that all previous maintenance activities under the Precept have been dealt with by either Melbourne Water, Kingston Council or Parks Vic as determined by the Independent Review.

CONCLUSION

As expressed to the ESC at our recent meeting, beyond my having willingly taken the time to meet with the ESC at their office, the ESC's request to respond to a Draft Decision that the ESC knows to be riddled with misleading information and factual errors has been an inappropriate waste of submitters valuable personal time.
None the less, I request that the ESC issue a new Decision based on the fundamental facts that have now been provided to the ESC in writing by myself and other submitters that should allow the ESC to make a more informed and more appropriate Final Decision that:

1. Continues to support the current approval and previously conducted weekly water quality testing that includes sampling, cell counting and regular visual inspections for surface scums to allow Melbourne Water to properly ascertain the conditions of the water for secondary contact recreational use, and any warnings that need to be disseminated regarding algal blooms.

2. Agrees that the running the bore is successfully managing safe levels of Blue Green Algae in the Quiet Lakes Legana and Illawong consistent with Design Flow's, Jason Sonnerman's final assessment of the bore trial reported at the Melbourne Water Bore Trial Review Meeting held 30/04/2015.

3. Is consistent with the information detailed within the NHMRC Guidelines, the Blue Green Algae Circular, the Blue Green Algae Warning Signs and the Blue Green Algae Community Information bulletins that qualify maintaining secondary contact water quality for safe participation in secondary contact activities of rowing, sailing, canoeing, boating, fishing, wading and paddling requires Blue Green Algae to be managed to < 10mm3/L

4. Is consistent with the Independent Review Recommendation 3 to implement the Design Flow Water Quality Management Plan that includes the continued use of bore at an extraction rate of 1.5ML/day to control safe levels of Blue Green Algae < 10mm3/L over the summer period of 01 Oct – 31 Mar.

5. Is consistent with the Independent Review Recommendation 4 that requires Melbourne Water to implement an engineering solution that guarantees flow through Lake Carramar to assist in maintaining safe levels of Blue Green Algae <10mm3/L over the summer period of 01 Oct–31 Mar.

6. Is consistent with the findings of the Independent Review Recommendation 6 that Melbourne Water continues to use the Melbourne Metropolitan Waterways and Drainage Charge funds to run the bore to maintain safe levels of Blue Green Algae < 10mm3/L by managing, funding and operating the system of interconnecting flows between the three Quiet Lakes to deliver the outcomes recommended in the Independent Review.

Regards,
Anthony Moffatt
PLQLOR Association - President
Independent Review Steering Committee – Residents Representative

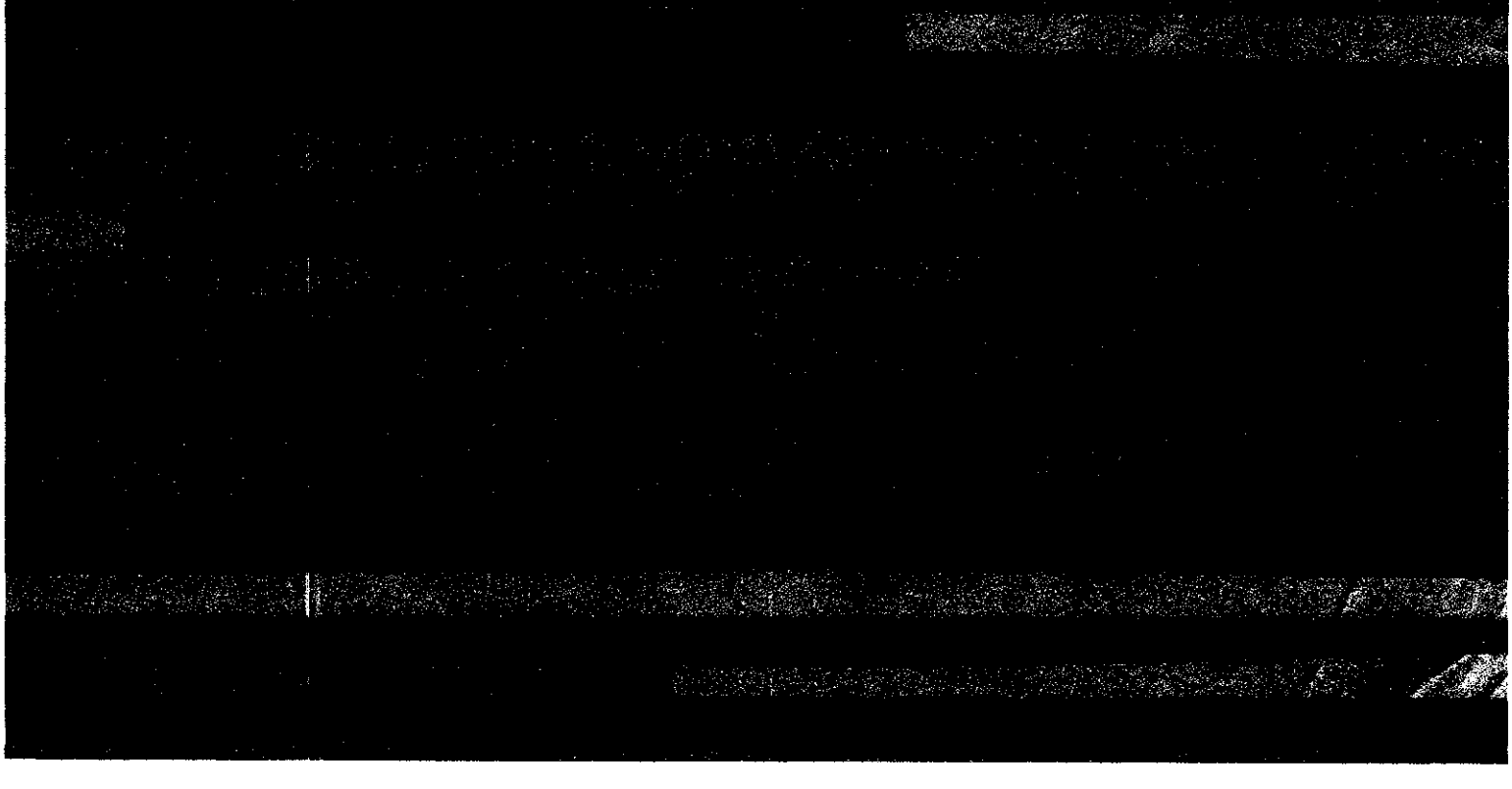
APPENDIX A

QUIET LAKES

Water Quality Management Plan

Updated April 2015

DesignFlow



1.3 Purpose

The Quiet Lakes Water Quality Management Plan outlines a range of low cost options for improving water quality within the Quiet Lakes. Options detailed in the strategy are the result of discussions with Melbourne Water, Patterson Lakes Advisory Committee, a number of site visits, analysis of lake water quality, sediment and groundwater data, modelling of the local catchment inflows and consideration of previous studies and reports.

The primary objective of this strategy is to provide water quality improvement options that will help to prevent cyanobacterial (blue-green algal) blooms developing and improve the overall water quality within the Quiet Lakes. The water quality management strategy seeks to provide a balance between the expectations of residents in terms of costs and enhancing the lake system's recreational and amenity values, mitigating public health risks and achieving a healthy, lake ecosystem.

Note: A glossary of the scientific terms used in this report has been provided in Section 9 to assist the reader.

2 Lake history

The Quiet Lakes were constructed in the early 1970s. In the period following construction, the lakes were colonised by both phytoplankton and filamentous algal communities (Caldwell Connell Engineers Pty Ltd, 1974). It is believed that the initial algal growth was stimulated by high water temperatures and light intensity, as well as nutrients released from organic material in the sediments and stormwater inflows (Caldwell Connell Engineers Pty Ltd, 1974). The development of excessive filamentous algal biomass on the surface of the lakes was seen to be a visual nuisance, and substantial quantities of algae were manually removed.

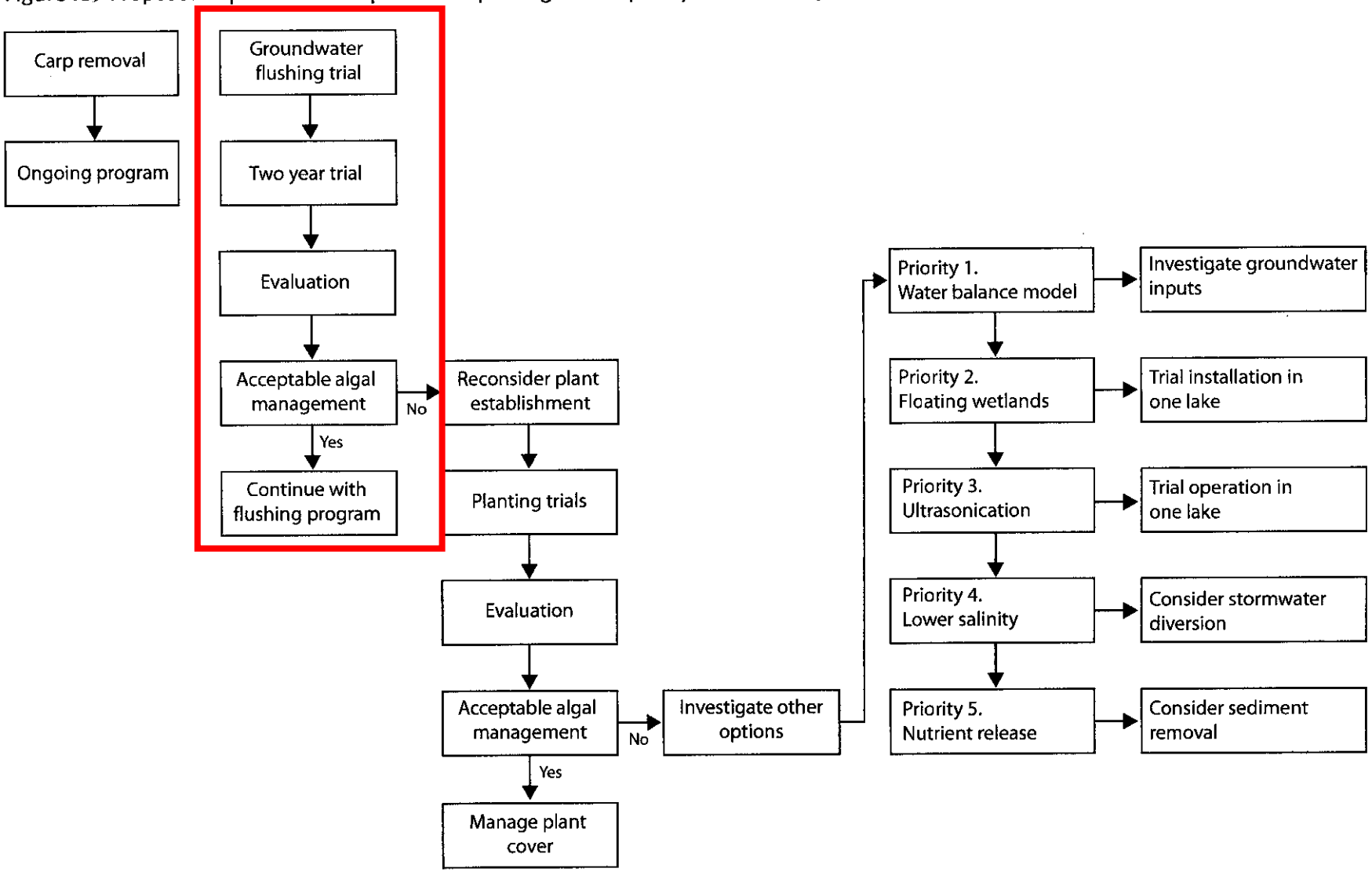
During the establishment phase, chlorophyll concentrations Lake Legana were generally low (below 5 ug/mL), and the lake was characterised by a high degree of water clarity (Caldwell Connell Engineers Pty Ltd, 1974).

Large populations of Daphnia (zooplankton) were present within the lake, and it appears that Mosquito fish and perhaps native Galaxiids may have been introduced to control the zooplankton, and to establish the basis of a food web for the introduction of 'sport fish' species such as bream, mullet and luderick (Caldwell Connell Engineers Pty Ltd, 1974).

Submerged macrophytes also appeared shortly after construction of the lake system. Early macrophyte communities within the Quiet Lakes were dominated by Charophytes, which covered most of the lake bed surface. Other macrophyte species present were *Potamogeton ochreatus*, *Elodea canadensis*, *Ruppia* sp. and *Nitella* sp. (Breen and Muir, 1989). European carp were also introduced into the Lake System at around this time and it appears that the carp population rapidly increased.

By the early 1980s, macrophyte cover extended to almost the complete area of the lake system. *Potamogeton pectinatus* appeared at this stage and started to gradually replace the Chara spp. from the deeper water areas. Extensive growths of *Potamogeton pectinatus* and *Ruppia polycarpa* developed in Lakes Illawong and Carramar, necessitating that macrophyte harvesting be considered (Breen and Muir, 1989).

Figure 10. Proposed implementation plan for improving water quality within the Quiet Lakes.



APPENDIX B


Melbourne Water
ATTENTION
Blue green algae is currently present in this water body
Melbourne Water recommends that you do not come into contact with this water as it may cause skin and eye irritations to both humans and animals.
For information or emergency phone 131 722 or visit our website www.melbournewater.com.au
Victoria
The Place To Be

APPENDIX C

Community Information

Important information for Lake Carramar residents

18 January 2017

Important Notice - Lake Carramar Water Quality

The latest test results measured on 17 January in Lake Carramar show that a toxic form of blue green algae, Microcystis has risen above the threshold level of 4mm^3/L (Blue Green Algae Circular 2016-17, DELWP).

Until further advice from Melbourne Water, we strongly advise that you and your guests avoid unnecessary contact with the water in Lake Carramar. We also advise that as far as possible you prevent your pets from entering or drinking the water.

Our weekly test results have shown that there may be an increased risk to people and pets that come in contact with the water in Lake Carramar. This is because of the increased volume of a toxic form of blue-green algae above the level determined to be safe for recreational use.

Risks from contact with, or ingestion of blue-green algae
Skin contact with either toxic or non-toxic forms of blue-green algae when participating in water-based activities can cause problems such as skin rashes, swollen lips, blisters, eye irritation and redness, ear ache and itchiness, sore throat, hay fever symptoms, asthma and possibly promotion of skin tumours. The risk is likely to increase with repeated exposure to the water and especially if water is swallowed.

Pets can also be affected, if they drink the water. Dogs are particularly susceptible because they tend to lick their coats after swimming.

Relative risks from activities
The risk from various activities ranges from zero where there is no skin contact, to high depending on the likelihood of an activity bringing an individual into contact with the algae. **The table on page 2 of this bulletin indicates of the level of risk for some water activities.** Wearing wet suits may result in greater risk of skin irritation because algal material trapped inside the wet suit may be in close contact with the skin for long periods.

See over the page for more

Risk	Activity
High	Swimming, diving, sail-boarding, paddling.
Medium	Canoeing, sailing, rowing (assumes avoidance of algal material when launching and landing and no rollovers or capsize).
Low	Fishing, passive shoreline recreation (picnicking, walking).

Blue-green algae blooms are a common, natural occurrence in Victorian waterways and can be triggered by many factors including nutrient loads, low inflows, low storage volumes and higher than normal temperatures. It is not known how long the warning will remain in place.

We will continue to monitor this situation and provide you with updates via the Quiet Lakes water quality monitoring webpage at melbournewater.com.au/pattersonlakes. Should you have any queries or concerns please do not hesitate to contact us.

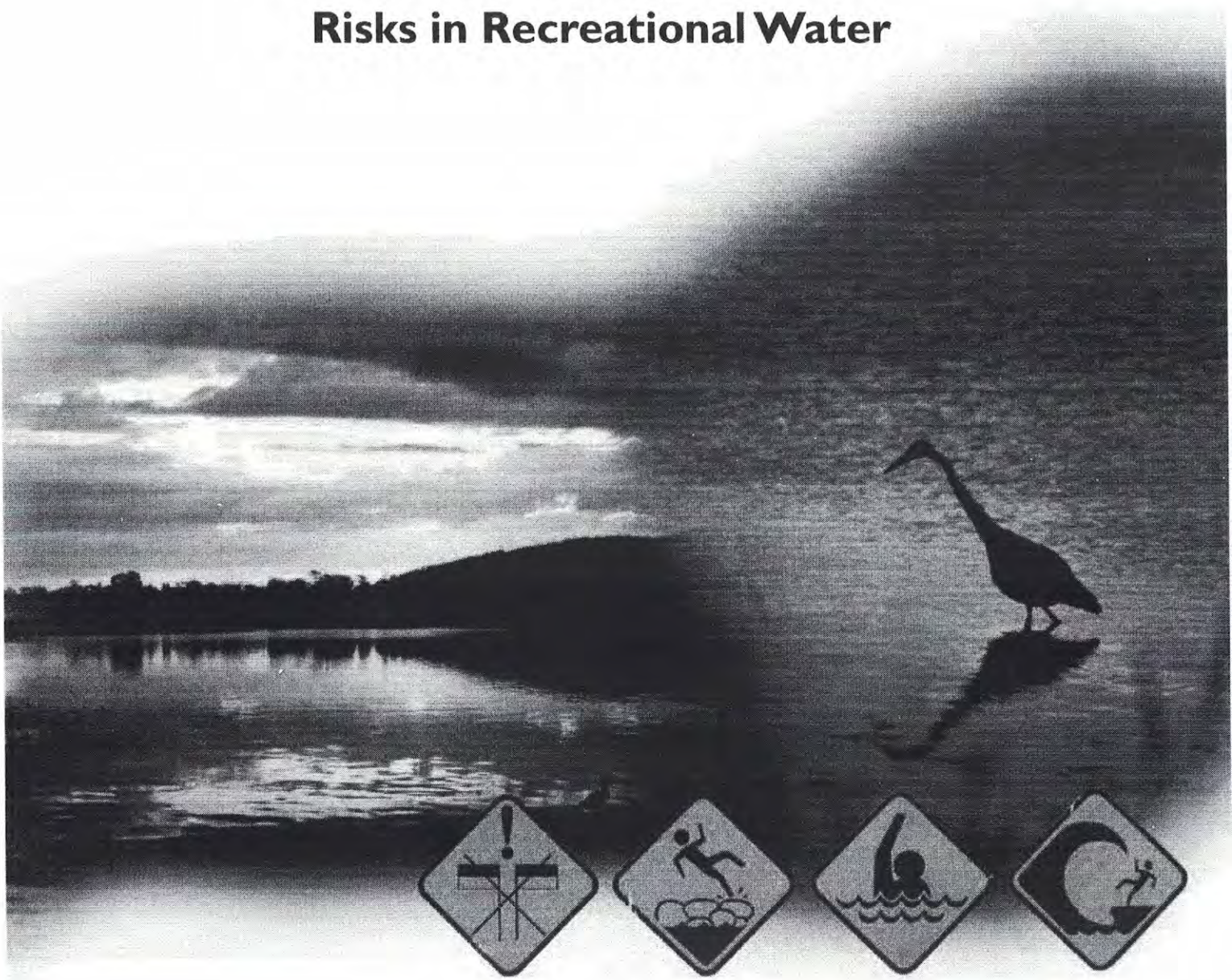
How do I find out more information?
For more information contact 131 722 or visit *melbournewater.com.au/pattersonlakes*

To find out about other Melbourne Water projects to enhance life and liveability contact 131 722 or visit *melbournewater.com.au*

APPENDIX D

Australian Government
National Health and Medical Research Council

Guidelines for Managing
Risks in Recreational Water



EXECUTIVE SUMMARY

The primary aim of these guidelines is to protect the health of humans from threats posed by the recreational use of coastal, estuarine and fresh waters. Threats may include natural hazards such as surf, rip currents and aquatic organisms, and those with an artificial aspect, such as discharges of wastewater.

These guidelines should be used to ensure that recreational water environments are managed as safely as possible so that as many people as possible can benefit from using the water.

These guidelines are not mandatory; rather, they have been developed as a tool for state and territory governments to develop legislation and standards appropriate for local conditions and circumstances. The aim of the guidelines is to encourage the adoption of a nationally harmonised approach for the management of the quality of coastal, estuarine and fresh waters used for recreation.

The guidelines do not directly address environmental aspects of the recreational use of water, but the environmental impacts of such use should be considered, because a healthy environment has many benefits for human health.

This document is divided into two parts:

- **Part 1: The guidelines** — Chapters 1 and 2, which provide a general overview of the management of recreational water, including a table of the key recommendations included in the guidelines; and
- **Part 2: Supporting information** — Chapters 3–10, which provide detailed information on potential hazards associated with recreational waters.

Figure A gives an overview of the structure of the guidelines and the key elements of the supporting chapters. Table A summarises the guidelines, including guideline values and specific comments.

The guidelines represent a major revision of the previous National Health and Medical Research Council (NHMRC) guidelines — *Australian Guidelines for Recreational Water Use* (NHMRC 1990). In particular, these new guidelines include a preventive approach to the management of recreational water that focuses on developing an understanding of all potential influences on a recreational water body, through local assessment and management of hazards and of factors that may lead to hazards.

This approach provides information on the local influences on recreational water quality, as well as numerical information on the likely level of contaminants. The results can be used to:

- classify beaches, to support informed personal choice;
- provide on-site guidance to users on the relative safety of the water;
- assist in identifying and promoting effective management interventions; and
- provide a basis for regulatory requirements, and an assessment of compliance with such requirements.

Potential adverse impacts on the health of recreational water users must be weighed against the enormous benefits to health and wellbeing (eg rest, relaxation and exercise) and to local economies that rely on water-associated recreational activities.

