A Framework for Integrated Urban Water Planning and Management for NSW

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This paper reports on the development of a multi-faceted framework for the NSW Department of Environment and Conservation to assist local government in the development of a 'next generation' integrated stormwater management planning (ISMP) mechanism. This approach has at its core the need to consider stormwater quality and quantity, ecosystem health, together with organisational and social values.

In 1998 the NSW Environment Protection Authority (now Department of Environment and Conservation) initiated its stormwater management planning (SMP) process. This required councils across the state to prepare SMPs and implement strategies to improve urban stormwater quality. Guiding this process was the draft Managing Urban Stormwater: Council Handbook (EPA 1997). While this process delivered an important outcome in bringing stormwater quality into the minds of councils and their stakeholders, the process did not effectively integrate water quality with water quantity / flooding and stream health processes and management.

To ascertain the direction in which councils are individually progressing urban stormwater management since this time, a survey was undertaken of councils in the Sydney Region regarding the inadequacies and constraints to integrating stormwater quality and quantity. The interviews confirmed that stormwater quality and quantity are generally managed by separate sections of Councils. Constraints to their integration include a lack of organisational support for integrated environmental management approaches and inter-departmental input, as well as the need for a water management planning framework that is linked to other activities of council.

Significantly, the surveys showed that several councils are beginning to develop their own stormwater management planning process, focusing on integration of water quality, water quantity / flooding and stream health. Furthermore, councils are suggesting that the proper integration of the urban water cycle into council processes goes beyond stormwater management and needs to be underpinned by a well-defined series of management outcomes that reflect the principles of ecologically sustainable development.

This paper focuses on the physical environment and environmental health assessment that forms one of the four core areas of information to be considered within the new integrated urban water planning and management framework.

1. INTRODUCTION

A range of authors (Brown 2003, Marsalek et al 2001, McManus and Brown 2002, and Niemczynowicz 1999) have commented that sustainable stormwater management requires a combination of:

- a strategic, robust and multi-objective framework which integrates local and state policy and planning;
- multi-disciplinary approaches and integrated planning strategies that seek to integrate social, environmental, economic and organisational aspects of local councils or stormwater managers; and,
- a total catchment approach underpinned by an understanding of ecological health and catchment condition.

Traditionally, stormwater management has been the function of engineers and more recently environmental scientists have entered the debate. However the integration of other professions including environmental policy, planning, health and social scientists are lagging and consequently not being integrated into stormwater management planning and works programs. As a consequence guiding documents, policies and programs include inconsistent and unrelated objectives and actions.

For example, bushland management is an area which is traditionally managed by a single department within local government. However much of the impacts on the natural environment stem from changes in hydrology and other aspects related to development that have not been incorporated into an overall catchment. Urbanisation can alter stormwater base flow conditions in existing drainage lines, create new drainage lines, and deliver larger stormwater quantities at higher velocities, resulting in erosion, sedimentation and the formation of weed plumes. These issues cross a number of departments within council and require a multidisciplinary approach which may include planning or policy intervention for better allotment and subdivision design or better onsite practices for disturbed vegetation communities, community and industry education, engineering intervention for the protection of infrastructure assets or rehabilitation and restoration programs.

Urban water managers are now realizing that, there is an increasing need for management decisions which consider the “uncertainties about how exactly ecosystems function, and the likely effectiveness of different recovery approaches” (BCC, 2002). There is also a need to relate such decisions to practical planning solutions, and thus to local and state policy, as well as intervention strategies. Increasingly the preferred sustainable approach to urban water management is a multi-disciplinary based approach founded on an understanding of ecosystem health and urban hydrology. This approach must be framed and linked to other council process including the social and organizational dimensions and the policy and legislative framework.

2. BACKGROUND

In the 1990’s urban stormwater quality practices were being applied, yet they were poorly understood with implementation being largely adhoc and lacking a catchment-based ecological focus (McManus and Brown 2002). Stormwater management has followed water quality management trends, starting with simple gross pollution control and developing into enhanced treatment via artificial wetlands. By the late 1990’s many local councils were attempting some form of stormwater pollution control, typically end of pipe solutions. While many projects delivered some benefits they lacked a holistic approach to integrated catchment management involving whole of catchment processes, that also drew on organisational and community attitudes, behaviours and capacities.

