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Sustainability and the Environment

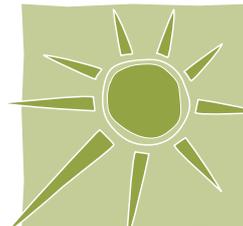
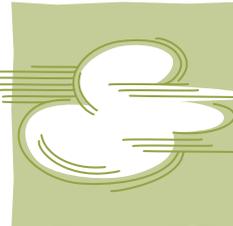
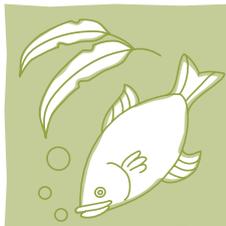
Report on the state of the watercourses and catchments for Lake Burley Griffin



Summary and Recommendations

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Commissioner for Sustainability and the Environment

April 2012



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ISBN 978-0-9873072-0-0

Published by the Office of the Commissioner for Sustainability and the Environment,
Canberra

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Citation

Commissioner for Sustainability and the Environment (2012), *Report on the state of the water courses and catchments for Lake Burley Griffin*. ACT Government. Canberra

Cover image: courtesy of the National Capital Authority

Acknowledgements

This *Report on the state of the water courses and catchments for Lake Burley Griffin* has been developed independently by an in-house team of the Office of the Commissioner for Sustainability and the Environment assisted by experts. It builds on preliminary work undertaken by the previous Commissioner, Dr Maxine Cooper. I am pleased to acknowledge the vital contributions of those involved in producing the Report.

Robert Neil

ACT Commissioner for Sustainability and the Environment

Office of the ACT Commissioner for Sustainability and the Environment

I am grateful for the work of the team within the Office of the Commissioner for Sustainability and the Environment (OCSE). I would particularly like to thank Mr Warren Geeves, senior Manager and Project coordinator, and his predecessor, Ms Narelle Sargent for their leadership and skills in integrating complex and multidimensional issues into an informative and readable report. Invaluable contributions in planning, revising drafts and preparing the Report were also made by Ms Joanna Temme and Mr Mark Donovan as Project Officers.

My thanks also to others in the OCSE team, Ms Sarah Burrows and Dr Aileen Power for their work in reviewing drafts, and Ms Sonya Hamley, Ms Amanda Slade and Ms Catherine Diomampo for their administrative and organisational assistance.

Commissioned papers

My special thanks go Mr Ian Lawrence, Emeritus Professor Ian Falconer (assisted by Mr Adrian Farrant and Mr John Woollard) and Professor Murray Raff for the preparation of the commissioned papers which informed the Investigation. In particular, I would like to express my gratitude to Ian Lawrence for his continued interest and commitment to this Investigation, and his dedication in providing answers to my many questions about Lake Burley Griffin and Canberra's other urban lakes.

Additional papers by Dr Richard Reilly, synthesising the submissions, and Interaction Consulting Group who collated the views expressed in the user forum, were also integral to the Report.

The Reference Group

My thanks also go to the following people who provided valuable guidance as members of the Reference Group:

Dr David Bagnall – community and recreational users

Mr Bob Crawshaw – communications and consultation

Dr Fiona Dyer – community group member and Senior Research Fellow with the Institute for Applied Ecology, University of Canberra

Emeritus Professor Ian Falconer – water quality expert

Mr Shane Jasprizza – community (Capital Region Fishing Alliance)

Mr Ian Lawrence – environmental engineer and scientist, and Senior Research Fellow with the Cooperative Research Centre for eWater

Associate Professor Mark Lintermans – fish ecologist with the Institute for Applied Ecology, University of Canberra

Ms Katharine Taylor – representing young people

Dr John Williams – former Commissioner, NSW Natural Resources Commission

The advisory group

People with expertise in health, recreation, environment protection regulation, water policy, management and research, local government and catchment management also made valuable contributions to support the work of the reference group. My thanks for those contributing in this way go to:

- Mr Peter Bascomb – Palerang Council
- Mr Peter Beutel – National Capital Authority
- Mr Simon Dolejsi – Sport and Recreation
- Mr Phil Hansen – Queanbeyan City Council
- Mr Daniel Iglesias – Territory and Municipal Services
- Mr Ross Knee – ACTEW Corporation
- Mr Daniel Walters – Environment Protection and Water Regulation
- Mr John Woollard – Health Protection Service

Government agencies

Special thanks go to Commonwealth and ACT Government staff for their cooperation in providing data, information and advice on various parts of the Report:

- Australian Government National Capital Authority;
- ACT Government Environment and Sustainable Development Directorate – Environment Protection Authority, and ACT Planning and Land Authority;
- ACT Government Territory and Municipal Services Directorate;
- ACT Government Economic Development Directorate; and
- ACT Government Health Directorate – Health Protection Service.