Table A Summary of the Guidelines

Characteristic	Guideline	Comment	Supporting information
Physical hazards	Recreational water bodies and adjacent areas should be free of physical hazards, such as floating or submerged objects that may lead to injury. Where permanent hazards exist, for example rips and sandbars, appropriate warning signs should be clearly displayed.	Injuries related to these objects may result during activities such as swimming, diving and water skiing.	Chapter 3
Sun, heat and cold water temperature	The temperature of recreational water bodies should be in the range 16–34°C. Recreational water users should be educated to reduce exposure to ultraviolet radiation (UVR), particularly during the middle of the day.	Exposure to cold water (<16°C) can result in hypothermia (excessive heat loss) or a shock response. Prolonged exposure to waters >34°C may result in hyperthermia (heat exhaustion or heat stress). Levels of UVR vary throughout the day, with a maximum occurring during the 4 hours around noon.	Chapter 4
Microbial quality	Preventive risk management practices should be adopted to ensure that designated recreational waters are protected against direct contamination with fresh faecal material, particularly of human or domesticated animal origin.	The main health risks are from enteric viruses and protozoa.	Chapter 5
Cyanobacteria and algae in fresh waters	Fresh recreational water bodies should not contain: • ≥10 µg/L total microcystins; ≥50 000 cells/mL toxic *Microcystis aeruginosa*; or biovolume equivalent of ≥4 mm^3/L for the combined total of all cyanobacteria where a known toxin producer is dominant in the total biovolume; or • ≥10 mm^3/L for total biovolume of all cyanobacterial material where known toxins are not present; or • cyanobacterial scums consistently present.	A single guideline value is not appropriate. Instead, two guideline values have been established, based on known risks associated with known toxins and probability of health effects caused by high levels of cyanobacterial material. A situation assessment and alert levels framework for the management of algae/cyanobacteria in recreational waters has been developed that allows for a staged response to the presence and development of blooms.	Chapter 6
Cyanobacteria and algae in coastal and estuarine waters	Coastal and estuarine recreational water bodies should not contain: • ≥ 10 cells/mL *Karenia brevis* and/or have *Lyngbya majuscula* and/or *Pfiesteria* present in high numbers.	A situation assessment and alert levels framework for the management of algae/cyanobacteria in recreational waters has been developed that allows for a staged response to the presence and development of blooms.	Chapter 7
Dangerous aquatic organisms	Direct contact with venomous or dangerous aquatic organisms should be avoided. Recreational water bodies should be reasonably free of, or protected from, venomous organisms (eg box jellyfish and bluebottles). Where risks associated with dangerous aquatic organisms are known, appropriate warning signs should be clearly displayed.	Risks associated with dangerous aquatic organisms are generally of local or regional importance and vary depending on recreational activities.	Chapter 8

faecal pollution. The resulting classification supports activities in pollution prevention and provides a means to recognise and account for cost-effective local actions to protect public health.

Quantitative microbial risk assessment (QMRA) is used to estimate the risk to human health indirectly by predicting infection or illness rates for given densities of particular pathogens, assumed rates of ingestion and appropriate dose–response models for the exposed population.

For the purposes of classification where recreational water is used for whole-body (primary) contact recreation (ie where there is a risk of swallowing water), two principal components are required for assessing faecal contamination:

- assessment of evidence for the likely influence of faecal material; and
- counts of suitable faecal indicator bacteria (usually enterococci).

These two components are combined to produce an overall microbial classification of the recreational water body.

Management strategies should include sanitary inspection of the areas affecting the recreational water body, to identify all sources of faecal pollution and periods when control may be most effective.

The inspection should include the following steps:

- plan the sanitary inspection and develop a checklist of issues that need to be considered;
- assemble and review available information;
- carry out a field inspection;
- conduct interviews and/or undertake a workshop with key stakeholders; and
- assess the contamination sources to determine the level of risk.

The combined outcome of the microbial water quality assessment and the sanitary inspection is a five-level classification for recreational waters, ranging from 'very good' to 'very poor'.

Cyanobacteria and algae in fresh water

Guidelines

Fresh recreational water bodies should not contain:

- **≥10 µg/L total microcystins; or ≥50 000 cells/mL toxic *Microcystis aeruginosa*; or biovolume equivalent of ≥4 mm³/L for the combined total of all cyanobacteria where a known toxin producer is dominant in the total biovolume; or**
- **≥10 mm³/L for total biovolume of all cyanobacterial material where known toxins are not present; or**
- **cyanobacterial scums consistently present.**

Cyanobacteria (or blue-green algae) are a common and naturally occurring component of most recreational water environments. They are of public health concern because some types produce toxins that can have a harmful effect on recreational water users. Furthermore, production of toxins is unpredictable, making it difficult to quantify the toxicity of waters and define the restrictions that should be placed on their use.

A single guideline value is not appropriate. Instead, two guideline values have been established for risks associated with known toxins and the probability of health effects from high levels of cyanobacterial material.

The first level recognises the probability of adverse health effects from ingestion of known toxins, in this case based on the toxicity of microcystins.

The second level covers circumstances in which there are very high cell densities of cyanobacterial material, irrespective of the presence of toxicity or known toxins. Increased cyanobacterial densities increase the likelihood of non-specific adverse health outcomes, principally respiratory, irritation and allergy symptoms. A situation assessment and alert levels framework for the management of cyanobacteria and algae in recreational waters has been developed that allows for a staged response to the presence or development of blooms.

These guidelines use a framework for determining the suitability of a water body for recreational use. The framework combines environmental grading of the water based on prior data for cyanobacteria with historical information on physicochemical conditions to identify risk factors.

Cyanobacteria and algae in coastal and estuarine water

Guideline

Coastal and estuarine recreational water bodies should not contain:

- ≥10 cells/mL *Karenia brevis* and/or have *Lyngbya majuscula* and/or *Pfiesteria* present in high numbers.

In coastal and estuarine waters, algae range from single-celled forms to the seaweeds that form a common and naturally occurring component of most marine and estuarine ecosystems.

These guidelines address exposure through dermal contact, inhalation of sea-spray aerosols and possible ingestion of water or algal scums. They do not include dietary exposure to marine algal toxins.

As with cyanobacteria in fresh water, the suitability of water for recreational use is assessed by combining environmental grading based on long-term analysis of data with a water body assessment.

Dangerous aquatic organisms

Guideline

Direct contact with venomous or dangerous aquatic organisms should be avoided. Recreational water bodies should be reasonably free of venomous organisms (eg box jellyfish and bluebottles). Where hazards associated with dangerous aquatic organisms are known, appropriate warning signs should be clearly displayed.

Venomous and potentially dangerous organisms are found in Australian recreational waters. Such organisms are generally of local or regional importance, and the risk associated with the organisms varies.

PART 1 THE GUIDELINES

1 INTRODUCTION

1.1 OVERVIEW

1.1.1 Need for recreational water use guidelines

Water-based recreational activities are popular in Australia. Although the country has an extensive coastline, there are highly localised pressures on accessible areas, particularly around major urban areas. The same is true for estuarine and freshwater rivers and lakes which are increasingly being developed and managed for recreational purposes.

Water-quality guidelines are necessary to protect human health during recreational activities such as swimming and boating, and to preserve the aesthetic appeal of water bodies. Such guidelines are used in monitoring and managing a range of physical, microbial and chemical characteristics that determine whether a body of water is suitable for recreational use.

Use of recreational waters can adversely affect health; for example, gastroenteritis can be caused by swallowing water containing disease-causing organisms (pathogens). However, any potential adverse effects must be weighed against the enormous benefits to health and wellbeing of recreational water use (eg rest, relaxation and exercise) and the positive impacts on local economies that rely on water-associated recreational activities (WHO 2003).

1.1.2 Aim of these guidelines

The primary aim of this document — the National Health and Medical Research Council (NHMRC) *Guidelines for Managing Risks in Recreational Water* — is to protect human health. The guidelines provide a best-practice, hands-on, practical approach aimed at helping those managing recreational water quality. They should be used to ensure that recreational coastal, estuarine and freshwater environments are managed as safely as possible, so that as many people as possible get as much benefit as possible from recreational water use.

These guidelines are not mandatory; rather, they have been developed:

- as a tool for local, state and territory authorities and other stakeholders (including local councils, health authorities, environmental agencies, policy makers and water managers at all levels), for use in developing legislation and standards appropriate for local conditions and circumstances; and
- to encourage the adoption of a nationally harmonised approach to managing the quality of water used for recreational purposes.

Although the guidelines are intended to be applied at designated and classified water bodies, this does not mean that water quality can be allowed to deteriorate at unclassified water bodies.

1.2 PREVENTIVE RISK MANAGEMENT APPROACH

These guidelines replace the *Australian Guidelines for Recreational Use of Water* (NHMRC 1990). They differ from the previous guidelines in that they advocate a preventive approach to the management of recreational water, focusing on assessing and managing hazards and hazardous events within a risk-management framework (Box 1.1 explains these terms). This preventive approach replaces the traditional reliance on percentage compliance with counts of faecal indicators to protect the microbial quality of water.[1]

Box 1.1 Hazards, hazardous events and risks

Although the terms 'hazard' and 'risk' are often used interchangeably, their meanings differ. In these guidelines, the terms hazard, hazardous event and risk are used as follows:

- a *hazard* is a biological, chemical, physical or radiological agent that has the potential to cause harm (ie loss of life, injury or illness)
- a *hazardous event* is an incident or situation that can lead to the presence of a hazard (ie what can happen and how)
- a *risk* is the likelihood of identified hazards causing harm in exposed populations in a specified timeframe; it includes the severity of the consequences.

The distinction between hazard and risk needs to be understood so that attention and resources can be directed to actions based primarily on the level of risk rather than simply on the existence of a hazard (NHMRC/NRMMC 2004).

The approach outlined in this document is consistent with that developed by the World Health Organization (WHO) between 1999 and 2001. The WHO approach formalised the use of risk assessment and management frameworks for all water sources and uses (illustrated in Figure 1.1), and started with the development of 'Annapolis Protocol' for recreational waters.[2] The aim of the protocol was to regulate recreational water quality in a way that reflected public health risk more accurately than the traditional approach, and that provided scope for different management options (WHO 1999). The protocol described a scheme for grading recreational water according to health risk, based on analysis of long-term data.

The approach developed in the Annapolis Protocol relies on identifying surrogate indicators of increased risk and taking action to manage those risks. For example, rainfall causing increased run-off into a water body and consequently influencing pathogen contamination could be used as a surrogate indicator of increased risk. An appropriate action to reduce this risk might be to advise the public not to use the water body for a particular time. Applying surrogate indicators in this way allows for 'real-time' management of faecally derived pathogens in recreational water. It also means that periods when health risks are high and recreational activity is controlled do not need to be counted towards the seasonal classification of the water body.

1 Faecal indicators are organisms that act as surrogates for potential pathogens (disease-causing organisms) associated with faecal contamination.

2 The 'Annapolis Protocol' derives its name from the fact that it was developed through a joint meeting of the United States Environmental Protection Agency and the WHO in Annapolis in 1998.

1.5 DESIGNATION OF RECREATION ACTIVITIES

Development of strategies to reduce the risks associated with the use of recreational water requires broad classifications of recreational activities. For risks arising from contact with, or ingestion of, water, an understanding of the different degrees of contact associated with different recreational water uses is essential. The amount of water contact directly influences the degree of contact with infectious and toxic agents and physical hazards, and the likelihood of being injured or contracting illness (WHO 2003). Routes of exposure to infectious and toxic agents in water will vary, depending on the type of water contact, but skin and mucous membranes are the most common exposure routes.

Recreational activities can be classified by the degree of water contact as follows:

- *Whole-body contact (primary contact)* — activity in which the whole body or the face and trunk are frequently immersed or the face is frequently wet by spray, and where it is likely that some water will be swallowed or inhaled, or come into contact with ears, nasal passages, mucous membranes or cuts in the skin (eg swimming, diving, surfing or whitewater canoeing).
- *Incidental contact (secondary contact)* — activity in which only the limbs are regularly wet and in which greater contact (including swallowing water) is unusual (eg boating, fishing, wading), and including occasional and inadvertent immersion through slipping or being swept into the water by a wave.
- *No contact (aesthetic uses)* — activity in which there is normally no contact with water (eg angling from shore), or where water is incidental to the activity (such as sunbathing on a beach).

In whole-body contact activities, the probability that some water will be ingested is high, although data on the quantities swallowed during recreational water use are difficult to obtain (WHO 2003). Inhalation can be important where there is a significant amount of spray, such as in waterskiing or even sunbathing at a surf beach. In water sports, the skill of the participant will also be important in determining the extent of involuntary exposure, particularly ingestion.

1.6 HAZARDS, HAZARDOUS EVENTS AND POTENTIAL OUTCOMES

Physical hazards

Drowning, near-drowning and spinal injuries are the most serious public health problems associated with the recreational use of water. Drowning is a major cause of death in Australia (AIHW 1995, Mackie 1999, ABS 2000). Spinal injury or permanent damage caused by near-drowning can have a major impact on the quality of life of the victim and a significant impact on health-care resources. Physical hazards are covered in detail in Chapter 3.

Sun, heat and cold

Health effects associated with the recreational use of water include hypothermia and hyperthermia, and exposure to ultraviolet radiation (UVR) leading to cancer or damage to the skin, eyes and immune system. Hazards from sun, heat and cold are covered in detail in Chapter 4.

Microbial contaminants

Water contaminated by human or animal excreta may contain a range of pathogenic microorganisms, such as viruses, bacteria and protozoa. These organisms may pose a health hazard, particularly when the water is used for recreational activities that involve whole-body contact, as there is reasonable risk that pathogens will enter the body during such activities.

Until recently, gastroenteritis was considered the main health effect likely to arise from microbially contaminated recreational water, but respiratory infections are now also thought to be important (Corbett *et al* 1993, WHO 2003). In most cases, the ill-health effects from exposure to water contaminated with pathogenic microorganisms are minor and short lived. However, contaminated water can cause more serious diseases, such as hepatitis, giardiasis, cryptosporidiosis, campylobacteriosis and salmonellosis (Philipp 1991), particularly in children, the elderly and the severely immunocompromised.

Hazards associated with microbial pathogens are covered in detail in Chapter 5.

Algae and cyanobacteria

Exposure to algae and cyanobacteria and/or their associated toxins are usually considered less of a concern than exposure to pathogenic microorganisms. However, several species of cyanobacteria and microscopic algae can be acutely toxic when ingested or absorbed through the skin, or can irritate the skin, eye or mucous membranes. These toxins can also cause risks in food; however, such risks are dealt with in other guidelines. Hazards from algae and cyantobacteria are covered in detail in Chapters 6 and 7.

Hazardous organisms

Some health risks are associated with wildlife in and around recreational water bodies. These include envenomation from vertebrates and invertebrates, and laceration and fatal trauma from various marine creatures, including sharks and crocodiles.

Various events, such as heavy rainfall, can have multiple consequences for the quality of a recreational water body by changing the physical profile of the catchment and the distribution of wildlife. Hazardous organisms are covered in detail in Chapter 8.

Chemicals

Chemical contaminants at concentrations that typically occur in recreational water are usually considered less of a concern than exposure to pathogenic microorganisms. However, certain chemicals can be acutely toxic when ingested or absorbed through the skin, or can irritate the skin, eye or mucous membranes. Chemical hazards are covered in detail in Chapter 9.

Aesthetic factors

Aesthetic issues play an important role in the public's perception of a recreational water area. The principal aesthetic concern is revulsion associated with obvious pollution of the water body, turbidity, scums or odour. Pollution may cause nuisance for local residents and tourists and environmental problems, and may lessen the psychological benefits of tourism.

Hazards associated with aesthetic quality of recreational water are covered in detail in Chapter 10.

Potential adverse health outcomes

Table 1.1 shows examples of the adverse health outcomes associated with various hazards encountered by recreational water users.

Table 1.1 Examples of adverse health outcomes associated with hazards encountered in recreational water environments

Type of adverse health outcome	Examples of associated hazards
Drowning (Chapter 3)	• Being caught in tidal or rip current • Being cut off by rising tide • Falling overboard • Being caught by submerged obstacle • Falling asleep in an inflatable and drifting into deep water far from shore • Slipping off rocks or being washed off by waves • Misjudging swimming ability
Impact injury (Chapters 3 and 8)	• Impact against hard surface or sharp object (broken glass, jagged metal), resulting from the action of the participant (eg diving, collision) or from the force of wind and water • Needlestick injuries from used needles • Cuts (eg from coral or oysters) and abrasions from slipping on wet rocks • Attack by aquatic animals (eg shark, moray eel, crocodile)
Physiological (Chapter 4)	• Chilling (hypothermia), leading to coma or death • Acute exposure to heat, leading to hyperthermia (eg heat exhaustion and heatstroke) • Acute exposure to ultraviolet radiation (UVR) from sunlight, leading to sunburn • Cumulative exposure to UVR, leading to skin cancer (basal and squamous cell carcinoma, melanoma)
Infection (Chapter 5)	• Ingestion or inhalation of, or contact with, pathogenic bacteria, viruses and parasites, which may be present in water through contaminated discharges from run-off or faecal contamination from people or animals using the water, or may be present naturally
Poisoning and toxicoses (Chapters 6, 7, 9)	• Sting of poisonous and venomous animal (eg jellyfish, snake, stonefish) • Ingestion or inhalation of, or contact with, blooms of toxicogenic cyanobacteria in fresh or marine water or dinoflagellates in marine water • Ingestion or inhalation of, or contact with, chemically contaminated water

Source: WHO (2003)

1.7 RISK ASSESSMENT

These guidelines require that risk be reduced to a tolerable level rather than being eliminated altogether (complete elimination of risk is impossible). For most healthy people, water conforming to the guideline value will pose only a minimal increase in daily risk. However, water conforming to the guidelines may still pose a potential health risk to high-risk user groups such as the very young, the elderly and those with impaired immune systems.

Determining risk involves considering the probability that a hazard or hazardous event will occur, and the consequences if it does. This is illustrated in Figure 1.2, which compares health hazards encountered during recreational water use. A severe health outcome, such as permanent paralysis or death because of diving into shallow water, may affect only a few swimmers each year, but may warrant a high management priority.

Table 1.1 lists and classifies the main adverse health outcomes associated with exposure to hazards encountered in recreational water bodies. The tables below provide examples of potential control measures and bases for reducing risks in water recreation that involves whole-body contact (Table 1.2), incidental contact (Table 1.3) and non-contact (Table 1.4). A recreational use may present more than one hazard; the particular hazards for each use will depend on the circumstances. Therefore, measures to reduce risk will be specific to each form of recreational activity and to particular circumstances.
The chapters in Part 2 of this document provide detailed examples of hazards associated with particular types of recreational activity.

Table 1.2 Hazards and measures for reducing risks in whole-body (primary) contact recreational use

Examples of whole-body (primary) contact recreational activities	Associated risks and hazards[a]
Scuba diving and snorkelling	1-11
Swimming	1-11
Surfing	1-3, 5-9
Water-skiing	1-11
White water canoeing, rafting	1-3, 5-7, 9-11
Windsurfing (sailboarding)	1-11
Children's exploratory activities and wading	1-11

Principal hazard	Potential risk reduction measures
1. Drowning	Where appropriate: safety rails, lifebelts/lifejackets, warning notices, broadcast weather alerts, education, legislation regarding use of lifejackets while boating, supervision and availability of rescue services. Personal care.
2. Waterborne infection[b]	Avoiding body contact after heavy rain. Licensing, control and treatment of discharges of sewage, effluents, storm overflows. Improvements where indicated as appropriate due to unsatisfactory microbial quality. Personal awareness of local conditions.
3. Sunburn, skin damage, skin cancer, eye damage and heat illness	Generalised and localised education and publicity programs including advice to limit exposure (between 10am and 3pm), seek shade, wear protective clothing (including hat), apply sunscreen, wear sunglasses, maintain hydration.
4. Cyanobacterial, marine algal toxicoses	Control of eutrophication, monitoring and reporting cyanobacterial populations, curtailing recreation during blooms, avoiding contact, washing body and equipment after recreation.
5. Impact injury	Notices indicating hazards. Personal awareness raising and avoidance, wearing head and body protection where appropriate. Supervision and presence of lifeguards and rescue services. Removal/mitigation of the hazard.
6. Injury; treading on broken glass, jagged metal waste, or needle stick injuries, infection following skin injury.	Litter control, cleaning of recreational area. Provision of rubbish bins. Prohibiting use of glass on beaches, and provision of sharps disposal facilities. Cover all injuries with waterproof dressings.
7. Collision with or entrapment by wrecks, piers, weirs, sluices and underwater obstructions.	Notices to mariners, marker buoys, posted warnings. Personal awareness. Legislation requiring boat training. Rescue services to respond to incidents and mitigate injuries. Appropriate oversight (eg harbour/beach patrols).
8. Stings from sea animals.	Local awareness raising where the problem occurs.
9. Attack by aquatic animals (eg sharks, crocodiles).	Posting warnings, personal awareness raising, avoidance.

