STORMWATER AUSTRALIA

Senator Anne Urquhart
Chair- Environment and References Committee
Australian Senate
PO Box 6100
Parliament House
Canberra ACT 2600

Dear Senator Urquhart,

On behalf of our members nationally we are pleased to provide this submission to the Australian Senate's Inquiry into the future of stormwater management in Australia.

We trust our submission will provide a compelling range of insights and arguments that provide strong cases for improved policy outcomes in the management of stormwater to the benefit of our communities.

Should the opportunity arise we would be delighted to appear before the Committee to further elaborate on any or all of the points we have included.

We are committed to assisting the Senate and all levels of Government to create a vision for stormwater management in Australia and navigate its implementation in response to the findings of the committee.

We hope the Senate finds the interest in the inquiry meets the importance that we feel the issues deserve. Stormwater Australia and our member states believes this should be the start of a long and fruitful dialogue.

Yours faithfully

Andrew Allan
President
Stormwater Australia

Senate Inquiry Submission
24 April 2015

Executive Summary

Stormwater Australia is a peak industry body representing the views of over 1,000 practitioners nationally and is pleased to provide its submission to the Australian Senate's Inquiry into the future of Stormwater management in Australia. Key aspects of our submission (against the Terms of Reference) are summarised as:

a) The size of stormwater resource is considerable from a resource perspective, and directly reflects the increases in runoff volume that has resulted from urban development. Equally the impacts from poor management are detrimental and can be valued.
b) Science has an important role to play in delivering long term outcomes that ensure progressive investment in desirable long term outcomes which ensure equitable outcomes into the future. The stormwater industry has a role to play in supporting science and informed government policy.
c) Cotemporary approaches to management of Stormwater will deliver multiple benefits which role as a positive contributor hinges on multiple benefits, the maturity of evaluation frameworks to recognise this and an acknowledgement of a need to adapt to future challenges (e.g. climate change) and address legacy development issues.
d) Valuation frameworks will benefit from the inclusion of integrated economics outcomes. There are international examples off funding models and approaches that empower all tiers of government which are based on principles of proportionality and catchment management which should be enshrined in national leadership.
e) Planning and building regulatory approaches should be seen as complementary. Current and future challenges need to be addressed through a long term vision that harmonises both approaches which recognise impacts and opportunities. Federal leadership is required for sensible, long term outcomes.
f) Examples of funding programs that could be offered at the federal level to support outcomes and specific examples are provided. Federally there needs to be a strategic mandate to use these to guide future stormwater investments. Grant funding, while useful, will not be a successful model unless strategic co-ordination is established; the stormwater industry has a role to assist in developing these.
g) Established frameworks exist for asset management and can be refined to support progressive stormwater management. Funding models that recognise proportionality principles and empower maintenance and renewal revenue will provide long term benefit over asset planning cycles.
h) Industry has a vital role to play in encouraging innovation alongside complementary science. Future innovation should incorporate engineering, ecology and IT disciplines to provide a technological solutions and co-partner with industry to establish performance benchmarks.
i) The stormwater industry is vibrant and multi-disciplinary, and as such seeks a seat at the table to assist with the realisation of the benefits of stormwater management into the future.

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Introduction

Stormwater Australia is a peak industry body representing the interests of over 1000 industry members nationally and includes members representatives of the government and private sector.

We consider our membership to be influential across arrange of other industry areas; in most states we work closely with other industry sectors to ensure sensible and considered approaches to understanding and responding to the many water and environmental challenges posed by in an evolving world.

Our members are drawn from a broad range of practitioners, including from; engineering, environmental science, urban planning and economics. We consider stormwater management to be an emerging, multi-disciplinary sector that is at the cutting edge in responding to the many challenges faced by a society that is responding to rapid population growth and the challenges of sustainable development.

Australia is uniquely placed to develop new knowledge and approaches that will be of both local and international significance and we look forward to working with the Australian Government in realising this potential.

I would like to acknowledge the considerable support, perspective and expertise of members in all states who assisted in the drafting process and the state presidents who provided specific insights from their jurisdictional perspective.

We are pleased to provide our responses to each of the Inquiry Terms of Reference.

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a. The quantum of stormwater resource in Australia and impact and potential of optimal management practices in areas of flooding, environmental impacts, waterway management and water resource planning.

Australia's urban areas are home to almost 90% of Australia's population, and produce an estimated 3000 GL average annual runoff. It is estimated that at least two thirds of this is in excess of what would have naturally occurred prior to settlement and is largely due to the large areas of impervious surfaces that are associated with urban development.

For the purpose of this submission, our definition for the quantum of the stormwater resource and impacts includes all rainfall falling on urban areas (ie it includes both rainwater and stormwater); without appropriate management interventions to manage their combined volumetric impacts they manifest similar effects on receiving environments to which they would ultimately discharge.

Typically, runoff exceeds the combined volume of water that cities draw from their catchments and groundwater sources (estimated at 2100 GL), however, with the exception of Perth, it is estimated that less than 3% of this rainwater and stormwater is used.

Figure 1a shows the typical layout of an urban drainage system. It shows water collected on different impervious surfaces being directed toward a drainage network where it is transported away, generally to a waterway or other receiving waterbody. As this submission develops its arguments it is worth keeping in mind that while overall there are the combined impacts from all runoff sources, there are different intervention opportunities closer to source depending on the nature of the impervious surface (eg water falling on roofs is likely to be cleaner than water falling on highways), while figure 1b shows the altered hydrology that occurs as a result of urbanisation.

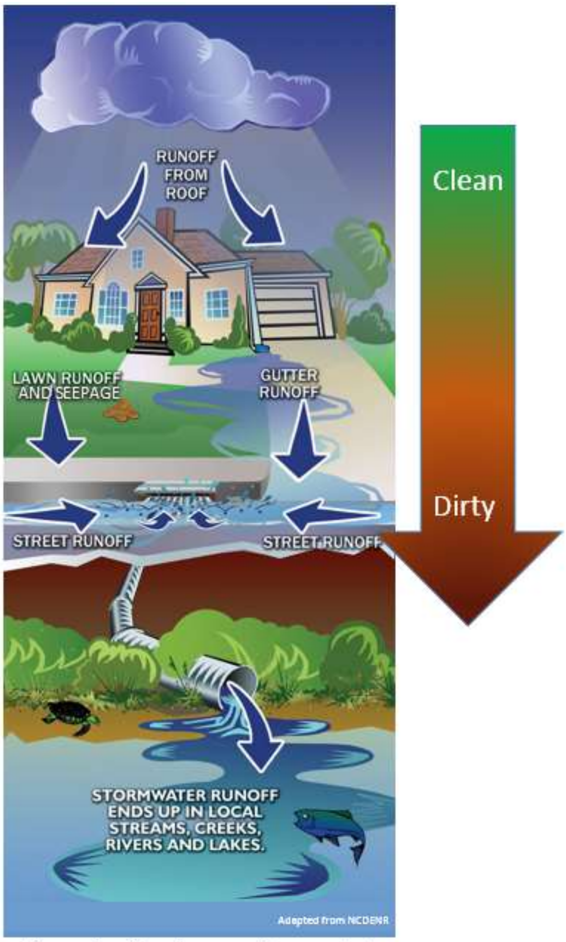

Figure 1a. Showing runoff generated from typical urban area.