Review of the Report papers

Many people, individually and as members of groups, participated in reviewing papers for the Report throughout its development.

Editing

Ms Ann Milligan, ENRiT.

Maps and photographic materials

Mr Ron Chesham (ESDD), Molonglo Catchment Group, Ms Anita Perkins (ESDD), Ms Liz Milligan, Mr Luke McPhail, NCA.

Summary and recommendations

1. Investigation context and process

On 27 May 2011, Mr Simon Corbell MLA, Minister for the Environment, Climate Change and Water, pursuant to section 12 (1) (b) of the *Commissioner for the Environment Act 1993*, directed the Commissioner for the Environment to undertake an Investigation into the state of the water courses and catchments of Lake Burley Griffin (hereafter referred to as this Investigation).

Four terms of reference were established by Minister Corbell to guide this Investigation:

Terms of reference

Investigate the state of the water courses and catchments for Lake Burley Griffin including:

- (i) possible improvements for managing water quality and the appropriateness of the current protocols for lake closures;
- (ii) identifying the causes of lower water quality, including possible resource implications of addressing them;
- (iii) jurisdictional implications for water quality management of the lake; and
- (iv) the implication of these findings for the ACT's other major recreational waterways, such as Lake Ginninderra and Lake Tuggeranong.

In responding to the Terms of Reference information was obtained from a variety of sources including public submissions, discussions with experts, Lake users, government agencies, and commissioned technical papers. This information was analysed to draw out the causes and impacts of poor water quality. It was also instructive in responding to the broader task of assessing the appropriateness of lake closure protocols, possible improvements in managing poor water quality, jurisdictional issues and implications for the ACT's other major recreational water ways.

In guiding the Investigation, poor water quality was defined as that which impairs the environmental and recreational values of the Lake. Within this definition the major threats to the recreational values are excessive concentrations of toxic blue green algae and/or concentrations of faecal pollutants (bacteria) and excessive flood debris. Both blue green algae and faecal contamination pose threats to human health and are managed through lake closure protocols.

- Establishing what "values" were compromised by poor water quality was achieved by an assessment of public submissions, many of which were from

active recreational users of the Lake. However, acknowledging that these views came from one segment of the total user population, reference was also made to the National Capital Authority's *Lake Burley Griffin Management Plan 1995* and the *Australian & New Zealand Guidelines for Fresh and Marine Water Quality 2000* ('the ANZECC Guidelines'). Consistent with the ANZECC Guidelines, community expectations are part of criteria for determining acceptable levels of water quality. Consequently there is a focus on recreational values, which are most at risk from poor water quality, caused by excessive concentrations of toxic blue green algae and/or bacterial contamination. This allows for identification of threats to those values and possible threat abatement actions. In other major recreational lakes and ponds values are derived from the Territory Plan, *Canberra's Urban Lakes and Ponds Plan of Management 2001* and the ANZECC.

2. Lake Burley Griffin, its catchment and values

Lake Burley Griffin is one of Canberra's key landscape features and plays a central role in defining the character and setting of the National Capital. It was created in 1963 with the construction of Scrivener Dam on the Molonglo River. The Lake is highly valued by the ACT community. In addition to its recreational and amenity values the Lake is an important part of the Murray-Darling Basin. It is a shallow lake which acts as a retention pond collecting pollutants and improving water quality downstream of the Lake.

The Lake's catchment has a mix of urban, rural and forest and conservation land uses that influence water quality in the Lake.

The *Lake Burley Griffin Management Plan 1995* identifies a number of the values of Lake Burley Griffin of particular interest to this investigation:

- natural heritage values – Lake Burley Griffin functions as a viable living freshwater system. The Lake provides habitat for variety of species both native and introduced.
- water resource management – the Lake plays a role in water resource management of the Molonglo River.
- use values (recreational, tourism and commercial development) – the Canberra community places a high value on the Lake for its social, recreational, aesthetic and scenic values.