Examples of whole-body (primary) contact recreational activities	Associated risks and hazards[a]
10. Bites of mosquitoes and other insect vectors of disease.	Health warnings; avoidance of infested regions, personal protection (eg clothing, insect repellents).
11. Leptospirosis (fresh water)[c]	Riparian management to control rodents; litter collection. Treating and covering cuts and abrasions before water exposure. Seeking medical advice if influenza-like symptoms are noticed a few days after recreational use of water.

a Numbers refer to principle hazards listed within table
b Infections caused by pathogens derived from faecal pollution
c Leptospirosis is associated with urine from animals and may be a concern in warmer regions of Australia

Table 1.3 Hazards and Measures for reducing risks in incidental (secondary) contact recreational use

Examples of incidental (secondary) contact recreational activities	Associated risks and hazards[a]
Rowing, sailing and canoeing	1-11
Wading and paddling	1-11
Fishing	1-11
Principal hazard	**Potential risk reduction measures**
1. Drowning	Where appropriate: safety rails, lifebelts/lifejackets, warning notices, broadcast weather alerts, education, legislation regarding use of lifejackets while boating, supervision and availability of rescue services. Personal care.
2. Waterborne infection[b]	Avoiding body contact after heavy rain. Licensing, control and treatment of discharges of sewage, effluents, storm overflows. Improvements where indicated as appropriate due to unsatisfactory microbial quality. Personal awareness of local conditions.
3. Sunburn, skin damage, skin cancer, eye damage and heat illness	Generalised and localised education and publicity programs including advice to limit exposure (between 10am and 3pm), seek shade, wear protective clothing (including hat), apply sunscreen, wear sunglasses, maintain hydration.
4. Cyanobacterial, marine algal toxicoses	Control of eutrophication, monitoring and reporting cyanobacterial populations, curtailing recreation during blooms, avoiding contact, washing body and equipment after recreation.
5. Impact injury	Notices indicating hazards. Personal awareness raising and avoidance, wearing head and body protection where appropriate. Supervision and presence of lifeguards and rescue services. Removal/mitigation of the hazard.
6. Injury; treading on broken glass, jagged metal waste, or needle stick injuries, infection following skin injury.	Litter control, cleaning of recreational area. Provision of rubbish bins. Prohibiting use of glass on beaches, and provision of sharps disposal facilities. Cover all injuries with waterproof dressings.
7. Collision with or entrapment by wrecks, piers, weirs, sluices and underwater obstructions.	Notices to mariners, marker buoys, posted warnings. Personal awareness. Legislation requiring boat training. Rescue services to respond to incidents and mitigate injuries. Appropriate oversight (eg harbour/beach patrols).
8. Stings from sea animals.	Local awareness raising where the problem occurs.
9. Attack by aquatic animals (eg sharks, crocodiles).	Posting warnings, personal awareness raising, avoidance.
10. Bites of mosquitoes and other insect vectors of disease.	Health warnings; avoidance of infested regions, personal protection (eg clothing, insect repellents).
11. Leptospirosis (fresh water)[c]	Riparian management to control rodents; litter collection. Treating and covering cuts and abrasions before water exposure. Seeking medical advice if influenza-like symptoms are noticed a few days after recreational use of water.

a Numbers refer to principle hazards listed within table
b Infections caused by pathogens derived from faecal pollution
c Leptospirosis is associated with urine from animals and may be a concern in warmer regions of Australia

For most parameters, there is no clear-cut value below which health effects are excluded; therefore, the derivation of guideline values and any conversion of guidelines to standards includes an element of valuation or judgment about the frequency, nature and severity of associated health effects. This valuation process is one in which societal values play an important role; thus, the conversion of guidelines into state or territory legislation and standards should take into account environmental, social, cultural and economic factors.

The existence of a guideline value does not imply that environmental quality should be allowed to degrade to this level. Indeed, a continuous effort should be made to ensure that recreational water environments are of the highest attainable quality.

When a guideline is not achieved, this should be a signal to:

- investigate the cause and identify the likelihood of future incidents;
- liaise with the authority responsible for public health to determine whether immediate action should be taken to reduce exposure to the hazard; and
- determine whether measures should be put in place to prevent or reduce exposure under similar conditions in the future.

Many of the hazards associated with recreational water use may occur over very short periods (eg injuries and infection following exposure to microorganisms). This means that short-term deviations above guideline values and conditions are important to health, and measures should be in place to ensure and demonstrate that recreational water environments are continuously safe during periods of actual or potential use. In practice this may be difficult to achieve; in which case, appropriate warnings should be issued.

1.10 SUMMARY GUIDELINES FOR RECREATIONAL WATER

Table 1.5 summarises the major hazards for recreational water, the guidelines, comments and where further information can be found.

Table 1.5 Summary of the guidelines for recreational water

Characteristic	Guideline	Comment	Supporting information
Physical hazards	Recreational water bodies and adjacent areas should be free of physical hazards, such as floating or submerged objects that may lead to injury. Where permanent hazards exist, for example rips and sandbars, appropriate warning signs should be clearly displayed.	Injuries related to these objects may result during activities such as swimming, diving and water skiing.	Chapter 3
Sun, heat and cold water temperature	The temperature of recreational water bodies should be in the range 16–34°C. Recreational water users should be educated to reduce exposure to ultraviolet radiation (UVR), particularly during the middle of the day.	Exposure to cold water (<16°C) can result in hypothermia (excessive heat loss) or a shock response. Prolonged exposure to waters > 34°C may result in hyperthermia (heat exhaustion or heat stress). Levels of UVR vary throughout the day, with a maximum occurring during the 4 hours around noon.	Chapter 4
Microbial quality	Preventive risk management practices should be adopted to ensure that designated recreational waters are protected against direct contamination by fresh faecal material, particularly of human or domesticated animal origin.	The main health risks are from enteric viruses and protozoa.	Chapter 5
Cyanobacteria and algae in fresh waters	Fresh recreational water bodies should not contain: • ≥10 µg/L total microcystins; ≥50 000 cells/mL toxic *Microcystis aeruginosa*; or biovolume equivalent of ≥4 mm^3/L for the combined total of all cyanobacteria where a known toxin producer is dominant in the total biovolume; or • ≥10 mm^3/L for total biovolume of all cyanobacterial material where known toxins are not present; or • cyanobacterial scums consistently present.	A single guideline value is not appropriate. Instead, two guideline values have been established, based on known risks associated with known toxins and probability of health effects caused by high levels of cyanobacterial material. A situation assessment and alert levels framework for the management of algae/cyanobacteria in recreational waters has been developed that allows for a staged response to the presence and development of blooms.	Chapter 6

2 MONITORING

The approach to assessing risks and managing hazards in recreational water outlined in Chapter 1 is based on a preventive strategy, which focuses on developing:

- an understanding of all potential influences on a recreational water body; and
- monitoring programs that can provide a real-time indication of water quality.

Management authorities responsible for recreational waters should establish a program for evaluating existing hazards and monitoring the area for any changes that may occur; such an approach will allow authorities to implement a responsive strategy to protect public health. Threats to human health may include natural hazards, such as surf, rip currents or aquatic organisms, or may arise from artificial sources, such as discharges of wastewater.

The design and implementation of programs for monitoring recreational water should be based on a framework of good practice; this chapter presents such a framework.

The framework consists of a series of statements of principle or objectives that, if adhered to, will lead to the design and implementation of a credible monitoring program. The framework applies in principle to the monitoring of all waters used for recreational activities that involve repeated or continuous direct contact with the water. In many circumstances, various approaches or methods can be applied to achieve the objectives of the framework. Although diverse approaches may be equally valid in isolation, adopting different approaches within a single program may mean that results will not be comparable across locations or enforcement programs.

The framework of good practice incrementally builds up the component parts of a successful program — identifying key health issues, monitoring and assessment strategies, and principal management considerations.

2.1 DESIGN OF MONITORING PROGRAMS

A monitoring program for recreational water should be based on a three-tier system:

- **Surveillance mode (green level)** involves routine sampling to measure contaminants (eg physical, microbial, cyanobacterial and algal).
- **Alert mode (amber level)** requires investigation into the causes of elevated contaminant levels, and increased sampling to enable a more accurate assessment of the risks to recreational users.
- **Action mode (red level)** requires the local government authority and health authorities to warn the public that the water body is considered unsuitable for recreational use.

In designing and implementing monitoring programs, all interested parties (legislators, non-government organisations, local communities, laboratories etc) should be consulted. Every attempt should be made to address all relevant disciplines and involve relevant expertise.

6 CYANOBACTERIA AND ALGAE IN FRESH WATER

Guidelines

Fresh recreational water bodies should not contain:

- ≥10 µg/L total microcystins; or ≥ 50 000 cells/mL toxic *Microcystis aeruginosa*; or biovolume equivalent of ≥ 4 mm^3/L for the combined total of all cyanobacteria where a known toxin producer is dominant in the total biovolume; or
- ≥ 10 mm^3/L for total biovolume of all cyanobacterial material where known toxins are not present; or
- cyanobacterial scums consistently present.

6.1 OVERVIEW

Cyanobacteria (blue-green algae) are bacterial photosynthetic autotrophs[6] that form a common and naturally occurring component of most aquatic ecosystems (Van den Hoek *et al* 1995). Cyanobacteria have some of the characteristics of bacteria and of algae. Their capacity to photosynthesise with the aid of green and blue-green pigments, and their size and tendency to occupy a similar habitat, make them look much like algae — hence the historical classification of the group as blue-green algae. They can occur singly or grouped in colonies (Whitton and Potts 2000) and can increase to such large numbers that they colour the water (a 'bloom') and form highly visible thick scums. The unicellular species range in size from 0.4 µm to more than 40 µm in diameter and some filamentous species have diameters over 100 µm (Whitton and Potts 2000).

The term 'algae' here often refers to microscopically small plants in fresh water. Algae can be single cells, or they can form colonies of many cells and reach sizes visible to the naked eye as small green particles. Algae are common in both aquatic and terrestrial habitats (soil etc). Like cyanobacteria, many species of freshwater algae can proliferate intensively in eutrophic waters[7] to the extent that they cause visible discolouration. However, unlike cyanobacteria, algae have been implicated in only relatively minor health problems. Because algae do not usually form dense surface scums as some cyanobacteria do, their numbers do not accumulate to concentrations likely to become a hazard to recreational water users, except on the rare occasions when the cell concentration (i.e. cell count/unit volume) becomes so great that it obscures submerged hazards. This would occur only in highly eutrophic water that would also be suspected of other types of potentially hazardous contamination (eg effluent, animal waste or agricultural pollution), and that would therefore be restricted. There is some evidence of rare irritation and allergic effects caused by algae, but this chapter is principally concerned with the health implications of cyanobacteria.

Cyanobacteria are of public health concern because some types produce toxins that have harmful effects on tissues, cells or organisms (Carmichael 1992, NHMRC/NRMMC 2004). These toxins are a potential hazard in waters used for human and animal drinking-water supplies, aquaculture, agriculture and recreation (Ressom *et al* 1993). Furthermore, production of toxins is unpredictable, making it difficult to identify the toxicity of waters and define the restrictions that should be placed on their use (Falconer *et al* 1999). There appears to have been an increase in both the incidence and awareness of algal blooms in Australia since the recognition of the issue of toxicity in the late 1980s.

[6] 'Autotrophs' are organisms that undergo photosynthesis (ie primary producers)

[7] 'Eutrophic waters' are those in which there are high levels of nutrients

WHO considered health effects to be in two classes:

- chiefly irritative symptoms caused by unknown cyanobacterial substances; and
- the potentially more severe hazard of exposure to high concentrations of known cyanotoxins, particularly microcystins.

Because of the two classes of effect, WHO found that a single guideline value was not appropriate. Rather, the organisation defined a series of guideline values associated with incremental severity and probability of health effects at three levels.

WHO Level 1: Relatively low probability of adverse health effects

The lowest level of 20 000 cyanobacterial cells/mL is recommended for 'protection from health outcomes not due to cyanotoxin toxicity, but rather to the irritative or allergenic effects of other cyanobacterial compounds'.

WHO Level 2: Moderate probability of adverse health effects

This level is based on 'data used for the drinking-water provisional guideline value for microcystin-LR' (WHO 1998). The level of '100 000 cyanobacterial cells/mL represents a guideline value for a moderate health alert in recreational waters. At this level, a concentration of 20 µg microcystin/litre is likely if the bloom consists of *Microcystis* and has an average toxin content of 0.2 pg/cell.' They indicate that 'with very high cellular microcystin content, 50–100 µg microcystin/litre would be possible' at this cell density.

The data further indicated that 'the level of 20 µg microcystin/litre is equivalent to 20 times the WHO provisional guideline value concentration for microcystin-LR in drinking water (WHO 1998) and would result in consumption of an amount close to the tolerable daily intake (TDI) for a 60 kg adult consuming 100 mL of water while swimming (rather than 2 litres of drinking water). However, a 15 kg child consuming 250 mL of water during extensive playing could be exposed to 10 times the TDI'.

WHO Level 3: High probability of adverse health effects

The highest level was defined by the presence of scums. The data indicate that scums represent 'a readily detected indicator of a risk of potentially severe adverse health effects for those who come into contact with the scums'. The recommendation at this level is for 'immediate action to control scum contact'.

The justification for selection of this upper level is as follows: 'Abundant evidence exists for potentially severe health outcomes associated with scums caused by toxic cyanobacteria. No human fatalities have been unequivocally associated with cyanotoxin ingestion during recreational water activities, although numerous animals have been killed by consuming water with cyanobacterial scum material. Calculations suggest that a child playing in *Microcystis* scums for a protracted period and ingesting a significant volume could receive a lethal dose, although no reports indicate that this has occurred. Based on evidence that a lethal oral dose of microcystin-LR in mice is 5000–11 600 mg/kg body weight and sensitivity between individuals may vary approximately 10-fold, the ingestion of 5–50 mg of microcystin could be expected to cause acute liver injury in a 10 kg child'.

Australian guideline

This document proposes a two-level guideline for Australia for exposure to cyanobacteria in recreational water, based on:

- **Level 1** — the probability of adverse health effects from ingestion of known toxins, in this case based on the toxicity of microcystins.
- **Level 2** — the probability of increased likelihood of nonspecific adverse health outcomes, principally respiratory, irritation and allergy symptoms, from exposure to very high cell densities of cyanobacterial material irrespective of the presence of toxicity or known toxins.

The difference between this two-level guideline and the three levels suggested by WHO is that the lowest level recommended by WHO (of 20 000 cyanobacterial cells/mL) for 'protection from health outcomes due to the irritative or allergenic effects' is here not considered sufficiently significant to warrant a specific warning. This decision is based on the study by Pilotto *et al* (2004) described above, which indicated that human skin contact with cyanobacteria across a wide cell density range results in a somewhat idiosyncratic response. The study showed that there were relatively low-severity adverse skin irritation reactions in a small proportion of the volunteers over a range of cell densities from 5000 to > 200 000 cells/mL, and that there was no dose–response across the concentration range for any of the cyanobacterial species tested. The interpretation derived from the study is that these mild skin irritative effects, which are readily resolved without medical treatment, do not warrant consideration in the setting of a quantitative guideline for recreational exposure.

Level 1 of the Australian guideline is therefore based on risk of exposure to microcystin toxins via ingestion. This is similar in principle to the WHO Level 2 guideline, which is based on that organisation's drinking water guideline, although a different derivation process and an alternative animal model study are employed here. The health risk associated with ingestion is estimated from basic animal toxicological data. Although acute mechanisms of toxicity are well known for the neurotoxins and microcystins, the information presented here estimates the risk for short-term repeated exposure, which is regarded as being relevant for recreational situations. Animal toxicity data for microcystin toxins and conventional toxicological calculations are used to derive a guideline for short-term (14-day) exposure to microcystins via ingestion for both children and adults based on typical bodyweights (Box 6.2). The guideline is derived using the lowest observed adverse effect level (LOAEL) from the 44-day pig study of Kuiper-Goodman *et al* (1999) as the most suitable for deriving a shorter term exposure LOAEL (ie 14 days) that is representative of a period of repeated daily exposure for an uninterrupted period of up to 2 weeks. Two weeks is regarded as a likely, albeit rather intensive, continuous exposure for swimming and aquatic recreation in a summer holiday season.

The child exposure guideline for microcystins (measured as total microcystins and expressed as microcystin-LR toxicity equivalents as per NHMRC/NRMMC 2004), is recommended as the Level 1 guideline in a typical recreational situation. The microcystin concentration is converted to an equivalent worst-case cell density of *Microcystis aeruginosa*, based on cell toxin data (NHMRC/NRMMC 2004). This guideline on equivalent cell density can also be translated into an equivalent biovolume of total cyanobacterial material to gauge the potential hazard of other cyanobacteria in the first instance, irrespective of whether toxic status is known (Box 6.2).

Table 6.2 Interpretation of cyanobacterial alert levels for recreational water

Green level Surveillance mode	Amber level Alert mode	Red level Action mode
≥500 to <5000 cells/mL *M. aeruginosa* or biovolume equivalent of >0.04 to <0.4 mm^3/L for the combined total of all cyanobacteria.	≥5000 to <50 000 cells/mL *M. aeruginosa* or biovolume equivalent of ≥0.4 to <4 mm^3/L for the combined total of all cyanobacteria where a known toxin producer is dominant in the total biovolume[a]. or[b] ≥0.4 to <10 mm^3/L for the combined total of all cyanobacteria where known toxin producers are not present.	Level 1 guideline: ≥10 µg/L total microcystins or ≥50 000 cells/mL toxic *M. aeruginosa* or biovolume equivalent of ≥4 mm^3L for the combined total of all cyanobacteria where a known toxin producer is dominant in the total biovolume. or[b] Level 2 guideline: ≥10 mm^3/L for total biovolume of all cyanobacterial material where known toxins are not present. or cyanobacterial scums are consistently present[c].

a The definition of 'dominant' is where the known toxin producer comprises 75% or more of the total biovolume of cyanobacteria in a representative sample.

b This applies where high cell densities or scums of 'nontoxic' cyanobacteria are present, ie where the cyanobacterial population has been tested and shown not to contain known toxins (microcystin, nodularin, cylindrospermopsin or saxitoxins).

c This refers to the situation where scums occur at the recreation site each day when conditions are calm, particularly in the morning. Note that it is not likely that scums are always present and visible when there is a high population, as the cells may mix down with wind and turbulence and then reform later when conditions become stable.

The grading is intended to provide an indication of the susceptibility of the water body to cyanobacterial growth. For a grading of 'very good', the water body will almost always comply with the guideline values for recreation. Water bodies graded as 'very poor' will be highly susceptible to cyanobacterial growth and may rarely pass the quantitative guidelines and their use for recreational activities is not recommended. For the remaining gradings ('good', 'fair' and 'poor'), it is recommended that a monitoring program be introduced.

The monitoring program that is then implemented is based on a three-tier alert levels framework, which is a monitoring and management action sequence that operators and regulators can use for a graduated response to the onset and progress of a cyanobacterial bloom in the water body. A similar system has been in use for management of cyanobacteria in drinking water sources for many years. The alert levels recommended for a recreational water monitoring program are summarised in Table 6.3, and discussed in more detail in Section 6.5.2.

Table 6.6 Recommended actions at different alert levels

Level	Recommended actions
Surveillance mode (green level)	Regular monitoring: • Weekly sampling and cell counts at representative locations in the water body where known toxigenic species are present (ie *Microcystis aeruginosa, Anabaena circinalis, Cylindrospermopsis raciborskii, Aphanizomenon ovalisporum, Nodularia spumigena*); or • Fortnightly for other types including regular visual inspection of water surface for scums.
Alert mode (amber level)	• Notify agencies as appropriate. • Increase sampling frequency to twice weekly at representative locations in the water body where toxigenic species (above) are dominant within the alert level definition (ie total biovolume) to establish population growth and spatial variability in the water body. • Monitor weekly or fortnightly where other types are dominant. • Make regular visual inspections of water surface for scums. • Decide on requirement for toxicity assessment or toxin monitoring.
Action mode (red level)	• Continue monitoring as for alert mode. • Immediately notify health authorities for advice on health risk. • Make toxicity assessment or toxin measurement of water if this has not already been done. • Health authorities warn of risk to public health (ie the authorities make a health risk assessment considering toxin monitoring data, sample type and variability).

Surveillance mode — green level

Green level (surveillance mode) is triggered when cyanobacteria are first detected at low levels in water samples, signalling the early stages of possible bloom development. The indicative cell numbers for *Microcystis aeruginosa* ($\geq$ 500 – < 5000 cells/mL) and the biovolume equivalent of $\geq$ 0.04 - < 0.4 mm^3/L for the combined total of all cyanobacteria are somewhat arbitrary. A cell count of 500 cells/mL is the approximate detection limit for cyanobacteria.

There are some important points to note in relation to sampling and cell counts for these level definitions. Firstly the cell numbers that define the levels apply to samples of the recommended type (ie composite 50 cm hose-pipes) that are taken at a representative location(s) in the water body (ie the likely or designated recreational areas).

In relation to cell counts the actual or real value for the cell concentration in the 500 to 5000 cells/mL range can vary from the measured value. This is due to inherent errors in the cell counting methods. There is a likely minimum precision of ±50% for counting colonial cyanobacteria such as *Microcystis aeruginosa* at such low cell densities. For counting filamentous cyanobacteria such as *Anabaena circinalis* the precision is likely to be better at these cell densities (~±20%). Also the biovolume equivalents given in the level definitions are calculated using the equivalent cell numbers of *Microcystis aeruginosa*[8].

[8] The biovolume is based upon a single cell of *Microcystis aeruginosa* with a volume of 87 μm^3. Therefore 5000 cells/mL x 87 μm^3 = 4.35 x 10^5 μm^3/mL ÷ 1 x 10^9 = 4.35 x 10^{-4} mm^3/mL x 1000 = 0.435 mm^3/L. This is rounded to a biovolume of 0.4 mm^3/L.

Action mode — red level

Red level (action mode) is defined by exceedance of the NHMRC guideline for cyanobacteria in freshwater defined in section 6.4.1 (see Table 6.2). This is the two level guideline triggered when representative samples exceed either:

Level 1 guideline: the toxin level of ≥ 10 µg/L total microcystins, ≥ 50 000 cells/mL of *Microcystis aeruginosa*, or a biovolume equivalent of ≥ 4 mm^3/L for the combined total of all cyanobacteria where a known toxin producer is dominant in the total biovolume

or

Level 2 guideline: ≥ 10 mm^3/L for total biovolume of all cyanobacterial material where known toxins are not present

or

Cyanobacterial scums are consistently present.

In action mode the local authority and health authorities warn the public of the existence of potential health risks; for example, through the media and the erection of signs by the local authority.

To reiterate the definition of the potential health risks the Level 1 guideline is developed to protect against short-term health effects of exposure to cyanobacterial toxins ingested during recreational activity, whereas the Level 2 guideline applies to the circumstance where there is a probability of increased likelihood of non-specific adverse health outcomes, principally respiratory, irritation and allergy symptoms, from exposure to very high cell densities of cyanobacterial material irrespective of the presence of toxicity or known toxins.