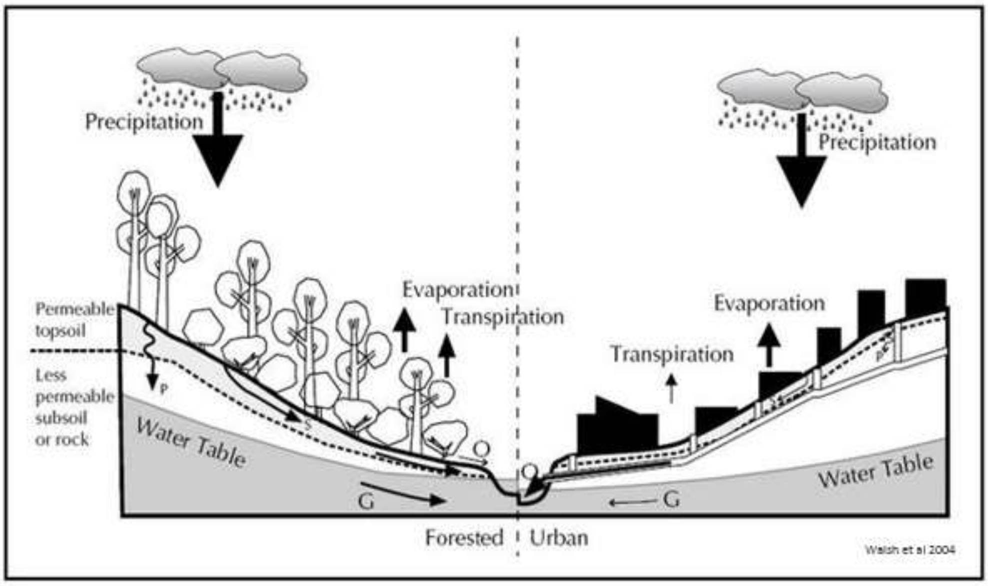

Figure 1b. Showing altered hydrology as a result of urbanisation- arrows weightings indicative of change. For a fixed amount of precipitation changes include reduced transpiration (from vegetation), reduced soil infiltration (and water table recharge), increased runoff and altered stream condition (eroded).

Until recently, stormwater was mostly managed by provision of drainage infrastructure which has traditionally been aimed at providing flood protection in order to avoid property damage and loss of life. The asset base that has been developed historically is believed to be in the order of tens of billions of dollars across major urban centres.

There is room for improved management of this asset base with discernible renewal and maintenance gaps in many jurisdictions, and opportunities presented by urban renewal provide an impetus to consider different approaches.

In the past few decades, the service requirements of stormwater assets has expanded to include; protection of receiving water bodies from pollution and volumetric impacts which disrupt ecosystem and waterway function, a greater focus on the management of flood impacts (especially in response to better analytical tools leading to understanding, as an adaptation approach to changing climate), and more recently a recognition of the potential of urban runoff as a source for consumptive supply.

Flooding

Storm flooding in urban areas is estimated to be a significant, but poorly understood cost to society. Recent inquiries into the insurance related costs of flooding have identified a range of different approaches and qualifications by insurance agencies in relation to flood damage.

Storm related flood damage can be divided into two categories. Major storm floods (generally 100 year Average Recurrence Interval (ARI) events) are reasonably well understood, especially within flood plains and in coastal areas. With the advent of modern computers and sophisticated modelling techniques there is a growing body of knowledge that will lead to a better understanding of the potentially significant costs associated with nuisance and legacy flooding associated with more frequent events (i.e. less than 100 year ARI frequency). This is perhaps best illustrated by way of an example.

Figure 2a shows major event flood extents within the City of Greater London and is based on similar 'disaster scenario' planning as is common in Australia. Recent work across the City of Greater London which was informed by more detailed flood studies is presented in Figure 2b (pers comm).
The analysis reveals that the impact of flooding is far more widespread and frequent than previously understood. Many of the historic and future issues that have led to the situation in London will be familiar to urban planners and hydrologists across Australia and points to a significant community cost that has not previously been well accounted for. As these cost estimates are improved there is potential for the cost of dealing with nuisance floods over time will exceed disaster recovery costs.
(see https://www.cityoflondon.gov.uk/services/environment-and-planning/sustainability/climate-change/Documents/surface-water-flooding-case-study-report.pdf for examples and case studies).

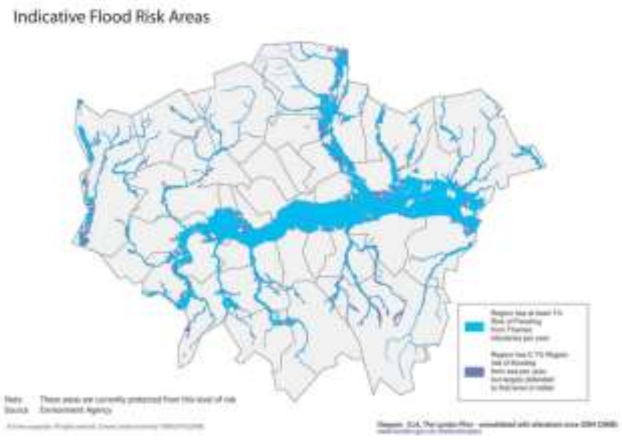

Figure 2a. Indicative flood risk in Greater London (traditional understanding)

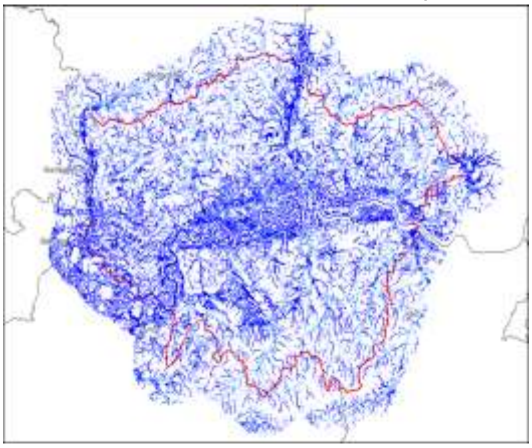

Figure 2b. Emerging flood risk in Greater London (contemporary understanding)

Conventional approaches have had a focus on mitigating the 100 year ARI flood event (i.e. 'act of god' event), however, given the cumulative effect of managing more frequent events (including insurance costs, clean up and diverted maintenance activity, damage to roads and other infrastructure, and managing community concerns) is likely to be significant and is not adequately captured in the 'headline event' approach. It is also true that the cost of managing flood impacts across a range of storm frequencies using traditional, drainage focussed approaches is often prohibitive, or when funded, diverts scarce financial resources from other programs that are of community benefit.