3. Water quality: history and impacts

The historical use of the Lake Burley Griffin catchment, together with ongoing human activities, has contributed significantly to the present-day water quality in the Lake. This has been adversely affected by numerous sources of pollution over the 50 years since its initial filling was completed in 1964. Sources of pollution have included the Captains Flat mine waste dumps (heavy metals); sewerage overflows (faecal matter)

and, prior to the mid-1980s, phosphorus in treated sewage effluent from the Queanbeyan City Council Sewage Treatment Plant, as well as runoff from rural land. The completion of Googong Dam in 1978 reduced river flows into the Lake significantly. Growing urban and rural residential populations have added to pollutant loads in the catchment.

Poor water quality has impacts on the values attributed to Canberra’s lakes. The main threats to Lake Burley Griffin’s values are high concentrations of blue-green algae and faecal contamination. These create:

- effects on environmental values, particularly the health of aquatic organisms;
- health risks to sporting and recreational users, and loss of amenity because of associated lake closures;
- scenic and aesthetic impacts of turbid water and blue-green algae scums and odours; and
- economic impacts, particularly those affecting businesses serving the needs of lake users, that reduce the estimated \$25.5 million per year value of activities in and near the Lake.

4. Management of Lake Burley Griffin and its catchments

Management responsibilities for the Lake and its catchments are spread across the Commonwealth, ACT, NSW and regional local governments, as shown in the table below (Table 4.1 from the report).

Table 4.1: Governance responsibilities for the Lake Burley Griffin catchment

Jurisdiction	Catchment	Relevant organisations
ACT Government	Central Molonglo (except areas controlled by the NCA)	1 Territory and Municipal Services Directorate (ACT Government) 2 ACTEW Corporation 3 Environment and Sustainable Development Directorate (ACT Government)
	Googong Foreshores	4 Territory and Municipal Services Directorate (ACT Government) 5 ACTEW Corporation
Commonwealth	The Lake and National Land surrounding the Lake	6 National Capital Authority
New South Wales	All areas outside the ACT	7 NSW Office of Water 8 NSW EPA 9 Murrumbidgee Catchment Management Authority
	Lower Queanbeyan River	10 Queanbeyan City Council

Jurisdiction	Catchment	Relevant organisations
	Jerrabomberra Headwaters	
	Upper Molonglo - as far as the ACT border	11 Palerang Council
	Googong - north (except Googong Foreshores)	
	Googong - south	12 Cooma-Monaro Shire Council

Note: Catchments named in this table are shown in Figure 2.2.

5. Water quality of the Lake and catchments

The water quality and ecology of a lake naturally reflect the inflows and associated nutrients and organic matter of its catchments. Typically, these vary over time, from low or zero inflows during extended dry periods, to extreme levels during wet periods or flood events.

A 'wet year' is defined as having an annual inflow greater than 1.5 times the Lake volume, or a water residence time of less than eight months; a 'dry year' is defined by annual inflow less than 1.5 times Lake volume, or a hydraulic residence time greater than eight months. A typical 'wet year' is 1998; a typical 'dry year' is 2006.

The rural and urban catchments generate much higher loads of nutrients and organic material in a 'wet year' than in a 'dry year'. In wet years, nutrients are adsorbed onto the surfaces of suspended solids and removed from the water column when the particles settle to the lakebed. The high energy of the inflows in a wet year results in mixing of the Lake waters, restoring dissolved oxygen concentrations and oxidising (decomposing) organic material, which limits the potential for re-mobilisation of phosphorus from the sediments. Consequently, it is the dry years, with small loads of suspended solids and poor mixing conditions that are more conducive to algal growth and incidence of cyanobacteria (blue-green algae) blooms. A summary of annual pollutant loads contributed from the Lake catchments is provided in Table 5.3, Chapter 5.

Causes of Poor Water Quality

Water quality in the Lake is a reflection its catchment and the biological, chemical, and physical processes that occur within the Lake. The assessment of water quality data for the period 1978 (when Googong Dam was completed) to 2010 revealed:

- organic matter loading in urban stormwater is the major potential threat to Lake water quality and ecology; the Biochemical Oxygen Demand created by decomposition of this organic matter is the primary factor driving low concentrations of dissolved oxygen;

- the release of phosphorus from sediments, when dissolved oxygen concentrations are low and there is poor mixing of the water column, are the primary factors driving the blooms of blue-green algae, particularly during dry periods; increasing urbanisation of the catchment is contributing more organic material to the Lake;
- the main sources of faecal pollution are: urban runoff; wildlife faeces; re-growth of bacteria already present in the lake; and possible leakages from aging sewer pipes; Queanbeyan City Council Sewage Treatment Plant is not a significant source of faecal pollution in the Lake except when infrastructure failures or overflows occur;
- the potential threat from nutrients, that would contribute to algal growth, in treated sewage discharges from QCCSTP is ameliorated by its low phosphorus and high nitrate concentrations; and
- the loss of submerged and emergent water plants, and the low concentrations of dissolved oxygen.