The stormwater management plans (SMPs) required of all urban councils by the NSW EPA were designed to force planning, communication and management across council and between other councils and state government agencies on a catchment basis. While the plans achieved an important outcome in bringing stormwater management into the minds of councils and their stakeholders, the planning process and outcomes failed to effectively integrate stormwater quantity with stormwater quality and stream health nor was there acknowledgement of social capital and organisational contextual issues (EPA 2000). By failing in these areas, the SMP process did not adequately engender sustainable urban stormwater management.

More recently, many councils, with assistance from the NSW Government Stormwater Trust, have sought to integrate non-structural solutions such as education strategies with structural solutions, which may include the installation of water quality improvement devices. This has occurred after collective recognition that projects should be focused on an understanding of behaviours and actions of people living within the catchment, rather than a simple assessment of pollution generation rates and catchment hotspots. Equally important has been the realisation by policy managers that integrated catchment management requires a strategic link with planning and policy decisions to set a framework for ecologically sustainable development and improved waterway health.

These trends reflect the outcomes of an evaluation of the stormwater management planning process (EPA 2000) which found:

- implementation of the SMPs has been largely limited to projects funded by the Stormwater Trust due to a lack of council resources to fund the 'full' implementation program;
- community engagement in the planning process was on the whole unsuccessful and resulted in plans not truly representing local values;
- there is a need to build on and improve the horizontal and vertical flow of information and skills across council structures; and,
- the focus of the stormwater management plans on quality was too narrow and needs to be integrated with quantity, runoff from non-urban areas and other environmental planning processes imposed on councils by the State Government.

Fundamentally missing from the existing stormwater management planning process is an understanding of ecosystem health and the development of abatement strategies based on the key issues and root causes which impact on waterway environments.

2.1. Gaining an understanding of the limitation of current stormwater management approaches within councils

A survey was undertaken of twenty councils in Sydney to determine the extent to which councils are progressing urban stormwater management since the finalisation of their SMPs four years ago, and to understand the inadequacies and constraints to integrating stormwater quality and quantity. It was determined that stormwater quality and quantity are generally managed by separate sections within councils. This, along with a lack of organisational support for integrated management approaches, has resulted in major barriers to effective integration. As shown by Brown (2003) and EPA (2000), the single disciplinary silos within council create communication barriers, lack of cohesion, lack of accountability, and a dislocation between maintenance and management.

Inadequate funding was identified as a main factor limiting an integrated approach to the design and implementation of stormwater quality and quantity works. This was complemented by a desire of all councils to have more detailed information on the current condition of the catchment, including information on the specific impact that urbanisation has on the aquatic environment.

While the lack of integration between water quality and quantity was clear from the feedback from councils, most (70%) stated that there were positive benefits in integrating water quality and quantity with respondents quoting that "both aspects are interdependent and need to be considered concurrently", or it is necessary to "treat both for effective solutions". The benefits to councils of integrating the water quality and quantity were summarised in the surveys, as:

- leading to greater environmental awareness of impacts of works;
- ensuring that upstream and downstream activities are managed consistently and within the capacity of the urban and natural environments;
- influencing the stormwater design to develop more appropriate solutions; and
- vital if councils are to achieve community values.

While it is evident that most councils see benefits in the integration of stormwater quality and quantity, other councils could not see the benefits. For example some reported that their catchment characteristics were "very small steep…with no major water quantity issues", or it was not the responsibility of the person within council and so they focus on their own issues. Several councils identified that they have put an emphasis on stormwater flooding control and that funds limit the adoption of water quality devices which are only installed through "external (grant) funding".