Damages from storm damage for a range of recurrence intervals is a cost burden that is likely to be passed back to the community through insurance premiums. The advent of better analysis techniques to identify potentially flood prone areas along with the inevitable implications of altered climate (generally agreed to result in more intense storm events) and a need to accommodate for population growth (with its perfect storm of increased habitation in flood prone areas and greater impervious area contributing to runoff) will increase the actuarial knowledge of underwriting costs. In 2006 the Victorian Auditor General identified as many as 82,000 homes in Melbourne that were potentially at risk of flood impacts with close to half susceptible to inundation at levels which would penetrate interior living spaces.
http://www.audit.vic.gov.au/reports_and_publications/latest_reports/reports_by_year_-_2005/20050719-manage-flood-risks.aspx

The report went on to conclude that this estimate of affected properties could easily be far higher as better knowledge of Council systems became known. Many Councils are now completing flood studies which are bearing out these predictions. The situation in other cities with legacy drainage systems is expected to be similar.

Recent history points to the potential for increased insurance costs arising as a result of stormwater flooding. In 2007 the 'Pasha Bulker' storm event near Newcastle resulted in an increased requirement for the insurance industry to pay out on stormwater damage and flooding claims.

Anecdotally, urban insurance premiums have experienced steep increases in recent years and comparatively, since 2007, rates have risen disproportionally to CPI. Enquires to insurance companies are often met with explanation that costs are rising as a result of a need to properly underwrite flooding costs.

An indicative survey of a small selection of households in Newcastle (near stormwater systems or waterways) indicated an increase in premium of around $470 from 2014 to 2015, with a total rise of over $700 since 2007. In contrast, insurance premiums in rural houses remote from stormwater systems or waterways were relatively constant during the same period (western NSW) which suggests some validity to the argument that stormwater and flood damage has increased insurance premiums.

If the premise that a significant proportion of insurance premium increases is related to storm flooding is accepted, the Melbourne example suggests a significant starting price tag (ie number of properties affected multiplied by component of insurance increase) of between $26- $59 million per annum (and this does not factor in flooding in council systems).

It is not currently well understood how insurance companies account and charge for flood risk, however if the costs are absorbed across the entire the customer base (i.e. if all customers are paying the increased premium) it would need to be multiplied by the number of insured properties to get a scale of costs. In 2007 the Insurance Council estimated around 6 million households holding insurance and a potential annual bill in the multiple of billions of dollars.

If insurance costs are currently absorbed across the entire customer base this is the case we expect access to better information and market competition will lead to increased premiums in known flood affected areas (ie same cost, but borne by a smaller, yet significant targeted group).

Standard Definition of Flood

The Australian Government finalised a 'standard definition of flood' for use in insurance policies in June 2012 after a Regulation Impact Statement undertaken by the Department of Treasury for use in insurance policies. The agreed regulatory definition describes flooding as:

'the covering of normally dry land by water that has escaped or been released from the normal confines of:

- any lake, or any river, creek or other natural watercourse, whether or not altered or modified; or
- Any reservoir, canal, or dam'.

We consider that this definition is misleading, many drainage systems have historically made use of pre-existing creeks and streams, and the current definition is still open to interpretation (we believe it relates mainly to riverine type flooding of the type experienced after the Brisbane floods). It is useful to note that the consultation document released by the Department of Treasury included a third definition relating specifically to storm related flooding.

With many jurisdictions now better understanding of flood risks (ie through flood mapping) we believe improved definitions will help to reduce confusion amongst policy holders and allow stronger price signals to support investment in infrastructure that manage risk, support resilience and deliver improved environmental outcomes.

Managing stormwater to achieve waterway and receiving water protection

The impacts of long term stormwater pollution into receiving waterways is recognised as severe and chronic. Ecosystem function of waterways receiving stormwater runoff are known to be compromised if as little as 2% of their catchment are developed and drained by conventional (piped) stormwater systems.

It is estimated that the current, aggregated total of all urban stormwater subject to treatment is less than 3%, and points to a long term degradation as a likely outcome.

(ref. Burns, M. J., T. D. Fletcher, C. J. Walsh, A. R. Ladson, and B. E. Hatt. 2012. Hydrologic shortcomings of conventional urban stormwater management and opportunities for reform. Landscape and Urban Planning 105:230–240, and Walsh, C. J., A. H. Roy, J. W. Feminella, P. D. Cottingham, P. M. Groffman, and R. P. Morgan. 2005. The urban stream syndrome: current knowledge and the search for a cure. Journal of the North American Benthological Society 24:706–723- can be supplied)

Urban pollutant loads can have impacts on ecosystems, amenity and recreational value of conspicuous and popular natural assets such as urban water courses and receiving water bodies. Left unmanaged, there is potential for significant detrimental economic outcomes for a range of reasons including adverse impact on industries such as fisheries and tourism and threats to human health.

In addition to the impacts of degraded water quality, waterways have to deal with altered flow regimes that affect ecosystem health and cause erosion. The altered timing and increased frequency of stormwater runoff as a result of urbanisation has an equal, if not greater negative impact on stream ecology. The cost of managing for erosion is significant, and with urbanising catchments often inefficient as it deals with the symptom rather than the cause.

Waterway impacts to date have been as a result of historical development and rainfall patterns. Into the future we will need to deal with the significant challenge of an altering climate, combined with greater urbanisation[1]. These two factors combined will have the nett effect of generating greater runoff volumes and are likely to compound management costs even more.

Stormwater presents a dichotomy of paradox only if we consider each of the management issues in isolation. The fundamental realisation that all management issues and options are driven by the process of runoff generated by urbanisation offers a new and compelling set of solutions to manage the system and catchment as a whole, and approaches broadly defined as Integrated Catchment Water Management (ICWM) and Water Sensitive Urban Design (WSUD) offer pathways to a new management paradigm.

[1] In particular, the increase in impervious areas in developing catchments is likely to be significant and needs to be managed.

b. The role of scientific advances in improving stormwater management outcomes and integrating these into policy at all levels of government to unlock the full suite of economic benefits.

We believe that public policy should be based on credible science. This is particularly the case when public good outcomes are sought.

For the purposes of this submission, we define public good as an approach which allows an informed policy development that considers the future city state (and broadly underpins urban planning) to ensure proper consideration of costs that could be borne or occur into the future.

Approaches which ignore or discount potential future scenarios are not likely to result in a full and considered understanding of costs, and lead to decisions made in the shorter term which in effect 'short-change' future prosperity. Similarly, approaches which focus on narrowly defined objectives are unlikely to properly account for the broader suite of transactions (e.g. how investment in mitigating flood could contribute to a water resources or ecological outcome).

By way of illustration, it is widely excepted proposition that population of a city doubles every 30 - 50 years, bringing with it the challenges of pollution (through increased consumption, and then a need to manage disposal of by-products). As is illustrated by the London example above, there is already likely a significant flood impact within the existing urban fabric, and as a city grows the population exposed to the risks and associated costs will increase accordingly.

This level of intuitional knowledge provides a logical proposition against which we can understand the notion of 'public good' as an approach that seeks to managing the impacts of development over time to avoid a gradual worsening of outcome and build future resilience.

Science in stormwater

Stormwater science has rapidly evolved over the past decade to the point where there is strong evidence of positive impacts across multiple outcomes. There is a need to continue to look to greater integration of these within a systemic framework that involves a genuine consideration of economic benefits across a range of scales.

There is a general awareness of the challenges that we face into the future; climate change, increasing population, and an economy in transition, all provide unique areas where a continued investment in scientific understanding is necessary to deliver good public policy outcomes.