In practical terms the biovolume definition component of the Level 1 guideline (ie total cyanobacterial biovolume of known toxigenic cyanobacteria ≥4 mm^3/L) may be used to initially trigger the action mode (red level) before toxicity or toxin analysis is available. If this is the case and the subsequent toxin analysis is negative, the mode may revert to alert mode (amber level) in the biovolume range ≥0.4 - < 10 mm^3/L. If cell numbers continue to increase, the Level 2 guideline definition applies if either the total biovolume of all cyanobacterial material exceeds 10 mm^3/L or cyanobacterial scums are consistently present.

As indicated in Section 6.4.1, the Level 2 guideline is applied in circumstances where toxicity testing and toxin monitoring has been carried out and the dominant cyanobacterium is identified as being 'nontoxic' — that is, where the population has been tested and shown not to contain known toxins (microcystin, nodularin, cylindrospermopsin or saxitoxins). In action mode, the monitoring of the bloom should continue as for alert mode to determine when the bloom is in decline so that normal recreational use can resume.

Changes in alert levels over time

It is recommended that the alert mode not be changed from a higher to a lower level (eg from red to amber) until two successive lower results from representative samples have been recorded. Toxicity testing is usually only warranted at 7–10 day intervals or less often. Experience suggests that the toxicity of a cyanobacterial population can change, but it is unlikely to become completely nontoxic or to decline in a period of a few days.

APPENDIX E

Department of Environment and Primary Industries

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DX 210098

Gavan O'Neil
Manager Special Ares Team
Melbourne Water
990 La Trobe Street
Docklands VIC 3008

Dear Gavan

RE Water Quality Quiet Lakes

Thank you for the letter dated 12 August 2013 regarding the management of water quality in Quiet Lakes.

In the absence of clear requirements, Melbourne Water needs to work with the responsible department and EPA to ensure that the requirements for public health and water quality are addressed.

I understand that you are working with the relevant officers from the Department of Health regarding clarification of appropriate secondary contact criteria for the management of this water body.

As the responsible local water manager for Quiet Lakes, Melbourne Water needs to manage any blue-green algae events as outlined in the Blue-Green Algae Circular.

Yours sincerely

Pradeepa Adihetty
Manager Emergency and Risk Management
Water Group
04/9/2013

Victoria

APPENDIX F

Department of Health

Incorporating: Health, Mental Health and Ageing

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Victoria 3000
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Melbourne
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04 SEP 2013

Our Ref: DHD/13/16332

Mr Gavan O'Neil
Manager, Special Areas Team
Melbourne Water
PO Box 4342 VIC 3001

Dear Mr O'Neil,

Thank you for your letter dated 12 August 2013 requesting advice about Melbourne Water's interpretation of the ANZECC *Australian and New Zealand guidelines for fresh and marine water quality (2000) and the* NHMRC *Guidelines for managing risks in recreational water (2008).*

The NHMRC guidelines promote the preventive risk management approach and provide guideline levels for cyanobacteria and algae in fresh, coastal and estuarine water. These guideline levels were derived for primary contact recreational activities. The ANZECC guidelines also provide a framework for water quality monitoring. However, the recreational water aspects of the guidelines were superseded by the NHMRC guidelines when published in 2008.

While the Department of Health has no formal regulatory role to administer these guidelines, I would advise Melbourne Water (as the local water manager for Patterson Lakes) to manage risk to protect public health as described in the NHMRC guidelines.

I understand the Patterson Lakes are promoted for secondary contact activities such as boating, rather than activities such as swimming. If this is the case, Melbourne Water should consider undertaking a risk assessment for cyanobacteria using the approach detailed in Chapter 6 of the NHMRC guidelines.

For further information please do not hesitate to contact Rachael Poon on 9096 0414.

Yours sincerely

Rodney Dedman
Manager Water

cc. Ms Cathy Bates, DEPI

State Government Victoria

APPENDIX G

Blue-Green Algae Circular 2016-17

Management Framework

VICTORIA State Government | Environment, Land, Water and Planning

1 Overview

This Circular provides updated information, roles and responsibilities on Cyanobacteria (blue-green algae) bloom coordination within Victoria for 2016 -17.

Blue-green algae (BGA) or cyanobacteria are not true algae but are a type of bacteria. They are a natural part of most aquatic environments and are found in streams, lakes, estuaries and the sea. Significant levels of BGA in water bodies can affect the natural ecosystem and potentially impact on human health.

Some species of BGA can produce chemical compounds that can taint the drinking water supply by causing discoloration and a musty odour and taste. More significantly, some species produce toxins that have serious health implications for humans, animals, birds and livestock if they are consumed, inhaled or come into contact with the skin.

As environmental conditions become favourable, typically in the warmer months, algae numbers can start to increase rapidly resulting in a BGA bloom, often making recreational water unappealing and possibly unsafe for activities such as swimming, boating and fishing. While BGA blooms are more prevalent in the warmer months, they can occur all year round and without warning.

BGA blooms require a prompt response in the form of monitoring and communication to minimise health and environmental impacts and risks they could place on humans, animals, birds and livestock and crops. Management of BGA blooms should be undertaken through cooperation between all relevant stakeholder agencies. The BGA Circular provides information about roles and responsibilities on blue-green algae bloom response and coordination within Victoria for 2016 -17.

2 BGA Coordination Framework

The response to BGA blooms in Victoria is managed through the coordination framework outlined within the BGA Circular. The objectives of this framework are for parties to work together to effectively manage BGA blooms through:

- minimising the impact of BGA blooms on waterways, public health and safety and local amenity;
- providing a coordinated response;
- communicating potential risk to water and waterway users and the broader community promptly and effectively;
- investigating the likely cause of the bloom and identifying what actions to take to minimise future occurrences; and
- where appropriate, providing timely and effective briefings and communication to the relevant Minister.

The BGA incident management is based on emergency management principles described in the Emergency Management Manual Victoria (EMMV) in terms of prevention, response and recovery and is classified as a class 2 emergency During a substantial regional BGA bloom, regional emergency arrangements will be implemented in managing the incident by DELWP. Refer to Appendix A – BGA Emergency Management Flowchart for the BGA Regional Incident Management flowchart.

3 Waterways Included in BGA Framework

The BGA framework applies to all water bodies accessible to public or waterways that discharge into publically accessible water bodies such as rivers, streams, wetlands, lakes, estuaries, inlets, water supply storages, irrigation channels and drains, wastewater treatment plant storages, ornamental lakes, marinas, stormwater and recycled water storages and treatment wetlands.

APPENDIX H

Meeting Notes (Final Draft)

Date 30 Apr 2015 **Time** 10.00 **Location** P Lakes Community Centre

Chairperson Sonia Tallarida **Meeting Subject:** Quiet Lakes Water Quality

Attendees: Louis Cali (LR), Anthony Moffatt (LR), Jason Sonneman (DesignFlow), Greg Bain (MWC), Jarrod Mitchell (MWC)

Apologies n/a

Note Taker Rachel Smithers

Agenda

1. **Why we are here – alignment on purpose and outcome**
2. **Overview of the bore flushing results**
3. **Discussion and questions**
4. **Implementation of the QL Water Quality Management Plan Recommendations**
5. **Next Steps**

1. Why we are here? – alignment on purpose and outcome

ST opened the meeting thanking all for attending. She stated that the meeting was a check point now that the DesignFlow QL Water Quality Management Plan was completed and issued. She then asked both MW and the residents to outline why they are here.

GB understood that the meeting today was a result of a direction by the Minister for Water (outcomes from meeting held on 16 September 2014) to wait until the end of the bore flushing trial to discuss the results and the next steps.

GB further stated that MW are here to clarify positions and are looking for a resolution on a way forward.

ST summarised GB statements:

a. Clarity around positions
b. Identify where they are the same and where they are different

JS stated he is at the meeting to cover off the results of the bore flushing trial and answer any questions regarding the QL Water Quality Management Plan.

AM and LC agreed with MW's understanding.

2. Overview of the bore flushing results

JS discussed the bore flushing results from the 3 year trial. See graphs attached in email.

Year 1
Legana and Illawong displayed good results. Carramar did fluctuate a bit but was encouraging.

Year 2
Results were good for all three lakes. Carramar had a spike in February and March.

Year 3
All lakes performed well. A bloom of *Microcystis aeruginosa* occurred in Carramar over the same time each year – February/March.

Overall the results are encouraging and indicate that the bore flushing is working.

JS also made the following points:

- Ammonia testing has indicated low levels in the system and as such the recommendation is to cease testing for ammonia
- The lakes are mirroring the bore salinity and is sitting at a level of 7000µs/cm
- The data indicates that there is no discernible difference with flushing 2mL/day over 1.5mL/day

AM asked about Carramar and the impacts of the bore flushing.

JS stated that Carramar is not a beneficiary of the flushing trial.

JM asked about the other recommendations outlined in the QL Water Quality Management Plan and what we agree on:

- Bore flushing
- Carp removal
- Revegetation

JS confirmed that the plan also recommends carp population removal which helps the water quality for the lake system.

There were no further questions for JS and as such he left the meeting.

3. Discussion and Questions + 4. Implementation of the QL Water Quality Management Plan Recommendations

LC asked MW if it is committed to implementing the IR which includes implementing the recommendations of DesignFlow's QL Water Quality Management Plan.

GB confirmed that MW agrees with the recommendations. What are MW's core business and legislation obligations MW is happy to fund such as carp removal and revegetation. Funding of the bore flushing is not.

LC asked why MW is not happy to fund the bore flushing.

GB stated that MW is happy to facilitate the running of the bore. MW's reading, interpretation and position on the IR confirms MW's position.

APPENDIX I

2016 Price Submission

Response to ESC Draft Decision
26 April 2016

VICTORIA
State Government

Melbourne Water

- Re-consideration of Melbourne Water's proposed major capital projects and allocations, while agreeing to a general efficiency target of 5% across all aspects of services excluding the Land Development area. This will ensure Melbourne Water has sufficient revenue to deliver on its services and avoid undue risk to the region's waterways and the water supply, sewerage and drainage systems.
- A refinement of the proposed approach to reforming the non-residential waterways and drainage charge by phasing out the outdated land-value based charges for non-residential customers over the next 10 years. Over the next five years, residential and rural customers' prices will increase with inflation only, while some non-residential customer prices will increase by $7 (before inflation) per year
- A new tariff to improve water quality in the Quiet Lakes area is proposed following community support for improved water quality
- An updated approach to calculating the cost of debt component of the WACC to better align with historical rates paid following consultation with Treasury Corporation of Victoria. A revised approach has also been developed to the annual updating process
- Establishing water headworks charges on the basis of entitlements and updated bulk sewerage charges
- Minor changes to the supporting indicators to provide better information to customers and ensure these indicators incentivise appropriate investment.

This response is supported by a revised financial model that is consistent with our recommendations and includes revisions to the tax liability.

All numerical values provided in this submission are in 2015/16 real dollars unless specified. All numerical values in the tables are subject to rounding.

service was a key recommendation of the Patterson Lakes independent review undertaken in 2013 at the request of the then Minister for Water.

To help users make an informed decision about the costs under a user-pays model, Melbourne Water agreed to fund a trial to determine if flushing the lakes with bore water could be used to control blue green algae in the lakes.

The trial ran for three years, ending on 31 March 2015. The final review of the trial concluded that the bore flushing had a positive impact on blue-green algae levels.

Consultation

Melbourne Water has consulted extensively with the residents of the Quiet Lakes on the outcomes of the independent review and the bore flushing trial. In September 2015 the Minister for Water confirmed in writing to Kingston Council and a Quiet Lakes resident that a user pays funding model needs to be considered for water quality services, consistent with the recommendations of the independent review.

Melbourne Water subsequently arranged for an independent ballot of all Quiet Lakes residents to be conducted in December 2015 to determine their willingness to pay for the Water Quality tariff. A majority of residents (75% - refer Table 35) voted in support of the proposal.

Table 35: Ballot of Quiet Lakes Property Owners – bore pump flushing charges

Response	Residents	Percentage
Yes	188	74.9%
No	24	9.6%
Opt-out	4	1.6%
Did not vote	35	13.9%
TOTAL	**251**	**100.0%**

Proposed services

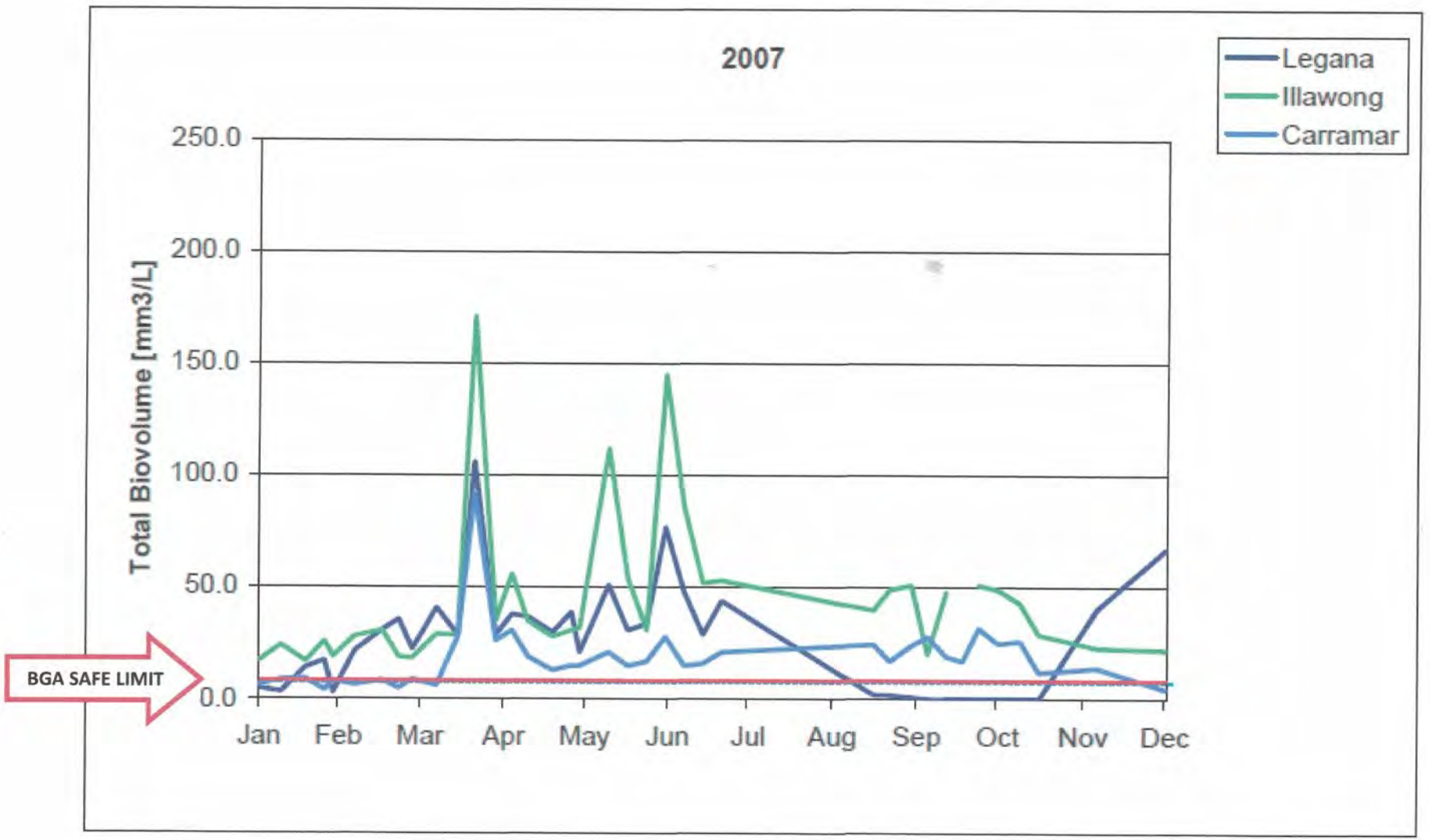
Proposed higher levels of water quality services consist of Melbourne Water running additional bore flushing over the summer months in Lake Legana and Lake Illawong. This includes pumping 253 million litres of bore water pumped into the lakes for six months of the year (from 1 October – 31 March each year), and weekly blue-green algae monitoring during October and November each year. Melbourne Water will also separately provide 20 million litres of water and additional water quality monitoring to assist in maintaining the lakes. This will be funded through the Waterways and Drainage Charge.

Cost of service and pricing

The total cost of providing bore water and algae monitoring services is estimated at around $39,000 per annum (see Table 36)

