HUNTER & CENTRAL COAST

WATER SMART MODEL PLANNING PROVISIONS 2012

Prepared for the Hunter & Central Coast Regional Environmental Management Strategy (HCCREMS)

Authors: BMT WBM

Contact Details:

HCCREMS

PO Box 3137

THORNTON, N.S.W. 2322

Phone: 02 4978 4020

Fax: 02 4966 0588

Email: envirodirector@huntercouncils.com.au

Suggested Bibliographic Citation:

HCCREMS 2012, *Water Smart Model Planning Provisions 2012* , BMT WBM

ISBN

CONTENTS

LIST OF FIGURES

LIST OF TABLES

1 INTRODUCTION

1.1 Natural and Urban Water Cycles

The natural water cycle is a fundamental ecological process that constantly mediates, shapes and maintains, weather, climate, landforms, soils, and ecological communities. The natural water cycle involves the exchange of water between storages including oceans, the atmosphere, glaciers, vegetation, soil, aquifers, wetlands, lakes, rivers and estuaries. Water transitions between these storages through physical processes including melting, freezing, evaporation, transpiration, precipitation, interception, surface runoff, infiltration, percolation, interflow, groundwater flow, stream flow and tidal exchange.

Urban development changes natural water cycle processes and impacts on ecological communities that rely on these processes. The urban water cycle can be viewed as the movement of water through a particular urban area and adjacent catchments that provide water resources or services on which the urban area depends, including the river basin where the urban area is located; external catchments and/or groundwater aquifers that supply water to the urban area; and creeks, rivers, wetlands, lakes, estuaries, coastal waters and other receiving environments that assimilate pollutants. Urban development typically not only changes the natural water cycle processes within the local catchment, but also introduces additional processes including the transfer of water from external catchments through water supply systems, and the discharge of this water once used through a wastewater system.

Typical natural and conventional urban water cycle processes are shown in Figure 1-1. Figure 1-1 also outlines a typical water smart development (or water sensitive urban design (WSUD)) approach to managing the impacts on the natural water cycle when urban development is introduced.

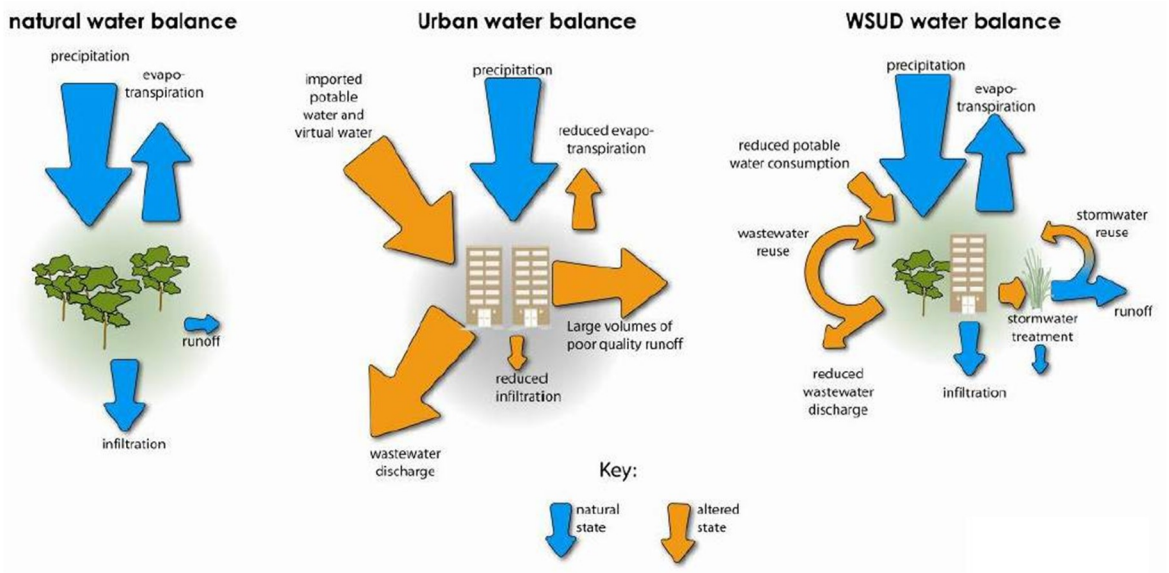

Figure 1-1 Water Balance (Wong and Hoban, 2006) WSUD and Resilience to Climate Change 2006 1st Hydropolis)

1.2 Conventional Urban Development

Conventional development often causes significant physical changes to natural vegetation, soils, streams, topography and catchment imperviousness. The physical changes in conventional developments significantly reduce the potential for interception, evaporation, transpiration, percolation and infiltration of rainfall. This has the related impact of reducing groundwater recharge and flow, whilst increasing surface runoff. These changes often occur too rapidly and are too extensive for ecological communities to adapt to the altered hydrologic conditions.

Conventional development has traditionally focused on the management of infrequent high surface runoff flows with a focus on reducing nuisance flooding for urban communities. Limited consideration of other water cycle processes and associated impacts on ecological communities has typically been undertaken. The management of infrequent high surface runoff flows has typically been addressed through the provision of drainage systems to efficiently convey surface runoff to receiving environments. These efficient drainage systems significantly increase the volume and rate of surface runoff resulting in increased stream erosion and sedimentation; impacts on receiving environment ecology; risks to recreational users; degraded aesthetics; and increased flooding. These drainage systems also efficiently convey elevated pollutant loads, further impacting on the receiving environments.

The impacts of conventional development are typically not limited to the local catchment, with regional catchments impacted by the construction of dams supplying large volumes of highly treated water to urban communities. A high proportion of this imported drinking quality water is then lowered in quality prior to transfer through a centralised sewerage system for partial treatment and discharge to a receiving environment. This approach has been enormously successful in improving the quality of human life, particularly through the reliable provision of clean water and reduction in the risk of infectious diseases. However, this large-scale centralised management of the urban water cycle has also led to significant environmental, social and economic impacts.

Society is now at a point where changing community values, technology, economic circumstances and climate change have increasingly raised questions about the future of urban water management. The community now places a much higher value on natural environments, and has a greater awareness of the interactions between the urban water systems, the natural environment and the availability of water. As a consequence, communities are increasingly expressing visions for significantly higher standards of treatment for stormwater and sewage discharges. In addition, the community has expectations for conservation of water and environmental flow releases downstream of dams.

A consensus is emerging that the long-term continuation of conventional urban water management practices is ‘unsustainable’ on a variety of social, economic and environmental grounds. This viewpoint seeks the development and implementation of modified approaches to urban water management that are part of a broader framework of ‘ecologically sustainable development’. The urban water cycle has an important bearing on the conservation of land resources and biodiversity, and intrinsically affects the quality of life for all urban inhabitants, present and future. A sustainable urban water cycle would make a significant contribution to the achievement of ecologically sustainable development. Out of this desire for sustainable urban water systems, the concept of Water Smart Development has emerged.

1.3 Water Smart Development

It is no longer tenable to consider the various types of urban water flows in isolation from each other. The urban water cycle needs to be considered as a system, so as to include all water flows, such as water supply, stormwater and wastewater. These flows have quantitative and qualitative impacts on land, water quality and biodiversity, and the public's aesthetic and recreational enjoyment of waterways.

Water Smart Development (WSD) is development that is designed, constructed and maintained so as to minimise impacts on the natural water cycle. It is part of the contemporary trend towards more 'sustainable' solutions that are cost effective, protect the environment and improve social outcomes. WSD can help counteract many of the negative impacts of conventional urban development on the natural water cycle. A lot scale example of typical conventional and water smart development is shown in Figure 1-2.

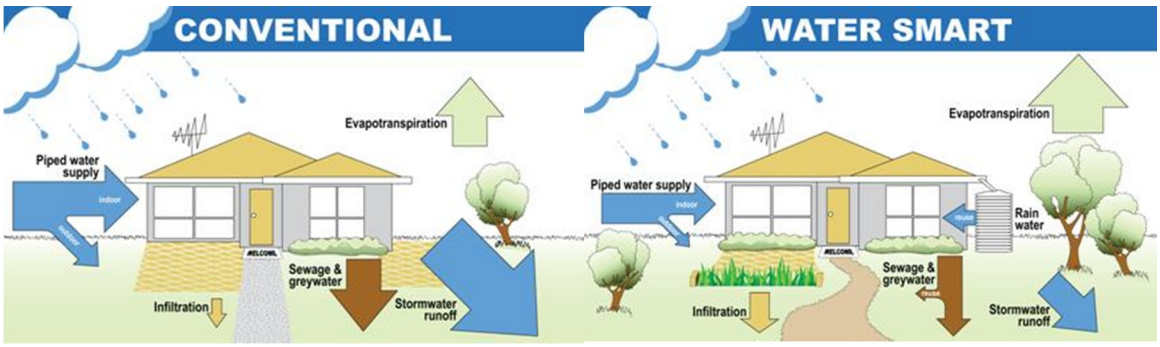

Figure 1-2 Lot Scale Conventional and Water Smart Development (HCCREMS, 2011)

WSD promotes a more decentralised approach that is more attuned to natural hydrological and ecological processes. It gives greater emphasis to source collection, treatment and use of water flows as part of an integrated system that may be applied in addition to, or in lieu of conventional measures. WSD allows for the integrated management of water supply, wastewater, stormwater, groundwater, flooding and riparian lands.

WSD aims to replicate natural water cycle processes by detaining, retaining, harvesting, filtering, infiltrating and biologically treating surface runoff to reduce the concentrations and loads of pollutants discharged to the receiving environments. In addition, harvesting and infiltrating runoff reduces the volume of runoff which otherwise has the potential to generate additional pollutants through elevated erosion and sedimentation in the receiving environments.

Water is our most precious resource and existing urban water supply systems are approaching their limits. Expanding existing water supply dams and creating new water supply sources is becoming increasingly difficult and there are growing community demands to increase environmental flows downstream of existing dams. As the urban population increases, more efficient use of water also becomes increasingly important. New development, redevelopment and alterations to existing buildings can contribute to environmental sustainability by incorporating a variety of water conservation measures.

Demand management processes should be applied to reduce, redirect, avoid or optimise demand for water where unmanaged demand would exceed environmental limits and cause degradation of natural resources.

1.4 IWCM and WSUD

Interactions between the strategic planning process and WSD are outlined in Figure 1-3. The strategic planning process as it relates to WSD is discussed in Section 4. Water Smart Development essentially comprises integrated water cycle management (IWCM) and water sensitive urban design (WSUD). Typically, IWCM is considered upfront during the earlier stages of development planning when key decisions are required on fundamental water management issues such as ensuring adequate water supply is available to sustain the future community and that an appropriate wastewater management system is feasible. WSUD, whilst considered during early stages of development planning, is typically implemented at the local scale within specific small or large developments. Whilst IWCM can also occur at the small or large development scale, regional decisions made on how water supply and wastewater will be managed for future development typically occurs at an earlier stage, which then effectively constrains sustainable options for local management of water supply and wastewater.

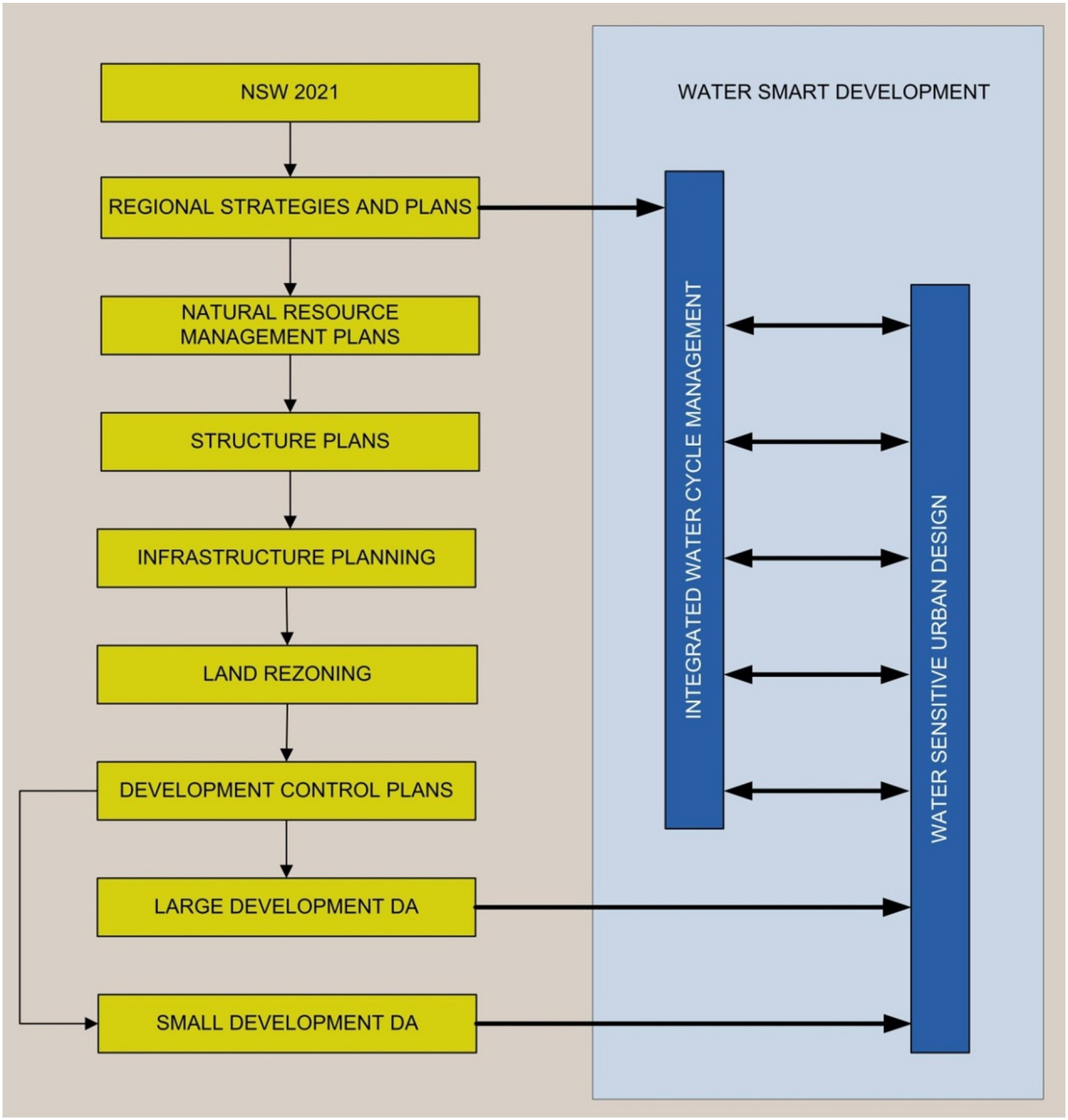

Figure 1-3 Planning and WSD

These Model Planning Provisions are structured as follows:

- Section 2 summarises sections of NSW legislation that are particularly relevant to WSD.
- Section 3 provides advice for developing a WSD policy including consideration of principles, values, visions, objectives and targets.
- Section 4 provides an outline of the strategic planning process and how this interacts with progressing WSD throughout the various planning stages.
- Section 5 provides guidance on WSD site planning for small developments that comprise the bulk of development applications that are assessed by councils.
- Section 6 provides guidance on WSD site planning for large developments that although representing a minor proportion of development applications assessed, represent the developments that have the potential to impact most on receiving environments.

The target audience for these provisions is council officers who are tasked with; developing WSD policy; undertaking strategic planning for urban development; managing natural resources; assessing small and large scale developments; managing constructed assets; and providing engineering support to planners. The provisions may also assist engineering consultants, land developers, landscape architects, and building industry professionals involved in the formulation of WSD strategies.

2 LEGISLATION

2.1 Environmental Planning and Assessment Act 1979

The *Environmental Planning and Assessment Act, 1979* (EP&A Act) is the prevailing legislation governing the planning process in NSW including the roles and responsibilities of government, other 'bodies', applicants and other parties in the preparation of Environmental Planning Instruments (EPIs), other plans and policies, development assessment, certification and enforcement. The following paragraphs set out key aspects of the EP&A Act relevant to these planning provisions.

Parts 1 and 2 of the EP&A Act set out the Objects of the Act; key definitions; and the roles of the Minister; and Director-General of the Department of Planning and Infrastructure (DoPI). Section 5 outlines the Objects of the Act including objectives specifically relevant to WSD, i.e.:

> *"(a) to encourage:*
>
> *(i) the proper management, development and conservation of natural and artificial resources, including agricultural land, natural areas, forests, minerals, water, cities, towns and villages for the purpose of promoting the social and economic welfare of the community and a better environment,*
>
> *…*
>
> *(vii) ecologically sustainable development".*

Part 2A commenced in early 2009 and relates to the functions of other planning 'bodies' including the Planning Assessment Commission (PAC) and Joint Regional Planning Panels (JRPPs). For various categories of development (as nominated in the EP&A Regulation or under and EPI), development applications must be reported by the local council in question to the PAC or relevant JRPP. Councils continue to be responsible for the assessment of applications but the panels make the determination and councils must abide by that determination.

Part 3 relates to EPIs and other plans which follow the following hierarchy:

- State Environmental Planning Policies (SEPPs);
- Regional Environmental Plans (REPs);
- Local Environmental Plans (LEPs);
- Development Control Plans (DCPs).

SEPPs generally relate to broader strategic planning policies applicable to the whole State or certain forms of development. Many SEPPs have been repealed in recent years to consolidate similar/related provisions into singular SEPPs or because the new system of 'Standard' or 'Template' LEPs will cover the provisions that were previously under SEPPs (see below). SEPPs are prepared by the DoPI at the instruction of the Minister. Key SEPPs for WSD are discussed in Section 2.2.

REPs have historically dealt with defined geographical areas (parts of an LGA or multiple LGAs). Reforms to the planning system in 2008 effectively made any existing REP a SEPP so as to remove one level of plan types. REPs are also prepared by the DoPI.

LEPs continue to set out the land use zoning and permissibility provisions which guide the development application process. LEPs are traditionally prepared by local councils although the Minister, through the DoPI, can instruct one or more councils to prepare an LEP. One of the key reforms in recent years commenced in 2006 with the introduction of a 'Standard' or 'Template' LEP which provides a standardised format for LEPs and includes a number of mandatory and optional clauses which must be used by all councils with only limited flexibility for 'local provisions' (refer Section 2.3). The purpose of the Standard LEP is to provide a singular LEP for each LGA and to provide a more consistent approach to format with standard clause references, zone names and certain mandated permissible/prohibited uses in those zones. The DoPI has instructed that all key numeric standards (such as height, floor space ratio, allotment size, etc) now be within the LEP rather than a DCP (refer Section 2.3). In addition, cross-reference to other documents (e.g. other legislation, DCPs, local policies/guidelines) is not permitted.

Most councils have been directed to update their LEPs in the Standard format by 2012 and ultimately, when all councils have prepared their Standard LEP, many of the provisions from various SEPPs and REPs will be incorporated into the LEPs and more SEPPs and REPs will be repealed.

Another key planning reform occurred in 2008 with the introduction of Exempt and Complying Development. This planning reform aimed at identifying development that does either not require any form of development approval, or reduces development approval times for development that meets basic criteria. Further discussion on the Exempt and Complying Development reforms is provided in Section 2.2.2). The Standard LEP includes Schedules where the Exempt and Complying Development types and criteria must be stated and these cannot be inconsistent with any overriding SEPP.