Engagement with industry allows science to be interpreted in practice. We contend that an ideal development of science involves meaningful engagement with practitioners, and ultimately it is the ability of the market to provide cost effective solutions that respond to regulatory and policy settings that will provide enduring public good outcomes.

Good government process involves a formal process of evaluating the cost of achieving regulatory outcomes, and there is a legitimate role for regulation and legislation intervention to achieve public good outcomes where purely market mechanisms are unlikely to be effective.

Often industry, responding pragmatically to the needs of their client base is able to develop novel and innovative solutions ahead of science. Science too has a role to play in developing, testing and providing confidence in new technologies.

There is an important role for industry to partner with science. Properly done there is an expectation that effective feedback loops will allow science to benefit from practice insights and practice to increase its confidence in the science. In isolation these outcomes are not assured and diminish the level of confidence that can be expected when setting appropriate regulatory standards or targets.

Where the science is credible, understood and tangible there is a realistic expectation of complementary investments across a range of government and industry sectors. This is most effectively achieved where the science supporting solution options inform a long term perspective that ensure resilience and encourage long term investment.

The Australian Government, through its investment in science at a national level has a key role to play. It is important that the knowledge frameworks that are developed allow for an understanding of regional variation capable of addressing locally specific needs.

There have been significant investments in science supported at the federal level which have been to the benefit and advancement of stormwater outcomes. A summary (albeit not -exhaustive) listing is provided below.

- Water quality
  Impacts on receiving water condition for some pollutants at some locations are relatively well understood. Management of litter, sediment and nutrient pollution (eg nitrogen and phosphorus) are common in many jurisdictions and scientific effort has been expended in developing stormwater treatment technologies. Much of the knowledge base relating to water quality was developed in the mid 1990's to the early 2000's. The focus on verifying the longer term effectiveness shifted as the nation moved into drought conditions and while many of these technologies could be described as 'familiar', longer term monitoring of performance is an area where there is room for improvement.

- Water systems integration
  Recent research has shown that treatment of urban stormwater with storage in aquifers and/or reservoirs can allow potable use that is safe, reliable and publicly acceptable at a cost significantly less than for seawater desalination. Similarly, operational costs associated with the distribution and conveyance of water is believed significant and varies spatially across urban areas. The use of stormwater at a range of scales has potential to offset these costs while delivering a suite of benefits. There is some frustration that the broader uptake is impeded by monopoly water utilities which often operate under narrowly defined sets of obligations that pose limits on their ability to consider or co-invest in alternate solutions. In some jurisdictions this is seen to manifest as a desire to avoid co-dependence on local government owned stormwater collection and harvesting infrastructure. Subsequently, less economic options for non-potable uses are adopted by local government requiring expensive separate distribution systems. The full potential benefits of stormwater revealed through research remain locked by institutional impediments that could be addressed through Australian Government policies.

- Flood modelling
  With the advent of more powerful computers, the ability to analyse complex drainage systems based on catchment parameters (including topography and climatic inputs) has vastly improved in the past decade but has developed largely in isolation from integration with stormwater quality outcomes. The knowledge gained from modern approaches to hydrologic catchment

understanding is significant and likely to provide compelling economic arguments which complement outcomes driven by receiving water quality objectives.

- Stream Ecology
  Internationally, urban stream ecologists recognise the disruptive impacts of urban stormwater runoff which includes quality of runoff, magnitude of runoff and the timing and frequency of runoff. Natural streams have evolved over time to reach an ecological equilibrium in tune with their catchments; the introduction of impervious areas connected to the stream with hydraulically efficient drains which convey urban pollution across all storm events is a major disruption to healthy stream ecology. Streams in poor ecological condition are further compromised in their ability to process pollutants leading to a spiral of decline. This science is starting to be adopted into stormwater management criteria and more effort is needed to assess effectiveness of these measures. For example, the Little Stringybark Creek project in Melbourne's outer eastern suburbs is looking to understand if the decline in stream health caused by stormwater runoff can be reversed by catchment based approaches which aim to limit the quantum and timing of runoff closer to natural (pre-development) conditions.

- Climate Science
  There is a growing global scientific consensus on the trends toward a warming climate and the associated changes in weather patterns. For the majority of populated Australia, a warming and drying climate is predicted, with repercussions for vegetation communities and human comfort. A key management strategy to improve resilience is to encourage the retention of soil moisture. Using urban runoff to achieve this is likely to be a low cost, intuitive and practical measure. At the same time, climate science predicts a higher frequency of more intense rainfall events which have the potential to exacerbate flooding in some areas. Viewed through a resilience lens, these two factors have the potential to demand solutions that address multiple factors and is an area where further understanding is required. Paradoxically, while rainfall dependent water supply from traditional catchments is likely to decrease (drying catchments generate less runoff), this is not the case with urban catchments, where impervious surfaces are effective generators of runoff with even small amounts of precipitation.

- Urban Planning
  We have entered an era where the majority of human habitation occurs in urban centres and this trend shows no sign of abating. With many urban centres now contemplating population growth that is close to unprecedented there is a need to simultaneously address the challenges of urban growth (ie expansion) and consolidation (ie infill). The opportunity to contemplate solutions that address future challenges (such as those posed by climate, financial viability, ensure good urban design and integrate smart technology to efficiently deliver solutions) leads these development opportunities and needs to be implemented as a matter of urgency.. Historically urban water planning has assumed certainty of future state, but as we are realising, there is a need to plan for an envelope of possibilities while at the same time accommodating time worn cycles of urban renewal and development dictated by market forces. A requirement to account for the full benefits and costs in urban planning and design would help unlock these benefits.

- Systems science
  An emerging area of scientific understanding has evolved over recent decades to take advantage of increased computing power and corresponding analytical capability, and the increasing availability and mobility of data supported by considerable information technology investments around the world. Systems science seeks to understand the process drivers to which complex, real world systems respond, and the interdependences and feedbacks between sub-systems.

When framed at an appropriate level these frameworks are useful in allowing the various risks and trade-offs to be understood for a future envelope of urban development and resource scenarios. Often, recognising complexity is the first step to managing it, and systems frameworks provide a coherent mechanism to navigate its many challenges to make informed, and balanced decisions across scales and timeframes.

c. The role of stormwater as a positive contributor to resilient and desirable communities into the future, including 'public good' and productivity outcomes.

As indicated above, there are many benefits that can be derived from the management of stormwater in an integrated manner which need to be supported by appropriate frameworks.

Stormwater, as a resource can be used to augment other water sources while at the same time avoiding detrimental environmental and property impacts.

Public good outcomes are enhanced by improved environmental protection, while productivity outcomes will be achieved over time through the reduction of costs associated with flooding (e.g. insurance) and management of public assets such as waterways.

For new housing estates, the opportunity offered by a ‘blank canvas’ when coupled with integrated design approaches can reduce the cost of infrastructure provision while at the same time enhancing the attractiveness of developments through the retention of water.

Due to the nature of traditional, subsurface stormwater infrastructure (e.g. large piped drains) installation costs can often be a dominant water servicing cost for development. Unlike many utility services which can be positioned within a development to respond to urban planning principles, stormwater flows are primarily determined by rainfall and topography, and represent a fundamental constraint that has to be addressed by development.