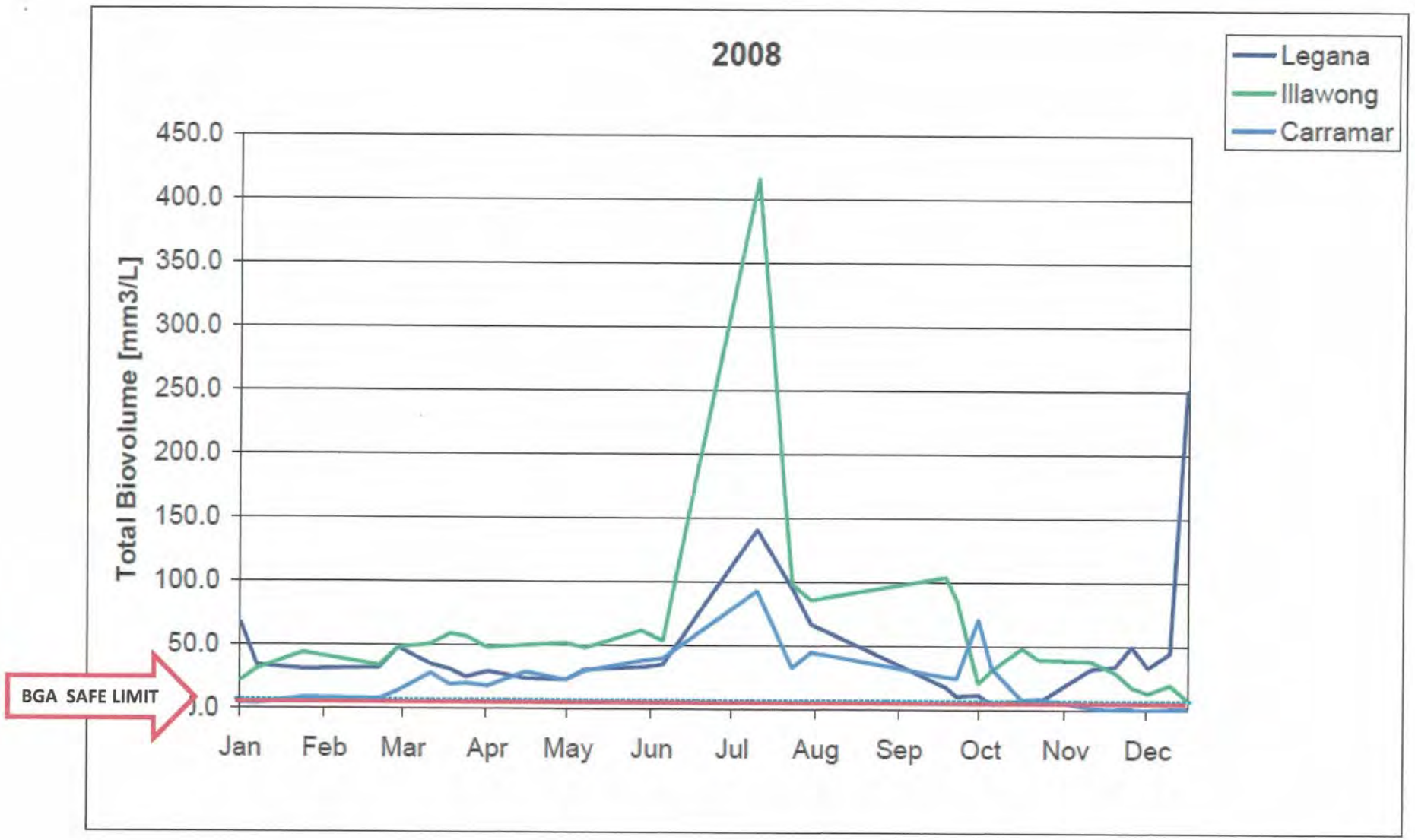
Quiet Lakes

BGA data - 2007



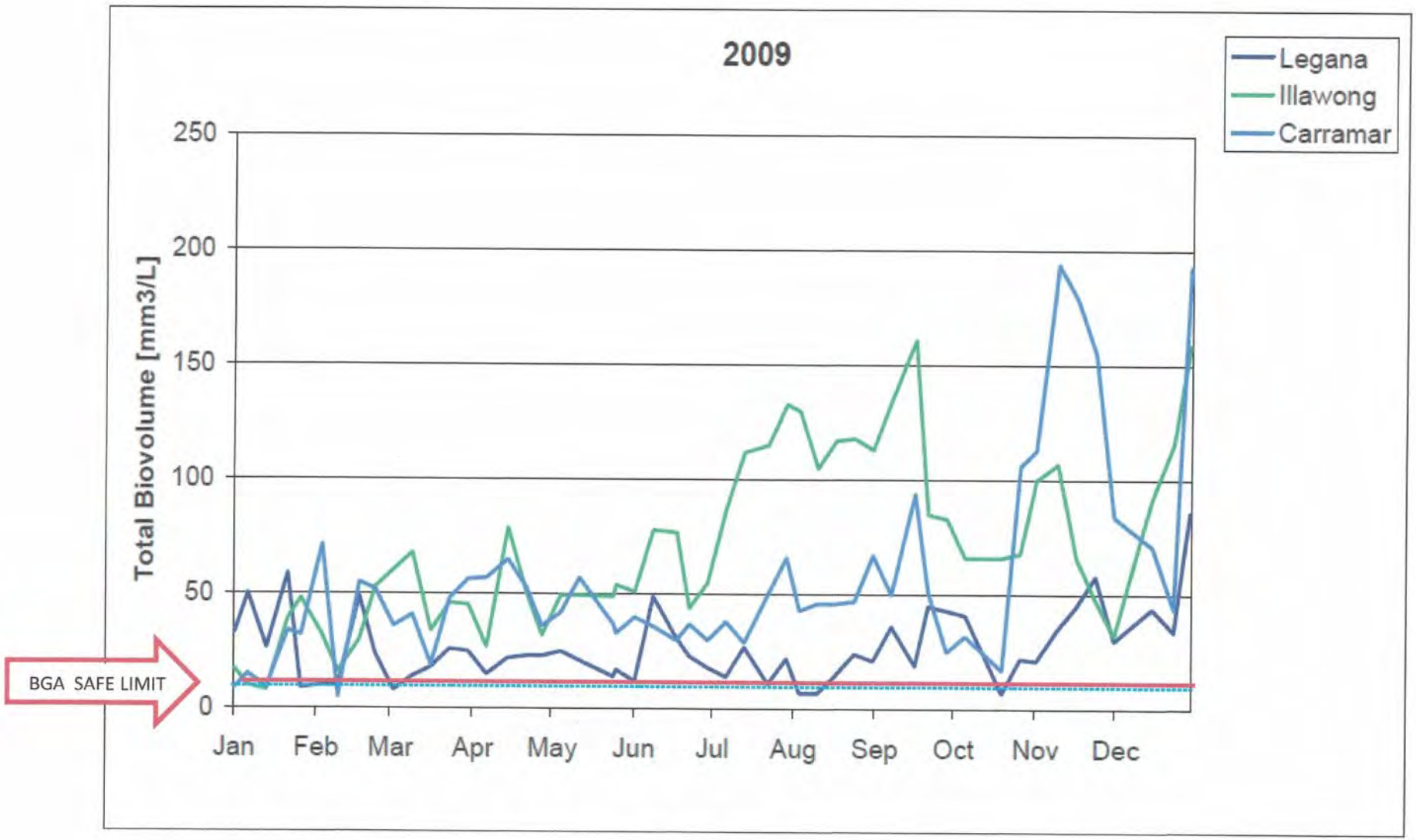
Quiet Lakes

BGA data - 2008



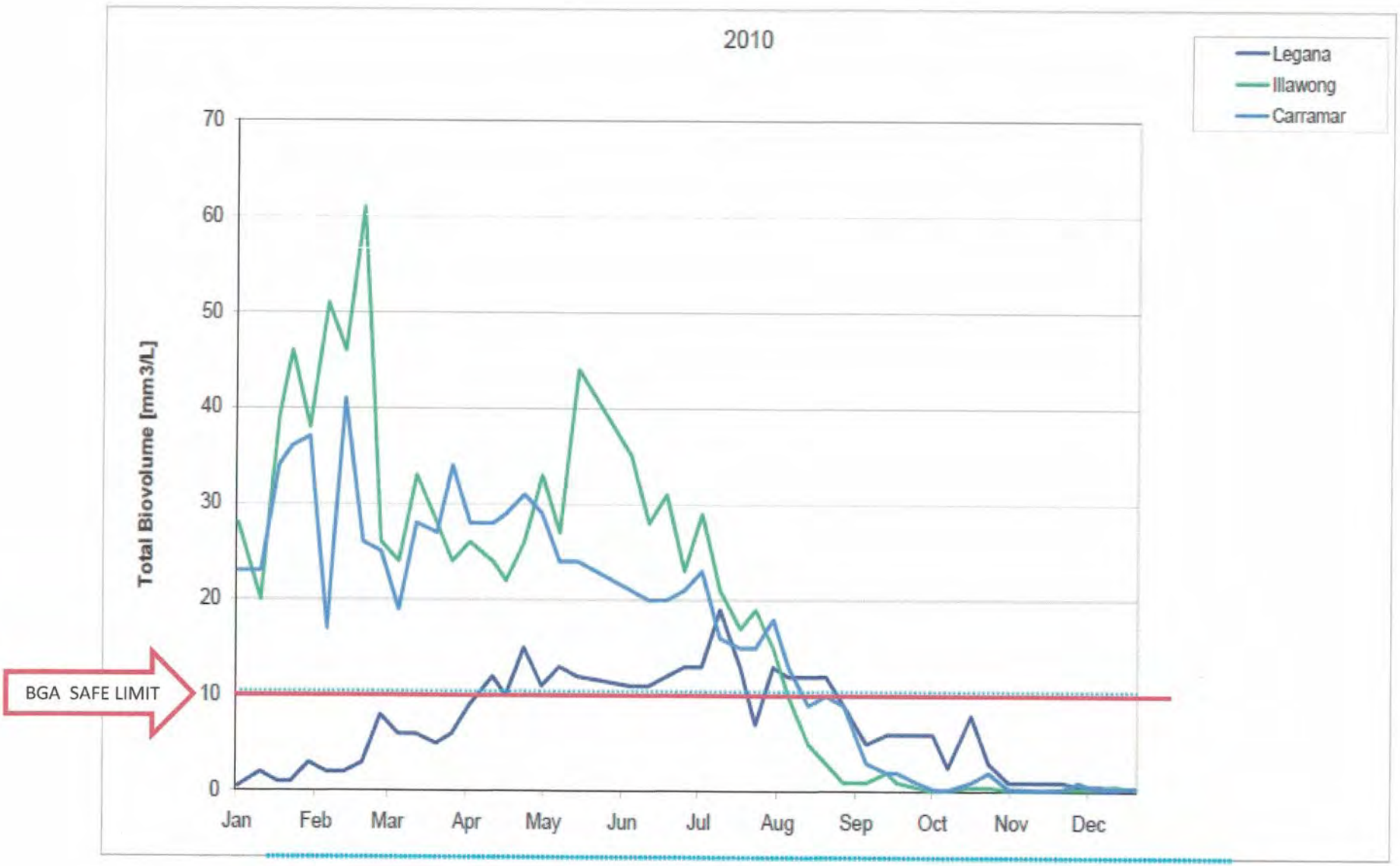
Quiet Lakes

BGA data - 2009



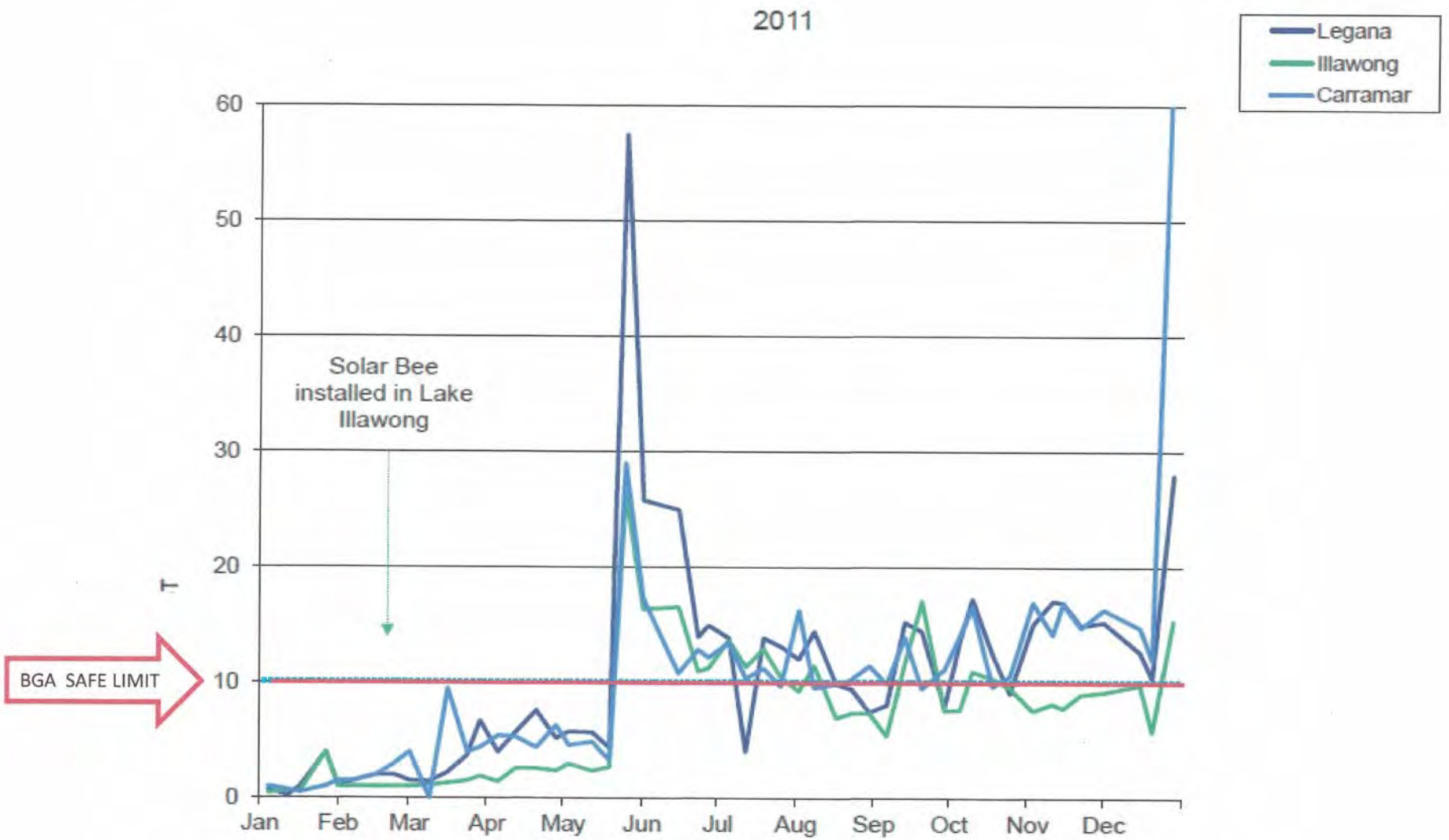
Quiet Lakes

BGA data - 2010



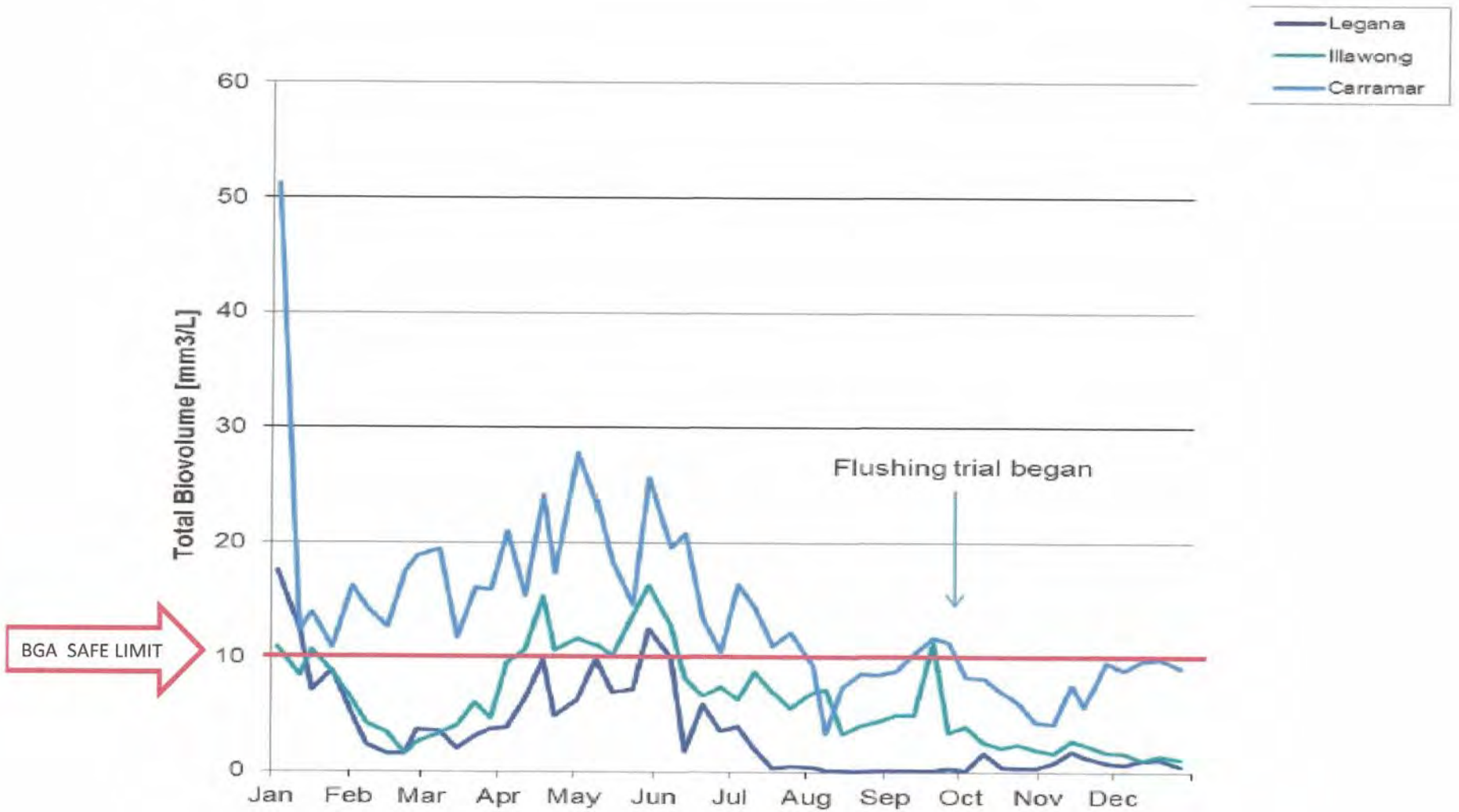
Quiet Lakes

BGA data – 2011



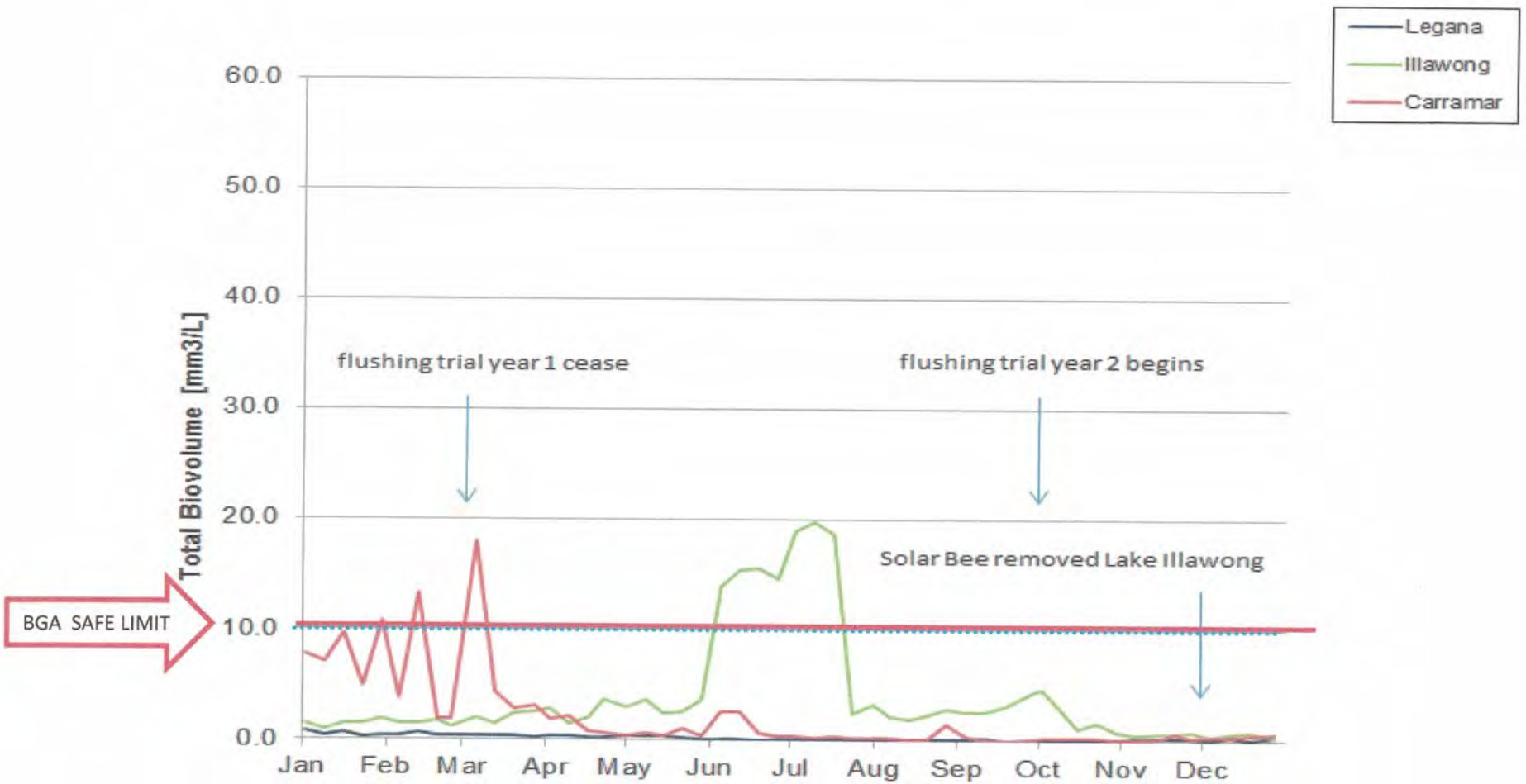
Quiet Lakes

BGA data 2012



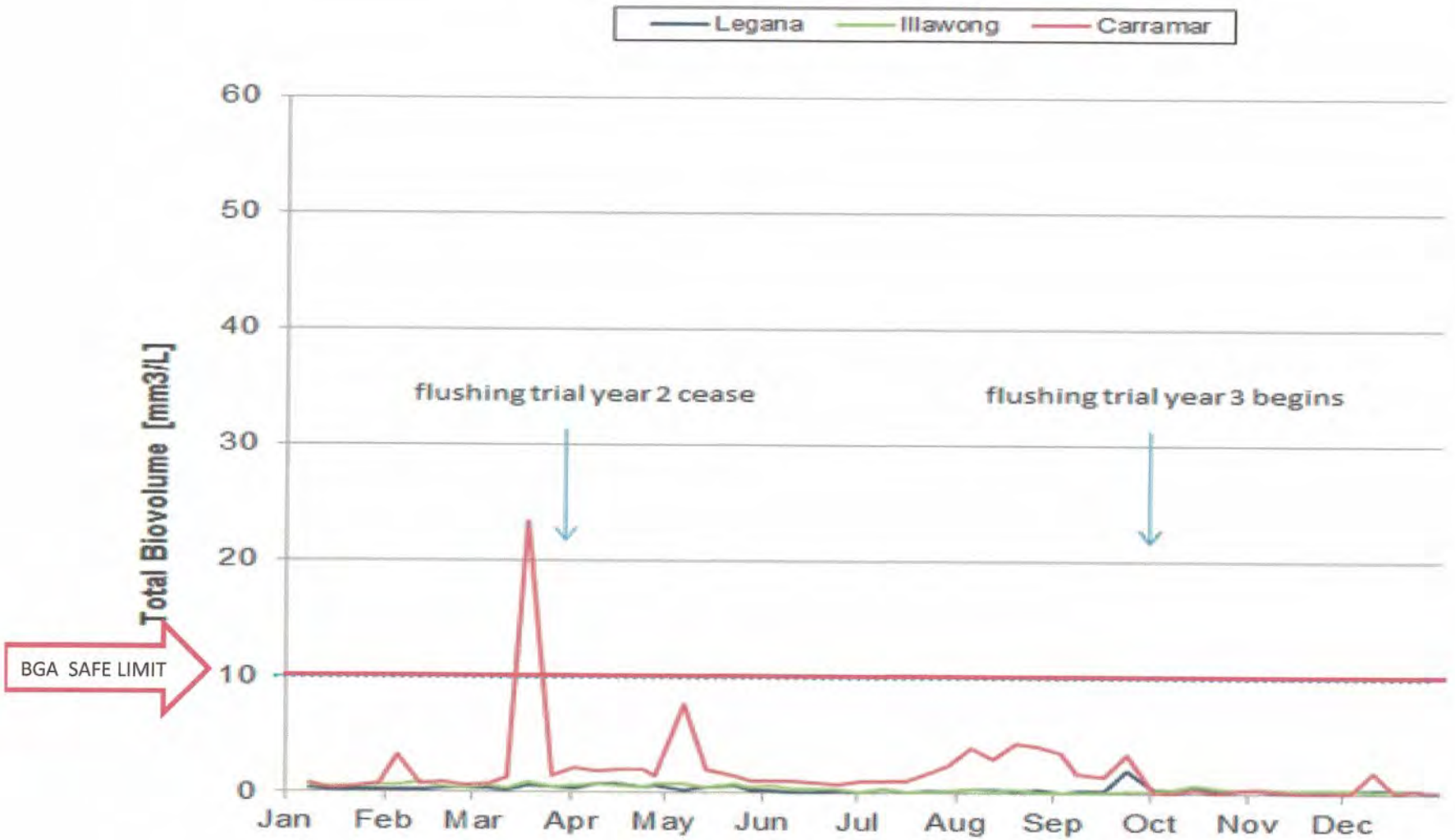
Quiet Lakes

BGA data 2013



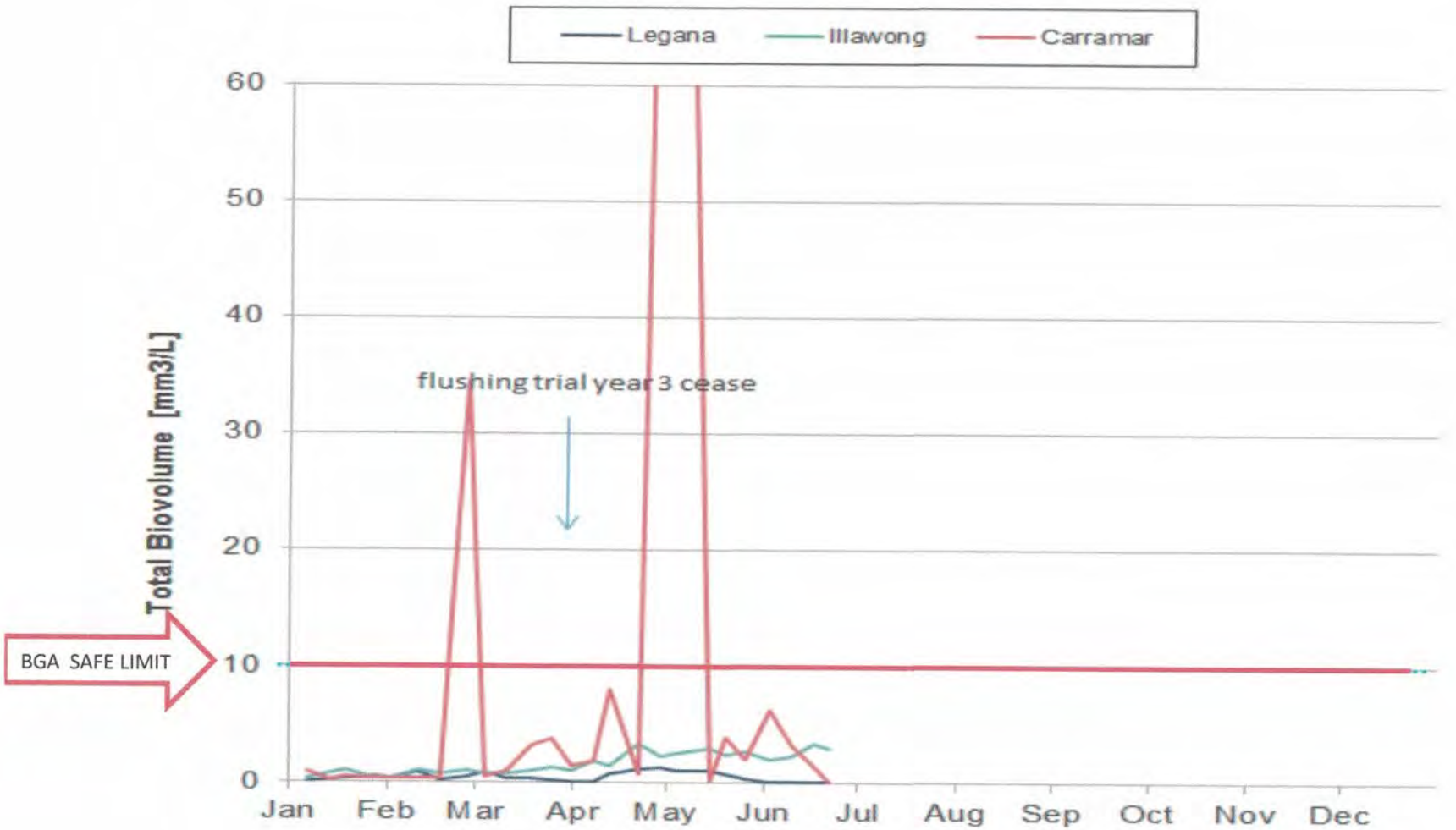
Quiet Lakes

BGA data 2014

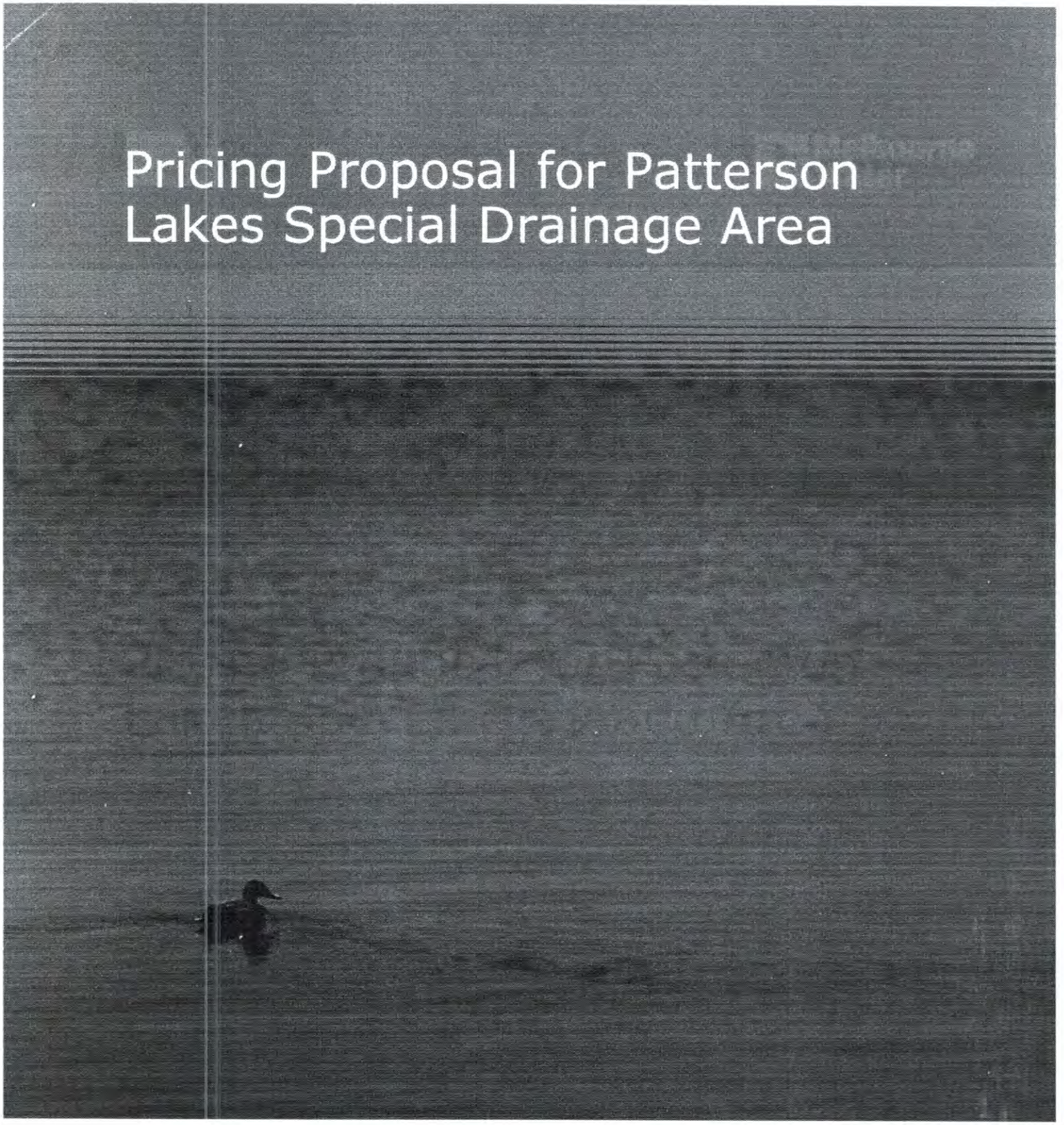


Quiet Lakes

BGA data 2015



Pricing Proposal for Patterson Lakes Special Drainage Area



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Melbourne Water

Proposal

Melbourne Water accepts the findings of the Independent Review Recommendations. Adoption of the key recommendations has lead Melbourne Water to develop the Patterson Lakes management strategy, consisting of:

- Melbourne Water ceasing to charge the former precept rate from 1 July 2013

- Implementing uniform user pays pricing for those services and assets that are linked to private recreational benefit. This is applicable to jetty replacement and maintenance, and dredging feasibility costs as determined in consultation with the community. The prices will apply to 731 jetty lease holders.

- For all other services considered to have a regional and community benefit, these will continue to be funded through the Waterways & Drainage Charge. These services and capital works in the Tidal Waterways include:
  - operation, maintenance and dredging of the floodgates
  - retaining wall maintenance & monitoring
  - interconnecting pipes maintenance
  - general civil assets monitoring & works
  - community communications/consultations

  In the Quiet Lakes, these include:
  - carp removal
  - water quality testing
  - general civil assets monitoring & works
  - community communications/consultations

- Melbourne Water is not obligated to provide water quality in the Quiet Lakes at a level higher than secondary contact standard except on a user pays basis. Trial use of a bore pump is proposed to address water quality concerns in the Quiet Lakes over a two year period. The outcome of this trial will inform Quiet Lakes residents and Melbourne Water whether user pays pricing for water quality improvements in the Quiet Lakes would be applicable. If so, user pays pricing for water quality improvements will be incorporated into the 2016 Water Plan submission subject to appropriate community consultation.

- Implementation of the recommendations of the independent review findings for the transfer of services accountabilities to Kingston City Council. The Independent Review recommended that Kingston City Council take over responsibility for certain services provided to Tidal Waterways and Quiet Lakes residents from 1 July 2014 (refer to **Appendix A** for full details). To date there has been constructive consultation with Kingston City Council regarding the transfer of accountabilities, and as proposed in this submission, if formal acceptance occurs it is anticipated that transfer of service accountabilities will take place in July 2014.

ESSENTIAL SERVICES COMMISSION

MELBOURNE WATER PATTERSON LAKES SPECIAL DRAINAGE AREA PRICE REVIEW 2014-15 TO 2015-16

Final decision

May 2014

1 INTRODUCTION

On 19 December 2013, Melbourne Water submitted its pricing proposal for the Patterson Lakes special drainage area for the period from 1 July 2014 to 30 June 2016, for the Commission's assessment. The proposal covers a range of services provided by Melbourne Water in Patterson Lakes (which comprises two separate areas, the Tidal Waterways and Quiet Lakes) including:

- in Tidal Waterways: jetty maintenance and replacement; operation, maintenance and dredging around floodgates
- in Quiet lakes: carp removal, water quality testing and monitoring and works on assets. [1]

When developing its price proposals for the 2013-14 to 2017-18 regulatory period, Melbourne Water consulted with the Patterson Lakes community to inform a price strategy to address what it claimed was a growing shortfall between costs and revenues, and to move away from property-value based pricing for the area.

After Melbourne Water was unable to reach agreement on pricing with residents, an Independent Review (the Independent Review) was established to consider aspects of the management of Patterson Lakes including the services to be provided to residents by Melbourne Water. Melbourne Water stated it would base its pricing proposal on the recommendations of the Review. The Independent Review's Report was published on 8 March 2013. [2]

---

1 See the attachment for a map of Patterson Lakes

2 Patterson Lakes Independent Review (2013), Report of the Independent Review, March, page 3.

Melbourne Water was not able to provide a full pricing proposal for Patterson Lakes for the Commission's assessment as part of its 2013-14 to 2017-18 price review. However, as an interim measure, Melbourne Water proposed to:

- cease the existing precept charge
- fund services that the Independent Review concluded had a public benefit through the Melbourne metropolitan waterways and drainage charge
- conduct further consultation with residents to inform a more detailed proposal at a later date.

The Commission approved Melbourne Water's interim proposal in its 2013 water price review final decision, noting that we expected a more detailed pricing proposal from Melbourne Water.[3]

Melbourne Water's December 2013 Patterson Lakes pricing submission proposed a management strategy for the delivery of services that was generally consistent with the recommendations and suggestions of the Independent Review. The management strategy comprised:

- implementing uniform user pays pricing for jetty related services and assets that are linked to private recreational benefit, including jetty replacement, maintenance and dredging feasibility costs.
- continuing to fund waterway health and regional drainage services through the waterways and drainage charge.
- a negotiated transfer of some open space and local drainage services to the City of Kingston.

On 4 April 2014, the Commission released its draft decision on Melbourne Water's pricing proposal for public consultation. The Commission proposed to accept Melbourne Water's pricing proposal for its jetty related capital charge and its annual jetty maintenance charge.

The Commission invited written submissions and comments in response to the decision. The Commission did not receive any submissions on its draft decision.

[3] Essential Services Commission 2013, Metropolitan Melbourne Water Price Review 2013 Final Decision, June.

5. WATER QUALITY AND QUANTITY

The following first provides some background information with respect to the design of the Patterson Lakes Waterways and secondly considers issues regarding water quality and water quantity for both the Quiet Lakes and Tidal Waterways.

5.1 Background

The Patterson Lakes Waterways were designed within a swamp floodplain to establish a network of waterways and lakes that would be capable of receiving and transmitting water between them and both the Patterson River and Kananook Creek. This operation was based on a sustainable network of drains, pumps and floodgates (Figure 14) that would work in a synchronised manner.

Figure 14: Tidal floodgate to the Tidal Waterways looking from the Patterson River into Whalers Cove.

The Quiet Lakes were designed such that stormwater would primarily fill each lake, and that a system of interconnecting pipelines and outflows would balance the water levels in each lake. This would also ensure that inter-flows of water were sufficient to maintain appropriate retention times in each water body. Retention periods (or hydraulic residence times) relate to the primary anaerobic treatment function of the

Recommendations from the Plan included restoration of water plants, mixing of water, improving lake salinity, nutrient reduction, groundwater flushing and carp removal. The Plan also recommended that sand retrieval from the lakes be minimized so that ultimately 50% of the bottom areas be colonised with submerged plants.

These recommendations led to further analysis by GHD into destratification of the water, and SKM into assessing the risk of flushing the lakes with increased inflows.

A Solar Bee was purchased by Melbourne Water and trialled in Lake Illawong since 2011 to increase the mixing of the water column and aeration of sediments. This appears to be part of a sustainable solution.

Design Flow recommended that the urban stormwater inflows be pre-treated or diverted, and deemed the increased nitrogen load in bore groundwater was likely to increase algal growth. The bore water is generally high in ammonia, which is a ready source of nitrogen, which can be toxic to the aquatic plants in the lakes. SKM[33] concluded that the unmitigated risk of increased algal growth was likely to be high, but regarded the risk to outflow downstream environments to be acceptably low.

Melbourne Water and the Quiet Lakes residents agreed to proceed with the flushing trial with bore water in September 2012, and despite some early beach sand erosion issues, they are reportedly encouraged by the improvements in water quality. Design Flow's recommendations have therefore not been followed.

Carp removal is also being undertaken, with netting and electro-fishing technology, then fish re-stocking with estuary perch.

Floating aquatic plants beds has been recommended, to remove nutrient from the lakes. This is being trialled, but several submissions expressed dissatisfaction with the plants obstructing swimming and boating activities.

Melbourne Water commissions weekly water quality testing, to ascertain the conditions for recreational use, and any warnings that need to be disseminated regarding algal blooms. These notices are publicly displayed and warnings provided to individual residents as needed. Submissions suggested that these Melbourne Water processes have been inadequate due to Notice Boards being relatively remote, and internet connectivity not widespread amongst residents.