It appears that the shift in algal composition to cyanobacteria (blue green algae) dominance during 'dry' periods is a reflection of the physical and nutrient conditions associated with 'dry' periods. These disadvantage growth of the Chlorophyta (green) algae and promote the growth of cyanobacteria algae.

Bacteria associated with faecal contamination of water pose a risk to primary contact users of the Lake, such as swimmers. It is impossible to regularly monitor for the entire range of potential pathogens in lake water. Monitoring therefore tests for particular organisms that are known to indicate a risk of human pathogens being present.

Sources of faecal contamination in Lake Burley Griffin include:

- urban stormwater runoff;
- faeces of birds and other fauna deposited directly in the Lake; and
- sewage spills/overflows and leakages from sewer systems into stormwater.

Faecal contamination guideline values are specified in the 2010 *ACT Guidelines for Recreational Water Quality*. The Water Quality Assessment found that, for the period 1999–2010, exceedances of guideline values for faecal contamination of recreational waters occurred mainly because of 'non-point-source discharges'; that is, urban runoff, leakages, sewerage pipes, wildlife faeces, and re-growth of bacteria already present in the Lake.

These findings need to guide both in-lake and catchment management responses aimed at improving water quality in the Lake.

6. Lake closure protocols

One of the tasks of this Investigation was to assess the appropriateness of lake closure protocols. In the ACT closures of recreational waterways occur in response to various threats to human health, including flood waters and subsequent excessive debris hazards, high concentrations of potentially toxic algae and/or microbial pathogens (such as bacteria), and accidental discharge of chemicals or other pollutants.

The impacts of Lake closures noted by submissions to this Investigation include: the uncertainty of planning for events because the Lake may be closed and the perception that the lake is polluted; inconvenience, logistics and costs of moving planned events to an alternate venue, if an alternate venue is available; and lower club recruitment opportunities and memberships.

Water quality guidelines and associated protocols for Lake Burly Griffin and Canberra's other major waterways (described in Chapter 6) are needed to ensure appropriate warnings and management strategies are in place to mitigate risks to human health from events such as blue green algal blooms and faecal contamination.

The 2010 ACT Guidelines for Recreational Water Quality are appropriate to guide management actions on warnings and lake closures. Measurement of toxin concentrations in Lake water to assess risks to Lake users was suggested as a possible improvement to current practice. The Investigation found that toxin testing does not offer any advantages over the current practice of monitoring of algal cell concentrations and biovolume for informing decisions on Lake closures.

The approach of the *ACT Guidelines for Recreational Water Quality* in cases of contamination by faecal matter is consistent with the *NHMRC Guidelines for Managing Risk in Recreational Water (2008)* and uses concentrations of intestinal *Enterococci* species as the indicator of contamination. There are some suggestions that regrowth-related bacteria are not a health risk. Further scientific studies would be required to test this assertion.

There is a view that use of multiple tests, when sampling and analysing water for faecal contamination, has the potential to cause confusion. This Investigation notes that the current two-test protocol negates the effects of false positive test results, but suggests that further assessment, against relevant national guidelines, should be pursued.

Several methods are used to inform the public about water quality risks in Lake Burley Griffin, and similar procedures operate in Canberra's other lakes:

- permanent signs are present at 'high traffic water-entry areas' at the lakes and are also to be installed at Lake Burley Griffin. These signs can be changed, and indicate the current risk for recreational activities at the particular site; and
- the NCA, ESDD and TAMSD, in consultation with ACT Health, issue media releases about medium, high and extreme blue-green algae alert levels, and lake closures or reopenings in relation to bacterial concentrations. They also

email key stakeholders, including recreational clubs and lakeside businesses, when there are changes in these alert levels.

Responses from participants in the Lake Users' Forum indicated that the way Lake Burley Griffin closures and reopenings are communicated through the use of media releases is not effective, and alternative approaches should be considered. It was suggested that more effective means of communicating when the Lake is open again for use after a period of closure, and providing certainty about the period of time for which it is closed and why, were needed. This also has direct relevance to other urban lakes in Canberra.