Innovative design approaches have potential to retain runoff from smaller storm events to support soil moisture profiles which in turn facilitate urban greening. The strategic placement of multi-functional stormwater assets can be integrated as open space in the public realm, while in the private realm the use of collected stormwater for a range of consumptive purposes can offset the need for other water sources required to supply consumptive uses.

A conceptual layout of such an approach is provided below in Figure 3.

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Figure 3. Integrated stormwater drainage.

Overseas there is growing evidence that more progressive approaches to development planning can result in significantly reduced development costs. This is a situation that is likely to be replicable in Australia if appropriate policy and economic frameworks are encouraged.

In 2007 the USEPA (http://water.epa.gov/polwaste/green/costs07_index.cfm) undertook a study of 17 urban development sites and compared the cost of a conventional approach to development and infrastructure provision with a Low Impact Development[2] approach. In 16 of these, development costs were found to have been reduced by between 15% and 80% and were largely attributable to reduced costs for site grading and preparation, stormwater infrastructure, site paving, and landscaping. It is important to note that the study looked at only the development cost, and did not undertake a broader economic analysis to identify the other benefits that would be delivered (eg able to align with a broader set of policy objectives, improved urban amenity, reduced environmental impact).

While the USEPA study was largely focussed on subdivision type development, there will be similar opportunities to reduce redevelopment cost for the large swathes of our cities that were developed in the post WW2 boom. In these circumstances, dealing with currently encumbered and tenured land requires a more nuanced approach to urban and infrastructure planning. Asset management, urban renewal and bringing infrastructure up to contemporary performance standards offer a different set of drivers, which together provide strong inputs to create a positive business case for change.

[2] Low Impact Development is the US term for what would be described in Australia as Water Sensitive Urban Design and includes a mix of conventional drainage techniques coupled with water quality treatment and retention of stormwater within the local area.

With the major Australian cities contemplating unprecedented growth in the forward outlook period there are multiple and major infrastructure challenges ahead. This is particularly the case for stormwater management. As identified above, topography is a major constraint on land development; when combined with increasing impervious surfaces contributing runoff as has historically been the case, there is a significant legacy issue in most Australian cities (akin to the London example cited earlier).

For both green-field and infill development opportunities stormwater management with the right settings will improve environmental and amenity outcomes and reduce costs associated with development that is required to respond to a range of policy deliverables.

d. Model frameworks to develop economic and policy incentives for stormwater management.

Any discussion of economic and policy incentive frameworks for stormwater management needs to recognise that under the current paradigm there are suboptimal arrangements that will frustrate progress.

Significantly, stormwater is not 'owned' by any agency. While there have been attempts in several jurisdictions to address this, until the fundamental question of how stormwater is valued (eg as a multi benefit resource) is answered, progress will be problematic.

It has been previously identified that the asset value of stormwater systems is significant, and that the impacts from poorly managed runoff have considerable cost implications for communities in both the short and long term. It is argued that as a matter of good policy, these systems need to be resourced and managed appropriately, to realise benefit and to ensure desirable standards of performance into the future.

A third, yet related issue is that there is a disproportionate balance between management responsibility and resourcing. At the local level, stormwater is managed by local governments, however, the ability to raise a sustainable revenue stream to support its management is problematic.

Often, many of the public good outcomes that could be achieved are not within the mandate of local government to deliver, or benefits are derived by a broader community outside the specific local government's area of responsibility.

While state governments have a role to play to establish a direction to set this broader framework (often through policy) the implementation is frustrated due to the lack of a valuation methodology and a current absence of proportionality principles to allow revenue to be directed to where intervention outcomes will be maximised.

At the state government level, it is also a consideration that the lack of 'ownership' and disparate responsibility arrangements are a frustration, and often attention is given to more familiar aspects of the water system (such as water supply and sewerage), where utility agencies provide a simpler area for focus. If the proposition that stormwater management provides significant value is accepted, then these arrangements have potential to lead to perverse outcomes in which a desire to maintain a service revenue stream competes directly with stormwater outcomes.

There are examples both within Australia and internationally where frameworks which provide financial management streams have been established and could be adopted in Australia.

A number of these are discussed below and are intended to serve as 'signposts' for the developing of a principles based approach that could be adopted at the federal level.

There is precedent for federal involvement in establishing direction in matters considered to be important across multiple jurisdictions. The National Water Commission which was set up in 2004 played a role in co-ordinating a state and federal response to river basin management where multiple states were involved.

Internationally, the European Union's Water Directive Framework provides a compelling example of how a co-ordinated response to river basin management across multiple countries can be achieved. (http://ec.europa.eu/environment/water/water-framework/info/intro_en.htm)

The initial framework was first adopted by EU member countries in 2000 and sets out timetables for the improvement of river basin health throughout Europe and deals with many issues familiar in the Australian context, including drought, flooding, ecosystem protection and climate adaptation.

Now over a decade since its inception, there are many emergent examples that testify to how a well-considered, top down approach can influence local management approaches that respond to climate predictions, urban growth challenges and area specific values (eg Greater London area).

Revenue generation directed to local authorities based on site impervious coverage is used widely in the United States and is attributed to Federal legislation (the Federal Clean Water Act). This model recognises the correlation between 'hard' surfaces such as roads and roofs and the generation of runoff (and thus, costs associated with its management) when these are directly connected to a drainage network. Typically the approach taken is to charge a fee based on land use type (e.g. a standard rate for residential etc).

A similar scheme has been in operation in Germany and arose out of a series of court rulings in the 1970's which required greater transparency and accountability on how stormwater charges were levied. The German model allows for variable charges to be levied based on the burden imposed on the stormwater system, and allows property owners the option of choosing to discharge in an unmanaged manner or undertake management works which reduce impacts. Broadly applied the model incentivises green infrastructure approaches at the individual scale.

In Australia, the NSW Government's Stormwater Management Service Charge scheme would be broadly similar to the approach used in the United States which recognises the costs associated with management of stormwater and provides local authorities the option of levying a property charge that can be directed towards the management of stormwater runoff to achieve a defined set of outcomes.

Special Rates and Charges and Developer Contribution Schemes offer opportunities to raise revenue and are used sporadically in different jurisdictions for specific purposes. Special Rates and Charges are typically used when a raised level of service beyond what would have been initially installed or allowed for are required, and find application in areas where current community expectations are not being met, often by historical infrastructure approaches (eg due to required standards at the time of development approval). Developer charges are a mechanism by which new development is required to contribute to bring infrastructure performance up to a contemporary standard, and are levied through land use planning approaches.

Some jurisdictions use a stormwater offset approach. This represents a modification of the developer charge approach and is typically levied as part of a new drainage scheme. Where these are used, a 'proxy pollutant' such as nitrogen is used to calculate contribution rates, and the developer has the option to either pay an offset or undertake water quality improvement works which achieve the desired regulatory outcome. These schemes are considered effective at managing a component of stormwater impact (eg nutrient pollution as opposed to stormwater volume), however, they are generally limited to new (greenfield) developments, are not universally applied and because of their focus on the development phase, are not set up to address longer term operational issues.

Recognising the fact that stormwater manifests itself within a catchment, there is opportunity for co-investment across different tiers of government and with private industry. This approach is commonly used in the design of competitive grants programs; however, considerable benefit would be achieved if a longer term program was developed to support efforts being focussed over a longer term. (eg The Federal Government's Roads to Recovery is a longer term scheme that provides federal funding for programmed road work in line with local priorities and agreed outcomes).