[33] SKM 'Quiet Lakes Trial Risk Assessment Report', 2012 (page 5 iii)

Community Bulletin

ESC approves Melbourne Water's pricing proposal for Patterson Lakes.

The Essential Services Commission (ESC) has released its final decision (May 2014) approving Melbourne Water's pricing proposal for the Patterson Lakes special drainage area.

Commission's Final Decision

On 19 December 2013, Melbourne Water submitted its pricing proposal for the Patterson Lakes special drainage area for the period from 1 July 2014 to 30 June 2016 to the Essential Services Commission for approval. Melbourne Water consulted with the Patterson Lakes community on this proposal from June 2013 onwards through community bulletins, doorknocking, information packs, information sessions and a community ballot.

The ESC is the independent economic regulator of the Victorian water sector and is responsible for regulating the prices levied by all State water businesses.

The proposal submitted to the Commission covers a range of services provided by Melbourne Water in Patterson Lakes.

A copy of the proposal and the ESC final decision can be located here:
www.melbournewater.com.au/pattersonlakes

The Commission's final decision has approved Melbourne Water's:

- proposed jetty related capital charges,
- proposed methodology for charges for stub jetties and jetty upgrades, and
- proposed annual jetty maintenance charge.

What does this mean for you?

Quiet Lakes

For Quiet Lakes properties, no additional charges result from the ESC final decision. Services that are of a general or public nature, such as carp removal and water quality testing will continue to be funded out of the general Waterways and Drainage charge. Melbourne Water is continuing to work with resident representatives through the Management Plan Steering Committee to develop an

Victoria

Melbourne Water

agreed level of service for the Quiet Lakes with any additional services over and above this agreed level of service to be funded by residents.

Tidal Waterways

For Tidal Waterways properties with a jetty mooring allocation, the following jetty related charges will apply.

Charge type	Annual payment	Total cost over term
Timber jetty replacement	$1,484	$22,690
Concrete jetty replacement	$1,031	$25,354
Annual maintenance	$133.80*	

Notes: Timber and concrete jetty replacement charges above include the annual $85 Dredging Feasibility Project Charge. The concrete jetty replacement price does not include the additional variable contribution that residents are required to pay for upgrading from a timber to a concrete jetty. *Annual CPI adjustments only apply to the annual maintenance charge – an adjustment of $3.80 has been applied for 2014. All the above charges do not apply to existing private licensed jetties.

These annual charges will be split into quarterly instalments and itemised on your next quarterly water bill from South East Water.

Residents who wish to pay the total capital costs upfront (jetty replacement and dredging feasibility) and receive the benefit of lower borrowing costs, are encouraged to contact Melbourne Water to make this arrangement. If you elect to pay the total capital costs upfront, only the annual maintenance charge will be payable and appear on your water bill.

All residents will continue to pay the general Waterways and Drainage Charge that is paid by all customers in Melbourne Water's service area.

For more information relating to our pricing proposal call 131 722. Or for information about other projects to enhance life and liveability, visit www.melbournewater.com.au

2 MONITORING

The approach to assessing risks and managing hazards in recreational water outlined in Chapter 1 is based on a preventive strategy, which focuses on developing:

- an understanding of all potential influences on a recreational water body; and
- monitoring programs that can provide a real-time indication of water quality.

Management authorities responsible for recreational waters should establish a program for evaluating existing hazards and monitoring the area for any changes that may occur; such an approach will allow authorities to implement a responsive strategy to protect public health. Threats to human health may include natural hazards, such as surf, rip currents or aquatic organisms, or may arise from artificial sources, such as discharges of wastewater.

The design and implementation of programs for monitoring recreational water should be based on a framework of good practice; this chapter presents such a framework.

The framework consists of a series of statements of principle or objectives that, if adhered to, will lead to the design and implementation of a credible monitoring program. The framework applies in principle to the monitoring of all waters used for recreational activities that involve repeated or continuous direct contact with the water. In many circumstances, various approaches or methods can be applied to achieve the objectives of the framework. Although diverse approaches may be equally valid in isolation, adopting different approaches within a single program may mean that results will not be comparable across locations or enforcement programs.

The framework of good practice incrementally builds up the component parts of a successful program — identifying key health issues, monitoring and assessment strategies, and principal management considerations.

2.1 DESIGN OF MONITORING PROGRAMS

A monitoring program for recreational water should be based on a three-tier system:

- **Surveillance mode (green level)** involves routine sampling to measure contaminants (eg physical, microbial, cyanobacterial and algal).
- **Alert mode (amber level)** requires investigation into the causes of elevated contaminant levels, and increased sampling to enable a more accurate assessment of the risks to recreational users.
- **Action mode (red level)** requires the local government authority and health authorities to warn the public that the water body is considered unsuitable for recreational use.

In designing and implementing monitoring programs, all interested parties (legislators, non-government organisations, local communities, laboratories etc) should be consulted. Every attempt should be made to address all relevant disciplines and involve relevant expertise.

Table 6.6 Recommended actions at different alert levels

Level	Recommended actions
Surveillance mode (green level)	Regular monitoring: • Weekly sampling and cell counts at representative locations in the water body where known toxigenic species are present (ie *Microcystis aeruginosa, Anabaena circinalis, Cylindrospermopsis raciborskii, Aphanizomenon ovalisporum, Nodularia spumigena*); or • Fortnightly for other types including regular visual inspection of water surface for scums.
Alert mode (amber level)	• Notify agencies as appropriate. • Increase sampling frequency to twice weekly at representative locations in the water body where toxigenic species (above) are dominant within the alert level definition (ie total biovolume) to establish population growth and spatial variability in the water body. • Monitor weekly or fortnightly where other types are dominant. • Make regular visual inspections of water surface for scums. • Decide on requirement for toxicity assessment or toxin monitoring.
Action mode (red level)	• Continue monitoring as for alert mode. • Immediately notify health authorities for advice on health risk. • Make toxicity assessment or toxin measurement of water if this has not already been done. • Health authorities warn of risk to public health (ie the authorities make a health risk assessment considering toxin monitoring data, sample type and variability).

Surveillance mode — green level

Green level (surveillance mode) is triggered when cyanobacteria are first detected at low levels in water samples, signalling the early stages of possible bloom development. The indicative cell numbers for *Microcystis aeruginosa* (≥ 500 – < 5000 cells/mL) and the biovolume equivalent of ≥ 0.04 - < 0.4 mm^3/L for the combined total of all cyanobacteria are somewhat arbitrary. A cell count of 500 cells/mL is the approximate detection limit for cyanobacteria.

There are some important points to note in relation to sampling and cell counts for these level definitions. Firstly the cell numbers that define the levels apply to samples of the recommended type (ie composite 50 cm hose-pipes) that are taken at a representative location(s) in the water body (ie the likely or designated recreational areas).

In relation to cell counts the actual or real value for the cell concentration in the 500 to 5000 cells/mL range can vary from the measured value. This is due to inherent errors in the cell counting methods. There is a likely minimum precision of ±50% for counting colonial cyanobacteria such as *Microcystis aeruginosa* at such low cell densities. For counting filamentous cyanobacteria such as *Anabaena circinalis* the precision is likely to be better at these cell densities (~±20%). Also the biovolume equivalents given in the level definitions are calculated using the equivalent cell numbers of *Microcystis aeruginosa*[8].

[8] The biovolume is based upon a single cell of *Microcystis aeruginosa* with a volume of 87 μm^3. Therefore 5000 cells/mL x 87 μm^3 = 4.35 x 10^5 μm^3/mL = 1 x 10^{-9} = 4.35 x 10^{-4} mm^3/mL x 1000 = 0.435 mm^3/L. This is rounded to a biovolume of 0.4 mm^3/L.

NOV 14.

Water quality day a success

Residents watch electrofishing in action and take home useful stormwater improvement tools and information

Big Carp Day

Thank you to everyone who attended Melbourne Water's Quiet Lakes Community Water Quality Day at Lake Legana. The event was held in conjunction with this year's electrofishing activity, which Melbourne Water periodically undertakes to remove carp from all three lakes.