While most council officers were able to identify benefits from integrating water quality and quantity it was harder for councils to identify methods or processes for integrating the two. The majority of councils did not know of any such techniques or stated that it is "always a separate issue and treated separately". Specific material that councils cited as integrating water quality and quantity include MUSIC modelling, council documents, and Australian Runoff Quality (IE Aust 2003), with further information available from the Cooperative Research Centre for Catchment Hydrology and Universities. While these tools themselves could assist councils in understanding water quality they have limited application in actually integrating water quality and quantity.[1]

Specific examples of where councils identified possibilities of integrating stormwater quality and quantity into current practice include: development assessments, stormwater management planning, new capital works in which greater weighting could be given to works that achieve multiple objectives, lot plans incorporating on site detention and retention (OSD and OSR) requirements including stormwater reuse through rainwater tanks, and policies for stormwater quality, OSD and extended OSD.

The survey found that most councils were addressing stormwater as effectively as they could within their given constraints. However, the lack of direction and integrated funding programs from State Government is likely to be a key determining factor in addressing future stormwater needs. Without any direct guidance, several councils are now independently undertaking new planning directions based on the integration of water quality with other related aspects, as discussed in the next section.

3. NEW PLANNING DIRECTION OF COUNCILS IN NSW

The survey identified that several NSW councils are developing their own multi-disciplinary approaches to urban water management. Interviews with these officers identified that council expectations are not being fully met by the present planning framework, as managers struggle to fully understand the relationships and priorities of a range of physical parameters (such as water quality, flood risk, riparian health, and drainage infrastructure condition) and how to objectively evaluate potential treatment options against catchment objectives and targets.

These councils are focusing on developing a new generation of integrated stormwater management plans at a strategic level, however they are uncertain as to the most effective approach needed to achieve outcomes. The evolution of stormwater management within these councils is directing them to make decisions based on integrating several or all of the following key factors:

- **Stream Health** – councils are focussing on stream health as the prime driver influencing catchment planning and council activities. This may incorporate factors such as riparian and terrestrial vegetation, fluvial geomorphology, and macro invertebrate sampling.

- **Water Quantity** – councils have existing budgets for flood estimation and flooding will always be a priority based on life and property liabilities. The preparation of flood studies is also supported by state and federal government grants on completion of a flood assessment study.

- **Sub-catchment planning** – sub-catchment planning of several 30-500ha catchments within the council area rather than the previous stormwater management planning scale which incorporates several councils into larger catchments.

- **Water quality** – water quality is a sub-component of any process through the identification of generic and specific hot-spots within a catchment.

[1] The MUSIC model enables catchment managers to determine the likely water quality emanating from specific catchments (IE Aust 2003), but it has a limited water quantity function. Similarly Australian Runoff Quality is aimed at providing direction to the current best practice in the management of urban stormwater quality.

- **Planning** – the outcomes of this evolving planning framework is to guide integrated council planning incorporating council issues. This is particularly relevant for those local government areas experience significant growth, both infill and at greenfield sites.

The focus of some of the councils that are presently undertaking planning of stormwater at a strategic level is outlined in Table 1. As shown these councils are linking water quality to other related aspects, including water quantity, stream health, and establishing an integrated water cycle approach. For example Marrickville Council is obtaining a better understanding of water quality processes through modeling of sub-catchments, and integrating this information with social and organisational processes, while Blacktown Council is undertaking an assessment of its riparian corridors and stream health to guide planning strategies within sub-catchments.

Parramatta Council (2004) is undertaking a project to build an ecological, social and economic assessment of Parramatta's waterways to allow for the allocation of scarce resources to meet the targets for the specific waterway. The project seeks to; develop a set of social, economic and ecological criteria to categorise our waterways, identify specific goals and targets for different parts of our waterways, and prioritise waterways reaches.

Hornsby Council is beginning to develop a sustainable water cycle management strategy that is based on the integration of stormwater quality and quantity, water supply, sewerage, transport and recreational planning, social and economic factors.