DCPs are local level plans that specify the detailed provisions to control development such as building setbacks, solar access requirements, WSD measures, etc. DCPs can be quite extensive documents and provide the bulk of controls against which development is assessed by council officers (refer to Section 2.5).

Part 3A of the EP&A Act relates to the development assessment and determination of major developments (e.g. mining, expansive residential and commercial developments, other industry, etc). This section of the EP&A Act was repealed on 1 October 2011 and the substantive provisions of the repealed Part 3A transferred (with some adjustments) to SEPP (State and Regional Development) 2011 (refer Section 2.2.1). The relevant Joint Regional Planning Panel (JRPP) and the Minister are the determining authorities for most State and Regional Development.

Part 4 relates to development assessment and contains the substantive provisions guiding the process for preparation, lodgement, consultation, assessment and determination of development applications. Some of the key Sections under Part 4 include:

- s79C - which sets out the matters for consideration in the assessment of a development application;
- s80A – which relates to the imposition of conditions of development consent;

- s93F – which provides for developers to enter into an agreement with council (or other planning authority) to provide monetary or other contributions towards offsetting the impacts of the development;

- s94 – which provides for councils to prepare a 'Contributions Plan' permitting the levying of monetary, land or other contributions from developers towards catering for the demands of future populations on public facilities (e.g. open space, recreation, traffic, stormwater, etc)

- s97 – which allows an appeal by the applicant to the Land and Environment Court against refusals or if they are not satisfied with the conditions of development consent imposed.

Part 4A relates to certification of development after development consent and essentially relates to the detailed engineering specifications applicable to the development. Key certificates include:

- Construction Certificates – there can be several of these for a given development consent and they may be required prior to commencement of construction, at certain completed stages and upon final inspection;

- Subdivision Certificates – which are only issued when all works are completed so that the land is serviced, etc and capable of being registered as a legal lot that can then be eligible for transfer of sale.

- Occupancy Certificates – which must be issued prior to a use commencing.

Certificates can be either issued by the local council or a private certifier. These provisions came into force in 1997 and reforms in 2008 introduce greater scrutiny on private certifiers to address issues associated with malpractice.

Part 5 of the Act relates to environmental assessment of other forms of development which fall outside Part 4 (or the previous Part 3A) or which are nominated as Designated Development by an EPI or the Regulation and require a detailed Environmental Impact Statement (EIS).

Part 5.1 of the Act was introduced in 2011 to reflect the changes associated with the repeal of Part 3A and the introduction of State Significant Infrastructure (see Section 2.2).

Part 8 contains numerous miscellaneous provisions including Section 149 which relates to Planning Certificates. The Regulation (Schedule 4) contains the details of the information to be included in Planning Certificates.

2.2 State Environmental Planning Policies (SEPPs)

2.2.1 SEPP (State and Regional Development) 2011

This SEPP provides a new regime for the assessment and determination of state and regionally significant development and its substantive parts replace the previous Part 3A regime. The SEPP introduces three classes of development, State Significant Development, State Significant Infrastructure and Regional Development.

State Significant Development (SSD) includes major mining, manufacturing, warehousing/distribution, agriculture, industries, education, correctional, recreational/tourist, health,

transport, water treatment and storage, ports and waste management facilities with specific minimum capital investment values (CIVs) developments. There are no residential or retail/commercial developments within this category. SSD also includes 'specified sites' including Honeysuckle and Warnervale Town Centre. Development Control Plans (DCPs) do not apply to State Significant Development (Clause 11). The Minister for Planning and Infrastructure is the consent authority.

State Significant Infrastructure (SSI) includes ports, wharfs and boating facilities with a CIV of more than $30 million, rail infrastructure with a CIV of more than $50 million, water storage or water treatment facilities with a CIV of more than $30 million (or desalination plants with a CIV of more than $10 million), pipelines, submarine telecommunications cables and certain development in reserved land under the National Parks and Wildlife Act 1974 with a CIV of more than $10 million. It also includes some former Part 3A Projects including dredging for berthing at Mayfield, Port of Newcastle and the Coolah to Newcastle gas pipeline. The Minister for Planning and Infrastructure is the consent authority.

Regional Development includes development specified in Schedule 4A of the EP&A Act including development with a CIV of more than $20 million, council related development over $5 million, Crown development over $5 million, Private infrastructure and community facilities over $5 million, Eco-tourist facilities over $5 million, certain Designated Development and certain coastal subdivision. The relevant Joint Regional Planning Panel (JRPP) is the consent authority.

In most circumstances, local councils and the general public have an opportunity for comment by virtue of the consultation requirements of the EP&A Act.

2.2.2 SEPP (Exempt and Complying Development Codes) 2008

State Environment Planning Policy (Exempt and Complying Development Codes) 2008 (the CODES SEPP) came into force on 27 February 2009 and introduced the concepts of exempt and complying development.

Exempt Development is development which does not require any form of approval or licence so long as it meets any standards for that type of development as specified by the SEPP (or an LEP which contains the same provisions within its Schedules). Exempt development typically comprises minor structures including such items as decks, cubby houses, garden sheds, driveways, retaining walls, pathways, rainwater tanks. Exempt development requires a self-assessment and accordingly, if a land owner/developer assesses that a development activity is exempt, the council will have no opportunity to impose restrictions on such development other than enforcement if the self-assessment was undertaken in error and the development completed.

Complying Development is development which requires consent in the form of a Complying Development Certificate (CDC) so long as it is permissible with consent in the land use zone in which it is being carried out and meets any standards for that type of development as specified by the SEPP. There are seven Complying Development Codes as follows:

- General Housing Code – which includes standards for new single and two storey dwellings as well as alterations and additions to single and two storey dwellings on residential zoned land;
- Rural Housing Code - which includes standards for new single and two storey dwellings as well as alterations and additions to single and two storey dwellings on rural zoned land;

- Housing Alterations Code - which includes standards for more minor alterations and additions to single and two storey dwellings on any land;
- General Development Code – which currently only relates to bed and breakfasts in existing dwelling houses;
- General Commercial and Industrial Code – which includes standards for minor alterations and change of use of certain types of lawful existing non-residential development;
- Subdivision Code - which includes standards for strata subdivision of a building other than a dual occupancy; and
- Demolition Code - which includes standards for demolition of certain buildings.

Whilst there are a myriad of standards applicable to different types of Complying Development, the following standard is particularly relevant to WSD and is applicable to Complying Development under the General Housing Code and Rural Housing Code:

"*3.32 Drainage*

(1) All stormwater drainage collecting as a result of the erection of, or alterations or additions to, a dwelling house or ancillary development must be conveyed by a gravity fed or charged system to:

(a) a public drainage system, or

(b) an inter-allotment drainage system, or

(c) an on-site disposal system.

(2) All stormwater drainage systems within a lot and the connection to a public or an inter-allotment drainage system must:

(a) if an approval is required under section 68 of the Local Government Act 1993, be approved under that Act, or

(b) if an approval is not required under section 68 of the Local Government Act 1993, comply with any requirements for the disposal of stormwater drainage contained in a development control plan that is applicable to the land."

This may require an assessment of compliance with a council's DCP, which highlights the need to have clear and quantifiable development controls in DCPs (refer Section 2.5). Complying Development requires an assessment, by council or an accredited certifier, against the 'Standards' stated in the respective Codes and against the provisions of the BCA. In relation to WSD, the Standards in the SEPP are basic and do not identify specific controls. However, controls can be included in a DCP and compliance against these must be demonstrated. Controls included in the DCP can be in addition to those provided in the SEPP, but they must not conflict with the SEPP requirements.

Relevant conditions which may be attached to CDCs and are generally common to the above Codes include:

"Compliance with plans

Works must be carried out in accordance with the plans and specifications to which the complying development certificate relates.

Sedimentation and erosion controls

Run-off and erosion controls must be effectively maintained until the site has been stabilised and landscaped.

Staging construction

(1) If the complying development is the erection of, or alterations or additions to, a dwelling house, the roof stormwater drainage system must be installed and connected to the drainage system before the roof covering is installed.

(2) Any approval that is required for connection to the drainage system under the Local Government Act 1993 must be held before the connection is carried out."

A council or an accredited certifier is not able to impose more stringent requirements on a development than the standards stated in the respective Code unless a local variation is in place. Such a variation would require a detailed submission from the council to the DoPI and inclusion of global variations in Schedules 2, 3, 4 or 5 of the SEPP. The Codes SEPP does not permit additional conditions to be imposed on a CDC, other than if the development attracted a Section 94 monetary contribution, in which case an appropriate condition could be added.

2.2.3 SEPP (BASIX)

State Environmental Planning Policy (Building Sustainability Index: BASIX) 2004 (BASIX) continues to be the overriding and mandatory instrument for setting water, energy efficiency and thermal comfort targets for 'BASIX affected development' which includes:

- the erection of a residential building containing one or more dwellings ('BASIX affected building');
- a change of use of by which a building becomes a BASIX affected building;
- development involving the alteration, enlargement or extension of a BASIX affected building, where the estimated construction cost of the development is $50,000 or more; and
- development for the purpose of a swimming pool or spa (or combination of the two) that services only one dwelling and that has a capacity (or combined capacity) of 40,000 litres or more.

Residential development applications must be accompanied by a BASIX Certificate which indicates compliance with the prescribed sustainability targets before development consent can be granted.

Applicants complete the on-line BASIX assessment to obtain a BASIX certificate, which can be printed only after they have selected sufficient water saving controls to meet the efficiency target for their location. The current water efficiency target for the whole Hunter Central Coast region is 40% (compared to a specified historical level of use), with the exception of the Upper Hunter LGA where it is 30% on account of the lower rainfall and higher evaporation.

To ensure that BASIX is the sole system of assessment for the above sustainability targets, SEPP BASIX disables the provisions of SEPP 1 and the ability to vary a development standard. It also renders inoperable any '*competing provisions*' in an EPI or DCP "to the extent to which they aim to reduce consumption of mains-supplied potable water". This includes provisions for residential development relating to:

- alternative water sources such as rain water tanks or recycled water systems;
- the water efficiency of tap fittings and/or flow regulators;
- the water efficiency of showerheads;
- the water efficiency of toilets and their flushing mechanisms;
- the volume of and covering of swimming pools;

- the water efficiency of washing machines and dish washers; and
- garden irrigation systems.

Such provisions for non-residential development (e.g. industrial and commercial) are not competing provisions and therefore continue to have effect.

Furthermore, EPI and DCP provisions which address aspects of sustainability other than residential water, energy efficiency and thermal comfort, continue to have effect in relation to development proposals assessed by BASIX. For instance, provisions to address WSD objectives are not overridden, even where they require, for example, rainwater or stormwater harvesting to retain stormwater on-site, although alternatives should be considered and/or provided for.

Councils are also not precluded, for residential development, from offering *incentives* which are aimed at encouraging a reduction in the consumption of mains-supplied potable water. For example, to encourage efficiencies over and above the minimums required under BASIX, councils could offer reductions in land rates or offer Section 94 contribution concessions.

2.3 Standard Instrument LEP

The Standard Instrument (SI) Principal LEP provides a mandated format for all new LEPs in NSW.

Part 1 Preliminary of the SI LEP is to specify the name of the plan, its commencement, aims, where the plan applies, the consent authority for the plan and the relationship with other EPIs. There is scope here for councils to include specific aims, some of which may relate to WSD.

Part 2 of the SI LEP relates to permitted and prohibited development and specifies the land use zones that are to be used under the plan. Land use zones are mandated, as are certain objectives, and certain forms of permissible and prohibited development. Councils can add to but not detract from the mandated objectives and forms of development. Land use zoning can and should be used to limit development either partially or entirely on land which a council deems to have certain environmental values.

Part 3 relates to Exempt and Complying development and amongst other things, introduces Schedules 2 and 3 of the SI LEP which specify the various types of and criteria for these forms of development.

Part 4 of the SI LEP provides for Principal Development Standards. These are generally numeric standards and in most cases, these are to be spatially identified on maps accompanying the LEP. Councils can add to the mandated objectives and specify the numeric standards to be used. For example, development standards such as allotment size can be used by councils to control the intensity of development in localities draining to sensitive receiving environments.

Part 5 is titled Miscellaneous Provisions and provides certain other compulsory provisions such as tree preservation, heritage, bush fire and the like.

The DoPI has provided guidance on the inclusion of additional Parts to the LEP which typically include a Part 6 Urban Release Areas and Part 7 Other Local Provisions. The Other Local Provisions part provides scope for mandated optional clauses to address specific environmental or geographic

issues such as natural resource management as well as other bespoke provisions to deal with unique local circumstances.

2.4 Model Local Provisions

A number of mandatory and optional clauses relating to natural resource management (Model Local Provisions) have been "settled" by Parliamentary Counsel (PC) and other Draft Model Local Provisions are expected to be "settled" in the near future.

Model Local Provisions are not part of the SI LEP and are optional, but should a council wish to have a clause relating to one of these matters, it must use the relevant Model Local Provision clause, rather than its own wording.

Previously "settled" Model Local Provisions relating to natural resource management include Flood Planning, Foreshore Building Lines and Acid Sulfate Soils. Practice Notes for Draft Model Local Provisions relating to natural resource management were publicly exhibited by the DoPI in 2010. These included the following Practice Notes that are of particular relevance to WSD:

- Biodiversity (Terrestrial);
- Contaminated Land;
- Drinking Water Catchments;
- Flood Planning;
- Groundwater Vulnerability;
- Riparian Land and Waterways;
- Salinity;
- Stormwater Management (Urban Zones); and
- Wetlands.

The DoPI has advised councils to consider using the Draft clauses in Draft LEPs, where appropriate. Departmental Guidance is clear that Model Local Provisions are not intended to contain detailed lists of considerations against which assessment is to occur. That is the function of DCPs.

2.5 Development Control Plans[1]

As indicated, the role of DCPs is to supplement the Act, SEPPs and LEP and provide greater detail on controlling and managing impacts of development. DoPI guidance is that DCPs must be consistent with an LEP and generally should not seek to repeat the provisions of an LEP. In the event of any inconsistency the LEP will prevail.

Where LEPs deal with the primary criteria (development standards) against which development is to be assessed with little or no scope for variation, a DCP can provide a wider range of provisions and a

[1] This Section is adapted text from the *Draft LEP Practice Note – Natural Resource Management and the Standard Instrument*, prepared by the NSW Department of Planning and Infrastructure in 2007 for consultation purposes.

degree of flexibility can be built into the DCP provisions, depending on the circumstances of the case. This can be by way of objectives, performance criteria, development controls or targets, for instance. With regard to NRM, a DCP might include provisions relating to:

- General development controls such as landscaping, soil erosion and sediment control, bushfire prone land, flood prone land, pollution control and management of waste;
- Development controls relevant to specific classes of development, such as residential, industrial, subdivision, dam construction and water based development; and
- Site or locality specific requirements, such as development in particular vegetation types, development on, near or in identified water bodies.

In the past, some LEPs and draft LEPs have includes detailed controls that should be contained in a DCP. This is often because councils have sought the statutory weight of an LEP over a DCP and so that the consent authority has limited or no discretion to vary the controls. However, the DoPI does not support this approach as DCPs do carry determinative weight as:

(a) Section 79C of the EP&A Act prescribes that a consent authority must take into consideration the provisions in a DCP when assessing a development application; and

(b) A number of decisions of the Land and Environment Court of NSW have demonstrated that DCPs can carry determinative weight. Relevant Judgments and Planning Principles can be found on the Court's website and the following summarises the Courts conclusions in this regard:

    - A DCP is a detailed planning document which reflects a council's expectation for parts of its area, which may be a large area or confined to an individual site. The provisions of a DCP must be consistent with the provisions of any relevant LEP however, a DCP may operate to confine the intensity of development otherwise permitted by a LEP;
    - A DCP adopted after consultation with interested persons, including the affected community, will be given significantly more weight than one adopted with little or no community consultation;
    - A DCP which has been consistently applied by a council will be given significantly greater weight than one which has only been selectively applied;
    - A DCP which can be demonstrated, either inherently or perhaps by the passing of time, to bring about an inappropriate planning solution, especially an outcome which conflicts with other policy outcomes adopted at a State, regional or local level, will be given less weight than a DCP which provides a sensible planning outcome consistent with other policies; and
    - Consistency of decision-making must be a fundamental objective of those who make administrative decisions. That objective is assisted by the adoption of DCPs and the making of decisions in individual cases which are consistent with them. If this is done, those with an interest in the site under consideration or who may be affected by any development of it have an opportunity to make decisions in relation to their own property which is informed by an appreciation of the likely future development of nearby property.

A council may also prepare guidelines (e.g. engineering guidelines) or assessment policies for particular matters of concern within their LGA which supplement a DCP. Whilst not of the same

statutory status as a LEP or DCP, such guidelines can be helpful when preparing a development application.

2.6 Local Government Act 1993

The functions of local councils are primarily set out and controlled by the *Local Government Act 1993* (LG Act) and of particular relevance to WSD are Section 64 and Section 68.

Section 64 (in conjunction with Sections 305 to 307 of the Water Management Act 2000) sets out the requirements with regard to Developer Servicing Plans (Section 64 Plans) and the legislation is supplemented by the DEUS Guidelines which provide more detailed methodologies for determining water and sewer charges. Only LGAs which are not covered by a water supply authority can prepare a Section 64 Plan, which can be used to levy for water and sewer supply as well as stormwater and drainage works.

Section 68 of the LG Act requires the approval of council to undertake various water supply, sewerage and drainage work as follows:

"1 Carry out water supply work

2 Draw water from a council water supply or a standpipe or sell water so drawn

3 Install, alter, disconnect or remove a meter connected to a service pipe

4 Carry out sewerage work

5 Carry out stormwater drainage work

6 Connect a private drain or sewer with a public drain or sewer under the control of a council or with a drain or sewer which connects with such a public drain or sewer".

In the case of land within the area of operation of the Sydney Water Corporation or Hunter Water Corporation, Section 68 does not apply. In other circumstances, where a water supply authority is constituted under the Water Management Act 2000, only Item 5 above is relevant for the local council/s in question.

Part 2 Division 3 of the EP&A Regulation provides more details relating to s68 approvals and clause 15(2) specifies that:

(2) In determining an application for the purposes of section 68 of the Act for an approval to do any of the activities to which this clause applies, the council must have regard to the following considerations:

(a) the protection and promotion of public health,

(b) the protection of the environment,

(c) the safety of its employees,

(d) the safeguarding of its assets,

(e) any other matter that it considers to be relevant in the circumstances.