Management Plan Steering Committee representative and Quiet Lakes resident Martin Cole attended the day and said; "it was good to witness the magnificently successful electro-fishing in Lake Legana."

Simon from FHE holding a large carp at Lake Legana

Carp contribute to poor water quality by contributing to a decline in the density of aquatic plants and may also stir up sediment and nutrients from the bed of the lakes as they forage for food. This combination can lead to favourable conditions for blue-green algae to grow.

A total of 111 exotic fish were captured and removed from the three lakes. Carp accounted for majority of the total catch (103). The largest carp measured 800 mm TL (from Lake Legana) and the smallest 470 mm TL (from Lake Carramar). The total weight of carp removed is estimated at 519 Kilograms. Additional 'alien' species captured were goldfish (7), and one carp-goldfish hybrid.

The carp caught in each lake numbered:

Legana 18,
Illawong 35,
Carramar 50.

In addition numerous native fish were observed including common galaxias (61), followed by flat-headed gudgeon (5), estuary perch (2), and short-finned eel (2). Freshwater shrimp were also observed in good numbers in Lake Illawong and particularly in Lake Carramar.

The carp caught in Lake Legana, in particular, were very large. The contractors from Arthur Rylah Institute (ARI) were surprised at the average size of the Carp noting that in the 15 years that they have been involved in fish survey and invasive species, these are some of the largest carp they have seen.

State Government Victoria

Melbourne Water

Community bulletin

March 2017

Quiet Lakes carp removal and bore flushing update

The recent carp removal activities were a huge success with over a thousand exotic fish removed from the three lakes.

Carp can contribute to poor water quality by contributing to a decline in the density of aquatic plants and may also stir up sediment and nutrients from the bed of the lakes as they forage for food. This combination can lead to favourable conditions for blue-green algae to grow.

A total of 1205 exotic fish were captured and removed from the three lakes. Carp accounted for majority of the total catch (943), with the vast majority of these being small juvenile carp. The largest carp measured 735 mm TL (from Lake Carramar) and the smallest 25 mm TL (from Lake Carramar).

While a large number of carp were removed this year the total weight of carp removed is estimated at 264 Kilograms which is less than the previous time carp removal was carried out when 519kg of carp was removed.

Additional exotic species captured were goldfish (245) and 8 European perch.

The carp caught in each lake numbered:

- Legana 55
- Illawong 40
- Carramar 848 (vast majority were young juveniles)

In addition numerous native fish were observed including Southern Black bream (4), flat-headed gudgeon (3), estuary perch (2), and common galaxias (1).

Continued over page

APPENDIX J

Table 6.2 Interpretation of cyanobacterial alert levels for recreational water

Green level Surveillance mode	Amber level Alert mode	Red level Action mode
≥500 to <5000 cells/mL *M. aeruginosa* or biovolume equivalent of >0.04 to <0.4 mm^3/L for the combined total of all cyanobacteria.	≥5000 to <50 000 cells/mL *M. aeruginosa* or biovolume equivalent of ≥0.4 to <4 mm^3/L for the combined total of all cyanobacteria where a known toxin producer is dominant in the total biovolume[a]. or[b] ≥0.4 to <10 mm^3/L for the combined total of all cyanobacteria where known toxin producers are not present.	Level 1 guideline: ≥10 µg/L total microcystins or ≥50 000 cells/mL toxic *M. aeruginosa* or biovolume equivalent of ≥4 mm^3L for the combined total of all cyanobacteria where a known toxin producer is dominant in the total biovolume. or[b] Level 2 guideline: ≥10 mm^3/L for total biovolume of all cyanobacterial material where known toxins are not present. or cyanobacterial scums are consistently present[c].

a The definition of 'dominant' is where the known toxin producer comprises 75% or more of the total biovolume of cyanobacteria in a representative sample.

b This applies where high cell densities or scums of 'nontoxic' cyanobacteria are present, ie where the cyanobacterial population has been tested and shown not to contain known toxins (microcystin, nodularin, cylindrospermopsin or saxitoxins).

c This refers to the situation where scums occur at the recreation site each day when conditions are calm, particularly in the morning. Note that it is not likely that scums are always present and visible when there is a high population, as the cells may mix down with wind and turbulence and then reform later when conditions become stable.

The grading is intended to provide an indication of the susceptibility of the water body to cyanobacterial growth. For a grading of 'very good', the water body will almost always comply with the guideline values for recreation. Water bodies graded as 'very poor' will be highly susceptible to cyanobacterial growth and may rarely pass the quantitative guidelines and their use for recreational activities is not recommended. For the remaining gradings ('good', 'fair' and 'poor'), it is recommended that a monitoring program be introduced.

The monitoring program that is then implemented is based on a three-tier alert levels framework, which is a monitoring and management action sequence that operators and regulators can use for a graduated response to the onset and progress of a cyanobacterial bloom in the water body. A similar system has been in use for management of cyanobacteria in drinking water sources for many years. The alert levels recommended for a recreational water monitoring program are summarised in Table 6.3, and discussed in more detail in Section 6.5.2.

APPENDIX K

Table 6.6 Recommended actions at different alert levels

Level	Recommended actions
Surveillance mode (green level)	Regular monitoring: • Weekly sampling and cell counts at representative locations in the water body where known toxigenic species are present (ie *Microcystis aeruginosa, Anabaena circinalis, Cylindrospermopsis raciborskii, Aphanizomenon ovalisporum, Nodularia spumigena*); or • Fortnightly for other types including regular visual inspection of water surface for scums.
Alert mode (amber level)	• Notify agencies as appropriate. • Increase sampling frequency to twice weekly at representative locations in the water body where toxigenic species (above) are dominant within the alert level definition (ie total biovolume) to establish population growth and spatial variability in the water body. • Monitor weekly or fortnightly where other types are dominant. • Make regular visual inspections of water surface for scums. • Decide on requirement for toxicity assessment or toxin monitoring.
Action mode (red level)	• Continue monitoring as for alert mode. • Immediately notify health authorities for advice on health risk. • Make toxicity assessment or toxin measurement of water if this has not already been done. • Health authorities warn of risk to public health (ie the authorities make a health risk assessment considering toxin monitoring data, sample type and variability).

Surveillance mode — green level

Green level (surveillance mode) is triggered when cyanobacteria are first detected at low levels in water samples, signalling the early stages of possible bloom development. The indicative cell numbers for *Microcystis aeruginosa* ($\geq 500 - < 5000$ cells/mL) and the biovolume equivalent of $\geq 0.04 - < 0.4$ mm³/L for the combined total of all cyanobacteria are somewhat arbitrary. A cell count of 500 cells/mL is the approximate detection limit for cyanobacteria.

There are some important points to note in relation to sampling and cell counts for these level definitions. Firstly the cell numbers that define the levels apply to samples of the recommended type (ie composite 50 cm hose-pipes) that are taken at a representative location(s) in the water body (ie the likely or designated recreational areas).

In relation to cell counts the actual or real value for the cell concentration in the 500 to 5000 cells/mL range can vary from the measured value. This is due to inherent errors in the cell counting methods. There is a likely minimum precision of ±50% for counting colonial cyanobacteria such as *Microcystis aeruginosa* at such low cell densities. For counting filamentous cyanobacteria such as *Anabaena circinalis* the precision is likely to be better at these cell densities (~±20%). Also the biovolume equivalents given in the level definitions are calculated using the equivalent cell numbers of *Microcystis aeruginosa*[8].

[8] The biovolume is based upon a single cell of *Microcystis aeruginosa* with a volume of 87 µm³. Therefore 5000 cells/mL x 87 µm³ = 4.35 x 10^5 µm³/mL ÷ 1 x 10^9 = 4.35 x 10^{-4} mm³/mL x 1000 = 0.435 mm³/L. This is rounded to a biovolume of 0.4 mm³/L.

APPENDIX L

Melbourne Water

Lake Carramar Residents Survey

Results of the consultation survey conducted in March 2015

Prepared for Melbourne Water by

Evaluation Solutions

Suite 6, 48 Edgewater Blvd
Maribyrnong VIC 3032
Phone +61 3 9988 7888
www.evaluationsolutions.com

Table of Contents

1. Introduction

1.1. Background to Survey

Ongoing maintenance of the Patterson Lakes waterways is a shared responsibility between Melbourne Water, Kingston City Council and area residents. Some residents have raised the prospect of introducing water flow through Lake Carramar, as it is possible that introducing water flow may have a beneficial impact on water quality.

Melbourne Water has indicated that any work to introduce water flow through Lake Carramar would be conducted on a cost recovery basis, as per the recommendations of the Patterson Lakes Independent Review. Therefore, Melbourne Water wished to consult with property owners who have a lake-front property or key access to Lake Carramar to determine the level of interest in pursuing this matter.

Melbourne Water engaged Evaluation Solutions to conduct the survey, to ensure that responses remain anonymous and confidential.

1.2. Survey Methodology

The survey of Lake Carramar property owners was undertaken in March 2015. The survey was mailed to 84 property owners along with a reply paid envelope, and residents had the option to phone Evaluation Solutions to complete the survey by phone. A follow-up reminder was sent part-way through the survey period, with a duplicate survey form.

Property owners were requested to return their forms by 31st March 2015, however as the survey closed just prior to Easter, responses were accepted up until 17th April to allow for the return of reply paid envelopes and delays due to public holidays.

Each survey included a unique property code, in order to prevent duplicate responses and to facilitate the sending of reminders to non-responders. However the survey is anonymous and confidential, and Melbourne Water staff have not been provided with access to individuals' completed survey forms.

A copy of the survey and associated communications is included at the end of this report.

1.3. Response Rates

In total, 84 surveys were delivered and 59 responses were received, giving an overall response rate of 70%.

The majority of surveys were paper-based; three surveys were completed by phone.

Table 1. Number of responses for the 2015 Lake Carramar Survey

Property Type	Invited	Responded	Percentage
Lake front	34	31	91%
Key Access	50	28	56%
TOTAL	**84**	**59**	**70%**

The survey was self-selecting, in that residents were able to select whether or not to participate. For this reason, it cannot be assumed that the results of the survey will represent the opinions of those residents who did not choose to respond.

In this report the terms "respondent", "resident" and "property owner" are used interchangeably unless otherwise clarified.

2. Results – Introducing Water Flow

2.1. Level of interest in introducing water flow

The majority of lake front property owners indicated a high level of interest in introducing water flows into Lake Carramar. However the majority of key access property owners indicated that they have no interest.

Table 2. Level of interest in introducing water flow

Property Type:	Lake Front		Key Access		Overall	
Option	Number	%	Number	%	Number	%
No interest	3	10%	20	71%	23	39%
Low interest	1	3%	3	11%	4	7%
Moderate interest	5	16%	2	7%	7	12%
High interest	21	68%	2	7%	23	39%
Did not answer question	1	3%	1	4%	2	3%
TOTAL	**31**	**100%**	**28**	**100%**	**59**	**100%**

2.2. Investigating options for introducing water flow

Respondents were asked if they would like Melbourne Water to undertake an options analysis on their behalf, to investigate options for introducing water flows in the lake.

The majority of lake front property owners who responded to the survey said YES (81%), however the majority of key access property owners who responded said NO (86%).

Table 3. Investigating options for introducing water flow

Property Type:	Lake Front		Key Access		Overall	
Option	Number	%	Number	%	Number	%
YES	25	81%	2	7%	27	46%
NO	5	16%	24	86%	29	49%
Did not answer question	1	3%	2	7%	3	5%
TOTAL	**31**	**100%**	**28**	**100%**	**59**	**100%**

Melbourne Water indicated it would pursue an investigation to introduce water flow if at least three quarters (75%) of all lakefront and key access property owners requested it.

When all property owners are taken into account (both those who responded and those who didn't), the final result in relation to introducing water flow is as follows:

- 25 of a possible 34 lakefront property owners said YES, which equates to **74%**
- 2 of a possible 50 key access property owners said YES, which equates to **4%**
- Overall, 27 of a possible 84 property owners said YES, which equates to **32%**

2.3. Cost of introducing water flow

Respondents were asked to give an indication of how much they would be prepared to pay per year to introduce water flows to the lake.

Some lakefront property owners indicated a specific amount, however the majority said they were undecided. Comments suggested some property owners would like to know what options are proposed, before indicating a dollar figure.

The majority of key access property owners were not prepared to pay to introduce water flows.

Table 4. How much would you be prepared to pay per year to introduce water flow?

Property Type:	Lake Front		Key Access		Overall	
Option	Number	%	Number	%	Number	%
Not prepared to pay	6	19%	24	86%	30	51%
Up to $100 per year	2	6%	3	11%	5	8%
Up to $250 per year	2	6%	0	0%	2	3%
Up to $500 per year	2	6%	0	0%	2	3%
Up to $1000 per year	1	3%	0	0%	1	2%
More than $1,000 a year	0	0%	0	0%	0	0%
Undecided / don't know	18	58%	0	0%	18	31%
Did not answer	0	0%	1	4%	1	2%
TOTAL	**31**	**100%**	**28**	**100%**	**59**	**100%**

2.4. Comments about introducing water flow

Respondents were invited to provide comments about the introduction of water flow.

Verbatim comments are displayed below.

Lake Front - comments about introducing water flows
We have been residents on Lake Carramar for 32 years. When the DVA (Dandenong Valley Authority) cared for water management the water was swimmable. We were told by DVA workers that the lake had a flow through system. Q1. What has changed and why? Who is at fault here? Q2. What has happened to the pre-existing infrastructure? Q3. How can it cost $5,000 - $10,000 for a couple of staff to check out what was once working fine from survey maps and on site inspection.
Yes, if < $120. We have lived here for 30 years. It is disappointing that the lake has deteriorated. Of course we are willing to put in, however we would need to be informed of how much you estimate as we are now retired.
Good swimming; Algae free water
I feel we pay enough for water rates per quarter now for parks and gardens. Every home owner pays their share as well. I'm a pensioner and just make do now with my bills. Thank you. [name provided]
We feel our rates (water) cover the needs of the lake. The water should be maintained as part of our rates as we have paid a large amount in years previous to this for upkeep.
I am very keen for the process to take place.

Lake Front - comments about introducing water flows (continued)
I presume there must have been a control valve on the pipe between Lake Illawong and Lake Carramar. If a removable stop-board was added to the "weir" structure leading to the Thompson Rd PS, and used alternately with the pressured existing stop valve, a pulse of water would enter Lake Carramar. The "stop-board" may only need to be say 50mm high and the valve opened (again) at overflow of the temporary raised weir. The effect would be small but may be a viable effect.
Need to maintain water quality for people's enjoyment.
Limited frontage to lake. Consultant not to use investigation as a cash cow.
Note: If Melbourne Water had undertaken the care and the responsibility of the lakes they should have known what they were getting into and factored it into consolidated revenue. This survey seems to me to be another grab for cash by some bean counter trying to elevate his or her status by increasing the bottom line. The only requirement here is to stop this continual paper warfare with residents and just get in and fix the problem and be done with it. This to me just wreaks of more bureaucratic nonsense. As a lake side resident I'm not responsible for stuff ups by previous water maintenance contractors or inefficient council decisions, and now have been placed in victim mode because of it. Lake Carramar used to be the cleanest lake in the system.
I did read somewhere that 75% would need to vote in favour - hopefully if that doesn't happen, there would still be further discussion.

Key Access - comments about introducing water flows
With only a handful of times the kids want to walk around the lake per YEAR, there would be no great benefit to our household if the water was cleaned up or not.
We are sick of going through this type of consultation every year. I just want to give the key back and let them fight it out.
We were not aware we had key access to the lake prior to this survey.
Maybe survey option to fill in substantially except for a creek trickle end to end. This keeps it as a scenic background to those backing onto it. And they of course pay for it 100%.
I have been at [address] for 33 years. Initially there was a covenant for the key access. This expired around 15 years ago. I have no interest in the lake what so ever.
We are a key holder, we never access the lake, nor have any intention to do so.
I don't have a key to Lake Carramar and I am not interested to have one. Never been there from the day I moved into my property.
I have lived at [address] for 18 years and have never accessed any of the Quiet Lakes. I thought it was all private property. I didn't know of any key access and don't wish to have it.
Do not live near Lake Carramar
Not paying anything. Not on water & no water access!!! Stick your water charges!!
I have lived here 5 years and was not aware that key access was available to Lake Carramar. I do not use it and its condition has no impact on my activities or property.
It's a lost cause

3. Results – Key Access Properties only

3.1. Access to Lake Carramar

Key access property owners were asked additional questions about their access to and use of the lake. The majority said they accessed the lake less than once a year. Many commented that they had never accessed the lake, or had not done so for a long time.

Table 5. On average, how often do you access Lake Carramar?

Property Type:	Key Access	
Option	**Number**	**%**
Less than one per year *(including those who wrote "never")*	22	79%
Once or twice a year	1	4%
Once or twice a month	1	4%
Once or twice a week, or more	1	4%
Did not answer question	3	11%
TOTAL	**28**	**100%**

3.2. Ongoing Key Access

Around three quarters of key access property owners indicated they would prefer to hand back their key. Many commented that they did not have a key, had never had a key, or did not know that key access was available. Those who didn't answer this question made comments that indicate they have no interest in having access to the lake.

Table 6. Would you prefer to relinquish your key access and not pay special charges?

Property Type:	Key Access	
Option	**Number**	**%**
YES	21	75%
NO	3	11%
No response	4	14%
TOTAL	**28**	**100%**

As shown above, three key access property owners indicated that they would like to retain their key. Two of these residents said YES to the question on pursuing increased water flows, and indicated they would pay up to $100 per year towards the cost of this. The third resident commented that they did not feel increased water flows would be of benefit, and they would not like to pay any special charges that arise in connection with the lake.

3.3. Comments about key access

Key access property owners were invited to provide additional comments.

Verbatim comments are displayed below.

Key Access – additional comments about access
I have never had key access. I have never received notice that key access was available. I definitely don't want to pay for it, and would like any charges I am paying for it removed.
We have no key described. No key was provided when we bought the property. We had no knowledge of it. Our property is away from Lake Carramar.
We do not have a key or access to the lake. Given the option, we would be open to obtaining key access to the lake, however we would not be prepared to pay additional costs for this access.
Do not have key access as we do not live near the quiet lakes.
We have not used the lake in 20 or so years. Since then the locks have been changed several times and have not been provided with a key.
We have never had keys access, nor do we wish to be paying for something that we have not been provided access to.
I had a birthday party with about 20 people about 9 years ago. Part of the event was to walk around the lake. Two of my guests were approached (separately) and told they had no right to be there. That was the last time I "used" the lake, so as to save embarrassment of any of my future friends.
With all the ongoing problems over the years, perhaps it would be far more useful if it was drained, and with a little imagination could be turned into a very good oval for the benefit of parents and children. A safe environment throughout the year for your children to play in is a very rare commodity these days, and because of that I don't think it would de-value the properties.
I have never seen the key.
As above, fill it in with minimal water feature. Immediate residents pay any levy. Key holders and outsiders don't use it and pay nothing.
I have not used the keys to enter the gate to the lake for 15 years. I am situated a little far back from the lake. I don't see the lake from where I live, and therefore I am not interested in the lake. I don't want to become involved in any costs towards the lake.
If we relinquish (hand back) our key, does that remove all cost currently being charged for access now? As above, we never access or use the lake area.
We have never had key access in the 8 years we have owned the house. We questioned this last time, only to have no one answer our calls. Disappointing.
As this is a rental property, I no longer have a key to access the lake. It was given to a previous tenant and never returned. [name and address supplied]
[selected "No - I would prefer to retain my key access"; deleted "and pay any special charges that arise"]
When I got sold the property, it wasn't mentioned to us. We got the key and wondered what it was. I didn't pay much attention until all this stuff started happening. I've got kids - I'd rather the money go towards a playground instead of a lake that no one uses.
When I moved here in 2003 I didn't receive a key. To my knowledge there was never a key. I don't use the lake. I'm worried about the costs that might come up, as I can't afford it. I love the idea of the lake for the people who live there, but it's really none of my business.

4. Survey

Melbourne Water

11 March 2015

NAME
ADDRESS LINE 1
ADDRESS LINE 2
ADDRESS LINE 3

Re: Property located at: <physical address>

Dear Property Owner

Consultation regarding introducing water flows through Lake Carramar

Some residents have raised the prospect of introducing water flow through Lake Carramar. It is possible that introducing water flow may have a beneficial impact on water quality however there is no guarantee of this.

Any work to introduce water flow through Lake Carramar would be above the level of service obligation provided by Melbourne Water under the Waterways and Drainage charge. Therefore, any work of this nature, including initial scoping, would be conducted on a cost recovery basis at a cost to Lake Carramar residents.

Before taking further action, Melbourne Water is conducting a survey of property owners who have a lake-front property or key access to Lake Carramar to determine the level of interest in pursuing the introduction of water flow through the lake.

Previous Investigation of Lake Carramar operations

Currently, as per the original design of the Quiet Lakes, bore water is pumped into Lake Legana from the deep bore located at the Gladesville Boulevard pump station at the north end of the lake. Water flows through Lake Legana into Lake Illawong before exiting into the local drainage system via the Thompson Road pump station at the south end of Lake Illawong. As per the original design, Lake Carramar receives only a passive exchange of water from Lake Illawong.

As recommended by the Patterson Lakes Independent Review, Melbourne Water previously completed investigative works to determine whether water flow through Lake Carramar was possible, based on the original design. The investigation found that the system of inter-connecting pipes has not been modified from its original design, and that water flow to Lake Carramar based on the original design is not possible.

Survey of Lake Carramar Property Owners

Melbourne Water is now conducting a survey of property owners who have a lake-front property or key access to Lake Carramar to determine the level of interest in pursuing this matter on a user-pays basis. If a high proportion indicate they wish to fund further investigation, Melbourne Water will investigate other options for introducing water flow through Lake Carramar.

