

DEPARTMENT OF NATURAL RESOURCES & MINES

**Planning Guidelines for Water Supply
and Sewerage**

March 2005

Guideline Status

In Queensland the provision of urban water supply and sewerage is essentially a local government responsibility. Since the 1960's guidelines for planning and design have been a key State Government input to Queensland's urban water industry to provide a consistent framework and benchmark for the planning, and to some extent design, of urban water supply and sewerage infrastructure.

This guideline is the first major revision of Queensland State Government planning guidelines on urban water supply and sewerage for over 10 years. The revised planning guideline has an emphasis on integrated system planning incorporating water, sewerage and stormwater. The planning phase of the asset lifecycle provides the greatest opportunity for delivering water and sewerage services at the lowest lifecycle cost while also meeting social and environmental requirements. The document focuses on the planning process and promotes consideration of a wide range of infrastructure, alternative sources and 'non-asset' solutions to meet community needs. The planning principles/processes outlined in this document are applicable to planning for other municipal services.

This guideline replaces the *Guidelines for Planning and Design of Sewerage Schemes (Water Resources, 1991/92)* and *Guidelines for Planning and Design of Urban Water Supply Schemes (Water Resources, 1989)*.

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1.0 Purpose of the Guidelines

The primary purpose of these guidelines is to facilitate strategic thinking in the planning process.

These guidelines are the first major revision of Queensland State Government Planning Guidelines on urban water supply and sewerage for over 10 years. Since then there have been substantial changes in the administration of, and regulatory framework for, the urban water industry as well as changes in the approach to water and sewerage planning. For instance the Water Services Association of Australia (WSAA) codes are adopted as suitable standards for the planning and design aspects of water and sewerage reticulation/collection systems previously covered in the State Government planning and design guidelines.

The revised planning guideline has an emphasis on integrated system planning incorporating water, sewerage and stormwater. The planning phase of the asset lifecycle provides the greatest opportunity for delivering water and sewerage services at the lowest lifecycle cost while also meeting social and environmental requirements. The document focuses on the planning process and attempts to promote consideration of a wide range of infrastructure, source substitution and 'non-asset' solutions to meet community needs. The planning principles/processes outlined in this document are applicable to planning for other municipal services.

This guideline encourages service providers to base their planning on 'real' data. It includes guidance on sizing of components and, as far as possible, attempts to continue the design philosophy in previous guidelines while achieving consistency with the WSAA Codes. Service providers can develop their own design parameters and sizing criteria based on the performance characteristics of their existing systems.

Each chapter includes a bibliography that provides a ready reference to more detailed information, much of which is accessible by direct linkage to specific Internet sites. It is proposed the bibliography will be updated at regular intervals.

Each chapter has a consistent structure which includes:

Purpose	succinctly describes the purpose of the topic in the chapter.
Key Principles	a short listing of guiding rules.
Why is This Important?	briefly highlights the importance of the issue, benefits to the service provider and possible risks of not addressing the issue.
When Should This be Undertaken?	describes when the activity should be undertaken in the planning process.
Key Elements	outlines the key elements of the process being considered.
Checklist	a listing of prompt questions which may assist the planner and internal reviewer.
Bibliography	a listing of references (many of which can be accessed on the Internet) from which more detailed information can be obtained

The guideline consists of the following chapters:

Chapter 1 – The Regulatory Framework. This provides an overview of the regulatory framework as it applies to the planning of water supply and sewerage services.

Chapter 2 – Knowledge Management. Effective knowledge management is a critical foundation for quality infrastructure planning. Without this foundation, the resources allocated to planning studies become focused on information capture and verification. This diverts the allocation of resources from the application of strategic thinking skills in developing and critically evaluating options to provide optimal solutions for stakeholders.

This chapter provides an overview of knowledge management as it applies to the planning process. It is based on the interim Australian Standard AS 5037 (int) 2003 Knowledge Management.

Chapter 3 – The Planning Process. This chapter provides an overview of the planning process, which includes:

- Identifying service needs in the short, medium and long term in order to deliver defined service standards, social, environmental and financial outcomes.
- Evaluating options for delivering the defined outcomes.
- Determining the optimal strategy that delivers the defined outcomes at the lowest financial, social and environmental (triple bottom line) cost.
- Communicating the outcomes of the planning process to decision makers through a planning report.

Chapter 4 – Stakeholders. This chapter provides guidance on:

- How to identify stakeholders and analyse stakeholder needs and requirements.
- What stakeholders are important through the different stages of planning.
- The tools used to identify the relative importance or significance of, different stakeholder groups and their potential to impact or influence the project or to be impacted on, or influenced by, the project.