Recommendations on lake closure protocols

The *ACT Guidelines for Recreational Water Quality* in 2010 have broad support from Lake users, however concerns have been expressed by some users regarding the assessment and interpretation of water quality data and the levels of risk posed by poor water quality. With Canberra's population increasing, more people are expected to value the Lake for recreational purposes. While improvements in the Lake's water quality should reduce the likelihood of Lake closures, the nature of the Lake is such that closures will continue to occur in order to mitigate risks to the health of Lake users. Considerable improvements in communicating lake closures have occurred in recent years however submissions indicate further efforts are needed.

To improve the availability of the Lake for recreational use the following is recommended:

- 1. The ACT Government (Health Directorate) undertake periodic reviews of the *ACT Guidelines for Recreational Water Quality* at intervals of not less than five years and include consultation with relevant stakeholders. The reviews should consider:**
 - a) developments in use of *Enterococci* bacteria as an indicator of faecal contamination and research on the health risks associated with regrowth pathogens;**
 - b) improvements in knowledge and technologies to determine whether toxin testing or blue-green algal concentration and algal biovolume testing is most relevant for ACT Lakes; and**
 - c) the characteristics and regrowth challenges of the lake embayments.**
- 2. The Current guidelines should be amended to recognise:**
 - a) the potential for Lake or part-Lake closure on a case by case basis, based on unusually extreme levels of blue-green algae; and**
 - b) closure practices in relation to very high bacteria concentrations.**
- 3. In line with the current Guidelines, the ACT Government and the Queanbeyan City Council, should identify and map sources of faecal contamination entering urban stormwater systems, the significance of the sources, and long-term strategies for reducing loading. In addition, a rigorous**

and comprehensive procedure for rapid 'sanitary surveys' in the event of elevated indicator concentrations should be established.

- 4. The ACT Government and the National Capital Authority improve communication with Lake user groups and the general public in the following key areas:**
 - a) during prolonged Lake closures, so that Lake users are aware that the Lake is closed and why;**
 - b) during closures or restrictions, Lake managers should undertake random checks on Lake use, and where necessary amend public notification methods to ensure lake users are aware of the alerts and management responses; and**
 - c) when the Lake is reopened.**

7. Options for in-Lake Management to improve water quality

No single treatment to address all the causes of poor water quality, and in particular, the key threats of blue-green algae and bacteria in Lake Burley Griffin, is available. The problems are the result of complex, and in some cases, long-standing practices. They also reflect not just localised, in-Lake processes, but the condition of catchments and the resultant quality of water arriving into the Lake.

While the expectation of a simple and immediate solution to address these complex issues is not feasible, opportunities are available for improved management actions in relation to the Lake itself. An informed choice of measures for improving water quality in Lake Burley Griffin and other urban lakes and ponds in the ACT will require thorough assessment of the environmental, social and economic impacts. As discussed in detail in Chapter 7, the results of this Investigation indicates these actions fall broadly into four categories:

- Restoration of large in-water plant (macrophyte) systems to restore oxygen levels in the Lake water, intercept pollutants and reduce pathogens such as faecal bacteria;
- Installation of artificial re-aeration systems to increase oxygen levels, and/or installation of mechanical mixer systems to distribute oxygen to lower levels of the Lake;
- Modification of phosphorus cycling in the Lake, including sediment treatment to reduce the availability of Phosphorous essential for, the growth of algae; and
- Algal management: algae farming to remove nutrients, and sonic destruction.

Recommendations on in-Lake Management to improve water quality

In-Lake techniques for improving water quality in Lake Burley Griffin such as macrophyte plantings, treating sediments and stirring water columns, need to be considered against the uncertainties that currently exist about their efficacy. Additionally, the employment of any such measures should also be enacted within

co-ordinated catchment management and include improved management at the source of pollution. With these provisos in mind, this Investigation recommends that:

- 5. The National Capital Authority and the ACT Government undertake a feasibility study, including a triple-bottom-line analysis, of macrophyte restoration across the Lake. Priorities for consideration should include:**
 - a) **construction of a wetland in the Lake between Springbank Island and the mouth of Sullivans Creek;**
 - b) **construction of a wetland in the Lake at East Basin; and**
 - c) **restoration of macrophyte beds in Lotus bay, Orana Bay, and at Weston Park East Beach.**
- 6. The National Capital Authority and the ACT Government jointly explore initiatives for in-lake interventions aiming to control blue-green algae in Lake Burley Griffin and other Canberra lakes. Desktop research, physical trials and cost-benefit analyses could examine (but not be limited to) systems for:**
 - a) **re-aerating sediments;**
 - b) **stirring the water column;**
 - c) **adsorbing and removing phosphorus from the water via additions of clay- or chemical-based substances; and/or**
 - d) **treating lake sediments to reduce phosphorus release, including by addition of nitrates or iron chloride to the water.**