Regardless of the specific framework, it should be recognised that a longer term application is needed to achieve the multiple benefits that stormwater promises, and is an appropriate area for the Federal Government to provide a role.

Internationally, Singapore is held up as an example where they are now able to collect all stormwater generated from the island nation and use this as a source water for their potable supply. The process to achieve this rolled out over several decades and was driven by the country's need to establish a secure water supply that was not reliant on the largess of their neighbouring state.

Within Australia, the rural city of Orange (in NSW) responded to the challenges of the millennium drought by implementing a stormwater harvesting scheme (Blackman's Swamp). Subsequent CSIRO research supported by the National Water Commission and Goyder Institute demonstrated that stormwater in Australian cities requires treatment equivalent to that already used in unprotected rural catchments to produce safe drinking water supplies. The researchers also developed a water safety plan for stormwater supplementing existing drinking water supplies in Mount Gambier, a procedure in use for 140 years. Research revealed that public acceptance of stormwater in drinking water supplies in Adelaide was considerably higher than for desalinated seawater.

In addition, non-potable uses for public open space irrigation, industrial and horticultural supplies may also be economic in circumstances where suitable aquifers or surface storages exist. Small scale rainwater harvesting to aquifers support green space and reduce mains water requirements with considerable economic benefit, notably in Perth, where rainwater recharge to aquifers is mandated. Further opportunities for small-scale and multi-scale stormwater treatment and harvesting offer considerable potential benefits but without policy drivers are yet to be exploited in other cities.

Even the humble rainwater tank has a legitimate role to play. Different jurisdictions offer a range of encouragements and discouragements for the installation of rainwater tanks, and often the full benefits of these are discounted on a limited contribution to supporting water resource outcomes, increased energy demands (eg to operate pumps) or perceived public health outcomes. These arguments ignore the cumulative contribution of distributed, allotment based approaches and their obvious compatibility with urban development (building) approaches. Public health arguments ignore the differences in risk posed by centralised, reticulated systems (where failures expose many to health risks) and private supplies.

As cases in point, both the Australian Drinking Water Guidelines and the World Health Organisation provide sensible guidance on how private water supplies (such as rainwater collection) can be managed. While this guidance has generally been assumed for remote areas, the public health arguments around risk will be similar if similar private supplies are used in urban areas.

This is particularly the case where private (rainwater) supplies are used to supply non-potable uses (which represent 30% or more of domestic consumption). The public health arguments for larger supplies are able to be discounted or reduced to low levels if these supply solutions are deployed amongst an informed community and may diminish to inconsequential levels.

It is evident from the examples provided that there are benefits to be realised at different scales. It is argued that catchment based frameworks are needed to allow these benefits to be properly considered. It is also recommended that these frameworks be developed to include both spatial and temporal opportunities and constraints to allow co-investments to be realised as development occurs.

A long term direction for stormwater management needs to recognise the important role that planning and building frameworks have to play in leveraging the development process (and by virtue co-investment) in delivering outcomes over the longer term.

e. Model land use planning and building controls to maximise benefits and minimise impacts in both new and legacy situations.

The Australian Government has a clear leadership role to play in setting the tone for planning and building controls, although the administration of these is largely seen as a state responsibility. For example, through its administration of the Australian Building and Construction Commission the Australian Government sets overarching guidance for different building typologies around the nation and supports skills development to deliver the required outcomes.

The ramifications of land use planning are likely to dominate the impacts of stormwater on new development and downstream receiving environments. Through a range of federal legislative instruments there are requirements that development and related activity do not prejudice natural assets (eg Ramsar wetlands) and in some cases federal agencies may be included in the approvals process.

Modifications to building stock and their immediate surrounds (eg landscaping) offer the greatest opportunity to manage stormwater close to source. Many local authorities are now beginning to implement policy approaches which require sustainable design principles to be demonstrated as part of the development application process. These often build upon state level policies, but seek to set locally specific targets in response to the needs of the local community.

Federal support in developing enabling frameworks for these approaches would be a useful inclusion in advocating for improved outcomes.

In considering the application of building and planning frameworks there is a perceived tension between the differing roles that each framework plays in guiding development outcomes. The reality is that both approaches complement each other. Planning approaches may not cover all development classes but where they exist, offer the best opportunity to allow development to integrate a range of outcomes (such as built form, drainage, water conservation) early in the conceptual development of proposals. Planning approaches require certain triggers to enable them, and as such, may be limited in their application. Building regulatory approaches have the advantage of being able to capture a greater range of development classes, but may not offer the same opportunities for nuanced design solutions.

The tension between planning and building is believed to be one of the main factors preventing a greater ability for development to respond to sustainability requirements. Recent history suggests that each system defers from the other as the preferred regime for solutions to be enforced. The reality is each should work to complement the other.

There are examples where local governments have come together to develop a coherent approach to encouraging more sustainable building solutions by standardising their sustainability frameworks and supporting assessment processes. This has occurred, in a large part, driven by a need to overcome the arguments raised at the state level about varying application of planning controls and the inevitable concerns about housing affordability and impact on job creation.

In a future economy, it is argued that approaches that recognise the important role that a long term, sustainability led approach as one that is desirable would best serve our communities into the future, and as such, should be supported at the federal level.

There are examples of policy frameworks which are able to recognise the potential synergies. Indeed, a recent planning panel report considering ESD amendments proposed by Councils in Melbourne found that there were likely to be complementary outcomes that are consistent with state policies. (see http://www.yarracity.vic.gov.au/planning--building/yarra-planning-scheme/planning-scheme-amendments/amendment-c133/)

A factor for consideration is the limited application of state policies where they exist. Policies which are recognised as focussing on greenfield developments may miss the opportunity to be applied to infill development, and where infill development is being considered there are questions on how changed legislative standards that have occurred since original development should be required and enforced.

We believe the issue of evolving standards (eg environmental protection, flood protection) are too important to be ignored, and Australian Government leadership in establishing frameworks to support the application of progressive policy that is able to holistically address water issues is required.

f. Funding models and incentives to support strategic planning and investment in desirable stormwater management, including local prioritisation.

A range of funding models have been discussed above. Their consistent application over time offers the best opportunity for long term benefit, and if the principle of proportionality is accepted along with the ability for local authorities to raise revenue to achieve a set of defined outcomes, prioritisation built around partnerships with other tiers of government is a likely outcome.

There are examples where a similar process currently occurs. The Roads to Recovery program administered by the Department of Infrastructure and Regional Development provides a mechanism for the federal government to support local road infrastructure. The program is well received by local authorities as it offers certainty of funding over a number of years.

The Natural Disaster Resilience Program (NDRP) is administered by the Attorney-General's Department and provides another model. Funds provided by the Australian Government are required to be matched by State Government, which in turn, secure additional funds from local authorities and business. Natural disaster spending is often characterised as post event, and reactive.

There is considerable evidence to support the business case for proactive planning and awareness over post disaster recovery,

With a number of Councils accessing NDRP funds to undertake flood investigations, we consider that the strategic use of investments in developing technical understanding is an opportunity that should be explored to maximise the impact of grant funding which is often administered to achieve a single outcome.