Chapter 5 – Demand/Flow and Projections. The accurate assessment of water demand and sewage flow forms the basis of all planning studies. This chapter provides guidance on the assessment of water demand and sewage flows and in particular addresses the assessment of future demand and flow based on historical records and future growth and water usage projections.

Chapter 6 – Network Modelling. This chapter provides an overview of the networking modelling process and highlights issues that should be considered to ensure that models efficiently deliver desired outcomes.

Chapter 7 – Options for Service Provision. A range of options exists for the provision of water supply and sewerage services. These include non-asset, source substitution and infrastructure options. This chapter outlines a number of these options and highlights the need to explore a wide range of solutions that go beyond the traditional infrastructure approach.

Chapter 8 – Remote or Small Community Issues. This chapter highlights some of the issues that need to be considered in the provision of water and sewerage services to small or remote communities.

Chapter 9 – Analysis of Options. The purpose of analysing options is to determine the preferred option which provides the optimal mix of financial, social and environmental outcomes for stakeholders. This chapter provides an overview of options analysis methodologies. Reference to more detailed information sources is provided.

Chapter 10 – Implementation. This chapter highlights the need to develop an implementation strategy for the preferred option or strategies arising from a planning study to determine:

- The criticality of the project to the service provider's capital works and operational programs.
- The most cost-effective means of implementing the option with minimal risk.

Chapter 11 – Planning Outputs. It is essential that the results of the planning process are effectively communicated to key decision makers and other stakeholders by means of a planning report. This chapter outlines how a planning report can provide key decision makers with information to assess and demonstrate how the preferred option best meets the service need.

2.0 Key Planning Principles

The Regulatory Framework

Planners must be aware of the regulatory framework and its potential impacts on options and implementation programs relating to the provision of water supply and sewerage services.

Knowledge Management

The management of both explicit and tacit knowledge facilitates effective and efficient planning.

Effective knowledge management exists when there is:

- a culture of knowledge sharing within an organisation and with key stakeholders
- a process in place for:
 - capture of explicit knowledge
 - sharing tacit knowledge
 - continual learning and improving
- appropriate information systems in place to collect, analyse and transfer knowledge
- an understanding of what knowledge is required and where it can be accessed.

The Planning Process

Planning should include a comprehensive and rigorous identification of all options to meet the defined service levels, including options based on non-asset solutions.

Planning should be an iterative process which attempts to balance service needs with infrastructure, operation and maintenance, financial and environmental options.

Key stakeholders should be identified and involved up-front in the planning stage.

Non-asset solutions, full lifecycle costs, risk and maximising existing infrastructure capability should be considered before deciding to either construct new assets or replace assets.

Effective planning outcomes can only result from rigorous analysis, the application of strategic thinking skills and the adoption of an integrated approach to urban water planning which considers, where appropriate, water supply, sewerage and management of stormwater as a single system.

Stakeholders

Stakeholder involvement can beneficially influence planning and project outcomes.

Stakeholders can provide useful information in identifying feasible options and quantifying constraints.

Documenting benefits and risks can assist in gaining Stakeholder support for planning outcomes.

Stakeholders can generate or impose constraints.

Stakeholders can influence or select outcomes.

Stakeholders should be provided with the appropriate level of information commensurate to their involvement or decision-making responsibility.

Demand/Flow and Projections

Future water demand and sewage flow including peaking factors should be based on actual system performance, historical records and a consideration of future demand pattern changes.

Existing and future water demand should be separated into internal and external components so that the impact of demand management changes can be properly assessed.

It is essential that planners examine the underlying basis for current and future water demand particularly in terms of the many variables affecting internal and external demand components. Unit water demands or sewage flows should be specified as per equivalent person (EP).

Water demand should be associated with a required water quality, so that the potential magnitude of water recycling from various sources (eg. stormwater, wastewater), or supply from alternate sources (eg. rainwater tanks, bores) can be assessed.

The components of water loss (eg leakage) should be determined. Actions required to reduce these components should be stated, where cost effective.

Peaking factors, particularly for water demand, should take into consideration the likely changes to historical patterns where water recycling is incorporated.

Sewage flow should take into account changes in internal water demand resulting from demand management initiatives. The impacts of infiltration/inflow management programs should also be considered.

Demand projections should be broken down to match sub-catchments where appropriate

Network Modelling

The desired outcomes of the modelling work and the extent/detail are to be established before commencing the process.

Operational staff should be involved in the construction and analysis of the network model.

Successful network modelling requires the investment of time by experienced staff to interpret the results of the modeling.

Model outputs should be verified against actual system performance.

Options for Service Provision

The objectives of a proposal to deliver an identified water supply or sewerage service should be clearly defined before evaluating options.

A range of options (non-asset, source substitution, new and replacement asset) should be examined in a holistic manner that considers water supply, sewerage and stormwater management as component parts of an integrated urban water management program.