Table 1 - Strategic Stormwater Planning within Sydney Councils

	Penrith	Blacktown	Hornsby	Parramatta	Marrickville
Water Quality	Yes	Yes	Yes	Yes	Yes
Water Quantity	Yes	No	Yes	Yes	No
Stream Health	Yes	Yes	Yes	Yes	No
Water cycle	No	No	Yes	No	Yes
Social	No	No	Yes	No	Yes
Organisation	No	No	Yes	No	Yes
Scale	Sub-catchment	Sub-catchment	Council and Sub-catchment	Sub-catchment	Sub-catchment

There is an emerging trend that these councils are seeking to evolve strategic stormwater management planning based on their own expectations and needs. The NSW Government is following to building on these processes and its own understanding of stormwater management to develop a more strategic stormwater management planning framework in its revised guidance *Managing Urban Stormwater: Council Handbook* (DEC in press).

4. STORMWATER MANAGEMENT PLANNING DIRECTION OF NSW GOVERNMENT

The development of a second generation integrated stormwater management planning process seeks to incorporate stormwater quality, flooding and risk management and environmental protection within the expectations of the community and other stakeholders, the capacity of local government and within the context of state policy and planning instruments.

By doing so the new planning framework seeks to address some of the existing inadequacies in the present planning system which have been identified by stormwater managers as:

- lack of multidisciplinary interaction between council staff/departments;
- poor interface between the science of catchment health/ecosystem functioning, council planning and policy decision-making, and the development and implementation of strategies;

- lack of integration of stormwater quality and quantity management eg technical tools and models do not necessarily integrate due to a range of technical and multidisciplinary factors nor do they address the role and needs of natural systems;
- inadequate resources and funding, and short-term monitoring with no long-term commitment, inadequate use of existing data; and,
- lack of baseline information about catchment dynamics and therefore lack of deterministic water quality and quantity targets/objectives, resulting in a lack of benchmarks for adaptive ecosystem management.

A key element to this new planning framework is the recognition that the impacts of storm events have different impacts on the physical, social and economic environment. Unlike existing plans this new approach seeks to plan for three categories of storm events within the hydrologic spectrum (frequent rain, infrequent storms and manor flooding storms) as illustrated in Figure 1 (Davies and McManus 2004). This is a significant departure from existing planning processes and it is intended that management outcomes will consider the benefits and impacts on each of the rain events within the catchment and sub-catchment. Under the proposed planning framework actions to address flooding must also consider other factors such as the health of the receiving water body, its surrounding natural or modified vegetation, current and future land use, social values and expectations, the ability of local government to maintain the proposed works and whether the project is moving towards achieving the adopted vision of the catchment.

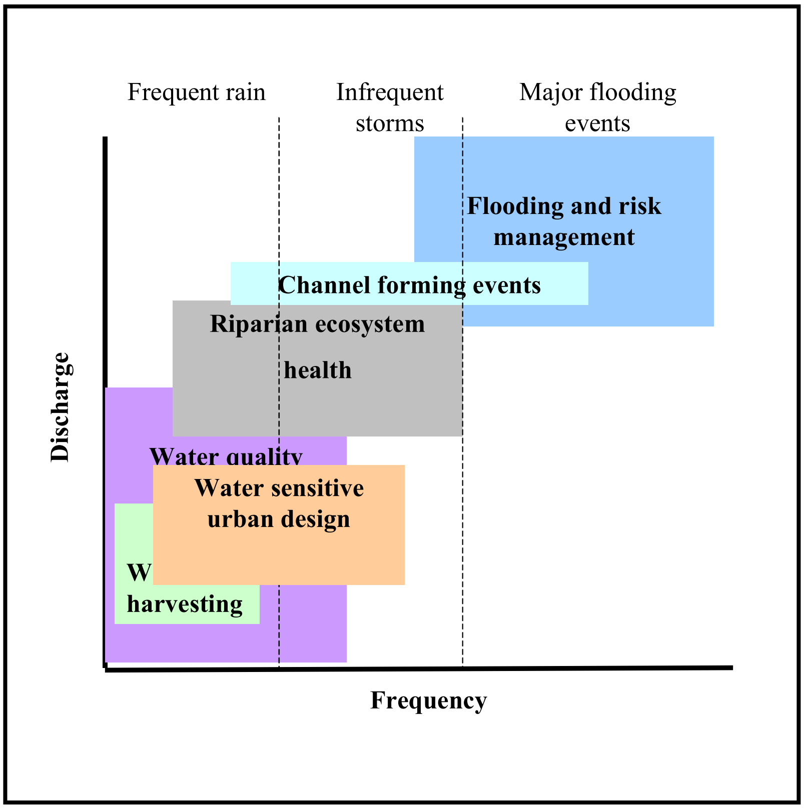

Figure 1 - Stormwater planning within scales and issues (Davies and McManus 2004) [2]