2.7 Water Management Act 2000

The *Water Management Act 2000* (WM Act) includes many provisions which were previously under the *Rivers and Foreshores Improvement Act 1948* (RFI Act) prior to its repeal, including those provisions regarding licences and approvals. The object of the WM Act is the *"sustainable and integrated management of the State's water for the benefit of both present and future generations"* and in particular:

> *"(a) to apply the principles of ecologically sustainable development, and*
>
> *(b) to protect, enhance and restore water sources, their associated ecosystems, ecological processes and biological diversity and their water quality".*

Part 3 of Chapter 3 of the WM Act relates to Approvals and Section 91(2) requires a 'controlled activity approval' for works at a specified location in, on or under 'waterfront land'. 'Controlled activity' and 'waterfront land' are defined by the WMA as follows:

> *"**controlled activity** means:*
>
> *(a) the erection of a building or the carrying out of a work (within the meaning of the Environmental Planning and Assessment Act 1979), or*
>
> *(b) the removal of material (whether or not extractive material) or vegetation from land, whether by way of excavation or otherwise, or*
>
> *(c) the deposition of material (whether or not extractive material) on land, whether by way of landfill operations or otherwise, or*
>
> *(d) the carrying out of any other activity that affects the quantity or flow of water in a water source.*
>
> *…*
>
> ***waterfront land** means:*
>
> *(a) the bed of any river, together with any land lying between the bed of the river and a line drawn parallel to, and the prescribed distance inland of, the highest bank of the river, or*
>
> *(a1) the bed of any lake, together with any land lying between the bed of the lake and a line drawn parallel to, and the prescribed distance inland of, the shore of the lake, or*
>
> *(a2) the bed of any estuary, together with any land lying between the bed of the estuary and a line drawn parallel to, and the prescribed distance inland of, the mean high water mark of the estuary, or*
>
> *(b) if the regulations so provide, the bed of the coastal waters of the State, and any land lying between the shoreline of the coastal waters and a line drawn parallel to, and the prescribed distance inland of, the mean high water mark of the coastal waters,*
>
> *where the prescribed distance is 40 metres or (if the regulations prescribe a lesser distance, either generally or in relation to a particular location or class of locations) that lesser distance. Land that falls into 2 or more of the categories referred to in paragraphs (a), (a1) and (a2) may be waterfront land by virtue of any of the paragraphs relevant to that land."*

Development requiring such an approval is designated under Section 91 of the EP&A Act as 'Integrated Development' and the consent authority (e.g. council) is required to refer the development application to the relevant 'approval body' which is currently the NSW Office of Water. The approval body is required to inform the consent authority whether it would be prepared to grant approval and if

so, the general terms of that approval. The consent authority cannot grant development consent if the approval body advises that it is not prepared to grant approval.

3 WSD POLICY

3.1 Purpose

A Water Smart Development (WSD) policy is an overarching written statement of a council's commitment to WSD. It outlines relevant principles, values, objectives and targets for WSD. To be effective, a WSD policy should reflect the communities desired values for the environments potentially impacted by development. The policy should be developed through consultation with the community as their support is vital for strengthening the policy. A WSD policy should include the following fundamental elements:

- WSD relevant principles that represent broadly accepted rules, facts and values that apply to all development, and the environments influenced by development. They reflect the broader views and desires of society.
- WSD relevant values that the local community places on the environments that form a source of water for development, and the environments that receive water discharged from the development.
- WSD relevant objectives for the receiving environments that the community desires to see protected from development impacts.
- WSD relevant targets for development that will ensure that receiving environments can be protected and for which the WSD credentials of a development application can be assessed against.

Key elements of a WSD policy are shown in Figure 3-1 along with resources available to assist with development of a policy. These elements are discussed further in the following sections.

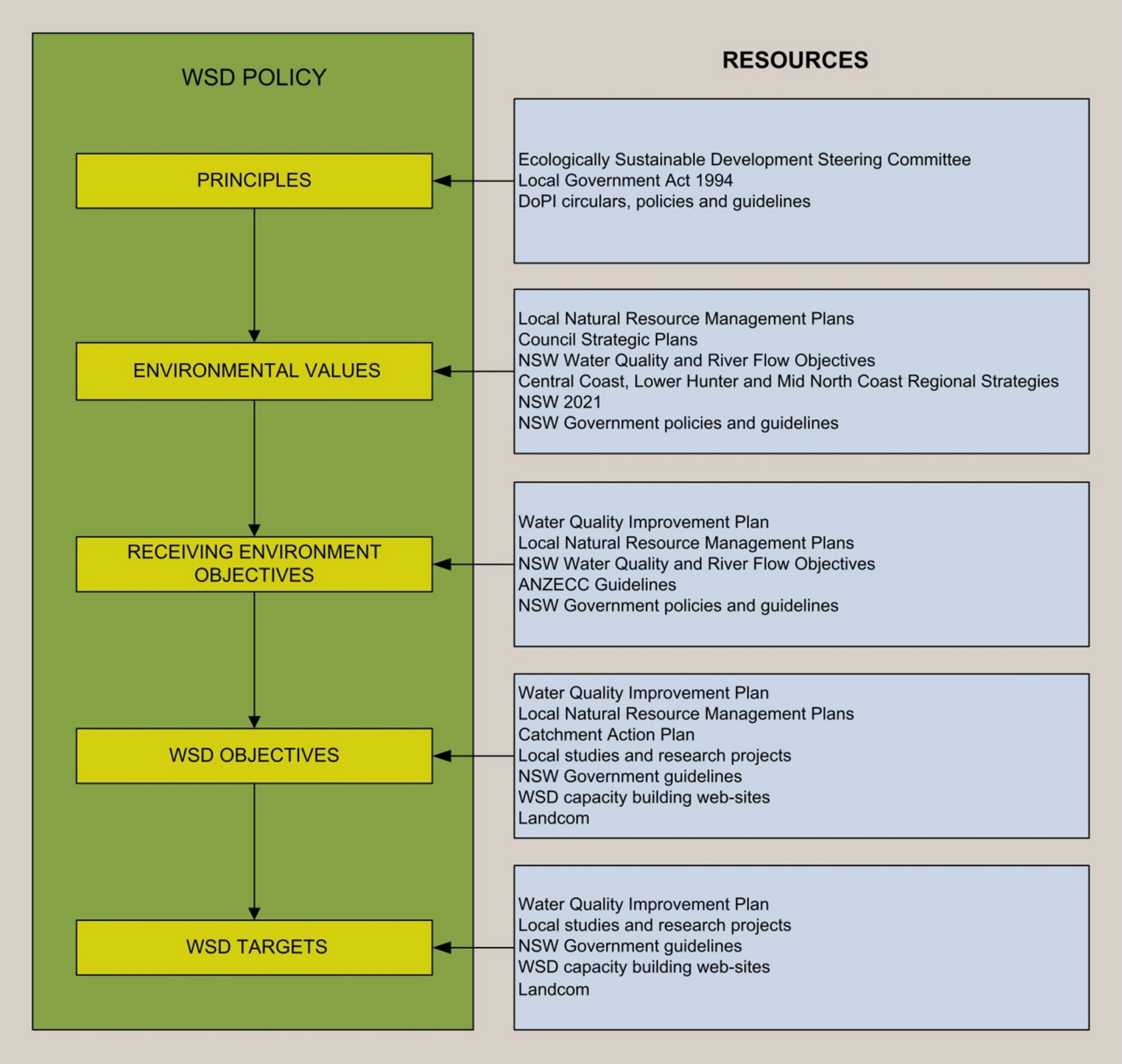

Figure 3-1 Elements of a WSD Policy

3.2 Principles

The overarching principles for WSD are outlined in the *National Strategy for Ecologically Sustainable Development (*Ecologically Sustainable Development Steering Committee, 1992) which sets out the broad strategic and policy framework under which governments co-operatively make decisions and take actions to pursue Ecologically Sustainable Development (ESD) in Australia. The Strategy plays the critical role of setting the scene for the broad changes in direction and approach that governments will take to ensure that Australia's future development is ecologically sustainable. Encouraging the principles of ESD is a specific objective of the *Environmental Planning and Assessment Act, 1979* (EP&A Act) which governs the planning process in NSW.

The National Strategy for Ecologically Sustainable Development includes the following key objectives to promote the principles of ESD:

"To develop and manage in an integrated way, the quality and quantity of surface and groundwater resources, and to develop mechanisms for water resource management which aim to maintain ecological systems while meeting economic, social and community needs."

Ecologically sustainable development requires the effective integration of economic and environmental considerations in decision making processes. Ecologically sustainable development is achieved through the implementation of the following principles and mechanisms:

(a) the precautionary principle, i.e. lack of full scientific certainty should not be used as a reason for postponing controls to prevent environmental degradation where there are threats of serious environmental damage;

(b) inter-generational equity, i.e. the present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations;

(c) conservation of biological diversity and ecological integrity, i.e. conservation of biological diversity and ecological integrity should be a fundamental consideration; and

(d) improved valuation, pricing and incentive mechanisms, i.e. environmental factors should be included in the valuation of assets and services.

Governments work towards ensuring that development decisions which impact on water resources are based on acceptable water quality and quantity criteria, and management requirements to meet those criteria on a sustainable basis are recognised. Efforts should be focussed on using water more efficiently; allocating water for stream flow and other environmental uses; and minimising pollution. It is also important that the efforts to improve water management can be funded and are in the community's interests.

The principles of ecologically sustainable development are a fundamental consideration when making decisions affecting land and water resources including urban water cycle management. As part of a council's charter to properly manage, develop, protect, restore, enhance and conserve the environment, these principles must be considered when:

- undertaking strategic planning for proposed or existing urban areas;
- undertaking regulatory functions, such as approving development applications;
- undertaking service functions, such as roads and stormwater drainage;
- setting rates and charges; and
- managing community land, such as parks and reserves.

3.3 Environmental Values and Visions

Environmental values are those that the community considers are important for sustaining healthy ecosystems and protecting community uses of the environments impacted by development. These environments may include source environments from which water is extracted to support urban development, and receiving environments that assimilate water and associated pollutants from the urban areas. For WSD, key relevant values typically include protection of aquatic ecosystems, primary and secondary contact recreation, passive recreation, drinking water supply, growing aquatic

foods, cultural values and visual amenity. The identified environmental values form the basis for developing a vision for these environments.

Visions outline a future desired condition and are developed through consultation with the local community. For WSD, these visions typically represent the desired conditions of the environments impacted by development. It is common for disagreement within the community on the value of a particular environment due to varying opinions and motivations that broadly reflect the range of views across the community. Council's role is to encourage, facilitate and balance the community views to identify a representative vision. Visions for particular environments are likely to vary, with some having higher value to the community than others.

Community values and visions for the management of catchments and receiving environments are often described within existing plans relevant to local natural resource management including:

- Strategic Plans;
- Stormwater Management Plans;
- Floodplain Risk Management Plans;
- Coastal Zone and Estuary Management Plans;
- Integrated Water Cycle Management Plans;
- Catchment Action Plans; and
- Water Quality Improvement Plans.

Where recent local plans are unavailable, further community consultation may be necessary to confirm community values and visions for WSD. Broader community visions for WSD can also be identified from state and federal government planning policies and guidelines including:

- NSW State Plan;
- NSW Water Quality and River Flow Objectives;
- NSW Wetlands Management Policy;
- Regional Strategies; and
- Regional Plans.

3.4 Receiving Environment Objectives

3.4.1 Overview

Visions outline the future desired condition of a particular receiving environment. Objectives for future development then need to be identified to work towards the vision being achieved. To be effective, each objective should have a measurable target so that the effectiveness of any proposed or implemented action can be assessed. Targets do not necessarily need to be numerical, but must enable comparisons to be made with a desired condition to ensure that actions are protecting or improving the receiving environment. It is also important that targets are realistic, achievable and sustainable.

Each source or receiving environment has particular water quality and hydrological needs that require management within developments to ensure that the ecological, recreational, economic and cultural values are protected. Objectives and targets should be linked to these specific needs. For example, some receiving environments can manage increased runoff volumes from development with limited impact (e.g. lakes, estuaries and oceans), whilst other receiving environments can potentially be significantly impacted (e.g. creeks and wetlands). Other receiving environments may be impacted significantly by increased nutrients (e.g. poorly flushed lakes and lagoons), whilst others may be less so (e.g. well flushed estuaries, large wetlands).

Adoption of uniform objectives for all receiving environments may result in insufficient protection for some environments, and excessive protection for others. In addition, the cost of excessive management of hydrology or water quality for a particular development may not be economically sustainable and therefore inconsistent with ESD principles. Spatial delineation of receiving environments extents can assist with defining receiving environment specific catchment objectives for future development (refer Figure 3-2).

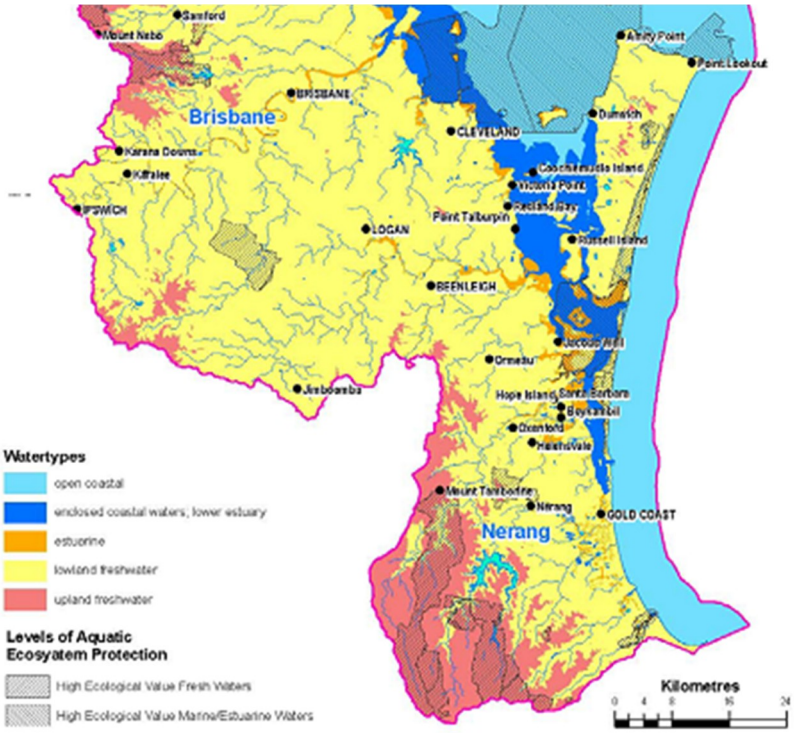

Figure 3-2 Receiving Water Types and Aquatic Ecosystem Protection (QLD DERM, 2009)

In addition to the water quality and hydrological needs of a receiving environment, values of the source or receiving environment including passive recreation, primary and secondary contact recreation, drinking water supply, growing aquatic foods and visual amenity need to be protected. Although, often many of the values can indirectly be protected by addressing the water quality and hydrologic needs of the receiving environments supporting aquatic ecosystems.

The *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZECC, 2000), (the "Australian Water Quality Guidelines") were developed to support the implementation of the National Water Quality Management Strategy (NWQMS). The Australian Water Quality Guidelines are the primary resource of guidance for establishing appropriate objectives and targets for receiving environments. The guidelines place a strong emphasis on understanding the local catchment

conditions and encouraging catchment managers to develop appropriate objectives and targets from a knowledge of local catchment conditions. The ANZECC guidelines were applied to derive the water quality and river flow objectives for most NSW catchments (www.environment.nsw.gov.au/ieo/) and were also applied to identify objectives and targets for the Wallis Lake and Botany Bay Water Quality Improvement Plans (WQIPs).

3.4.2 Groundwater

Groundwater aquifers are layers of permeable soils or rock through which water is able to flow. Groundwater is typically the initial receiving environments for infiltrated stormwater. Contaminants that enter groundwater can persist for timescales that are orders of magnitudes higher than surface water environments, and therefore protection of groundwater from contamination is a high priority. Where infiltrated stormwater is relatively uncontaminated, attenuation and biological treatment of the infiltrated stormwater can occur prior to the groundwater flow intersecting a creek, wetland or other receiving water. In these situations the slower flow assists with treatment and reducing potential pollution.

Developments proposed within the zone of influence of sensitive groundwater dependent ecosystems (particularly groundwater recharge areas) typically must prepare an environmental assessment of the risks of the development to the ecosystem (DLWC, 2002). Groundwater typically will be the source of most flow to wetlands in coastal areas. Changes to the quality and quantity of water entering groundwater can have significant impacts on the wetland habitats. Development may also be located within catchments where aquifers are utilised for drinking water supply (e.g. Tomago sand beds). In these areas, protection of the aquifer from development impacts is of critical importance.

3.4.3 Freshwater Creeks

Many developments will initially discharge into a creek as concentrated flow from a piped or otherwise constructed drainage system. Creeks are often the initial receiving environment where development impacts are observed. Creeks may be impacted by point discharge of stormwater into the streams resulting in localised scouring of banks. More frequent and elevated discharge from impervious surfaces in the development can also increase erosion of stream banks and beds. Stormwater also conveys pollutants into the stream impacting on water quality and smothering of bed sediments that support aquatic fauna.

3.4.4 Coastal Wetlands

Wetlands are areas of land that are wet by surface water and/or groundwater for long enough periods that the plants and animals in them are adapted to, and depend on, moist conditions for at least part of their lifecycle. They include areas that are inundated cyclically, intermittently or permanently with fresh, brackish or saline water. Hydrology is typically the most significant issue for the management of wetlands. All wetlands are integral to landscape processes such as nutrient cycling, detention of flood water and sediment trapping (DECCW, 2010).

Coastal wetlands include estuarine lakes and lagoons, coastal floodplain forests, dune swamps, mangrove swamps and saltmarsh swamps. Many wetlands are ephemeral, that is, they are not permanently wet. The hydrology for estuarine lakes and lagoons, mangrove swamps and saltmarsh swamps is primarily influenced by tides. The hydrology for coastal floodplain forests and dune

swamps is primarily influenced by groundwater, surface water runoff from catchments and higher tides. Ephemeral coastal wetlands are particularly threatened by development within the catchment. Development may indirectly impact on the hydrology, morphology and vegetation characteristics of wetlands, in addition to direct impacts from excavation, filling, over drainage and exposure of acid sulfate soils.

3.4.5 Coastal Lakes, Lagoons and Estuaries

Estuaries contain diverse ecosystems that form the foundation of the coastal food chain. They provide important habitats for a variety of marine and terrestrial plants and animals. Water quality conditions are governed by a range of catchment, marine and estuarine processes.

Seagrasses, macrophytes and other bottom-dwelling plants and animals are extremely important components of estuarine ecosystems that exist in coastal lakes and lagoons. They provide food and shelter to a wide range of fish and importantly threatened seahorses and pipe fishes. Water clarity is important for establishing the depth that seagrasses can grow to and subsequently the area that sea grasses can cover within a lake or lagoon. Suspended sediments washed into a lake or lagoon in excessive levels increase water turbidity and results in light penetrating to a lower depth. In addition to suspended sediments, coarse sediments discharged into lakes can directly cover and smother sea grasses. If seagrasses do not receive adequate light due to increased turbidity or smothering by sediment they are unable to survive and this subsequently impacts on the availability of suitable habitats for the aquatic animals reliant on the seagrass cover (Great Lakes Council, 2009).

Light penetration can also be reduced by excessive algal growth, as a result of nutrients discharged into the lake being taken up by algae. Direct growth of algae on seagrasses can also significantly reduce the amount of light reaching the sea grasses. Whilst the growth and death of algae occurs in cycles, nutrients absorbed by algae in the growth phase sink to the lake bed with the dead algae cells, and over time the concentration of nutrients in the sediments increases. Under particular environmental conditions the nutrients are able to be released from the sediments and recycled by algae. As the concentration of nutrients increases, more frequent and longer lasting elevated algal levels can be sustained between rainfall events that provide additional nutrients.