8. Catchment management to improve the Lake's water quality

The water quality in Lake Burley Griffin reflects the overall pattern, composition and amounts of water and pollutant loads from the rivers, creeks and drainages that enter the Lake from its sub-catchments, as well as the biological, chemical, and physical processes that occur within the Lake. However, the overall management of the sub-catchments and the Lake itself is separated across the governments of Commonwealth, ACT and NSW.

The Investigation has identified four targets for management interventions directed towards remediation of Lake environmental and recreational values:

- urban catchments;
- rural catchments;
- sewage treatment and discharge; and
- river flow management.

Urban catchment management

Urban areas are likely to have the greatest impact on the water quality in all Lakes in Canberra. Increasing urban areas inevitably increase the area of impervious surfaces such as roads, paths and roofs, significantly modifying the natural hydrology of a catchment. This leads to increased water runoff and nutrient exports to receiving waters such as rivers and lakes when catchments are urbanised.

This Investigation has found that organic matter from the urban catchments (including soil, leaves and other green waste and animal wastes) washed off gardens, parks, sporting grounds, nature strips, reserves and streets and carried to the Lake has been identified as a major cause of blue-green algae blooms.

The design of urban development and stormwater drainage systems influences the water quality of urban lakes. Water sensitive urban design (WSUD) is a contemporary approach to urban design, for capturing and treating urban stormwaters and removing some or all of the pollutants they carry. While WSUD has been applied in many parts of Canberra's stormwater system, particularly since the late 1990s, there has been little done to measure its effectiveness. A more strategic approach to WSUD is needed to ensure the most efficient and effective combination of WSUD interventions are developed.

While Governments are taking steps to improve the water quality of runoff within their own jurisdictional areas this needs to be better coordinated through a consultative approach to the governance of the sub-catchments.

To more effectively manage urban water pollution the following recommendations are made.

Recommendations on urban catchment management

7. **The ACT Government should develop a strategic approach to WSUD. This should include:**
 - a) **Identifying sites where installing catchment intervention, such as wetlands and pollution control ponds, would improve water quality entering Lake Burley Griffin. This should include:**
 - i. **initial feasibility studies into the construction of pollution control ponds or wetlands on the Yarralumla drainage line and Jerrabomberra Creek should be undertaken. Any installations should be designed to be of an appropriate size to treat the catchment area they service.**
 - ii. **identifying WSUD that complement current programs of installing wetlands and water control ponds in both new urban areas and retrofitting in existing suburbs where applicable.**
 - b) **Ensuring that WSUD requirements are enforced in particular;**
 - i. **ensuring that wetlands and ponds are of appropriate sizes to service their catchments; and**
 - ii. **undertaking auditing/compliance arrangements to ensure that temporary pollution control ponds for sediment control during the construction phase in new estates are maintained and functioning effectively.**
 - c) **Monitoring the effectiveness of WSUD through improved monitoring following urban developments to determine whether water quality meets WSUD general code targets. Results should be used to inform improvements in WSUD standards.**

- d) **Comparison of ACT approaches to WSUD with those of other Australian urban areas to help ours remain consistent with developing technology and best practice.**
 - e) **Reviewing the efficacy of existing GPTs. The review should include:**
 - i. **effectiveness in pollutant reduction;**
 - ii. **effectiveness of current maintenance of pollution control measures**
 - iii. **capital costs;**
 - iv. **ongoing maintenance costs to ensure the current drainage infrastructure remains high-standard and is in line with current best practice, protecting downstream environments;**
 - v. **reduction of polluted leachate water; and**
 - vi. **the capacity to manage requirements of future urban growth and development.**
 - f) **working with the NCA and NSW Councils in the catchment to coordinate a strategic approach across the catchment.**
8. **The ACT Government, Queanbeyan City Council and National Capital Authority work collectively to raise awareness of the impact of organic matter, and other household or commercial materials (e.g. garden and lawn fertilizers) on the Lake Burley Griffin catchment. Information should include the contribution that all sectors of the community can make to improving water quality by appropriately using and disposing of such materials.**
9. **The ACT Government and Queanbeyan City Council evaluate their street sweeping practices and schedules to minimise leaf litter and other organic matter from having adverse impacts on Lake Burley Griffin's water quality.**

Rural Catchment Management

This Investigation has found that changes in discharges of pollutants from the rural catchments over recent decades have been significant. Rural catchments have been found to be major sources of phosphorus, organic matter (measured as BOD) and suspended solids, during wet periods, but they are only minor sources of these pollutants during dry periods.