Targeted grant funding from the Australian Government has been used previously to promote co-investment from local government and parts of the water industry and is almost universally well received. In 2011, $250 million was eventually excised from the larger $2 billion Urban Water and Desalination Fund (UWDF) and directed to support stormwater harvesting schemes around the country.

Delivering up to 14 billion litres worth of mains water savings annually, a typical rationale for many of the funding applicants to the UWDF was the potential to deliver a water source that would be benchmarked against (current at the time) water supply costs, while at the same time delivering environmental or amenity benefits.

A key driver underpinning the UDWF was to develop a response to water scarcity that arose as a consequence of the millennium drought, and its requirement for significant matching capital contributions made it problematic for many smaller projects to be considered. There were examples where consortia applications were submitted, demonstrating the premise that incentive funding is an effective way to foster collaborative approaches. It is postulated that the effect could be enhanced if a more strategic approach was developed in partnership with industry to maximise the potential to leverage spending across multiple areas of government.

Finally, if the premise raised in the discussion around building and planning is accepted, there is another funding mechanism that is able to be accessed through developer contributions. Planning frameworks in most jurisdictions are mature enough to allow these contributions to be rationally calculated, and the authorities which develop the contribution plans are well positioned to understand the trade-off between rates which are ‘too high’ and what would constitute a reasonable impost. It is unlikely to be the role of the Australian Government to rule on the specific application of a contribution scheme, rather just to establish the framework.

If strategic partnership models are additionally developed, this is likely to provide an efficient framework to leverage spending across all government and development sectors.

Importantly, it needs to be recognised that funding and incentives need to be consistently applied over a prolonged period. While this is likely pose challenges in a tightening fiscal environment, the reality is that frameworks which encourage co-investment will reduce the burden on individual government tiers and industrial sectors in the long term, and a longer term application will reduce the financial ‘shock’ that is associated with short term initiatives.

g. Asset management and operations to encourage efficient investments and longevity of benefit.

Asset management is an area that is growing in maturity and Australian Government guidance on how it could be applied to allow integrated stormwater approaches needs to be seriously considered. Stormwater assets are typical of infrastructure in that they have high costs and long life. We have discussed previously the significant investments already made in the current stormwater asset base.

In new development areas there are investments being made to expand the stormwater asset base. In areas where this is supported by appropriate planning and regulatory frameworks, these investments will include contemporary stormwater management approaches, including ICWM and WSUD, however, for a large number, a 'business as usual' approach will be employed. In some instances an overly conservative approach may lead to a hybrid outcome in which drainage and environmental objectives are met in an inefficient and uncoordinated manner.

It is true that for any asset base, that without a supporting framework to allow an income stream to be provided to contribute to the long term management of the asset base (i.e. operational cost and a 'sinking' fund to allow renewal and replacement), performance outcomes against standards and objectives will deteriorate over time.

Stormwater assets are no different and represent a major investment in water infrastructure which competes in magnitude with other aspects of urban water management, and as such, require revenue streams for their long term maintenance.

For many urban areas the combined effect of ageing assets and urban renewal (which impose an additional service burden to cater for increased flows from increasingly impervious catchments, more stringent environmental requirements and to ensure resilience margins to cater for future climate imposts), make the case for progressive approaches more compelling.

Work done by the Local Government and Planning Minister's Council has resulted in a proposed National Asset Management Assessment framework. While the framework is initially targeted at understanding the current asset management situation, the implementation of any outcome should consider the role of asset management to expand beyond traditional approaches to accommodate assets that achieve a more holistic set of community outcomes.

Under the current paradigm, asset investments are usually considered on core functions (eg replace a drain with a drain), but a holistic framework could see investments maximised by leveraging other functions.

A more sophisticated approach to asset management and funding which incorporates integrated functionality is warranted ahead of any 'end of life' renewal cycle. Significant infrastructure is typically understood to have a useful life of 80 to 100 years, and for many urban centres it is considered that the closing of the time window to make optimal, long term investment decisions is nearing, if not already upon us.

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h. The role of innovation in supporting desirable outcomes and transparent decision-making, including access to information and novel technologies for planning, design and implementation.

Two fundamental roles of research and innovation are;

(a) to inform government policy, governance, setting of targets and standards, informing city-wide options and combinations at a range of scales, evaluating cross-sector benefits and costs of current practice and future options accounting for changes in urban population, urban form and climatic change, evaluating public aspirations and acceptance of options and considering necessary level of investment and long term life-cycle benefits and costs of policy and technology options; and

(b) to assist industry to innovate and adapt through testing and improvement of product and system performance under a range of applications, aiming to reduce capital, maintenance and operating costs, establish cohesive systems to achieve goals, monitor implementation and provide feedback to allow continuous improvement.

Recent cost saving measures at the Australian Government level to withdraw funding from key scientific institutions are likely to be a considerable threat to the advancement of progressive policy and practice.

We believe that a commitment to adequate Australian Government support for good science is a desirable outcome from this review, but this needs to done in an applied sense in partnership with industry.

Importantly, as peak a body representing a broad cross section that includes researchers, regulators, and solution providers and purchasers we see an important role to ensure that science, when developed with public money, needs to be accessible to the broadest section of industry to allow market processes to drive competition and cost-effective outcomes.

Nationally we have been working closely with technology suppliers (and initially with suppliers of stormwater treatment technologies), to develop an evaluation framework which will allow the veracity of treatment performance to be established in a transparent manner to then support considered investment decisions in the marketplace.

Our motivation to developing consistency in approach was borne out of seemingly different concerns raised by different industry sectors. Our analysis revealed that regulators felt they were not always able to obtain desired information from suppliers, and although suppliers were willing to invest in testing to meet regulatory requirements, varying (and sometimes changing) requirements in different jurisdictions was a frustration leading to excessive cost. Specifiers and designers shared similar concerns, and the nett effect was to frustrate attempts to achieve regulatory outcomes and adding unnecessary cost (which further undermines confidence in progressive regulation).

The approach taken by industry recognises the appropriate roles of science to provide credible theoretical frameworks that allow commercial decisions to be taken that lead to the development of technological solutions. Commercial operators then take on the risk of developing products that respond to regulatory needs. By creating a transparent and level playing field, different solutions can be developed with the commercial entities bearing the associated risk of product development to achieve a price point that they believe will be acceptable to the marketplace. Scientific institutions supported by knowledgeable practitioners then have a role to play in assessing the veracity of claims made as a result of product development and testing.

This approach is considered to be a true innovation pathway and has been designed to be replicated at various scales. It recognises the important role that the 'supply' side has in responding to regulatory requirements and is broadly modelled on other industries where standards are developed. The stormwater industry is unique in that we are required to innovate to deliver policy outcomes and our membership base includes suppliers, purchasers, advisors and regulators and provides a melting pot where science and innovation coalesce.

While there are a range of funding models and financial incentives that support investment in technology and provide the opportunity for innovation to flourish when supportive regulatory and design frameworks are developed in co-ordination to leverage the investments made by solution providers, these could be better supported by government in the form of R&D taxation concessions.