Estuarine water quality is typically controlled by tidal flows and inputs from diffuse and point sources within the catchment. When compared to coastal lakes and lagoons, more efficient tidal flushing of estuaries assists with maintaining superior water quality. Although, reduced flushing of upper waterway and embayment areas along the estuary typically results in lower water quality in those areas.

3.4.6 Ocean Beaches

Catchments that drain directly onto ocean beaches are usually relatively small. Many small runoff events are captured within the beach sands and filtered prior to flowing as sub-surface flow into the ocean. During larger events, surface flow may occur across the beach causing localised scouring and transfer of pollutants directly into the near shore zone. Typically impacts on ocean beaches from stormwater runoff are relatively short term, with water quality impacts dissipated within several days after conclusion of a large runoff event.

3.4.7 External Catchments

In addition to direct impacts within the catchment of a development, there are other potential impacts on external catchments that form a water supply source for the development and for the assimilation of treated sewage discharges. WSD should also consider impacts on these external environments, particularly during initial planning stages when the potential for implementing integrated water cycle management systems to manage stormwater, flooding, water supply and wastewater is being considered.

3.5 WSD Objectives

The implementation of WSD requires the clear definition of objectives that are to be achieved through its application. These objectives ensure consistency in the delivery and integration of WSD and facilitate achievement of the receiving environment objectives.

For many areas within Australia, such objectives will already have been defined within various management plans (e.g. stormwater management plans, catchment management plans, integrated water cycle management plans, water quality management plans, etc.) that will have included specific input from community and government bodies. Where such material already exists, it should be used as the basis for WSD objective setting.

Objectives can apply at varying scales, such as broad regional objectives that may identify overall goals for receiving environments such as oceans, rivers and estuaries, down to the local scale where specific objectives relevant to WSD may apply to creek health, house lot configurations, and road design.

Whilst the ANZECC guidelines assist with establishing objectives for receiving environments they do not explicitly provide guidance on appropriate objectives and targets for catchments and development that are necessary for protecting the receiving environment values. Catchment objectives are specific elements that need to be managed to achieve the community's objectives for the receiving environments. Example catchment objectives include:

- protection and enhancement of the ecology of natural water systems (creeks, rivers, wetlands, estuaries, lakes, lagoons, groundwater systems);
- protection and enhancement of water quality, by improving the quality of stormwater runoff from urban catchments;
- maintenance of stream stability by reducing the frequency and duration of elevated stream flows from urban catchments;
- minimisation of harmful impacts of development upon water balance, surface and groundwater flow regimes, and flooding;
- integration of stormwater management systems into the landscape in a manner that provides multiple benefits, including water quality protection, stormwater retention and detention, public open space and recreational and visual amenity;
- conservation of potable water to achieve more efficient use of water resources;
- implementation of sustainable mitigation systems that can be maintained efficiently using resources available to council; and

- creation of opportunities for community involvement and education on water management.

3.5.1 Development Catchments

Catchments are the key source of impacts on receiving environments resulting from new development. Development in a catchment has the potential to significantly alter the natural hydrology and water quality characteristics of catchment runoff. In addition, water is imported for human uses and discharged back to the environment following this use. The impact of these changes on the source and receiving environments for the development will vary with the needs of these environments and their resilience to the changes. The key changes in catchments that occur following conventional development (without mitigation) that are relevant to WSD include:

- Evapotranspiration and infiltration is lowered due to increased impervious surfaces;
- Groundwater recharge is lowered due to reduced infiltration;
- Surface runoff is increased due to clearing of natural vegetation, soil compaction and construction of impervious surfaces;
- Surface runoff quality is lowered due to increased sources of pollutants;
- Surface runoff and groundwater recharge flow regimes are altered;
- Rainfall is effectively increased through irrigation of pervious areas with imported water; and
- Imported water is used and discharged into sewerage systems.

These broad changes to the water cycle that occur within catchments following development have varying implications for different receiving environments that developments discharge into.

Table 3-1 Resources for Establishing Receiving Environment and Water Smart Development Objectives

Resource	Receiving Environment Objectives						
	External catchments	Groundwater	Creeks and Rivers	Coastal Wetlands	Coastal Lakes and Lagoons	Estuaries	Ocean Beaches
Receiving Environment Objective Resources							
National Water Quality Management Strategy Guidelines (available at http://www.environment.gov.au/water/policy-programs/nwqms/)	■	■	■	■	■	■	■
ANZECC (2000) *Australian and New Zealand Guidelines for Fresh and Marine Water Quality*			■		■	■	■
Natural Resources Commission (2005) *Recommendations - State-wide Standards and Targets*	■	■	■	■	■	■	■
NSW Government (1999) *NSW Water Quality and River Flow Objectives,* (available at www.environment.nsw.gov.au/ieo)		■	■	■	■	■	
NSW DECC (2009) *NSW Diffuse Source Water Pollution Strategy*		■	■	■	■	■	
NSW DECC (2006) *Local Planning for healthy waterways using NSW Water Quality Objectives*		■	■	■	■	■	
NSW DECC (2006) *Using the ANZECC Guidelines and Water Quality Objectives in NSW*		■	■	■	■	■	
Great Lakes Council (2009), *Great Lakes Water Quality Improvement Plan: Wallis, Smiths and Myall Lakes, Forster, NSW*					■	■	
Sydney Metropolitan Catchment Management Authority (2011) *Botany Bay & Catchment Water Quality Improvement Plan, Sydney*			■		■	■	
NSW DECCW (2010) *NSW Wetlands Policy*, NSW Department of Environment, Climate Change and Water				■			
Sydney Coastal Councils Group (2001) *Model DCP: Protecting Sydney's Wetlands,* Prepared by Sydney Coastal Councils Group and Protecting Wetlands Steering Committee				■			
Ecological Engineering, (2005) *Water Sensitive Urban Design Solutions for Catchments Above Wetlands*, Report prepared for Hunter Councils.				■			
NSW DLWC (1998) *The NSW Groundwater Quality Protection Policy,* NSW Department of Land and Water Conservation		■					
NSW DLWC (2002) *The NSW State Groundwater Dependent Ecosystems Policy*, NSW Department of Land and Water Conservation		■					
NSW DECC (2005) *Marine Water Quality Objectives for NSW Ocean Waters - Hunter and Central Coas*t, Prepared by the Department of Environment and Conservation.							■
NSW DLWC (2000) *NSW Salinity Strategy,* NSW Department of Land and Water Conservation		■	■	■			
Water Smart Development Objective Resources							
NSW DECC Managing Urban Stormwater Series of guideline documents							
Water Sensitive Urban Design (WSUD) in the Sydney Region Capacity Building Program (http://www.wsud.org/index.htm).							
Hunter Central Coast Regional Environmental Strategy WSUD Capacity Building Program (http://www.urbanwater.info/index.cfm).							
Water by Design Capacity Building (http://www.healthywaterways.org/wbd_project_overview.html).							
Clearwater Capacity Building Program (http://www.clearwater.asn.au/).							

3.6 Targets

Targets are typically established to provide a benchmark for assessing if WSD objectives would be achieved within a development. To be effective, each objective should have an associated measurable target.

Targets are often established based on current best practice, and in many circumstances best practice WSD measures will be insufficient for achieving full protection of receiving environments. Targets that are established relative to the performance of current best practice should be regularly reviewed in order to narrow the gap between what can be achieved, and what is required to provide a high level of protection to receiving environments.

3.6.1 Stormwater Pollutant Loads

3.6.1.1 % Reduction relative to developed site condition

The most commonly applied runoff quality target is a load based reduction relative to the developed site condition. The targets are applied by comparing the estimated load difference between the developed (without treatment) and developed (with treatment) scenarios.

The pollutant load reduction targets are relevant to surface water discharges to receiving environments and infiltration to ground water. Typically a development applicant is required to demonstrate how the load reductions would be achieved prior to infiltration or discharge to a receiving environment.

In circumstances where developments are located near sensitive environments or within sensitive catchments, base load reduction targets that apply to other developments are often increased by creating ‘stretch’ or ‘sensitive receiving environment’ targets to provide a higher level of treatment.

MUSIC software is typically used to estimate the pollutant loads for each scenario and compare the results against the load reduction targets. Load reduction targets are typically established for total suspended solids (TSS), total phosphorus (TP), total nitrogen (TN) and gross pollutants (GP) as these are the pollutants currently able to be modelled within MUSIC. It is generally accepted that a treatment series that removes these pollutants would also be effective at capturing most other common stormwater pollutants.

Key advantages of this target:

- Development industry familiarity.
- Relatively simple to apply and model within MUSIC.

Key disadvantages of this target:

- Targets may enable a significant increase in loads to the receiving environment when the existing land use generates a low pollutant load.
- Targets may not provide sufficient protection to receiving environments that accumulate pollutants and are not regularly flushed.

Table 3-2 Example Pollutant Load Reduction Targets

Resource	Mean Annual Load Reduction			
	TSS	TP	TN	GP
NSW Office of Environment and Heritage (DECC Draft)	80%	45%	45%	All<3mth
Sydney Metropolitan CMA	85%	65%	45%	90%
Queensland Government , South-eastern Queensland Regional Plan	80%	60%	45%	90%
Melbourne Water, Urban Stormwater Best Practice Environmental Management Guidelines	80%	45%	45%	70%
BMT WBM – Options for WSUD National Guidelines	80%	60%	45%	90%
Landcom, WSUD policy – base targets	85%	65%	45%	-
Landcom, WSUD policy – stretch targets	90%	85%	65%	-
Sydney Metropolitan CMA, Botany Bay WQIP - Greenfield, large brownfield development	85%	60%	45%	90%
Sydney Metropolitan CMA, Botany Bay WQIP - Multi-unit, commercial, industrial, small brownfield re-development	80%	55%	40%	90%
Great Lakes Council , WSUD DCP- Greenfield sites	No increase relative to existing			90%
Great Lakes Council, WSUD DCP- Brownfield sites	80%	60%	45%	90%
Parramatta City Council - DCP	85%	60%	45%	90%
NSW Growth Centres Commission (base targets)	85%	65%	45%	90%
NSW Growth Centres Commission (ideal targets)	95%	95%	85%	100%

3.6.1.2 No increase relative to existing site conditions

Receiving environments including coastal lakes and lagoons, estuarine embayments, water supply dams and water supply catchments/aquifers are susceptible to nutrients and other pollutants accumulating within bed sediments and poorly flushed areas of these sensitive environments. This target is typically applied to minimise the potential for accumulation of excessive nutrients in the receiving waters leading to eutrophication, more frequent algal blooms, smothering of aquatic vegetation and periods of low dissolved oxygen which impacts on the aquatic ecosystems and increases treatment costs for water supply.

Key advantages of this target:

- For developments where the existing land use generates low pollution, target will generally provide a higher level of treatment and protection of the receiving environment when compared to a % reduction objective.
- WSD strategies prepared based on these targets will typically provide a higher level of redundancy and greater coverage of controls than one based upon a % reduction objective.
- Relatively simple to apply and model within MUSIC.

Key disadvantages of this target:

- For developments where the land has previously been developed or used for agricultural activities, this target will potentially provide a lower level of protection to the receiving environment compared to the % reduction objective.
- Requires the existing site loads to be modelled which is more complex. In addition, there is typically limited water quality data available to assist with accurately estimating existing pollutant

loads. This can often result in a wide range of existing results in due to the increased number of critical model parameters when compared to a highly impervious developed site with less critical model parameters.

- Targets may not be achievable for some sites where the existing pollutant loads are low.
- The level of treatment required to achieve the targets may not be sustainable for some developments from both a capital and longer term maintenance perspective.
- Strategies prepared utilising these targets require a greater level of modelling expertise, guidance and/or scrutiny from experienced assessors to confirm that modelling parameters adopted by the development applicant are appropriate.

It is important if these objectives are applied that a minimum % load reduction objective is also referred to. This is to ensure that in circumstances where a lower pollutant generating development replaces a higher pollutant generating development a minimum treatment standard is set. Adopting a no net increase objective in these circumstances would not require the development applicant to provide any treatment.

3.6.1.3 No increase relative to natural site conditions

This objective is similar to the no increase relative to existing site objective. The main difference is that for most developments, this target will be very difficult (or not possible) to achieve.

Ideally, the catchments where this target is necessary to protect receiving environments should be identified during initial strategic planning. These catchments should then either be quarantined from development, or specific development controls put in place to ensure that only developments capable of achieving this objective are allowed.

3.6.2 Water Conservation

State Environmental Planning Policy (Building Sustainability Index: BASIX) 2004 (BASIX) continues to be the overriding and mandatory instrument for setting water efficiency targets for 'BASIX affected development' which includes a range of proposed residential developments (refer Section 2.2.3). The current residential water efficiency target for the Hunter Central Coast region is a 40% reduction (compared to a specified historical level of use), with the exception of the Upper Hunter LGA where it is 30%. There are currently no legislated water conservation targets for industrial, commercial and other non-residential developments. Whilst residential water conservation targets specified in SEPP BASIX are unable to be increased by council, separate water conservation targets for non-residential developments can be set.

Potable water conservation potential for non-residential developments will vary significantly considering the wide-ranging water demands for these developments. Unlike residential development, there is limited data available on historical water uses for a range of non-residential developments to use as a benchmark for establishing potable water use reduction targets. For these developments, potable water conservation targets could be based on an assessment of potable water use without conservation measures in place, and a specified reduction in potable water use from this 'business as usual' scenario selected as a target. It will be important that consideration is given to the available sources to achieve the targets, for example a development with a high water

demand, but small roof area, may struggle to achieve a set water conservation target due to the limited potential to source an alternative water supply (i.e. rainwater harvesting).

Water conservation targets for other than BASIX effected development can also be established by outlining acceptable solutions that a development applicant is required to integrate within their development to achieve approval, e.g.:

- All plumbing fixtures to meet minimum Water Efficiency Labelling and Standards (WELS) Scheme Standards including 3 star rated showerheads, 4 star rated toilet cisterns, 5 star rated urinals and 6 star rated water tap outlets.
- Appliances are to be 3 stars (WELS Scheme) or better rated with respect to water use efficiency.
- Rainwater tanks or other alternative water sources are to be installed to meet 80% of toilet and laundry demands.
- Connection to recycled water (where development is serviced by dual reticulation) for permitted non-potable uses such as toilet flushing, laundry, irrigation, car washing, fire fighting, industrial processes and cooling towers.
- Incorporate passive cooling methods that rely on improved natural ventilation to supplement or preclude mechanical cooling,
- Cooling towers are to be connected to a conductivity meter to ensure optimum circulation;
- Water meters connected to a building water metering system to monitor water usage and to employ alternative water sources where practical.
- Water use within open spaces to be minimised by improved soils, passive irrigation and integration of vegetated stormwater treatment system into open spaces.
- Irrigation, water features and other open space features are to be supplied from alternative sources (e.g. rainwater, greywater, or wastewater) to meet 80% of demand.

Adopting a prescriptive approach to water conservation would need to make allowance for how perm anent the fixtures are. For example whilst toilet cisterns are unlikely to change significantly in a development's lifecycle, fixtures such as showerheads can be changed readily after a development is occupied.

3.6.3 Stormwater Retention

Urban development results in natural pervious surfaces progressively being covered by impervious roof, road pavement and other paved landscaping surfaces. This significantly reduces the potential for rainfall to be intercepted and retained in the landscape prior to evapotranspiration. The consequence of this 'lost' landscape storage capability is that evapotranspiration and groundwater recharge volumes are reduced, and runoff frequency and volumes increase. For many urban streams, deposition of sediment along the stream bed during frequent smaller events is also a significant issue impacting on stream geomorphology and health.

In catchments draining to ephemeral creeks, development can often result in the surface runoff discharges to creeks increasing from less than 10 days/yr to around 100 days/yr. The increased impervious areas in catchments have been shown to strongly correlate with reduction in the number and diversity of freshwater aquatic animals that exist in habitats in the creek bed.

To minimise impacts, stormwater retention criteria are increasingly being applied for urban development to capture runoff from small rainfall events and either slowly release the runoff into the creeks or harvest the runoff for non-potable uses within urban development. The objective is to typically retain developed runoff during events that under natural conditions would have been retained in the landscape.

Table 3-3 Example Stormwater Retention Targets

Organisation	Target
HCCREMS	Retain 14mm, 10mm and 7mm rainfall depths for sites with natural sandy, clay loam and clay soils respectively. Rainfall depths apply to total impervious surfaces within the site.
Newcastle City Council	Retain 12mm rainfall depth from a minimum of 90% of the total impervious area within the site (equivalent to 10.8mm depth from all impervious areas).
Queensland Government	Retain 15mm runoff depth from impervious surfaces when site is 0% to 40% impervious. Retain 10mm runoff depth when site is greater than 40% impervious. Retained runoff to be released within 24 hours of the runoff event to ensure storage is available to capture a following event.
BMT WBM – Options for WSUD National Guidelines	Capture and infiltrate or re-use the first 15mm/day of surface runoff from impervious surfaces

Key advantages of this target:

- Simple target to apply.
- Typically low additional cost as retention storage can readily be accommodated with controls provided to also manage runoff quality.

Key disadvantages of this target:

- Will typically not reduce the total volume of runoff discharging to environments sensitive to increased runoff volumes, except in circumstances where re-use of retained runoff is also undertaken.
- May have limited influence for higher rainfall days that have a greater influence on stream erosion.

3.6.4 Wetland Flow Regimes

The hydrological regime of wetlands determines the depth, frequency, duration and temporal pattern of flooding and drying and therefore influences the physical, chemical and biological characteristics of the wetland substratum. The natural hydrologic regime of wetlands is particularly susceptible to the impacts of increased urban stormwater. Typically urbanisation will increase the frequency and volume of stormwater discharged to wetlands. Therefore, wetlands that naturally dry would be less likely to dry, and where drying occurs, the interval between drying cycles is likely to increase and the period of drying is likely to reduce. This limits opportunities for new plant growth and can lead to drowning of the wetland vegetation.

In order to reduce impacts on natural wetlands, it is therefore critical that stormwater runoff volumes are reduced. This can typically be achieved by harvesting stormwater, distributed infiltration of stormwater throughout the catchment or diversion of flows away from the wetland. In many catchments the opportunity to infiltrate stormwater is limited by the soil types and groundwater levels. For most catchments, the most feasible options for reducing the volume of runoff draining to a wetland is therefore stormwater harvesting or diversion of flows.

Saltmarsh wetlands are particularly susceptible to exposure to surface runoff. Saltmarsh typically grows in areas that are only exposed to tidal waters during the highest of tides. Stormwater runoff from development should be diverted away from these wetlands.

Forest swamps and acid swamps (Wallum Froglet habitat) are also common along the coastal areas of the region. These wetlands are susceptible to increased runoff which not only can drown vegetation, but also affect the water chemistry (particularly pH). A number of these wetlands have a low pH, which can be altered with the introduction of higher pH stormwater runoff from urban areas. Typically urban development in catchments draining to forest swamps and acid swamps will need to harvest or otherwise reduce stormwater runoff to reduce impacts on these wetlands.

An investigation undertaken by the Hunter Councils (HCCREMS, 2007) identified flow management objectives for minimising the impacts of catchment urbanisation upon wetlands, based on the definition of the wetland inundation and drying characteristics of different wetland types. Flow duration frequency curves representing maximum flow and minimum flow conditions are considered to provide the principal hydrologic index for wetland flooding and drying respectively. This guideline document should be referred to identify appropriate objectives for the wetlands types that exist in the region.