[2] The scale of rain events that affect the key issues as identified is designed to provide some relativity as to how they are perceived and managed under current planning processes. It does not represent limits of influence of rain frequency or duration on the parameters

4.1. Framework for a new planning process

The planning process being developed which will form the basis of the next generation planning process, as shown in Figure 2 and includes the following steps:

1. **Catchment Snapshot** – initial assessment of catchment processes including an assessment of the physical, organizational and social aspects of stormwater management.
2. **Objective setting –** interactive discussion with the community and other stakeholders to identify the outcomes that the community wants and the environment requires. This step aims to establish desired levels of environmental protection and other objectives, as well as setting appropriate performance targets.
3. **Option Evaluation** / **Develop an integrated stormwater management plan –** based on the issues presented it is necessary to identify a series of appropriate mitigation strategies, addressing the pollutants / issues of concern. The framework for evaluating the options needs to consider the economic, social and environmental costs and benefits, as well as an assessment of long-term benefits of any options developed.
4. **Integrated Strategy** – an action / priority list needs to be developed based on the option evaluation and taking into account funding mechanisms, council management planning, social needs, and organisational capacity to implement and maintain any actions.
5. **Adaptive Management –** monitoring of the outcomes of the implementation and aquatic and terrestrial health, and refining the process to ensure improved outcomes in the future.

4.2. Catchment snapshot

Developing the catchment snapshot is a high level assessment of the state of the physical, social, organisational, political and planning frameworks that influence integrated decision making and the management of stormwater. It serves to provide an overview of the existing and relatively attainable information that then informs opportunities, constraints, and knowledge gaps. As part of this process there is a need to understand why the plan is being prepared in the first instance and what political interest or support exists. The main components of the snapshot as shown in the detail of Figure 2, include:

a. **Physical –** assessment of the aquatic, riparian, terrestrial, hydrology and flooding issues within the catchment. This assessment will build on existing information and be a quick exercise for council.

b. **Organisational –** assessment of the council processes and direction of the council including local DCPs and LEPs, assessment of past stormwater works, and initiate council support for the process.

c. **Social –** identification of community knowledge and attitudes, collated through social plan, surveys, and community expectations. This information will establish a vision for the catchment, which will be refined through later steps.

d. **State and Local Policies** – identification of State Legislation and State Policies (eg BASIXs, Floodplain Management Manual, Riparian Policy, development release areas), which have the potential to impact on the future stormwater management initiatives and establish a framework by which the opportunities and constraints can be identified and adhered to. Some of these policies will be generic for NSW and others will be localised, based on the existing environment.