Key source of pollutions were found to include soil erosion, pollutants from rural residential settlements and agricultural activities. However, the implications of the growth in rural residential settlements do not appear to be addressed at a strategic regional level, particularly in relation to the implications for the Lake Burley Griffin catchment.

In the ACT, effective management of the Googong Foreshores and Jerrabomberra Wetlands Nature Reserve has the potential to strengthen protection of Lake water quality.

Recommendations on rural catchment management

To more effectively manage rural water pollution the following recommendations are made:

10. That the ACT and NSW governments and the National Capital Authority support planning and implementation of on-ground actions to reduce the potential for soil erosion in the upper Queanbeyan River, upper Molonglo River and Jerrabomberra Creek. In doing so active involvement of Palerang Council, the Molonglo Catchment Management Group, ACTEW and other NRM groups should continue to be strongly encouraged and supported.
11. That the ACT Government finalise and implement the Googong Foreshores Draft Plan of Management. The plan should include adequate monitoring, reporting and review, and mechanisms to ensure effective cooperation between ACTEW, NSW and ACT in the management of the Googong Foreshores.
12. That the Jerrabomberra Wetlands Board of Management, ACT Government, and NCA investigate management of the Jerrabomberra Wetlands watercourses in improving water quality in Lake Burley Griffin. This should include:
 - a) advancing identification and implementation of cattle exclusion zones in the Jerrabomberra wetlands; and
 - b) investigating improving the way the Wetlands currently function through alteration of the watercourses. However any changes should not detrimentally impact the environmental, cultural, recreational scientific and educational values of the Wetlands.

Sewage management

Sewage pollution can enter the Lake when sewerage systems within the catchment, leak partially treated or untreated sewage. Potential sources of sewage pollution are both point sources and non-point sources and include the potential for leaks from the Queanbeyan City Council Sewage Treatment Plant or Fyshwick Sewage Treatment Plant as well as stormwater and nearby sewer pipes following powerful stormwater events. Despite regular concern regarding the discharges, permitted under Environmental Authorisation Number 0417 from the Queanbeyan City Council Sewage Treatment Plant this Investigation found that such discharges can be considered beneficial to the Molonglo Reach and Lake under current conditions. However, discharges of partially treated effluent pollute the Lake and compromise its use values. Regular review and improvement of sewerage system management can mitigate some of the potential risk of leakage of partially treated or untreated sewage into the Lake.

Recommendations on sewage management

To more effectively manage potential pollution from sewerage treatment plants in the catchment, the following recommendations are made:

13. The ACT Environment Protection Authority review and update the Environmental Authorisation number 0417 for sewage treatment within the Queanbeyan City Council Sewage Treatment Plant to ensure that the treatment process results in discharge quality that matches contemporary best

practise for a modern, urban sewerage treatment plant. In line with this, the QCCSTWP should continually review and improve its mitigating practises for inundation and washout events at the treatment plant.

- 14. The ACT Government require ACTEW to report regularly on the condition of the sewer system in urban areas in the Lake Burley Griffin catchment and identify priorities for upgrading to reduce sewer blockages and possible leakages from the system, and reduce the risk of system failures.**

River flow management

This Investigation has found that the construction of the Googong Dam on the Queanbeyan River has had a potentially significant impact on the water quality and ecological processes of Lake Burley Griffin. Diversion of an average of 7 per cent of the Lake's potential inflow has meant that water moves more slowly through the Lake, increasing nutrient and algal equilibrium levels. There is potential to change the flow regime and thereby reduce nutrient and algal equilibrium levels and this should be considered by the full range of regional stakeholders involved. Changes could include increased minimum flows (base flow) during summer months.