3.6.5 Stream Stability

Increased imperviousness is known to elevate and increase the frequency of stream forming discharges to natural creeks following development with a related increase in sediment transport capability and stream erosion potential. Initially catchment development is known to increase sediment loads to streams. However, the coarse sediment load to streams may drop below natural levels following maturation of urban development (particularly when measures are provided to filter the catchment runoff). A decreased coarse sediment supply to a stream can lead to increased bed erosion as stream energy is expended on erosion.

Stream stability targets typically require development applicants to develop a strategy to temporarily detain/retain stormwater prior to harvesting or slowed release to creeks. Two main targets are typically applied to manage potential stream forming flows, bankfull discharge flow mitigation and the stream erosion index.

3.6.5.1 Bankfull Discharge

This target requires a development applicant to limit a particular post development design flow to the pre-development flow for the same design event. The design flow adopted for comparison is selected to be representative of the typical bankfull flow for an average stream. For most streams, the bankfull flow typically lies within the 1 to 2 year ARI range.

Table 3-4 Example Bankfull Discharge Targets

Organisation	Target
Sydney Metropolitan CMA	1.5yr ARI post development flow <= 1.5yr ARI pre-development flow
Queensland Government	1yr ARI post development flow <= 1yr ARI pre-development flow
Melbourne Water	1.5yr ARI post development flow <= 1.5yr ARI pre-development flow
Landcom	1.5yr ARI post development flow <= 1.5yr ARI pre-development flow
BMT WBM – Options for WSUD National Guidelines	1yr ARI post development flow <= 1yr ARI pre-development flow

Key advantages of this target:

- Simple target to apply.
- Estimation of design flows is familiar to WSD consultants and consent authorities.

Key disadvantages of this target:

- Whilst the target enables the developed discharge to be maintained at the pre-development discharge for the selected design event, the developed site will typically generate a much higher volume of water than the existing site resulting in the stream bed and banks being exposed to elevated flow for a longer period than existing conditions. The higher volume of water flowing over the stream bed and banks for an extended period of time has the potential to generate elevated erosion.

3.6.5.2 Stream Erosion Index

Recent investigations and refinement of the procedure for defining the stormwater management objective for reducing geomorphic impacts of urban waterways have led to a development of an additional target to the bankfull discharge target, the Stream Erosion Index (SEI).

The SEI has been applied as a stormwater flow target for protecting streams from increased erosion following new urban development. The SEI is defined as the ratio of the volume of post development stormwater flows exceeding the 'stream forming flow' to the volume of stormwater flows exceeding the 'stream forming flow' under natural catchment conditions (Brookes and Wong, 2009). This target therefore takes account of both the magnitude and duration of flows potentially impacting on the stream.

The stream forming flow (or critical flow) is related to the stream bed and bank material composition which is strongly influenced by the catchment geology. The stream forming flow represents the flow at which destabilisation of the soil at the toe of the stream bank begins to occur. Increased frequency of minor flows due to urbanisation and impervious area connectivity are key hydrological changes following urbanisation and these elevated more frequent flows can erode sediment at the bank toe.

Bedrock controlled, clay-rich stream beds and banks are usually more robust and typically expand to a lesser extent than sand-rich channels. Typical stream forming flows for typical soils found in streams within coastal NSW catchments include:

- Sand and silts: 10% of 2 year ARI flow
- Silty clays: 25% of 2 year ARI flow
- Stiff clays: 50% of 2 year ARI flow

Typically 50% of the 2 year ARI flow is adopted as an appropriate critical or stream forming flow.

Table 3-5 Example Stream Erosion Index (SEI) Targets

Organisation	Target
Sydney Metropolitan CMA	SEI = 2.0 (maximum)
Landcom (base target)	SEI = 1.0 (maximum)
Landcom (stretch target)	SEI = 2.0 (maximum)

A SEI of 1 to 1.5 should be achievable for most streams receiving runoff from development with a reasonable coverage of WSD measures.

Key advantages of this target:

- Incorporates consideration of both the magnitude and duration of stream flows for numerous events, as opposed to the bankfull discharge target which considers magnitude for one specifc event.
- Target is based upon hydrology only and does not require geometrical data on the stream profile and cross section.

Key disadvantages of this target:

- Estimation of the SEI is relatively new to most practitioners and education is likely to be required to ensure that the target is evaluated appropriately.
- Continuous simulation modelling is required to complete the assessment. Typically 10 years of good quality pluviograph rainfall data is required to develop the models and this may not be available for some locations. In addition, development of the models requires a good understanding by the modeller of hydrological processes to ensure the predicted flows are reasonable.
- This method assumes that the erosion potential is linear as flows increase above the stream forming flow. The SEI does not account for the increased erosion potential that exists at higher flow stages.

3.7 WSD Relevant Urban Design Targets

In addition to defining targets specifically relevant to management of water from the development, establishing urban design targets relevant to WSD can assist with reducing the quantity and improving the quality of runoff generated at the source. To be effective, WSD urban design objectives should have an associated target against which the merit of the development proposal can be assessed. Whilst it may be difficult to quantify the merits, assessing how the proposal development performs could be achieved utilising qualitative criteria (i.e. :

- The structure and configuration of urban development responds and contributes positively to the hydrological and ecological functions of natural watercourses, floodplains, wetlands and native vegetation.
- Urban structure responds to the topography of the site and street networks are designed to avoid unnecessary large-scale modification of natural landforms.
- Development patterns and supporting water cycle infrastructure is consistent with and supports the regional adoption of integrated water cycle management.
- Remnant native vegetation is retained and restored within the open space system and linked where possible with retained or revegetated corridors.
- The natural drainage system forms the spine of the open space and habitat corridor system, retaining natural alignments and profiles where possible.
- The drainage system protects natural water quality, ecology, stream stability, flooding and recreational characteristics of the riparian corridors.

- Constructed drainage systems are designed to reduce the efficiency of connections to the natural drainage system through maximising the potential for retention, harvesting and infiltration of runoff from development
- Points of concentrated stormwater discharge to riparian corridors are minimised.
- Local water harvesting and reuse is facilitated through retention of adequate open space for treatment and storage, and potential gravity supply to open space irrigation uses.
- Street and allotment layouts are configured to minimise changes to natural drainage systems
- Bridge crossings have been considered and are proposed in preference to culverts where viable.
- Road reserves and other public spaces have allocated space for measures to manage urban water cycle impacts.
- Planning for flood control and water quality treatment has considered the recreational opportunities of multiple use drainage systems.
- Planning of urban structure, accessibility and transport networks has considered the likely role of key recreational focal points in the open space and habitats.

Table 3-6 Receiving Water Objectives and Development Targets for WSD

Example Receiving Environment Objectives	Targeted Parameters	Relevant Receiving Environments							Relevant Development Targets for WSD							
		External catchments	Groundwater	Creeks and Rivers	Coastal Wetlands	Coastal Lakes and Lagoons	Estuaries	Ocean Beaches	% reduction in pollutant loads relative to the developed site	No increase in pollutant loads relative to the existing site	Water conservation	Runoff retention	Runoff flow regimes	Stream Erosion Index	Bankfull discharge	Urban design
To prevent adverse changes to natural groundwater flow regimes.	recharge volume		■									■				
To maintain groundwater levels critical for supporting dependent ecosystems.	recharge volume		■		■							■				
To prevent localised scouring at stormwater drainage outlets.	outlet locations, stormwater runoff flow rate			■	■	■	■	■								■
To protect creek beds and banks from increased erosion.	stormwater runoff flow rate and volume			■										■	■	■
To maintain water clarity and light penetration for aquatic flora.	suspended solids, turbidity, nutrients, chlorophyll-a					■	■		■	■		■				
To prevent chemical contamination of benthic habitats/loss of sensitive fauna.	heavy metals, pesticides, hydrocarbons			■	■	■	■		■							
To prevent the smothering of aquatic flora and fauna.	gross pollutants, coarse sediment			■	■	■			■							
To prevent the establishment of non-indigenous plants and weeds.	suspended solids, nutrients, chlorophyll-a			■	■	■			■			■				
To reduce raw sewage overflows and leaks discharging to waterways.	pathogens, nutrients, gross pollutants, suspended solids		■	■		■	■	■			■					■
To maintain aesthetic, landscape and recreational values.	gross pollutants, coarse sediment, stormwater runoff flow rate and volume			■	■	■	■	■	■					■	■	
To minimise impacts on the natural water balance.	runoff volume		■		■						■	■				
To minimise impacts on the wetting and drying cycles.	runoff volume				■						■	■	■			
To maintain natural dispersed flow discharge patterns.	runoff volume, drainage				■			■				■				■
To prevent disturbance of acid sulphate soils.	excavation for drainage				■											■
To maintain water chemistry and quality.	pH, salinity, nutrients, heavy metals, recharge volume		■		■				■	■		■				
To prevent excessive and increased frequency of algal blooms.	suspended solids, nutrients					■	■		■	■						
To prevent smothering of sea grasses, macrophytes and benthic habitats.	coarse sediment, nutrients, chlorophyll-a					■	■		■	■						
To minimise foreshore erosion.	runoff flow rate, drainage					■	■									■
To minimise organic debris and litter contacting with animals and humans.	gross pollutants					■	■	■	■	■						
To integrate stormwater, water supply, wastewater and flood management.	potable water demand, runoff volume, capital cost	■									■	■				■
To increase the conservation of potable water.	potable water demand, runoff volume	■									■	■				
To reduce impacts on water supply catchment receiving environments.	imported potable water volume	■									■	■				
To improve the water quality of environments receiving treated sewage.	pathogens, nutrients, gross pollutants, suspended solids	■		■			■	■								■
To reduce the cost of providing and maintaining infrastructure.	lifecycle costs															■

3.8 Resources

There are a range of resources that councils can utilise to identify reasonable initial objectives and targets for receiving environments impacted by development within their LGA. Often insufficient data is available for local receiving environments, requiring interim objectives and targets to be established based on investigations and studies for similar receiving environments. Further local investigation and ecological/water quality monitoring should then be completed to confirm if the interim objectives and targets are appropriate. A summary of key resources that can assist with identifying objectives for receiving environments and WSD are discussed below.

3.8.1 National Water Quality Management Strategy

The National Water Quality Management Strategy (NWQMS) is an initiative that provides a national approach to improving water quality in Australia's waterways. The NWQMS was developed by the Federal government in cooperation with the State and Territory Governments. The NWQMS aims to deliver a nationally consistent approach to water quality management. The NWQMS comprises three main elements; policies, a process and guidelines.

The main NWQMS policy objective is *"to achieve sustainable use of the nation's water resources by protecting and enhancing their quality while maintaining economic and social development"* which reflects the central objective of Ecologically Sustainable Development. Participants in the NWQMS are working to protect the nation's water resources by improving their quality, reducing pollutants and at the same time supporting the businesses, industry and communities that depend on water for their continued development.

The process involves the community and government developing national guidelines that can be implemented through local scale management plans for each catchment, aquifer, estuary, coastal water or other water body. Guidelines are provided on following water resources topics to support implementation of the NWQMS objectives:

- Water quality (fresh, marine and drinking water);
- Groundwater management;
- Diffuse and point source pollution (rural and urban catchments);
- Sewerage systems (domestic, industrial and agricultural); and
- Water recycling.

Application of the NWQMS guidelines has occurred in the development of Water Quality Improvement Plans for hotspot locations throughout Australia.

3.8.2 Water Quality Improvement Plans

Through the application of the National Water Quality Management Strategy (NWQMS) the Australian Government is working in collaboration with States and Territories to develop Water Quality Improvement Plans (WQIP) to reduce pollution being released into aquatic ecosystems with high ecological, social and/or recreational values across the country. The WQIP sites include Wallis Lake located in the Great Lakes Council LGA.

Water Quality Improvement Plans (WQIPs), prepared consistent with the Framework for Marine and Estuarine Water Quality Protection, amongst other matters identify the most cost-effective and timely projects for investment by all parties including the Australian Government, State and Local Governments, and community and environment groups.

WQIPs seek to deliver significant reductions in the discharge of pollutants to agreed high value receiving environments through:

- identification of the environmental values of water;
- determination of water quality objectives and load targets for pollutants of concern;
- development of environmental flow objectives and environmental water provisions;
- implementation of catchment based management actions, including control of point and diffuse sources, market-based instruments and adaptive management; and
- the application of predictive models and ambient monitoring programs.

A WQIP provides an ecosystem based approach to integrated water cycle management, supported by science. It is designed to:

- engage state, local government, NRM groups and cooperatively prepare a WQIP and implement interim projects;
- resolve major impediments to Water Quality planning and management through a catchment management based approach;
- address the key priority threats to water quality and environmental flows, and establishing methods to continuously improve management knowledge and systems; and
- establish governance arrangements that ensure all relevant stakeholders are party to WQIP implementation.

Figure 3-3 Water Quality Improvement Hotspots (http://www.environment.gov.au/water/policy-programs/nwqms/wqip/hotspots.html)

3.8.3 National Water Initiative

The Federal, State and Territory Governments have put in place an inter-governmental agreement - the National Water Initiative (NWI), which is a comprehensive national strategy to improve water management across the country. The NWI encompasses a wide range of water management issues and encourages the adoption of best practice approaches to the management of water in Australia.

In the context of WSD, the NWI is intended to facilitate better and more efficient management of water in urban areas. It is recognised that Water Sensitive Urban Design (WSUD), is a key way in which this objective can be achieved.

The NWI targets are overseen in NSW by the Natural Resources Commission (NRC) which was established to oversee the implementation of the targets agreed by COAG.

3.8.4 Evaluating Options for WSUD – A National Guideline

National Guidelines for Evaluating WSUD were prepared on behalf of the Joint Steering Committee for Water Sensitive Cities in 2009 (BMT WBM, 2009) for the National Water Initiative (NWI). The guidelines were developed in accordance with NWI Clause 92(ii) objective:

"Develop National Guidelines for evaluating options for water sensitive urban developments, both in new urban subdivisions and high-rise buildings"

These guidelines:

- Identify issues that should be considered in evaluating strategies to achieve WSUD;
- Provide a consistent framework which can be applied nationally for the facilitation and evaluation of WSUD proposals. The framework may be used by developers and development assessors and will maximise the success of WSUD proposals;
- Supplement (but not replace) existing WSUD regulations and detailed design and implementation guidelines. In areas where local guidelines don't exist, these Guidelines may assist with the assessment and evaluation of WSUD proposals;
- Direct readers to more detailed technical WSUD literature on specific issues and for location specific advice; and
- Could be used or considered in developing WSUD planning scheme provisions.

3.8.5 Natural Resources Commission

The Natural Resources Commission (NRC) is an independent body that provides the NSW Government with advice on natural resource management in the environmental, economic, social and cultural interests of the state. The NRC's primary areas of responsibility are to independently review Catchment Action Plans (CAPs) prepared by the Catchment Management Authorities (CMAs), audit their implementation and provide recommendations to the NSW Government based on the review/audit findings. The NRC also has specific roles under environmental planning legislation to review and advise the Minister on development master plans, or consider requests to waive the need for a master plan. In addition, the NRC conducts reviews of scientific and policy issues under legislation or as requested by the NSW Government.

The NRC was tasked with recommending state-wide standards and targets for natural resources management to the NSW Government in 2005. The NRC identified 13 state-wide targets for natural resource management, including 5 specific water management targets:

- Target 5: By 2015 there is an improvement in the condition of riverine ecosystems.
- Target 6: By 2015 there is an improvement in the ability of groundwater systems to support groundwater dependent ecosystems and designated beneficial uses.
- Target 7: By 2015 there is no decline in the condition of marine waters and ecosystems.
- Target 8: By 2015 there is an improvement in the condition of important wetlands, and the extent of those wetlands is maintained.
- Target 9: By 2015 there is an improvement in the condition of estuaries and coastal lake ecosystems.

The state-wide targets are promoted through the CAPs and are also relevant for future development planning.

3.8.6 NSW Water Quality and River Flow Objectives

The NSW Government provides guidelines on water quality and river flow objectives for waterways in NSW (see http://www.environment.nsw.gov.au/ieo/). These guidelines are intended for local councils, Catchment Management Authorities and state agencies to consider and include in strategic, catchment and land use planning processes.

NSW Water Quality and River Flow Objectives were established by the NSW Government in 1999 for the majority of NSW catchments. One of the five catchments for which objectives had not been established is located in the Hunter Region (Williams River catchment).

The guidelines provide an overview of specific water quality and river flow issues for each catchment that were identified by the community and provide a useful resource for developing visions for water management. The guidelines outline water quality objectives for aquatic ecosystems, visual amenity, secondary recreation, primary recreation, livestock water supply, irrigation water supply, homestead water supply, drinking water and aquatic foods. In terms of river flow objectives, the guidelines include protection of pools, low flows, high flows (i.e. water rises), wetland and floodplain inundation, drying in temporary waterways, natural flow variability, groundwater, effects of weirs and other structures, and effects of dams.

3.8.7 South-East Queensland Regional Plan

The Queensland Government recently established objectives and targets for WSUD (Queensland Government, 2009). The objectives and targets were developed in consultation with various stakeholders and a panel of nationally recognised technical experts. They were tested to ensure that they effectively contribute towards achieving environmental outcomes, and are practical for applying to typical developments in the south-east Queensland region. The design objectives established address three components of urban stormwater that affect water quality and waterway health:

- Manage stormwater quality to protect receiving water by reducing the percentage of sediment, phosphorus, nitrogen and litter in stormwater runoff generated by urban development, compared with that in untreated runoff.

- Improve waterway stability to reduce exacerbated in-stream erosion downstream of urban areas by controlling the magnitude and duration of sediment-transporting flows.
- Manage the frequency of flows to protect in-stream ecosystems from the effects of more frequent runoff by capturing the initial runoff from impervious areas.

Table 3-7 Resources for Establishing Development Targets for WSD

Resource	Development Targets for WSD							
	% reduction in pollutant loads relative to the developed site	No increase in pollutant loads relative to the existing site	Water conservation	Runoff retention	Runoff flow regimes	Stream Erosion Index	Bankfull discharge	Urban design
Landcom, (2009) *Water Sensitive Urban Design Book 1 - Policy*	■		■			■	■	
State Environmental Planning Policy Building Sustainability Index: BASIX (2004)			■					
Water by Design (2009) *Concept Design Guidelines for Water Sensitive Urban Design Version 1,* South East Queensland Healthy Waterways Partnership, Brisbane	■			■			■	
WSUD.org, *WSUD Design Objectives for Sydney*	■		■		■	■	■	
Great Lakes Council (2009), *Great Lakes Water Quality Improvement Plan: Wallis, Smiths and Myall Lakes, Forster, NSW*	■	■						
Sydney Metropolitan Catchment Management Authority (2011) *Botany Bay & Catchment Water Quality Improvement Plan, Sydney*	■							
Ecological Engineering, (2005) *Water Sensitive Urban Design Solutions for Catchments Above Wetlands*, Report prepared for Hunter Councils.					■			
HCCREMS (2007) *Water Smart Model Planning Provisions*				■				

4 STRATEGIC PLANNING

4.1 NSW 2021

The NSW State Plan was replaced by *NSW 2021* in September 2011. NSW 2021 is ten year plan and is the NSW Government's strategic business plan. The plan comprises 32 goals and 180 targets relating to economy, transport, health, family and community services, education, police and justice, infrastructure, environment and communities and accountability. With regard to environment and communities, the Plan states the following relevant objectives:

> *"22. Protect our natural environment*
>
> *23. Increase opportunities for people to look after their own neighbourhoods and environments*
>
> *…*
>
> *28. Ensure NSW is ready to deal with major emergencies and natural disasters"*

The targets for these objectives encompass a variety of actions including: managing weeds and pests; protecting and conservation land, biodiversity and vegetation; protecting rivers, wetlands and coastal environments; devolution of decision making roles (Catchment Management and Landcare); and, preparing floodplain management plans.