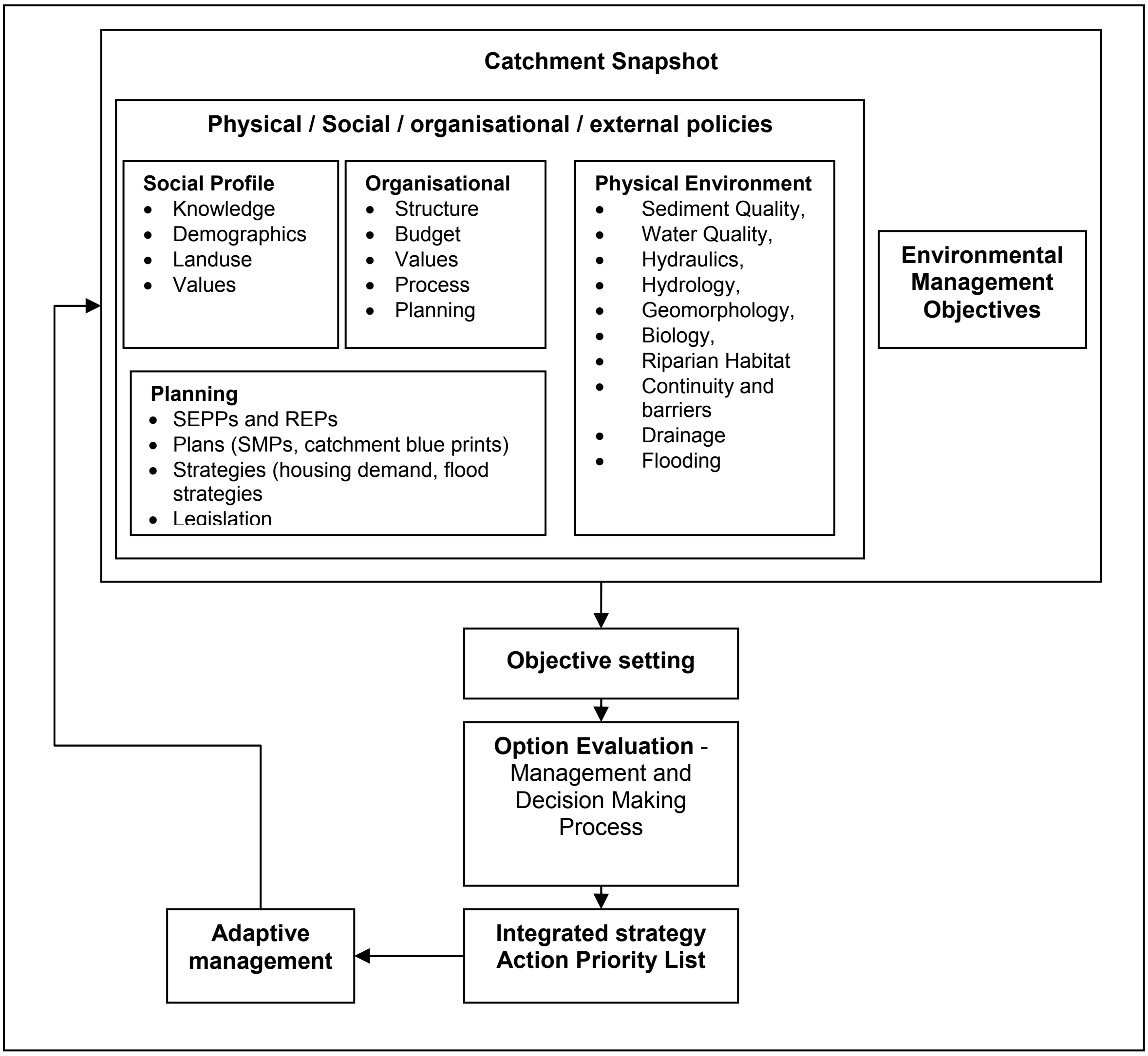

Figure 2 – Five stages of the stormwater planning process

Information assisting the input into the process is proposed to be divided into three tiers based on the complexity, time and cost it takes to collect, and include:

- tier 1 - high order that can be collected in a matter of days;
- tier 2 - detailed site investigation, modeling, surveys etc that would take week; and
- tier 3 - thorough investigation aimed at determining the answer to a specific questions that are not answered through a tier 2 data collection process.

Concurrently, Department of Environment and Conservation is preparing detail on appropriate environmental management objectives on aquatic environment values (stream health, channel form, and receiving waters), terrestrial environment values (riparian zone and bushland), social values (aesthetic, and disturbance) and economic values (flood damage and water demand). These objectives will be related to specific flow management objectives (small, medium and large events), water quality events and riparian / aquatic habitat, that are required to protect the environment from the impact of urban stormwater. Importantly, these objectives may replace those as identified in councils existing SMPs and the update those on the Council Handbook (EPA 1997), as shown in Table 2.