Melbourne Water ABN 81 945 386 953
990 La Trobe Street Docklands VIC 3008
PO Box 4342 Melbourne VIC 3001 Australia
T 131 722 F +61 (0) 3 9679 7099
melbournewater.com.au

Victoria

The survey is being conducted by Evaluation Solutions, external consultants who have previously conducted several surveys of Quiet Lakes residents. The survey is confidential, and Melbourne Water will not have access to your individual responses or survey form.

Further investigation of options for introducing water flow will be on-charged to property owners, so it is important that we understand your preferences.

Please return the attached survey form in the enclosed reply paid envelope by 31 March 2015, or contact Evaluation Solutions on 03 9988 7887 to complete the survey by phone.

How will the outcome of the survey be decided?

Any cost recovery would be spread across all Lake Carramar lake-front properties and properties with key access. Therefore, it is important that a high proportion of property owners agree for the project to proceed.

Melbourne Water will only pursue an investigation to introduce water flow if at least three quarters (75%) of all lakefront and key access property owners request this.

What will it mean if residents agree to pursue the introduction of water flow?

If the required proportion of property owners request Melbourne Water to proceed with the investigation, we will continue in two stages:

1. **Options Analysis** – MW will engage a suitable consultant to conduct an options analysis to investigate potential and relevant options for introducing water flow into Lake Carramar, as well as the estimated costs of specific options. This analysis is expected to cost $5,000 - $10,000 or approximately $60-$120 per Lake Carramar lake front or key access property.

2. **Further consultation** – since any works will be undertaken on a cost recovery basis, MW will present the relevant options and cost estimates so that Lake Carramar property owners may decide whether to proceed with implementing any solutions. The cost of implementing any solutions are unknown at this stage.

Further information

Further information about the Quiet Lakes, including the Independent Review and previous investigations, can be found on Melbourne Water's website:
www.melbournewater.com.au/PattersonLakes

If you have questions about this consultation, please contact Melbourne Water on 131 722.

Yours sincerely

Jarrod Mitchell
Team Leader, Dandenong & Bayside Area, Waterways and Land
Service Delivery, Melbourne Water

Melbourne Water ABN 81 945 386 953
990 La Trobe Street Docklands VIC 3008
PO Box 4342 Melbourne VIC 3001 Australia
T 131 722 F +61 (0) 3 9679 7099
melbournewater.com.au

Property Code:
SAMPLE

Lake Carramar Survey

The following survey is for property owners who have a lake-front property or key access to Lake Carramar. The survey is intended to determine the level of interest in pursuing the introduction of water flow through the lake on a resident-funded cost recovery basis.

Thank you in advance for your participation.

Instructions for completing the survey

The survey is open to all property owners with lake-front or key access to Lake Carramar. Please complete the survey by **Tuesday 31st March 2015**, via one of the following options:

1. Paper Survey

Complete this survey and return it in the reply paid envelope provided, or mail to

The Survey Manager
Suite 6, 48 Edgewater Blvd
Maribyrnong VIC 3032

2. Phone

To complete the survey by telephone please contact Evaluation Solutions on **03 9988 7887** during business hours. You will be asked to confirm the unique code printed above.

Alternatively, email info@evaluationsolutions.com to request a return telephone call. Please include your name, phone number, and preferred day/time to be contacted. One of our consultants will endeavour to call you at your preferred time.

About your privacy and confidentiality

Melbourne Water has engaged Evaluation Solutions to conduct the survey, to ensure that your responses remain anonymous and confidential. Melbourne Water will not have access to your individual survey form.

Each survey is marked with a unique property code, in order to prevent duplicate responses, and to enable Evaluation Solutions to undertake follow-up reminders if required. Your individual preferences will remain anonymous and will not be recorded with personal information.

Please be aware that your comments will be included in the report that Melbourne Water receives. If you include specific information in your comments that may identify you, this will be included in the report, but it will not be linked to the rest of your survey response.

Please turn over the page to complete the survey

Property Code:
SAMPLE

Melbourne Water

Lake Carramar Survey

1. Level of interest in introducing water flow

How much interest do you have in introducing water flow into Lake Carramar?

- ❍ No interest
- ❍ Low interest
- ❍ Moderate interest
- ❍ High interest

2. Investigating options for introducing water flow

Do you want Melbourne Water to undertake an options analysis on behalf of residents to investigate options for introducing water flow into Lake Carramar?

❍ **Yes**	❍ **No**
I agree to pay a share of the costs of this investigation should any works proceed	No further action should be taken

Your comments are welcome:

_____

_____

_____

_____

_____

_____

_____

3. Cost of introducing water flow

Melbourne Water will investigate options for introducing water flow into Lake Carramar if 75% of all direct and key access property owners request this. To assist Melbourne Water in determining applicable options based on budget, please indicate how much you would be prepared to pay per year to increase water flow. (You are not making a commitment, this is an indication only).

- ❍ Not prepared to pay to introduce water flow into Lake Carramar
- ❍ Up to $100 per year
- ❍ Up to $250 per year
- ❍ Up to $500 per year
- ❍ Up to $1,000 per year
- ❍ More than $1,000 per year (please specify) _____
- ❍ Undecided / Don't know

Please complete the additional section for Key Access properties, attached.

Property Code:
SAMPLE

Melbourne Water

Lake Carramar Survey – Key Access Properties

The following additional questions are for property owners who have key access to Lake Carramar.

4. Access to Lake Carramar

On average, how often do you access Lake Carramar?

- ❍ Less than once per year
- ❍ Once or twice a year
- ❍ Once or twice a month
- ❍ Once or twice a week, or more

5. Ongoing Key Access

We recognise that some property owners no longer use their key access to Lake Carramar, and would prefer not to pay any further costs for services provide on a cost-recovery basis.

If the option was available, would you wish to relinquish (hand back) your key access if it meant not having to pay any future Special Charge/s relating to Lake Carramar or the Quiet Lakes?

❍ **Yes**	❍ **No**
I would prefer to cancel my key access.	I would prefer to retain my key access, and pay any Special Charges that arise for services provided on a cost-recovery basis.

Any additional comments are welcome:

Thankyou. Please return your completed survey by **Tuesday 31st March 2015**.

PATTERSON LAKES **QUIET LAKES** OWNERS & RESIDENTS INC.
Association #A0050282B

Registered address:
5 Gladesville Boulevard, Patterson Lakes Vic 3197

Memo

To	Jarrod Mitchell
Cc	Ross Bleazby; Greg Bain; Sonia Tallarida; Andrew Meehan, David Jordan
Date	24/04/2015

Purpose

This memo replies to Melbourne Water's (MW) assessment of the Lake Carramar residents' consultation 'flow through' survey conducted in March 2015.

Discussion

Thank you for sending the survey results.

The PLQLOR Association is very disappointed in MW's decision not to further investigate the flow through options with the Lake Carramar lakeside community. We do not believe it was appropriate for MW to unilaterally decide – based on its' survey results – that "no action" needed to be taken without consulting with myself or Louis Cali (as IR Steering Committee's Residents Representatives). The survey goes directly to Recommendation 4 of the IR (p. 75) that "adequate through flows in Lake Carramar are to be guaranteed by Melbourne Water", and any interpretation of the data could have and should have been discussed with us first.

The survey is notable in that an overwhelming majority of lakeside residents (those households that abut the lake) expressed a willingness to pay for the investigation of the flow through options (80.6%). The same percentage of lakeside residents (80.6%) further expressed a willingness to consider payment for the future operation of flow through. Even under MW's arbitrary and unilaterally determined requirement of a 75% positive response from the Lake Carramar community, this is an outstanding response rate.[1]

[1] The 80.6% positive response is based on 25 of 31 lakeside dwellings. Two additional dwellings were 'interested in flow' but 'not interested to pay for flow through'. Interestingly, 31 of a possible 33 lakeside dwellings (93.9%) participated in MW's survey, which is an unprecedented response rate. Further, 27 of 31 lakeside dwellings (87.1%) that participated expressed an interest for flow through. Two particular dwellings were 'interested in flow' but 'not interested to pay for flow through'. Finally, one residence (2/10 Kalang Court) is currently a deceased estate with no occupancy and, as MW has acknowledged, residences that do not participate are not to be represented in any survey response. "It cannot be assumed that the results of the survey will represent the opinions of those residents who did not choose to respond."

MW's conclusion that less than 75% of Lake Carramar residents expressed interest in a flow through investigation included responses from residents that do not abut the lake itself. As was made abundantly clear to MW in the past, those residents can easily forfeit their access to the lake (via the locked gate) if they do not wish to be included in the decision making concerning the ongoing health and safety of Lake Carramar. Indeed, failure to consider this demonstrates a total lack of consideration toward the detrimental health concerns affecting the Lake Carramar lakeside community who are repeatedly exposed to toxic BGA. Any conclusions regarding flow though on Lake Carramar ought to at least consider the immediate health and safety of its residents. MW's interpretation of its own survey fails to do just that.

MW's stated plan to do nothing more at this time is simply unacceptable. MW should at least consult further with the residents that do not abut the lake (the non-lakeside community) or simply change the security gate lock to exclude any future involvement of those non-lakeside residents who are not interested in flow through. A new key can be provided to those particular households (which at the moment includes 3 non-lakeside households) who express a willingness to pay for flow through.

Conclusion

Given the above, we request that Melbourne Water:

1. Review their interpretation of the statistics;

2. Reconsider their response;

3. Proceed with its commitment to investigate flow through options for the lakeside community in recognition of the overwhelmingly positive response of lakeside residents (well beyond MW's arbitrary 75% requirement) to its survey.

4. Engage with the steering committee members in person about the next steps. This level of consultation is reasonable and proper given the existence of the steering committee for that purpose, and the clear mandate stated in Recommendation 4 of the IR.

Regards,

Anthony Moffatt
President PLQLOR Association
IR Steering committee member

Louis Cali
PLQLOR Association committee member
IR Steering committee member

Melbourne Water

14 May 2015

Mr Anthony Moffatt
President PLQLOR Association
IR Steering Committee member
5 Gladesville Boulevard
PATTERSON LAKES VIC 3197

Sent via email.

Dear Anthony,

RE: PLQLOR Memo Concerning the 2015 Lake Carramar Survey

Dear Anthony

Thank you for your recent memo concerning the Lake Carramar Survey.

Melbourne Water undertook the independent survey at the suggestion of and consultation with PLQLOR representatives and at our cost. It was made clear at a Steering Committee Quiet Lakes working group meeting prior to the survey that a significant majority of all Quiet Lakes residents (including key access) needed to support further investigation in order for Melbourne Water to proceed. Not only was a significant majority not achieved, a simple majority was not even achieved with the actual response being 32%. The suggestion that Melbourne Water has unilaterally and arbitrarily determined this result is misleading and unhelpful.

As you are aware, Recommendation 4 of the Independent Review was made by the Panel in the belief that flows into Lake Carramar were possible under the original engineering design and were being inhibited or prevented by infrastructure modifications. Subsequent investigations and maintenance on the interconnecting pipe network confirmed that the original design was not modified and that through flows did not occur. Adequate through flows therefore, cannot be guaranteed under the original design as the original design did not provide for through flows.

We agree there is a distinct difference in the levels of support between lakefront and key access residents. As stated in an email to you and Louis dated 23 April, 'Melbourne Water will re-engage with lake front residents regarding through flows if a bore flushing regime or any other user pays model relating to the Quiet Lakes is supported by residents.' As previously discussed, if a bore flushing regime is not funded by residents, investing in infrastructure to introduce through flows to Lake Carramar is a moot point.

The survey has established that a majority of key access property respondents do not wish to continue key access or be consulted further on this matter. It is not Melbourne Water's intention to force non-lake frontage property owners to maintain key access. As a result of the survey results, we will be considering whether key access is continued in the future. Should any key access property owner feel strongly about continuing access and agrees in writing to contribute to any future user-pay regimes, we will allow them to opt-in on an individual basis under an agreed set of conditions.

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PO Box 4342 Melbourne VIC 3001 Australia
T 131 722 F +61 3 9679 7099
melbournewater.com.au

The results provided by the independent survey research firm are what they are. PLQLOR was aware of the survey parameters prior to the survey being undertaken. The significant level of resident support needed has not been reached and Melbourne Water will not be proceeding with further investigative works on through flows on the basis of the survey results. This does not preclude the PLQLOR from undertaking its own independent investigations. However, as stated above, as there is a significant level of support from lake front property respondents, should a resident funded bore flushing regime be instigated, further consultation with all lakefront property owners regarding through flows into Lake Carramar will be undertaken by Melbourne Water.

Yours sincerely,

Mark Chicoine
SENIOR COMMUNICATIONS AND
ENGAGEMENT ADVISOR

Lake Carramar Through Flow Preliminary Concept Options

Desktop Study - October 2014

State Government Victoria

Melbourne Water

Table of contents

Background

To assess 'Recommendation 4' of the Patterson Lakes Independent Review Melbourne Water engaged engineering consultancy Water Technology to undertake a review of the original design plans for the Quiet Lakes and compare it to a recent survey of head works completed by Aurecon.
Melbourne Water completed this investigative works on Lake Carramar and determined the ability of flows through the lake. The investigation found that through flows based on the original design is not possible.
It was agreed in the Steering Committee meeting held on the 22/01/14 that the as constructed plans from 1973/74 can be adopted as the original design plans.

At a recent meeting with the Quiet Lakes Steering Committee Resident Representatives a request was made to Melbourne Water to investigate potential user pays options to incorporate flow through Lake Carramar. To assist residents and the user pays process Melbourne Water have contributed by developing this preliminary concept options desktop study.

Intention

The following is a series of potential however un-proven concept options to facilitate a flushing flow into Lake Carramar. The desktop study has been undertaken by Melbourne Water at the request of Quiet Lakes steering committee members to assist residents with user pays activities/works.
Any further investigation or works in respect to this matter will be on a user pays basis .

Disclaimer

This desktop study may be of assistance to Quiet Lakes residents, Melbourne Water does not guarantee it is without flaw of any kind and therefore disclaims all liability for any error, loss or other consequence which may arise from relying on any information in this desktop study.

Preliminary Concept Options

The following options have been developed by Melbourne Water. The options are presented in no particular order. No engineering or hydraulic analysis has been undertaken on the options.

Option 1

Place a small pump in the southern pit on the edge of the beach in Lake Carramar (see red star below) and run a flexible pipe from the pump inside the existing pipeline to the Kingston Council pipeline past the weir and discharge into the existing council drainage line

Option 1.

Desktop Analysis/ Considerations

- This option requires approval from KCC to pump additional water into their drainage line, it is possible that the drainage line would not have capacity to take the additional flow.

- Placing a flexible pipe inside the existing concrete pipe would prevent the flood gate from working therefore under some storm conditions water from the council line could enter Lake Carramar.
- It might be possible to locate the pump downstream of the flood gate however a suitable electrical source would need to be located.
- Pump noise may be disruptive to neighbouring residents.

Estimated Cost

Capital: Low to Medium
Operating: Medium

Option 2

Insert a smaller diameter pipe into the balance pipe that runs between Lake Illawong to Lake Carramar. Then incorporate a small pump into Lake Carramar to pump the water back to lake Illawong.

Option 2

Desktop Analysis/ Considerations

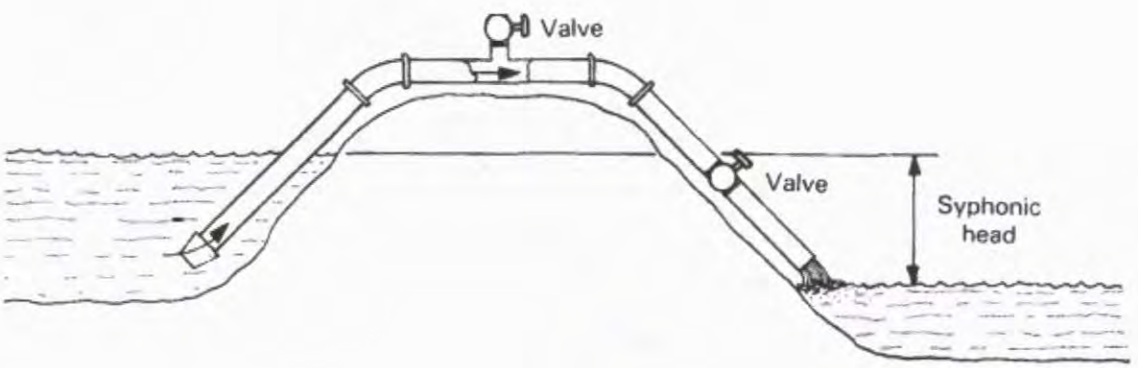
- Pump noise may be disruptive to neighbouring residents.
- Pump requires electricity source
- May need to extend the pump pipe some meters into the lake to achieve better circulation.

Estimated Cost

Capital: Low to Medium
Operating: Medium

Option 3

Install a syphon between Lake Carramar and the tidal canals to enable the water to get over the weir in the council pipeline located to the south of Lake Carramar.



Example of a syphon only.

Desktop Analysis/ Considerations

- A pipe inside the council line may prevent drainage flow, would require approval from council.
- It is possible that the existing drainage line would not have capacity to take the additional flow.
- Depending on existing pipe invert levels, the levels may not be suitable

Estimated Cost

Capital: Low to Medium
Operating: Low

Option 4

Utilise the existing valves on the balance pipes to lower Lake Carramar, the water should drain to McLeod road pump station. Once the lake water level has been lowered sufficiently return all valves to original position and allow head difference between the lakes to push flow back into Lake Carramar. Repeat on semi-regular intervals to turn over the Lake Carramar water more often.

Option 4

Desktop Analysis/ Considerations

- The continual change in water level may cause beach erosion in Lake Carramar.
- Involves regular officer management to open and close valves

Estimated Cost

Capital: Low
Operating: Low to Medium

Option 5

Extend the Balance pipe between Lake Illawong and Lake Carramar so that it reaches further out into the middle of Lake Carramar. Modify existing council pipe and pit to allow water to drain directly from Lake Carramar to McLeod Rd pump station.

Option 5.

Desktop Analysis

- This would require Lake Carramar water level to be lower than Lake Illawong.
- Existing Council pipeline may not be able to take the additional flow.

Estimated Cost

Capital: Medium
Operating: Low

Option 6

Variation on option 5, modify one or more local council drainage pits around Lake Carramar that naturally flow back to McLeod Rd pump station to take water from Lake Carramar. May also include the installation of a pipe within Lake Carramar to connect to the local Kingston Council drainage pipe.

Option 6

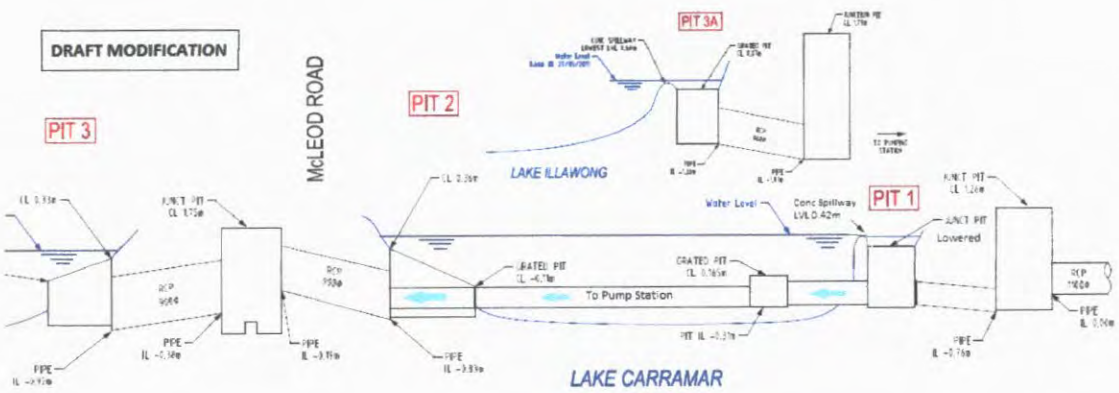
Desktop Analysis

Similar to option 5 refer to option 5.

Option 7

Modify the outlet located at the southern end of Lake Carramar to be lower than the water level in Lake Illawong. Install a pipe to run from the outlet through Lake Carramar, into/sleeve the balance pipe. Modify connections to discharge directly to the McLeod Road pump station.

Option 7



Modified plan of lake system

Desktop Analysis

Requires modification of existing infrastructure including; downstream pit, installation of pipeline and existing connections to the McLeod Road pumps station. The option will modify the original normal water levels in the lakes.

Estimated Cost

Capital: Medium to high
Operating: Low

Option 8

Modify the bore outlet to be a dual outlet one to discharge into Lake Legana the other to extend all the way down to Lake Carramar, this could potentially be achieved using a small poly pipe laid into the lakes. This will allow Lake Carramar to receive bore water, this water will then flow through the balance pipe to Lake Illawong and out to the McLeod Road pump station.

Option 7

Desktop Analysis

May increase the water level in Lake Carramar.
Lake Legana will receive less of the direct flow.

Estimated Cost

Capital: Medium to high
Operating: Low

END


Patterson Lakes
Melbourne Water UG Drains
Council Drains
Catchment Boundary - size 3.74 square km
Map at A2
Scale 1: 9,858
17/09/2012
N
MGA55
Melbourne Water
Kingston
Bonbeach
PATTERSON RIVER COUNTRY CLUB
BONBEACH 3196
PATTERSON LAKES 3187
CARRUM 3197
Carrum
Greater Dandenong
Frankston
THOMPSON RD
WADSLEY RD
BOUNDARY RD
NEPEAN HWY
PENINSULA LINK
MORNINGTON
Edithvale-Seaford Wetlands
Patterson River Sec. Coll.
Frankston Motorcycle Club
Frankston Australian Clay Targets Club
Melway
East
Plant
INDEX TO STREETS AT E1
1. MALCOLM DR
2. CUTHBERTSON CT
3. BLUE GUM CT
4. CYPRESS CT
5. HUTCHINGS CT
6. CARPENTER CT
7. KYBERD CT
8. BANKSIA CT
9. PARKLAND DR
10. MANNA GUM CT
PATTERSON RIVER RAMPS
CAUTION:
NO SWIMMING
Speed Limit 5 Knots