The objectives within NSW 2021 should guide the objectives, actions, controls and performance criteria of the regional strategies as well as council LEPs and DCPs.

4.2 Regional Strategies and Plans

The Central Coast and Lower Hunter Regional Strategies are relatively unchanged since their original publication in 2006 and 2008 respectively, and continue to reference the importance of ensuring planning instruments, development controls and policies incorporating WSD matters. Relevant actions listed for the Hunter, Central and Lower North Coast region include:

- Implementing the Regional Plans prepared by the NSW Government for the Lower Hunter, Central Coast and Lower North Coast regions;
- Assisting local councils with updating and reviewing their LEPs and Strategic Plans;
- Implementing current regional infrastructure priorities as identified in the State Infrastructure Strategy;
- Developing and implementing Regional Conservation Plans;
- Implementing the Hunter Central Rivers CMA Catchment Action Plan; and
- Improving environmental outcomes for native vegetation, biodiversity, land, rivers and coastal waterways (including improved water quality).

The Regional Strategies also recognise the vulnerability of water supplies to impacts from droughts, limited storage capacities and water pollution. For example the Lower Hunter Regional Strategy:

- Promotes water-sensitive urban design in residential developments; and
- Requires that LEPs protect drinking water catchments, in particular the vulnerable aquifers of Tomago, Tomaree and Stockton.

LEPs and DCPs should be prepared to incorporate controls and guidelines to implement these regional strategies.

4.3 Natural Resource Management Plans

Natural resource management plans are typically prepared by councils, Catchment Management Authorities and water utilities to assist with local planning for natural resources management. These plans are non-statutory, but carry significant weight, particularly when the plans have been adopted by council or state government authorities and directly referred to within planning instruments such as LEPs or DCPs. These plans are usually prepared with significant community involvement and consequently often outline community values for the local environment. Typical natural resource management plans include:

- Floodplain Management Plans;
- Estuary Management Plans;
- Catchment Action Plans;
- Integrated Water Cycle Management Plans;
- Stormwater Management Plans; and
- Coastal Zone Management Plans.

4.4 Structure Plans

Structure plans are a framework that guides long-term future development over regional, sub-regional or precinct scales. Structure plans provide a vision on how future development within a larger area will progress. They incorporate holistic and integrated consideration of urban design elements that is often not possible to achieve at later stages of development planning when development sites are considered in a more fragmented manner. Structure plans typically include consideration of key strategic elements including:

- Locations of specific neighbourhood areas;
- Types of land uses and configuration of the land uses within the neighbourhoods;
- Open space areas, sporting facilities and other central public facilities;
- Landscape character;
- Identification of street hierarchy, key transport links, pedestrian networks and cycle ways;
- Major carparking areas;
- Infrastructure requirements; and
- Locations of protected heritage, cultural or ecological sites.

The structure planning stage provides the greatest opportunity for consideration of integrated water cycle management systems within future infrastructure planning for the area. Development planning at this scale enables integrated consideration of water supply, wastewater and stormwater systems to identify opportunities that are unavailable at later development stages when planning is often more constrained by previously constructed infrastructure.

Structure planning also incorporates identification of the landscape character for the area. At this early planning stage, consideration of the opportunities for WSD to be incorporated into the road reserves and public areas would be important to contribute to the overall vision for the structure plan area.

4.5 Infrastructure Planning

Structure plans outline the general location and configuration of future development. Additional infrastructure planning investigations are then necessary to confirm the location, size, staging and cost of infrastructure upgrades required to support future development. Infrastructure investigations will often be completed in parallel with the Structure Plan to ensure that the future development would be financially feasible. These investigations will typically consider infrastructure requirements including:

- Water supply servicing;
- Sewerage servicing;
- Local flooding and drainage;
- Water sensitive urban design;
- Road reserve configurations;
- Electricity, telecommunications and gas;
- Public transport;
- Community facilities; etc.

This stage is important for confirming the sustainability of the future development. Ensuring that integrated consideration of infrastructure upgrades is undertaken will assist with avoiding duplication of infrastructure and assist with optimising future maintenance requirements. For WSD, it is important that water supply, sewerage, flooding, drainage, WSD and road reserve configurations are considered in an integrated manner to ensure that WSD can be implemented successfully at later stages of development.

4.6 Land Rezoning

Land rezoning can be undertaken at a range of scales from spot rezoning of infill developments to rezoning associated with large urban release areas or structure plans. Rezoning investigations are undertaken for a particular site or area when a change in land use is proposed. The extent of investigations required will typically vary with the development scale, the existing site characteristics, previous land uses and sensitivity of the existing environment. Large scale land rezoning will typically follow on from the structure plan stage and related infrastructure investigations. Completion of these investigations is necessary prior to making decisions on rezoning of the land.

Rezoning investigations are initiated through a variety of planning mechanisms, including the Urban Development Program, Section 117 Directions, urban investigation zones and council policies. The investigations are important for ensuring that any conceptual development layout derived is prepared in a way that conforms to the principles of WSD, particularly retaining existing waterways and minimising impacts on riparian corridors.

The extent of rezoning investigations required will vary with the existing site characteristics and the sensitivity of the local receiving environment to impacts from future development. Natural resource constraints including flooding extents, riparian land corridors, high value aquatic and terrestrial habitats, bushfire asset protection zones, slope instability areas, areas of highly erodible or saline soils and coastal hazard zones are often primary constraints for future development. In addition to natural resource constraints, infrastructure constraints including easements should be identified. These natural resource and infrastructure constraints are typically mapped and the maps utilised as planning overlays to assist with confirming potential developable areas. The rezoning investigations also focus on additional urban planning constraints including water cycle management, soil characteristics/contamination, visual/landscape, traffic, heritage, archaeology and financial feasibility.

The water cycle management investigations are a particularly important component of the rezoning investigations as the inability to manage water appropriately within the future development can result in significant impacts on natural resource constraints (flooding, riparian corridors and high value habitats). It is important that water cycle management is considered during rezoning investigations to ensure that sufficient land can be allocated to water cycle management infrastructure and that potential impacts on the natural resource constraints can be mitigated. Identifying the extent of controls required at this stage is also important for ensuring the overall financial sustainability of the future development.

At rezoning stage, the development layout is typically incomplete, although it is important that a development layout broadly representative of the final layout be initially tested to ensure that a feasible WSD solution is available. Whilst all aspects of the water cycle should be addressed at least in conceptual form, numerical modelling using latest software (e.g. MUSIC) should also be completed to compute runoff volumes, stream flow regimes and pollutant loads. This will encourage relevant land and water issues to be considered in an integrated way, rather than in isolation, whilst allowing them to be related to other issues such as biodiversity, urban structure and community development.

Councils should give consideration to amending relevant policy documents or zoning provisions (whilst remaining compliant with the Standard LEP Instrument) so as to specifically require a WSD strategy to be prepared as part of rezoning investigations. The rezoning phase WSD strategy should include investigation of hydrological issues affecting the feasibility, performance, sustainability and implementation of future development including:

- A summary of the principles, objectives and targets relevant to WSD within the site;
- Mapping of natural resource and infrastructure constraints within the site;
- Identification and discussion of other relevant social, environmental and economic constraints;
- Identification of appropriate WSD measures;
- A description of a conceptual WSD strategy that addresses the principles, and would achieve the objectives and targets within the rezoned site;
- A summary of numerical modelling and risk assessments completed to evaluate the performance of the conceptual WSD strategy against the targets;
- Potential coverage, locations and/or footprint of the conceptual WSD measures; and
- A preliminary estimate of operation and maintenance costs and maintenance requirements associated with the WSD strategy.

4.7 Site Specific DCPs & Masterplans

The NSW planning system enables councils to prepare DCPs at either LGA-wide or site-specific scales. Where a DCP is prepared as a site-specific scale it must be consistent with the LGA-wide DCP and the standard practice, as required by the DoPI, is to include the site-specific provisions within the overarching LGA-wide DCP (usually as a separate chapter).

Site-specific Development Control Plans (DCPs) can be prepared to ensure that the structure and configuration of 'greenfield' (new urban release areas) or 'brownfield' (re-development) sites support sustainable urban water cycle outcomes. Previously adopted masterplans are now deemed to be DCPs. A site-specific DCP may be prepared in conjunction with or following rezoning of land for future development.

The DoPI has prepared a Local Provision for urban release areas for inclusion in a council's Standard LEP. This clause includes a requirement for a DCP to be adopted by council prior to development consent being granted to any development application. Preparation of this DCP is the opportunity for detailed WSD measures to be built into the strategic process prior to any development occurring.

Used in a master planning role, a site-specific DCP is a plan that specifies objectives, principles or criteria for the design and layout of development within a defined precinct or location, and may include written information, maps and diagrams. In addition to guiding the layout and design of new or significant infill residential, commercial or industrial sites, they can be used to accommodate diverse environmental circumstances in different parts of an LGA, such as the steep skeletal soils of upper catchments, verses flat flood prone areas in the lower catchment, or the environmental sensitivity of developments in catchments above wetlands.

Both LGA-wide and site-specific DCPs provide an important opportunity to ensure that the structure and configuration of new urban development supports sustainable urban water cycle outcomes. Matters that need to be addressed include:

- protecting the essential hydrological and ecological functions of natural watercourses, creeks, floodplains, and wetlands;
- using water and other landform features as key urban design elements;
- taking sympathetic advantage of the hydrological, ecological and recreational values offered by the site;
- adopting an urban structure that supports integrated water infrastructure systems and on-site stormwater management, consistent with any comprehensive water cycle strategy; and
- reconciling these requirements with other issues such as accessibility, urban structure, biodiversity conservation, flood risk management, etc.

4.8 Sustainable Financial Development Planning

4.8.1 Developer Contribution Plans

Sections 94 and 94A of the EP&A Act enable councils to seek development contributions ('Section 94 contributions') in relation to the capital cost of providing new or augmented services and facilities to serve the demands of future development. These contributions cannot be applied to operation and

maintenance costs, nor in respect of facilities provided by other authorities. Water and sewerage supply authorities are able to impose developer charges separately under separate legislation although there is scope for stormwater and drainage infrastructure to be levied under a Section 94 Plan (EP&A Act) or a Section 64 Plan (LG Act).

In order to levy monetary contributions, a Contributions Plans must be prepared pursuant to Section 94AB of the EP&A Act and this plan must provide the justification to impose development contributions. These plans identify the future development likely to occur over a given time period and the consequential demand for community services and facilities. This enables formulae to be developed to calculate contribution rates. Contribution plans have generally focused on conventional public amenities and services such as open space, recreational facilities, car parking, libraries and other community facilities. However, they are also a potential means for financing the capital cost of dealing with many urban water cycle elements such as stormwater drainage, stream rehabilitation, flood control and water quality control. At present, Section 94 Plans cannot be used to levy for land acquisition costs associated with riparian corridors.

Contributions plans require reliable information on which to justify the 'nexus' between future development and the WSD infrastructure. Section 94 cannot be used to fund WSD infrastructure necessary to address existing deficiencies unless costs are reasonably apportioned between existing and future development. In addition, for Section 94 to apply it is necessary to establish that the future development would result in a net increase in demand. If the new development is replacing current development that has similar characteristics then it will be difficult to justify that the development has generated an increased impact. Any existing development can be credited against future development and the net difference levied where impacts are likely to increase.

The preparation of comprehensive WSD strategies at the Structure Plan / Infrastructure Planning phase provides a solid foundation for contributions plans dealing with urban water cycle management issues.

4.8.2 Planning Agreements

Section 93F of the EP&A Act relates to Planning Agreements, sometimes referred to as Voluntary Planning Agreements (VPAs). VPAs are voluntary agreements which may be sought by a development applicant with a council or other government authority, to enable the provision of a wide range of community facilities, services and infrastructure. Councils cannot require or force an applicant into offering or entering into a VPA (or vice-a-versa) although councils can adopt policies stipulating under what circumstances they may consider a VPA to be appropriate or under which council would be prepared to enter into such an agreement.

Unlike Section 94 Plans (refer Section 4.8.1), VPAs are not bound by the same restrictions regarding recurrent costs (e.g. funding of future operation and maintenance) and provide a degree of flexibility for applicants and consent authorities to achieve development outcomes that are in the public interest and may offer a public benefit either not envisaged or not possible through a Section 94 Plan or other means.

4.8.3 Developer Service Charges

As indicated in Section 2.6, Section 64 of the LG Act in conjunction with Sections 305-307 of the WM Act, developer service charges for stormwater drainage facilities are permitted. This provides another option for councils to levy new development for communal water management controls, but again, only if there is a net increase in demand.

4.8.4 Stormwater Management Service Charge

Section 496A of the Local Government Act 1993 enables councils to levy an annual charge for stormwater management services for each parcel of rateable land for which a stormwater management service is provided, with the exception of rateable land owned by the Crown and leased for private purposes under the Housing Act 2001 or the Aboriginal Housing Act 1997.

The Local Government Act defines a stormwater management service as "a service to manage the quantity or quality, or both, of stormwater that flows off land, and includes a service to manage the re-use of stormwater for any purpose". The stormwater management service charge enables councils to raise additional revenue to cover some, or all, of the costs of providing new or additional stormwater management services within a catchment, suburb, town or local government area (LGA). The charge is to cover costs additional to those attributed to the level of service provided to the area in previous years and funded from council's general income. The cost of continuing to provide the level of service equivalent to that provided in previous years must continue to be funded from council's general income.

Councils may apply the charge to rateable land categorised as residential or business under the Local Government Act within an urban area, that benefits from the proposed new/additional stormwater management services. The stormwater management service charge cannot be used for dealing with stormwater run-off from public land. If a council is concerned about stormwater quality from rural residential or other rural land, an option to fund associated stormwater management activities would be to apply a special rate.

The upper charge limit is set at $25 for urban residential land, and $25 per 350m, or part thereof, for urban business land, and the charge must not exceed the anticipated cost of providing a new or additional stormwater management service to land subject to the charge. In addition, a council cannot levy the charge where an existing special rate or drainage charge provided primarily for stormwater management is in place. A council is also not to levy a stormwater management service charge if it is a water supply authority and levies a stormwater charge under the Water Management Act 2000 (e.g. Gosford and Wyong Shire Councils). These charges are regulated by the Independent Pricing and Regulatory Tribunal (IPART)

The *Stormwater Management Service Charge Guidelines* prepared by the Department of Local Government (DLG, 2006) outline specific allowable uses for the funds and provide specific guidance on calculation of appropriate stormwater service charges.

4.8.5 Security Bonds

Security bonds can be used by council as a way of ensuring compliance and environmental outcomes associated with approvals under:

- Local Government Act – conditions of approval s.97
- EP&A Act – s.80A

Section 80A of the EP&A Act is the exclusive and only source of power for a consent authority to require the provision of security as a condition of development consent issued under s.97 of the LG Act and is limited to the circumstances set out in that sub-section. Bonds can be used to protect waterways and other environmentally sensitive areas that are adjacent to development work on private land.

A development consent may be granted subject to a condition, or a consent authority may enter into an agreement with an applicant, that the applicant must provide security for the payment of the cost of any one or more of the following:

- Making good any damage that may be caused to any council property as a consequence of the doing of anything to which the consent relates;
- Completing any public works required in connection with the approval (including drainage and environmental controls); and
- Remedying any defects in any such public work that arise within 6 months after the work is completed.

The security is to be for such 'reasonable amount' determined by the consent authority. The security may be provided, at the applicant's choice, by way of:

- deposit with the consent authority, or
- a guarantee satisfactory to the consent authority.

The security is to be provided before carrying out any work in accordance with the development consent or at such other time as may be agreed to by the consent authority. The funds realised from a security may be paid out to meet any of the costs referred to above. Any balance remaining is to be refunded to, or at the direction of, the persons who provided the security.

5 SITE PLANNING - SMALL DEVELOPMENTS

5.1 Introduction

Small developments have a small site area with a typical associated lower risk of harm to receiving environments. Small developments represent the majority of DA's processed by councils and to assist with efficient processing of DA's it is often preferable to provide simplified assessment requirements and development controls for this scale of development. Typically small developments are defined to comprise individual lot, spot rezonings and small subdivisions. An example small scale development planning protocol is outlined in Figure 5-1 and discussed further below.

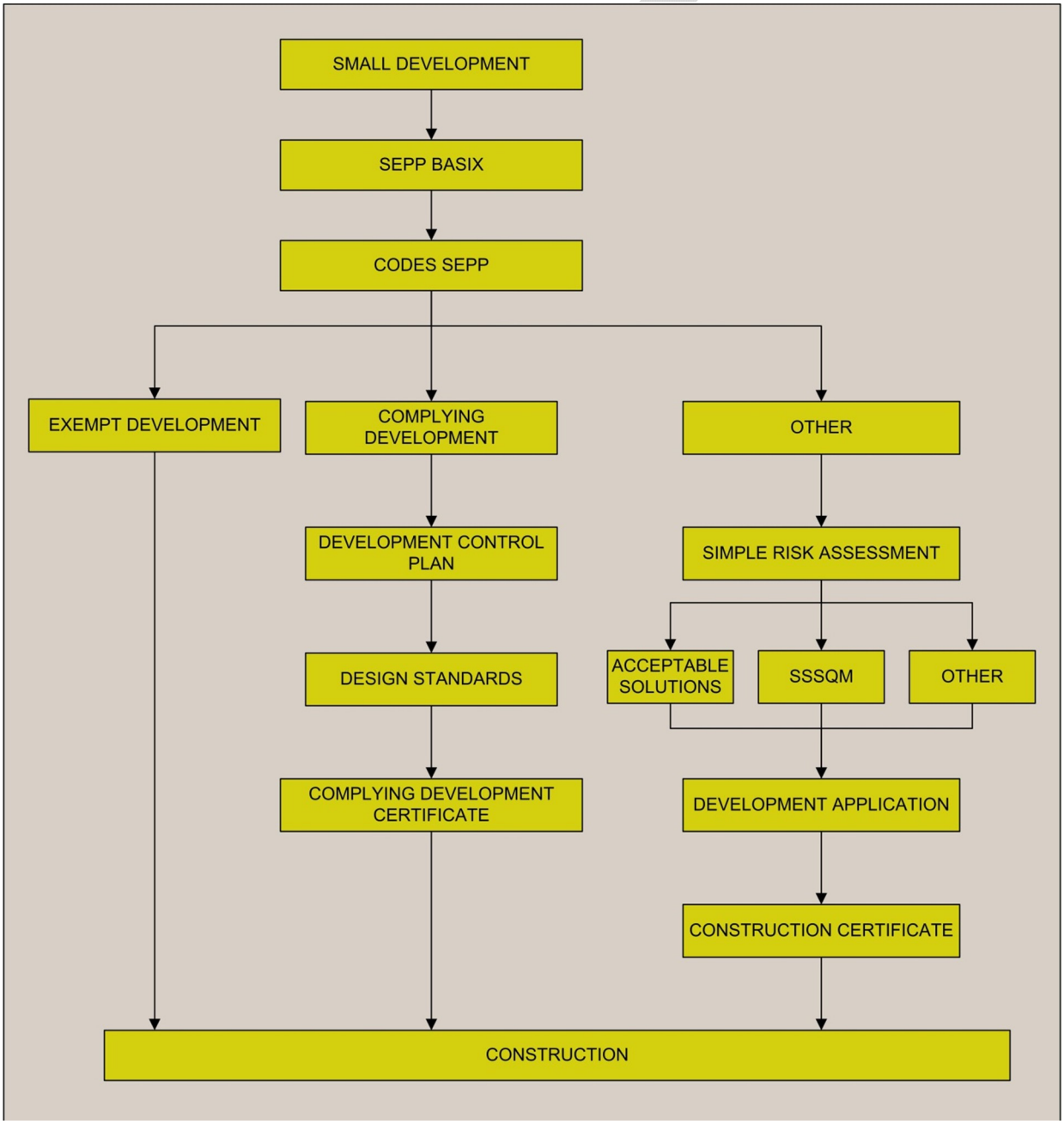

Figure 5-1 Small Scale Development Planning Protocol

5.2 Development Size

An initial step is to define an appropriate cut-off line that determines which developments council considers small and which are considered large. Typically, small scale developments are defined based upon a particular maximum lot area or number of lots. A review of data on recent DA's processed by council should assist with determining an appropriate limit for small scale development. Some example limits for small-scale development include:

- Maximum business, industrial or residential individual lot area of 4000m^2; or
- Maximum of four residential lots.