Table 2 - Current best practice stormwater management targets

Pollutant	Current best practice performance objective:
Suspended solids	80% retention of the average urban annual load
Total phosphorus	45% retention of the average urban annual load
Total nitrogen	45% retention of the average urban annual load
Litter	Retention of litter greater than 50mm for flows up to the 3-month ARI peak flow
Coarse Sediment	Retention of sediment coarser than 0.125mm for flows up to the 3-month ARI peak flow
Oil and Grease	No visible oils for flows up to the 3-month ARI peak flow.

(EPA 1997)

The remainder of the paper presents an overview of the physical environment and aquatic ecosystem health component of the catchment snapshot.

5. PHYSICAL ENVIRONMENT / ECOSYSTEM HEALTH MANAGEMENT

Waterways provide numerous benefits to the urban environment and include a range of physical, socioeconomic, cultural and ecological values. While waterways provide important functional aspects such as flood conveyance, waterways also provide important landscape and aesthetic features. Human amenity is also enhanced by water bodies adding to the value of developments, and the intrinsic notion of a clean and healthy waterway.

Important in the identification of urban values is the inherent ecological value of aquatic ecosystems. The condition of an aquatic ecosystem reflects and responds to the processes and state of its catchment and surrounding environment. Therefore, changes to the catchment, riparian zone, or waterway will prompt changes to the ecological structure and function of the ecosystem and its biotic community. Given the interaction between waterways, the degradation of one section of a stream will impact both upstream and downstream environments. For example, erosion in one part of a catchment will be experienced by the downstream ecosystems.

Ecological health has been proposed as a term to gauge the condition of an ecosystem (Costanza *et al.* 1992; Norris *et al.* 1995), with determinants of ecosystem health being identified by Wong et al. (2000) as:

- the structure and function of biological communities;
- the interaction and interdependence of the biological, chemical and physical components of an environment;
- temporal and spatial scales; and
- the response to natural and anthropogenic influences.

Nine physical, chemical and/or biological factors which influence stream communities and ecosystem health, have been identified by Wong et al. (2000) and are shown in Table 3. While each of these factors may have disproportionate impacts on an aquatic ecosystem, each one will ultimately affect the whole community and environment. For example, fish and bacteria are likely to respond differently to changes in habitat and alteration of the carbon supply, but both taxa will be affected by both changes eventually.

It is proposed that an assessment of these factors be integrated into the new stormwater planning framework. Importantly, these factors go beyond an analysis of water quality which has been traditionally used by catchment managers to guide the development of stormwater planning and management strategies. These factors are able to provide a comprehensive understanding of the impacts of urban development on the aquatic ecosystem, and thereby allow the development of remedial strategies which are based on catchment processes.

Table 3 - Nine key factors that influence the ecological health of aquatic ecosystem (after Wong *et al*. 2000)

Factor	Components of each factor	Type of factor		
		Physical	**Chemical**	**Bio**
Biology	The measurement of biology provides an indication of degree of change/disturbance to the balance of species in the ecosystem (related to change in the balance of competition for space and resources and the balance of other physical and chemical factors in this table).			✓
Continuity and barriers	Roads and bridges impact on the connectivity of the waterway and hamper biophysical interactions including hydraulic disturbance, nutrient transfer, habitat availability and corridor connectivity.	✓	✓	✓
In-stream habitat	Indicate disturbance to the interaction between physical factors and stream biota, eg. Changes in the organic composition of benthos impacts food sources, changes in particle size can impact on the presence and location of habitat and shelter and can lead to changes in vegetation composition and location which also impacts on the supply of carbon to the system	✓		✓
Riparian habitat	Disturbance to the floodplain and to fluvial processes can impact on the health of the creek. For example the loss of aquatic and riparian habitat and disruption to nutrient cycling/food supply. The removal of riparian vegetation reduces the roughness of the channel banks thus reducing resistance to erosion. The loss of riparian zone also influences in-stream light availability (through shading) and temperature.	✓		✓
Water quality	Changes in water quality parameters reflect impacts of urbanisation on stream biota, for example DO is a relatively simply measure. However, measuring baseflow DO night and morning the difference in values can be used as a measure of the response of the photosynthetic stream community to urbanisation (ie increase nutrient runoff).	✓	✓	✓
Sediment quality	Sediment quality (including organic and inorganic particulates) is a critical element in determining ecosystem health. Many pollutants are associated with, and transported in, the particulate form and as such tend to accumulate in stream sediments. A simple field test for gross sediment pollution is to disturb the sediments and check for odours such as hydrocarbons. If hydrocarbons odours can be detected with human senses, it is likely the sediments are grossly polluted.	✓	✓	
Geomorphology	Geomorphology reflects the arrangement, behaviour and stability of the basic physical materials in the environment. The physical processes which underpin the structure of waterways can also influence habitat availability and therefore changes to that structure can indicate changes to ecosystem health and stability of biotic populations.	✓		
Hydrology and Hydraulics	% effective imperviousness has been shown to be correlated to alterations in pollution concentrations, flow distribution and geomorphologic changes. This results in changes to the instream biota. Eg changes to stream hydraulics impacts on nutrient transfer, availability of refuge for instream biota, distribution of sediments and the vegetation associated with geomorphic units. Changes in the frequency of event flows such as the pre-development 1.5-2yr ARI flow impacts on the lifecycle of stream biota. By measuring the change in this frequency we can gauge the impact of urbanisation on ecosystem health.	✓ ✓		