Recommendation on river flow management

- 15. The National Capital Authority should investigate the feasibility, costs and benefits of providing water releases, for example increased flow over the summer months as part of Googong Dam's multi-objective role. This should be undertaken in consultation with the ACT and NSW Government, relevant local government and community stake holders.**

9. Management of other major recreational waterways

The Investigation findings in relation to Lake Burley Griffin and its catchment clearly have implications for the ACT's other major recreational waterways because of the similarities between their catchments and those of Lake Burley Griffin. As discussed in Chapter 9, water quality in these lakes varies, with Lake Ginninderra, for example, having generally high water quality whereas Lake Tuggeranong is subject to frequent extended closures because of blue-green algal blooms. Water quality is also anticipated to change differentially over time with longer term trends for Gunghalin Pond indicating improvement in water quality whereas Point Hut Pond is seeing the continuation of excessive suspended solids, phosphorus and algal growth.

In addressing these water quality challenges The ACT will need to apply the following four principles:

- decisions about ways to secure acceptable water quality, need to recognise the multiple roles performed by urban lakes and ponds, particularly their role in downstream water quality management. They also need take into account the environmental, social and economic values that the ACT

community places on recreational waterways, as the context for assessing the costs and benefits of any decisions;

- management and planning of the recreational waterways' catchments needs to be integrated across the responsible ACT government agencies;
- pollutants must be intercepted at their source and in tributaries upstream of recreational waterways; and
- on-site management of the recreational waterways must apply best practice and technological developments in water quality management.

The results of this Investigation indicate that there is a need for much greater understanding across ACT Government agencies of the benefits, costs and opportunities for improving water quality in recreational waterways. Although the current *Canberra's Urban Lakes and Ponds Plan of Management* (2001) recognises the multi-functional roles of the lakes and ponds, it does not guide strategic decision-making for these waterbodies in the face of current and future challenges.

Recommendations for management of the ACT's other major recreational waterways

To improve understanding of the role of urban Lakes and enable the ACT Government to better manage the urban catchments, recreational lakes and ponds it is recommended that:

- 16. A comprehensive assessment of the environmental, social and economic value of key lakes in the ACT be undertaken and take into account current and predicted challenges to water quality. This assessment should inform:**
 - a) a review and update of *Canberra's Urban Lakes and Ponds Plan of Management* involving extensive community consultation and taking into account the long-term challenges to water quality in the urban catchments;**
 - b) the need for government investments in water quality;**
 - c) decisions regarding trials of appropriate in-lake and catchment management measures, with the results assessed from scientific (environmental), social and economic perspectives; and**
 - d) decisions regarding implementation of lake and catchment management options.**

10. Improving coordination of catchment management

In recent decades, approaches to catchment management in Australia have increasingly considered catchments as whole units with a natural interdependence between the land, water and other natural resources, rather than as a collection of disparate components. Yet despite widespread acceptance of the importance of integrated catchment management, no such agreement is in place for the Lake Burley Griffin catchment.

No shared vision or clear and integrated agreement on values and strategies for achieving it currently exists. Furthermore, despite previous calls for co-ordinated governance of water and an existing MOU on potable water in the catchment, there is currently no standing governance forum, or other structure, to facilitate intergovernmental arrangements for the Lake. As a result, there is no mechanism to prioritise actions, guide discussion or establish a shared vision for the Lake among the residents, businesses, and governments that use and manage the Lake's catchment.

All jurisdictions involved in the management of Lake Burley Griffin and its catchments are fulfilling important roles in managing water quality issues. However, without coordination of their efforts, these actions are insufficient to deal with the threats to Lake values. The challenges to effective management of the Lake and its catchments will only intensify as the human population grows. A coordinated inter-jurisdictional approach is essential to improving water quality in the Lake and its catchments.

Recommendation to improve coordination of catchment management

17. The ACT, Australian, NSW and local governments establish a Burley Griffin-Molonglo-Queanbeyan catchment management agreement. Such an agreement should outline:

- a) strategic objectives for the integrated and coordinated management of the Lake and catchments, to encompass water quality, environmental flows, potable water, land use, wastewater, and future urban and climate change impacts on the catchment;**
- b) each party's responsibilities for water quality in the Lake and its catchments;**
- c) a long-term catchment planning framework; and**
- d) an evidence-based, adaptive, management workplan.**

To avoid past challenges of multi-jurisdictional catchment management co-ordination, such an agreement should include a dedicated governance group with representation from all jurisdictions, a consistent and persistent mechanism to ensure implementation and accountability, and reporting requirements.

The National Capital Authority, as Lake manager, should in the first instance convene a meeting of relevant jurisdictional representatives to guide the above recommendations.

*“the future is
not somewhere
we are going, it
is something we
are creating.”*

Professor Ian Lowe