5.3 SEPP BASIX

State Environmental Planning Policy (Building Sustainability Index: BASIX) 2004 (BASIX) continues to be the overriding and mandatory instrument for setting water, energy efficiency and thermal comfort targets for 'BASIX affected development'. Residential development applications must be accompanied by a BASIX Certificate which indicates compliance with the prescribed sustainability targets before development consent can be granted.

To ensure that BASIX is the sole system of assessment for the above sustainability targets, SEPP BASIX disables the provisions of SEPP 1 and the ability to vary a development standard. It also renders inoperable any '*competing provisions*' in an EPI or DCP "to the extent to which they aim to reduce consumption of mains-supplied potable water". Such provisions for non-residential development (e.g. industrial and commercial) are not competing provisions and therefore continue to have effect.

Furthermore, EPI and DCP provisions which address aspects of sustainability other than residential water, energy efficiency and thermal comfort, continue to have effect in relation to development proposals assessed by BASIX. For instance, provisions to address WSD objectives are not overridden, even where they require, for example, rainwater or stormwater harvesting to retain stormwater on-site.

5.4 CODES SEPP

The majority of small developments will fall within the definition of Exempt and Complying developments. Exempt and Complying developments are certain types of development that typically have minimal or low environmental impact and accordingly, either do not require any form of approval or do not require the same level of assessment as for a development application.

The majority of small developments are now assessed under *State Environment Planning Policy (Exempt and Complying Development Codes) 2008* (the CODES SEPP). This theoretically means that some forms of development may not be subject to assessment under a council's LEP or DCP (Exempt) or that private certifiers may undertake the assessment (Complying) without the council being involved at all.

Complying Development requires an assessment, by council or an accredited certifier, against the 'Standards' stated in the respective Codes and against the provisions of the BCA. In relation to WSD, the Standards in the SEPP are basic and do not identify specific controls. Notwithstanding

this, a private certifier must still assess whether a Complying development proposal complies with the provisions of a DCP, and this highlights the importance of having clear WSD controls within a DCP. Controls included in the DCP can be in addition to those provided in the SEPP, but they must not conflict with the SEPP requirements.

If a council wishes to impose more stringent requirements on a development than the standards stated in the Codes SEPP, a local variation must be in place. Such a variation would require a detailed submission from the council to the DoPI and inclusion of global variations in Schedules 2, 3, 4 or 5 of the Codes SEPP.

5.5 Acceptable Solutions

Acceptable solutions are typically defined for small developments that have a low risk to the environment. The acceptable solutions may comprise both qualitative and quantitative criteria that the development applicant is required to achieve for development approval.

The size of WSD measures defined in the acceptable solutions will typically require council to initially complete modelling considering their local climate to determine appropriate sizes of measures necessary to minimise risks to the receiving environments. The size of measures may need to be varied across the LGA to account for variations in rainfall and should include some safety factor allowance to account for variability in site conditions across the LGA.

Simple calculations are typically required to determine the size of measures required for a particular development configuration to achieve the acceptable solution criteria. For example, a raingarden required for a particular development may need to be sized to have a surface area equivalent to 2% of the impervious site area and have a minimum surface storage volume equivalent to a 15mm runoff depth from impervious sites areas.

Consideration should be given to providing options within the acceptable solutions to enable a development applicant to select an appropriate solution for their particular site and development configuration. Although, the number of options listed in the acceptable solutions should be limited to reduce complexity. Acceptable solutions may also be derived applying a points system, where the development applicant selects measures from a list of options that each have assigned points. The development applicant selects options from the list until they have achieved the number of points required to achieve the acceptable solution criteria. Care is required with this method to ensure that the effectiveness of the various combinations of options required to achieve the minimum points criteria is similar.

Only measures that are relatively simple to construct, inspect and maintain should be included. Typical measures that may be appropriate for most small scale development sites may include disconnected roof and paving areas, rainwater tanks, permeable paving, stormwater retention, raingardens, and media filters. Links should be provided within the acceptable solutions to practice notes that provide further details on the configuration of each measure.

Sources for examples of acceptable solutions (typically referred to as deemed to comply) include:

- Wyong Shire Council *Draft Water Sensitive Urban Design Deemed to Comply Solutions*
- South East Queensland *Deemed to Comply Solutions – Stormwater Quality*

5.6 Spreadsheet Models

Spreadsheet models can also be applied to estimate the size of measures required for small developments to achieve acceptable solutions. These are typically simplified models based on results generated from multiple runs of the MUSIC model. One example is the Sydney Metropolitan Catchment Management Authority's Small Scale Stormwater Quality Model (SSSQM) which facilitates the application of WSD and related targets to small developments. The SSSQM requires users to input characteristics of the site and proposed development, such as the type of development, site area and the area of roof and other impervious surfaces (i.e. driveway, paved areas). The user is then required to select from a list of measures provided within the tool, the type, configuration and size of WSD measures proposed for the development. The measures listed in the SSSQM currently include:

- Pervious pavement;
- Green (vegetated) roof;
- Vegetated buffer / filter strip;
- Vegetated swale;
- Bioretention basin, swale, raingarden or bioretention planter box;
- Sand filter; and
- Infiltration system.

The SSSQM analyses the inputs and then indicates whether the proposed WSD measures would achieve the applicable stormwater targets. If the proposed WSD measures do not comply, the user has the option to adjust the measures and iterate to an acceptable solution. The SSSQM also incorporates an acceptable solution solver that provides sizes of rainwater tanks and bioretention systems required to achieve the targets.

Once a complying solution is achieved, the SSSQM enables the user to print a WSD Commitments Summary, which is then attached to the Development Application for submission to council. The commitments made using the SSSQM then form part of the conditions of consent. Further information on the SSSQM can be accessed in the Small Scale Stormwater Quality Model User Guide (SCA, 2010).

5.7 Simple Risk Assessment

Every development site has unique characteristics which require at least a simple risk assessment to be undertaken to confirm the presence of any 'show stopper' issues that significantly reduce the potential for an acceptable solution to be feasible. This is important for small developments to minimise the risk of particular measures not functioning when installed, or requiring significant modification during construction.

A simple risk assessment should focus on the key site constraints that may impact on the feasibility of the acceptable solution being considered for the proposed development. The simple risk assessment typically would comprise yes/no answers to questions that the development applicant would need to consider when selecting an appropriate acceptable solution option to adopt for their development.

Yes answers to the questions would not guarantee that a particular acceptable solution will work for a particular site, but would assist with reducing the risk of a particular solution not working.

If all answers to the key questions are yes, the development applicant can be referred to the relevant acceptable solution for their development type and confirm that the size of the measure required can be incorporated into the development layout. If the answer to any of the simple risk assessment questions is no (or not known), the development applicant should discuss options with council to confirm if an alternative option is available, or if a detailed assessment of relevant site conditions would be required to demonstrate that the targets can be achieved. Some example simple risk assessment questions may include:

- Is the site accessible for construction of the measures?
- Is it feasible to connect the site drainage system to the measure?
- Can drainage from the measure be connected to a kerb, interallotment drainage line or other acceptable drainage system element?
- Will the measures be accessible for future maintenance using machinery (if required)?
- Can the measures be constructed whilst avoiding services within the site?
- Will the measures be located away from building footings, trees, retaining walls and other structures?
- Will the measures be located outside existing easements?
- Will the measures create any potential visual or noise impacts for adjacent residents?
- Is the ground slope within the site appropriate for the measures?
- Can the measures be constructed avoiding rock and groundwater?

6 SITE PLANNING - LARGE DEVELOPMENTS

6.1 Introduction

Large developments can simply be defined as any development that exceeds the limits set for small development. The large development category would typically include most subdivisions and larger commercial and industrial lot scale development sites. Associated with the increased development footprint is an increased potential for adverse impacts on the existing environment. This increased risk potential warrants closer consideration of a range of physical and institutional constraints to ensure that a WSD strategy prepared for the development responds appropriately to the constraints. A planning protocol for large developments is outlined in Figure 6-1 and discussed further below.

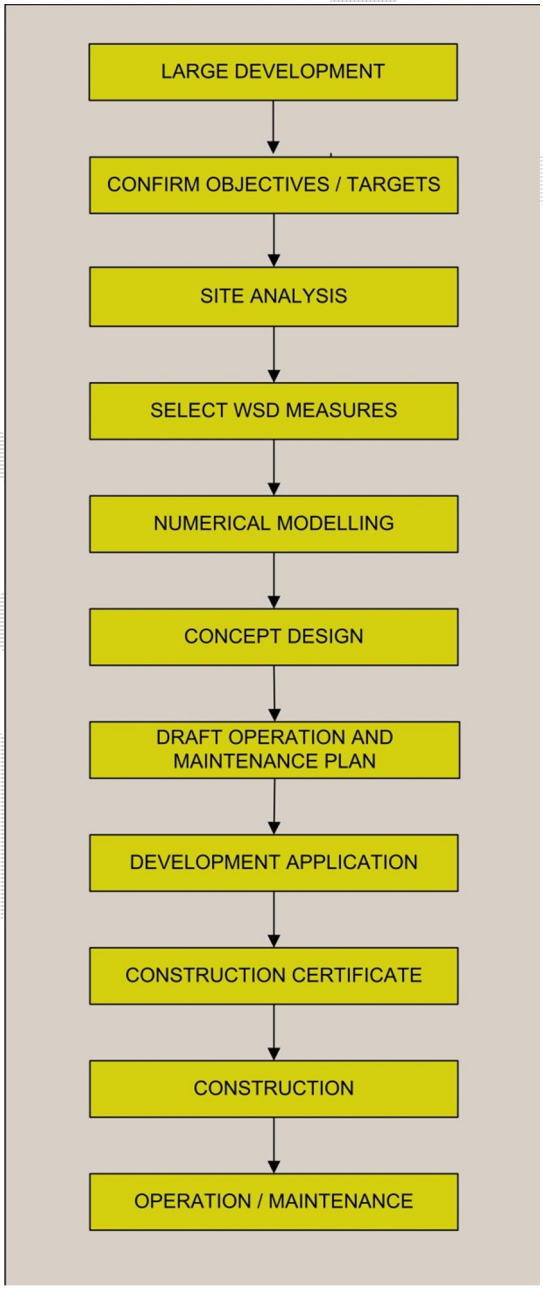

Figure 6-1 Large Development Planning Protocol

6.1 Confirm Principles, Objectives and Targets

The initial step in developing a WSD strategy for a large development is to confirm the WSD principles, objectives and targets that apply to the development site. Typically these are identified for the site during initial strategic planning.

The development applicant shall ensure that any additional planning requirements applying to the development are identified and addressed. The development applicant should provide concise statements of how the individual principles and objectives are addressed within a WSD strategy. Further discussion on WSD objectives and targets is provided in Section 3.4 and Section 3.6.

6.2 Site Analysis

6.2.1 Scope

A site analysis should be completed to confirm the flooding, terrain, soil, groundwater, riparian land, existing services and infrastructure characteristics, and other site features that would potentially pose a constraint (or opportunity) to WSD. Sub-catchments should be defined and receiving environment characteristics (including those beyond the site boundaries) described.

Depending on the scale of the proposed development, the site analysis may also include consideration of other relevant urban design criteria where it influences WSD (e.g. terrestrial ecology, landscaping, visual, bushfire, heritage, archaeology, acoustics, transport etc). The site analysis should include a summary of key constraints and opportunities, and confirm potential risks to the receiving environments if WSD measures are not provided within the development.

6.2.2 Desktop Review

Prior to detailed site planning for large development sites, investigations during earlier strategic planning (e.g. structure planning, infrastructure planning, rezoning) are likely to provide useful data that can assist with preparing a development application. Whilst this data is often useful, strategic planning is completed on a broader scale and may provide limited detail on the specific site under consideration. Typically, further more detailed investigations may be required for a large site at the development application stage to fill in gaps in the strategic planning data.

Any review of background reports/data and additional site investigations undertaken to inform the site analysis shall be referenced and described.

6.2.3 Flooding

Flooding is typically a key constraint for WSD when development is planned adjacent to watercourses, overland flow paths, water bodies and near lower lying areas. WSD measures are often positioned in the lower lying portions of a development site near watercourses. To ensure that these measures are not at risk from flooding and will not have adverse impacts on flooding behaviour it is important that the measures be located outside floodways and ideally beyond flood storage or flood fringe areas. In order to achieve this, it is first necessary to confirm flooding characteristics for a particular site.

The location and details of existing local overland flow paths and constructed drainage systems within and adjacent to a proposed development site should be confirmed. Existing flood studies and data should be sourced and council contacted to confirm Flood Planning Levels (FPLs) for the site. Flood levels, depths, velocities and hazards are often mapped from flood studies and this data can provide a useful resource for evaluating flooding constraints for WSD. Where existing data is insufficient to define the FPLs, a local flood study may be required.

If WSD measures are planned within flood storage areas or flood fringe areas, a flooding assessment is often necessary to estimate the impact of the WSD measures on flooding behaviour. The assessment should be completed in accordance with the *NSW Floodplain Development Manual* and Council's Flood Liable Lands Policy.

6.2.4 Riparian Land and Watercourses

Riparian lands should be protected by excluding urban infrastructure (including WSD measures). The NSW Office of Water (NOW) provides guidance on appropriate widths for riparian lands. Riparian corridors are defined within the *Guidelines for Controlled Activities - Riparian Corridors* (DWE, 2008). Riparian corridor zones (Core Riparian Zone and Vegetated Buffer) and adjacent Asset Protection Zone are shown in **Figure 6-2**.

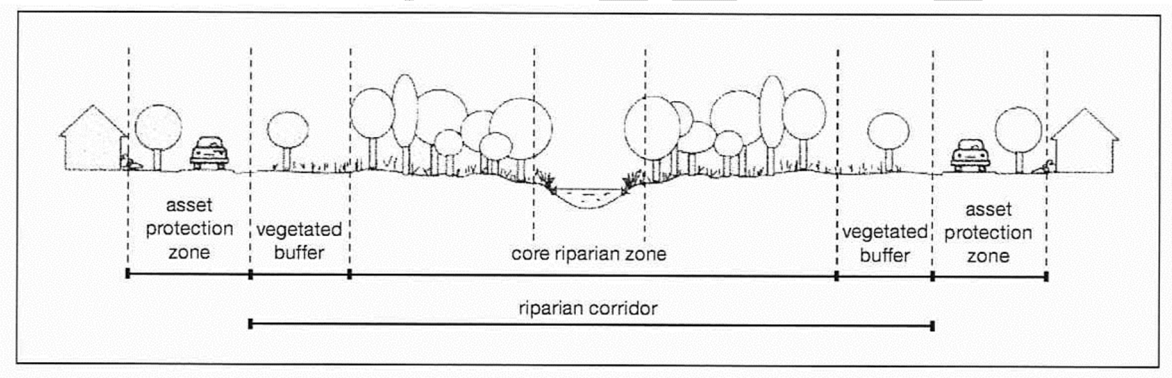

Figure 6-2 Riparian corridor zones (DWE, 2008)

The Core Riparian Zone (CRZ) is the land contained within and adjacent to the watercourse. NOW typically seeks to ensure that the CRZ remains, or becomes vegetated, with fully structured native vegetation (including groundcovers, shrubs and trees). The Vegetated Buffer (VB) protects the environmental integrity of the CRZ from weed invasion, micro-climate changes, litter, trampling and pollution. WSD measures should not be positioned within the CRZ or VB without approval from NOW.

Asset Protection Zones (APZ) are a requirement of the NSW Rural Fire Service and are designed to protect assets (house, buildings etc) from potential bushfire damage. The APZ should contain cleared land which means that it cannot be part of the CRZ or VB. WSD measures can typically be located within the APZ provided the NSW Rural Fire Service requirements are met. APZ requirements are provided in the NSW Rural Fire Service document *Planning for Bushfire Protection, 2006.*

The identification and classification of watercourses is typically undertaken in accordance with the *Water Management Act 2000* and the *Guidelines for Measureled Activities - Riparian Corridors*

prepared by DWE. The *Guidelines for Controlled Activities - Riparian Corridors* recommend minimum core riparian zone widths based purely on the hydrologic function of the stream. Recently, the focus has changed to consider (in addition to hydrology) the ecological, water quality and geomorphic functions of the watercourse. For example, Wollongong City Council adopts the following categories:

- Category 1 – Environmental Corridor – This category aims to provide extensive habitats for terrestrial and aquatic fauna and to maintain and restore the viability of riparian vegetation as well as protect water quality and provide bank stability.
- Category 2 – Terrestrial and Aquatic Habitat – This category aims to maintain and restore the natural functions of a stream in order to maintain the viability of riparian vegetation and provide suitable habitat for terrestrial and aquatic fauna as well as improve water quality and provide bank stability.
- Category 3 – Bank Stability and Water Quality - This category aims to minimise sedimentation and nutrient transfer to provide bank stability, improve water quality and protect native vegetation. This typically applies to open channels with little remnant vegetation and limited engineering to protect the bed and banks. Focus is often on providing flood appropriate vegetation to reduce flood impacts.

Minimum environmental objectives for each stream category are shown in Table 6-1.