An assessment of these factors is undertaken to gain an understanding of the ecological health of the aquatic environment, and assist in the determination of the main stressors on the on the waterways. From this understanding it is therefore possible to make a comprehensive assessment of in-stream issues and effects, and have a more informed works and implementation strategy, which covers the breadth of structural and non-structural practices.

The application of the factors outlined in Table 3, into the new planning framework involves a two stage process of desk-top review and infield testing and verification, whereby an ecological health rating from very poor to very good can be applied. The assessment process is described in the next section.

5.1. Aquatic ecosystem health process

An assessment of the ecosystem health by a council involves a series of tasks, which revolve around an in-house desktop analysis of existing information and a subsequent field assessment of aspects of the nine factors of creek health to support and verify findings. These tasks are described below as:

1. Desktop analysis - the desktop investigation will require a process of ‘data mining’ where relevant literature, studies, and observations are collected and analysed to inform the historical changes to, the temporal geomorphic changes in the creek bed slope and meandering, and the stormwater improvement works in local catchment. The desktop analysis will be used to identify sites for detailed assessment.
2. Assessment of the local catchment health - a field assessment of the local creek will complement the initial desktop analysis and investigate the nine factors which impact on ecosystem health. The investigation will enable the validation of reach boundaries, the identification of geomorphic, ecologic and hydraulic relationships and the profiling of reach character and condition.
3. Determining ecosystem targets and objectives - following inspection of the site and review of available information, key members of the project team will meet to establish preliminary management objectives for the creek and surrounding catchment. These preliminary objectives will inform the management decisions required to identify the solutions to ensure the long term stability, integrity and health of the catchment.
4. Catchment health and condition snapshot - the catchment creek health and condition report will summarise the outcomes of the above tasks, identifying the issues that affect the healthy functioning of the catchment.

This methodology is now being refined and trialed to ensure its applicability.

6. CONCLUSIONS

Urban stormwater management planning in NSW has for the past five years been directed by the NSW Government Stormwater Trust through its requirement of all urban councils to prepare a stormwater management plan. This requirement has been supported by five rounds of grants, providing over $65 million to implement these plans. Significantly since the finalisation of the plans four years ago, there has been no direction from government, with several councils developing their own planning processes. These processes reflect the needs of councils to include stormwater quality and quantity issues at a minimum and potentially extend into other related facets of stormwater management including, stream health, integrated water cycle management, and social and organisational capacity.

The direction that councils are applying for new stormwater management planning are now being reflected in the development of State level guidance as shown through this paper to include a five step process for managing urban stormwater. The process is being developed in close consultation with councils and will be ready in 2005. The implementation of the process will be left to councils when the new *Managing Urban Stormwater: Council Handbook* is released, and the NSW Government Stormwater Trust is concluded.

7. ACKNOWLEDGEMENTS

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