In the future, we expect innovation will extend to provide a greater role for information technology and leverage the considerable investments that government has, and continues to make in data collection and transfer (eg NBN). In an age where complex medical procedures can be performed remotely across the globe it seems a strange paradox that the management of water focussed technologies is not maturing at the same pace.

Government agencies (including the Bureau of Meteorology and water utilities) have spent considerable time and effort in collecting data on the various systems they oversee, however to date, the main application of these efforts has been to provide a communication tool back to consumers of their product (eg how much water is consumed at the household level). The next innovation area would be to identify management interventions that respond intelligently using this information.

As a case in point, the Bureau of Meteorology's rainfall radar websites are amongst the most viewed in the country, but are essentially used for information purposes. Building upon the obvious popularity of these contemporary weather techniques (such as Nowcasting) could be leveraged to allow smarter stormwater systems that can be adapted to manage the trade-offs between flood and environmental protection and water resource outcomes.

Another example of where recent technology may be appropriate involves the use of aerial and satellite photography techniques to better understand and monitor the impact of urbanisation on vegetation, thermal comfort and potential impact on receiving waterways. Satellite and aerial imagery collected across a range of spectra would support analytical techniques that can be used to identify general trends in urban condition, including the growth of impervious areas. In turn these could be used as powerful inputs to inform policy and calculate impact rates and charges.

Capacity and skills building is another important aspect of the innovation cycle. This is an area that lends itself well to the involvement of industry bodies which are required to respond to the total needs of members, and in most states, capacity building programs have been established with the assistance of state agencies. Capacity and knowledge within the stormwater sector is broader than other water related service industries.

Our members are drawn from a broad range of disciplines that extends a traditional engineering base to include environmental science, urban planning, economics and policy development. Over half of our members are drawn from the local government sector where exposure to water related issues includes stormwater, water conservation and environmental design, many of whom are acutely aware of the urban water challenges faced by communities during recent drought episodes, along with the specific issues that are faced in stormwater management.

The stormwater industry is acutely aware of the important role that innovation and knowledge developed by consultant members responding to client needs has to play in advancing industry capacity, as is testified by the hundreds of papers and presentations offered by the various state stormwater industry associations each year.

The Australian Government has a strong leadership role to play in supporting credible science and innovation pathways that build from these. Recent cuts to the CSIRO and impending threats to the Cooperative Research Centres Program ignore the important roles that a strong science policy approach has to play in encouraging the innovative approaches that will be increasingly important if Australia is to transition to a knowledge and service based economy. This is particularly important in the area of science designed to support policy and regulation, where there is a legitimate role to provide outcomes that aren't easily translated into directly consumable products but underpin the needs of safe, healthy and attractive communities required for prosperity.

We believe a legitimate role for the Australian Government would be to interpret the considerable insights and knowledge of practitioners and provide overarching capacity building and knowledge frameworks that could be assimilated nationally in training programs appropriate for different industry sectors.

i. Any related matters

We hope the information contained in this submission is accepted and provides some compelling arguments for Australian Government leadership in a range of areas.

As an industry that has rapidly evolved over the past couple of decades we would argue that we represent a talented, diverse and committed cohort of professionals who are well poised to provide a positive contribution to the economy as it transforms to a professional services economy.

Recently, engineering and infrastructure technologies were imported from overseas to respond to urban water shortages that were encountered during the drought. We believe that the world has much to learn from a country that has a proud tradition of innovation and problem solving. Indeed, in a future knowledge economy, Australia's competitive advantage may stem from its widely recognised circumstance as being the world's driest inhabited continent, most at risk from a changing climate. Clever solutions that manage future challenges, build resilience, address legacy issues and integrate outcomes are all things that we believe will attract increasing economic interest in the years to come, and with the right policy settings and Australian Government leadership, will ensure Australia remains at the forefront.

Stormwater is described in policy literature as a 'wicked' problem, defined by a multitude of actors motivated by a range of reasons, often requiring new approaches to achieve resolution. (http://www.apsc.gov.au/publications-and-media/archive/publications-archive/tackling-wicked-problems).

As a peak body industry association, Stormwater Australia is happy to embrace the challenges posed by different scales of intervention, multiple outcomes and trade-offs and the variation across jurisdictional responsibilities.

With the loss of key Australian Government agencies such as the National Water Commission (which had a role to play in urban water reform) we see a legitimate role for Stormwater Australia to be involved in providing considered advice at the national level.

We provide a summary table outlining some of the areas that we consider the Australian Government has a legitimate role in providing settings and frameworks, and we look forward to working with the Australian Government to support the future prosperity and wellbeing of our nation.

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Australian Government				
Policy areas	**Example Objectives**	**Stormwater Program**		
		Suggested Actions	**Impacts**	**Targets**
1/ National Water Initiative	Efficiency and fairness in water use. Recognise and address impacts beyond water supply and sewerage. Aligning environmental outcomes across jurisdictions, and expanding to recognise detrimental impacts of excess urban runoff.	Establish a national policy framework for stormwater in urban water management.	Open pathway for investment. Minimise start-up costs. Encourage new solution providers/ market entrants.	Urban water reform.
2/ Economic Development	Reduce costs of water. Open new markets.	Develop co-investment models for investment in stormwater management. Provide market incentives to support prototype projects and technologies. Establish new funding mechanisms and markets. Provide support for establishment of industry technology verification program.	Align local, state and common-wealth government policies, approvals and actions to streamline achievement of policy outcomes. Encourages market competition through the creation of a level playing field.	New business and cost savings which significantly exceed the value of commonwealth investment.
3/ Managing Risk	Floods mitigated, damage minimised.	Undertake further measuring, modelling and monitoring of flood risk and costs. Provide innovation seed funding for projects which aim to manage risk differently.	Demonstrated savings in flood damage to community. Demonstrate ability to support broader agenda for safe and reliable water supplies.	Reduction in flood damage costs and in flood mitigation costs. Investments aligned to support improved liveability and water security.

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Australian Government				
Policy areas	**Example Objectives**	**Stormwater Program**		
		Suggested Actions	**Impacts**	**Targets**
4/ Investment in Science and innovation	Confidence in technologies to support policy and regulation. Support cost	Provide support for research investment targeted to meet industry needs and knowledge gaps. Stormwater innovation included as application criteria in R&D priorities of existing blue sky and applied programs.	New technologies leading to market led solutions (through access to information promoting competition). Better preparation for future challenges and opportunities – potential for very high return through integration and change.	Improved water management Develop knowledge led local and export industries. Water cycle industries adaptive and implement innovation.
5/ Sustainable Cities	Greener cities, smaller environmental footprint. Climate resilient cities.	Incorporate guidance in National construction standards and legislative instruments. Provide seed funding for new technologies and/ or targeted to support priority development areas.	Green city targets met, discharge standards met at appropriate scale to address adverse impacts. Climate resilience.	Ecosystem and recreation benefits conspicuous to community. Amenity and future resilience.
6/ Industry skills and development	Effective translation of science and innovation into built outcomes. Enhance Australia's international reputation as a knowledge and education economy.	Develop national accreditations for stormwater solution standards. Support for capacity building programs which embed recent science into practice.	New innovation is sustaining the competitive advantage.	Australian stormwater businesses adaptive, competitive internationally, Local research well understood and developed into world leading export opportunity.