Table 6-1 Riparian Categories and Environmental Objectives (DIPNR, 2004)

Minimum Environmental Objective for Riparian Land	Category 1 Environmental Corridor	Category 2 Terrestrial & Aquatic Habitat	Category 3 Bank Stability & Water Quality
Delineate riparian zone on a map & map appropriately for environmental protection	Yes	Yes	If resources are available
Provide a minimum core riparian zone width	40m from top of bank	20m from top of bank	Usually 10m from top of bank
Provide additional width to counter edge effects on the urban interface	10m	10m	Generally not required
Provide continuity for movement of terrestrial & aquatic habitat	Yes (including piered crossings)	Yes (with appropriate crossing design)	Where appropriate
Rehabilitate/re-establish local provenance native vegetation	Yes	Yes	Where appropriate
Locate services outside the core riparian zone wherever possible	Yes	Yes	Merit consideration
Locate playing fields and recreation activities outside core riparian zones	Yes	Yes	Merit consideration
Treat stormwater runoff before discharge into riparian zone of the watercourse	Yes (outside CRZ and buffer)	Yes (outside CRZ and buffer)	Yes

6.2.5 Sea Level Rise, Coastal Erosion and Increased Flooding

Coastal areas at risk from sea level rise are currently being identified by councils within coastal zone management plans. These plans will outline the identified coastal risk areas for strategic land use planning and these plans should be referred to when planning WSD. Properties within identified

coastal risk areas will be assigned with Section 149 certificates that identify the property is affected by sea level rise, coastal erosion and/or increased flooding.

Development applicants in areas affected by sea level rise, coastal erosion and/or increased flooding are required to identify appropriate management responses or adaptation strategies to respond to the coastal risks. The WSD measures would need to be planned to ensure that appropriate consideration is given to the identified coastal risks.

Whilst it is envisaged development controls will be in place to manage future development on land potentially inundated by sea levels in the future, sea level rise may also impact on the function of WSD measures. Typically larger WSD measures installed to manage runoff quality and quantity will be located in the lower sections of a development site. It will be important for planning of WSD measures in coastal areas that close consideration of the site levels is undertaken to ensure that the hydrologic, hydraulic and water quality functions of WSD measure would not be compromised by sea level rise.

WSD measures should be planned and located beyond predicted flooding and inundation extents associated with climate change. Where this is unavoidable, analysis should be completed to ensure that WSD infrastructure will not impact adversely on flooding behaviour or not be extensively damaged by flooding and innundation.

Ideally, WSD measures should be configured to be fully functional under current climatic conditions, but have the potential to be adapted in the future under predicted climate change conditions. For example, vegetation selected for planting in WSD measures should be tolerant to changes in climatic conditions.

Numerical modelling of WSD strategies should incorporate rainfall and evapotranspiration inputs scaled to account for potential climate change impacts. A spreadsheet tool has recently been developed by the Sydney Metropolitan CMA to assist with scaling pluviograph (6 minute) data to account for potential climate change for use in software such as MUSIC.

6.2.6 Terrain and Drainage

The terrain of a site and adjacent land is typically one of the key constraints for WSD. The site terrain is typically interpreted to confirm sub-catchments and drainage pathways for a particular development for both internal and external parts of the site. The terrain analysis also assists with confirming surface drainage pathways within the site. A slope analysis may also be undertaken across the site to confirm appropriate locations for particular WSD measures based on surface gradients.

The terrain of the site is commonly assessed utilising geographical information systems (GIS) and/or digital terrain models (DTM) that enable catchments to be delineated and the spatial distribution of site gradients to be interpreted. The terrain can also be interpreted from topographic maps or contour surveys where GIS data is unavailable. By aligning infrastructure along the contours it may also be possible to achieve gradients more amenable to WSD measures.

In addition to the terrain, the location of existing stormwater drainage systems and roads should be considered when determining sub-catchments as this infrastructure can modify catchments from that indicated by the general topography. The sub-catchments should also be defined considering land uses and the future development configuration.

In addition to assessing the gradients across the site, other terrain features should also be identified that potentially will impact on the location of WSD management elements including areas of slope instability and rock outcrops.

6.2.7 Soils and Groundwater

A key objective of WSD is to minimise changes in stormwater runoff volumes and impacts on stream flow regimes following development. Typically this can be achieved through rainwater/stormwater harvesting and/or maximising infiltration/evapotranspiration within the remaining pervious areas.

In order to assess the suitability of a particular site for infiltration it is important that soil investigations are undertaken. Whilst infiltration will assist with reducing the volume of stormwater it is also important to consider the potential impacts of increased infiltration on factors including groundwater mounding/levels/flow/quality, downslope seepage, soil salinity and the function of WSD measures.

Preliminary desktop investigations may be undertaken using published soil landscape mapping/data and previous geotechnical investigations in the area. These studies can assist with preliminary planning and scoping geotechnical field investigations.

Geotechnical field investigations will be necessary on larger sites to confirm appropriate locations and types of WSD measures. The geotechnical investigations typically will also assist with defining parameters for numerical modelling. The extent of investigations required will depend on the individual characteristics of the site and may include:

- Description, classification and mapping of the soil types within the site;
- Depth of individual soil layers in the profile and the depth to bedrock;
- Depth to groundwater and assessment of the groundwater response to rainfall/seasonal influences;
- Groundwater monitoring/sampling and assessment for salinity, water quality, seasonal movement and flow direction/velocity;
- Saturated hydraulic conductivity testing and assessment of the permeability of surface and sub-surface soil layers (hydrophobic, hard setting soils);
- Soil pH and assessment of the presence of potential and/or actual acid sulfate soils;
- Presence or evidence of any soil contamination;
- Soil salinity classification;
- Soil dispersibility and erosion potential; and
- Existing groundwater uses (including protecting water supplies).

6.2.8 Services and Infrastructure

Existing infrastructure and services can often impact on the location of WSD measures. A services search should be undertaken through Dial-Before-You-Dig to identify the location of existing above and below ground infrastructure. Liaison with council and the local water utility may be required to identify the location of stormwater drainage, sewerage and water supply infrastructure.

The location of services including water supply, sewerage, gas, electricity, telecommunications, oil pipelines, drainage etc should be confirmed by field survey. A plan should be prepared showing the location and typical depth (or actual depth if known) of existing infrastructure that would potentially conflict with the location of proposed WSD measures.

The site analysis should also include investigations for any planned infrastructure and services.

6.2.9 Others

Other urban design issues may need to be considered for WSD for particular sites including:

- Heritage and archaeology;
- Aquatic and terrestrial ecology;
- Landscape; and
- Public safety and crime prevention.

6.3 Select WSD Measures

A creative WSD response to the site objectives and site analysis should be encouraged. Designers should be free to select the measures that are best suited to the site conditions provided the objectives and targets can be achieved. Innovation should be encouraged for large developments to ensure that the WSD strategy provides an appropriate response to the site constraints.

If there are any relevant issues remaining unresolved, recommendations shall be included within the WSD strategy to resolve these issues during detailed design. It will be important that any issues that impact on the feasibility of a particular WSD measures be resolved at this stage. Only issues that potentially would require minor modifications to the selected WSD measures should be deferred to the detailed design stage.

A WSD strategy should be prepared as a component of rezoning investigations (where relevant) and development applications for large development sites. The level of detail provided within the WSD strategy for these two different stages of the development process will vary. Typical requirements for a rezoning stage WSD strategy are discussed in Section 4.6.

At the land rezoning stage, typically a preliminary concept of the future development configuration is only available. Whilst the scale and land use composition of the future development is confirmed through the rezoning process, specific details on road and lot layouts and site grading are often preliminary. At this stage, a preliminary WSD strategy can be prepared that broadly identifies the intended approach to managing the water cycle within the development.

At the development application stage, a road and lot layout close to the final constructed form should be available for subdivision developments. Similarly, near final building footprints, driveway/carparking, and landscaping layouts should be available for lot scale developments. At the development application stage an appreciation of the final site levels and grades is required. The availability of this more detailed information at the development application stage enables the preparation of a final WSD strategy for the site. This final WSD strategy should not vary much to the construction certificate stage.

6.4 Numerical Modelling

The WSD strategy should describe the numerical modelling completed to assess the performance of the proposed WSD measures against numerical targets. This section of the report should summarise the model input data used, modelling assumptions, modelled configuration of the WSD measures and model results. The numerical modelling section shall include comparisons between the modelled WSD strategy and the targets relevant to the development. A statement should be provided confirming if the targets would be met by implementing the proposed strategy. It will be important that the numerical modelling results presented are based upon feasible and practical WSD configurations. Numerical models should be submitted with the WSD strategy report.

6.4.1 Stormwater Quantity and Quality

Stormwater quantity and quality modelling should be completed using the Model for Urban Stormwater Improvement and Conceptualisation (MUSIC) (or other similar approved software) to estimate runoff volumes and loads of common stormwater pollutants. MUSIC includes algorithms to evaluate the hydrology and concentrations / loads of common stormwater pollutants (i.e. TSS, TP and TN) from urban catchments and estimate the performance of WSD measures at capturing these pollutants. MUSIC is considered within the industry to be an appropriate conceptual design model for the assessment and sizing of WSD measures. The modelling should be used to inform development of a concept plan and WSD strategy for a development site.

MUSIC can be utilised for comparison of alternative scenarios that adopt the same base inputs. Although the magnitude of the estimates is likely to be different to the actual site conditions (due to limitations in available data for a particular site), the relative differences between scenarios is expected to be appropriate for decision making. Practical guidance to assist with the development of MUSIC models in NSW is provided in the Draft NSW MUSIC Modelling Guidelines (SMCMA, 2010). These guidelines will assist with developing MUSIC models, but additional local model parameters (e.g. rainfall, potential evapotranspiration, rainfall runoff parameters, runoff quality parameters) will typically need to be confirmed by local studies.

6.4.2 Event-based modelling

Event-based modelling is typically completed for WSD to estimated peak discharges for evaluating bankfull flows to assess stream erosion targets. Runoff routing software including XP-RAFTS, RORB, DRAINS etc are typically utilised to evaluate hydrology for specific design events. Typically the 1 year and 2 year ARI flows for the existing and developed (with WSD measures) scenarios will be of most interest for evaluating stream erosion criteria.

6.5 Concept Design

Concept design drawings/sketches should be prepared showing the location, size and conceptual configuration of the WSD measures. Sufficient information should be provided to clearly demonstrate how the WSD measures function and co-ordinate within other urban design elements of the proposed development.

A sub-catchment plan should also be provided to show all site and external catchments draining to the WSD measures. Contours should be shown at an appropriate interval that clearly indicates

proposed site gradients and any distinct changes in ground levels. Where the WSD measures will capture runoff from areas external to the development, contours and sub-catchments for the external areas should be shown.

The location and total footprint of the WSD measures in relation to other infrastructure proposed within the development should be shown. The total estimated footprint may be shown as a shaded area on a plan that shows the other elements of the development. To confirm the total footprint of the WSD measures, it will be important that consideration is given to embankments, cutting and retaining walls necessary to construct the measures. This will be particularly important within steep sites where the total footprint of a WSD measure may substantially exceed the modelled requirements.

A conceptual plan of the WSD measures showing the configuration of the measures should be provided. Examples of design elements that the concept plan should show include total width/length/surface area, vehicular access, embankment and cutting extents, planting areas, maintenance access locations, proposed inlet and outlet connections to drainage systems etc.

A conceptual section/s through the WSD measures should be provided showing the dimensions and key features of the WSD measure. Examples of the design elements that the concept sections should show extended detention depths, internal and external batter slopes, retaining wall locations, embankment crest widths, filter media layer depths, filter media characteristics, drainage pit and pipe size/location, plant species, locations and densities, inlet location/configuration etc.

Locations of existing services within or external to the development site that may require adjustment to construct the WSD measures should be shown along with proposed connections to external drainage systems (including the existing drainage system characteristics).

There are a number of resources available to assist in the development of concept designs for WSD measures. Some examples are provided below:

- Argue, J.R. (ed), 2004, *Water Sensitive Urban Design: Basic Procedures for Source Control of Stormwater,* Stormwater Industry Association, University of South Australia and Australian Water Association.
- Brisbane City Council, (2005), *Water Sensitive Urban Design Engineering Guidelines: Stormwater, (Draft),* Brisbane City Council, Brisbane.
- Engineers Australia, (2006), *Australian Runoff Quality: A Guide to Water Sensitive Urban Design,* Engineers Australia, ACT.
- Gold Coast City Council, (2007), *Water Sensitive Urban Design Guidelines,* Gold Coast City Council.
- HCCREMS, (2011) *WaterSmart Practice Notes,* Hunter & Central Coast Regional Environmental Management Strategy.
- Melbourne Water (2005). *WSUD Engineering Procedures: Stormwater*. CSIRO Publishing.
- Moreton Bay Waterways and Catchments Partnership 2006, *Water Sensitive Urban Design: Technical Design Guidelines for South East Queensland,* Moreton Bay Waterways and Catchments Partnership and Brisbane City Council, Brisbane.

- NSW Department of Environment and Conservation, (2006) *Managing Urban Stormwater – Harvesting and Reuse*
- UPRCT (2004), *Water Sensitive Urban Design – Technical Guidelines for Western Sydney* Stormwater Trust and Upper Parramatta River Catchment Trust.

A number of web sites are also good sources of up-to-date information for developing concept designs including:

- Water Sensitive Urban Design (WSUD) in the Sydney Region Capacity Building Program (http://www.wsud.org/index.htm).
- Hunter Central Coast Regional Environmental Strategy WSUD Capacity Building Program (http://www.urbanwater.info/index.cfm).
- Water by Design Capacity Building (http://www.healthywaterways.org/wbd_project_overview.html).
- Clearwater Capacity Building Program (http://www.clearwater.asn.au/).

6.6 Draft Operation and Maintenance Plan

An Operation and Maintenance Plan (OMP) is a living document that is typically progressively reviewed and updated at various stages throughout the development lifecycle as further details of the development are confirmed. The OMP should typically be prepared, reviewed and/or updated at the following stages:

- Development application (developer);
- Construction certificate (developer);
- Asset hand over (developer); and
- Asset management (asset owner).

At the development application stage, critical issues relevant to future operation and maintenance of WSD measures should be addressed in a Draft OMP to ensure that appropriate consideration has been given to maintenance prior to proceeding to the construction certificate and construction stages. Key issues that should be resolved at the development application stage are summarised below.

The **maintenance responsibility** for the WSD measures is typically confirmed early in the planning process. The development applicant typically would confirm if the future maintenance responsibility lies with council, the private property owner or a body corporate/community association. Most councils have a preference for large WSD measures to be located within public lands formed by the development to ensure that council has a legal right to access and maintain the measures. To achieve the full benefits of WSD though, some measures typically would need to be located within private land.

It is important that the availability of an appropriate **site and WSD measure access** is confirmed early in the planning process. It will be important that a legal and geometrically viable site access for the types of equipment required to maintain the measures is available. If maintenance activities will require heavy vehicles (e.g. tip trucks, excavators) then the access pavement must be planned to have sufficient strength for these traffic loads. The access alignment and gradients shall be suitable

for the required maintenance vehicles for all weather access. The site should also be checked to confirm that existing or future features/infrastructure would not impede maintenance (e.g. overhead power lines, sewerage, tree branches). The presence of other conditions that may impede future maintenance shall be confirmed (e.g. base flow, tidal flows). It will be important that safety for maintenance personnel is also considered to ensure that the measures can be safely maintained in the future (e.g. conflicts with traffic can be avoided).

A **description of the WSD measures** should be provided including the locations and types of WSUD measures proposed. This description shall also include a summary of the catchment area, land uses, imperviousness and other details of the catchment draining to the measures. The development applicant should also identify the expected types, sources and loads of pollutants that would be captured by each measure. Where possible, non-structural controls to manage pollutants closer to the source should be identified (e.g. good housekeeping).

A **description of any staging** associated with the proposed development or WSD measure construction should be provided. It will be important that it is demonstrated that sufficient WSD measures will be provided throughout the development and building phases to ensure that the objectives and targets would be achieved from commencement to completion of all road and building construction. It is also important that measures that will subject to potential damage and/or excessive sediment loading during a building construction phase are staged to ensure that the measures will be functional when building works have neared completion and the catchment is stabilised. The O&M plan should clearly demonstrate how the construction of measures will be staged (e.g. temporary sacrificial vegetation or media layers during construction replaced by final layers prior to asset handover).

A **description of the maintenance methods** for the WSD measures should be provided. A fundamental consideration for council will be that the proposed measures can be efficiently maintained using available council equipment and personnel. The maintenance methods described shall include a summary of the likely inspection and maintenance frequencies, equipment and number/qualifications of maintenance personnel required.

An **estimate of the operation and maintenance costs** for the WSD measures is important during early planning to ensure that council has a good appreciation of the future long-term operation and maintenance costs associated with the WSD measures. The operation and maintenance costs for WSD measures should be estimated at the development application stage to avoid construction of measures that will ultimately be ineffective due to excessive and impractical maintenance costs. Cost estimates shall be provided for the operation, maintenance and replacement/decommissioning cost elements for each measure. Cost estimates should be justified based on existing similar installations. More detailed guidance on evaluating operation and maintenance costs for a range of WSD measures is provided in a report titled ‘An Introduction to Life Cycle Costing Involving Structural Stormwater Quality Management Measures’ prepared by the Co-operative Research Centre for Catchment Hydrology (Taylor, 2003a). MUSIC can be utilised to undertake preliminary lifecycle cost estimates, although these estimates should also be checked using available local cost data.

6.7 WSD Strategy Report

A WSD strategy report is typically prepared in support of a development application. The following elements are typically addressed within a WSD strategy report:

- A description of the existing site, receiving environments and proposed development;
- The potential development impacts on the receiving environments.
- The principles, objectives and targets relevant to WSD for the site;
- A site analysis of WSD relevant characteristics;
- A summary of appropriate WSD measures;
- A description of the WSD concept;
- A summary of numerical modelling completed to evaluate the performance of the WSD concept;
- A WSD concept plan and typical section drawings of key WSD measures;
- An estimate of the operation and maintenance costs for the WSD strategy; and
- A draft operation and maintenance plan.
- Summary and justification of how the WSD strategy has considered the principles and addresses the objectives;

Typically as the size of the development increases and the environmental sensitivity of the receiving environments increases, the range of professional expertise required to assist with preparation of the WSD strategy and background studies will also need to increase to ensure that appropriate solutions are proposed. The WSD strategy for large developments should typically be prepared by a qualified professional Civil or Environmental Engineer with qualifications suitable for admission to Engineers Australia who is actively practicing in the area of WSD.

7 REFERENCES

BMT WBM (2009), *Evaluating Options for Water Sensitive Urban Design – A National Guide,* Prepared for the Joint Steering Committee for Water Sensitive Cities.

Brookes, K. and Wong, T.H.F. (2009) *The adequacy of the Stream Erosion Index as an alternative indicator of geomorphic stability in urban waterways.* WSUD09 proceedings.

DLG, 2006 *Stormwater Management Service Charge Guidelines,* Department of Local Government, July 2006.

Great Lakes Council (2009), *Great Lakes Water Quality Improvement Plan: Wallis, Smiths and Myall Lakes, Forster, NSW*

HCCREMS *Funding Environmental Compliance*

HCCREMS, 2010 *Potential Impacts of Climate Change on the Hunter, Central and Lower North Coast of NSW.*

Queensland Government (2009), *South East Queensland Regional Plan 2009–2031 Implementation Guideline No. 7 Water sensitive urban design: Design objectives for urban stormwater management* November 2009