Non-asset solutions should generally be considered preferentially. Traditional solutions involving new infrastructure construction may not always be the optimal solution for providing a service.

Remote or Small Community Issues

Planners should take into account the ability of the community and service provider to fund, manage and sustain the proposed infrastructure.

The appropriateness of proposed solutions should be rigorously assessed.

Sustainable operational strategies are an essential consideration for planning studies for small and remote communities.

Regional solutions for service provision, management and operations should be considered for small or remote communities.

Analysis of Options

Informed investment decisions can only be made through thorough analysis that considers financial, social and environmental impacts (positive and negative) and implementation risks throughout the lifecycle of the infrastructure.

Analysis of planning options must identify the long-term financial impact (eg recurrent costs, including depreciation, and customer charges) of all planning outcomes before proceeding with capital investment decisions.

All feasible potential options to meet service levels, including non-asset solutions should be considered in the options analysis.

The assumptions underlying the analysis of options must be justified and clearly documented in a planning report.

Implementation

Stakeholders, including asset owners, need to be aware of issues and risks associated with the implementation of projects proposed through a planning study.

A rational approach to project prioritisation is essential to effectively deliver a capital works program.

The recommended implementation strategies should be based on a thorough review of potential risks and how they will be managed.

Planning Outputs

Planning reports should clearly and succinctly communicate to key decision makers and other stakeholders how the preferred option best meets the service need, taking into account future development scenarios and assumptions.

Planning reports should demonstrate that a rigorous examination (at an appropriate level) of options, costs and risks has been undertaken, and that all legislative, financial, environmental and social issues have been addressed, or at least considered.

3.0 Glossary of Terms

access chamber	¹	Large diameter inspection/maintenance chamber which allows operator access to a sewer.
aerosols		Vapour droplets created during spray irrigation which may contain disease causing organisms
alliance	⁵	Where several companies or service providers work together to deliver the project.
annual demand	¹	Total water demand for a year.
aquifer	⁸	An underground layer of permeable rock, sand or gravel that absorbs water and allows it free passage through pore spaces
aquifer recharge	²	The infiltration or injection of natural waters or recycled waters into an aquifer, providing replenishment of the groundwater resource.
average day demand	¹	Annual demand divided by 365.
average dry weather flow	⁷	This is the combined average daily sanitary flow into a sewer from domestic, commercial and industrial sources.
avoided costs		Costs which are unavoidable if nothing is done, but may be avoided if action is taken.
beneficial use		The use of any element or segment of treatment wastes or by-products that contributes to public benefit, welfare, safety, health or aesthetic enjoyment.
Biochemical Oxygen Demand (BOD)	¹	A measure of the dissolved oxygen required for the breakdown of organic material.
biosolids		Stabilised organic solids derived from wastewater treatment process sludge which can be beneficially used.
Build Own Operate (BOO)	⁵	Similar to BOOT, except that the private sector consortium is responsible for the facility in perpetuity.
blackwater		Toilet waste that contains organic matter from urine, faecal matter and toilet paper.
Build Own Operate Transfer (BOOT)	⁵	A private sector consortium is responsible for design, construction, operating, owning and financing a facility for the life of the project (normally 20-25 years). At the end of this period ownership of the facility is transferred to the service provider.
Build, Transfer, Operate (BTO)	⁵	A private sector company is responsible for design, construction and operation of a facility (normally 20-25 years). Ownership is transferred to the service provider after commissioning on payment of most of the capital cost.
common effluent drainage (CED)	¹	A system with septic tank effluent collected and conveyed in a gravity sewerage network.
community service obligations (CSO)	³	Activities which would not normally be undertaken by a commercial entity (usually because they are not profitable) and are provided by a commercial entity under an agreement with government.
compost	¹	Material produced by aerobic biological decomposition of organic material.

composting toilet	¹	On-site treatment which uses the principle of composting to break down excreta to a humus type.
Concession	⁵	This is an extension of BTO where a private sector company is responsible for operation and maintenance of the system together with capital investment required over the life of the concession, typically 20-30 years.
consequence	⁶	The outcome of an event expressed qualitatively or quantitatively, being a loss, injury, disadvantage or gain. There may be a range of possible outcomes associated with an event.
constant flow system	¹	A water supply system where water is supplied at a constant rate of flow, with peak demands being obtained from individual storages at each house.
constructed wetland		A wetland that has been purpose built to achieve a set of design objectives. Constructed wetlands apply the functions of natural wetlands and utilize soil, water and biotic processes to achieve these objectives.
Customer Service Standards	¹³	A document developed by a water service provider to inform customers who do not have contracts with the service provider of the level of service standards
denitrification	¹	process which transforms nitrates and nitrites into gaseous nitrogen in the absence of freely available oxygen.
Design & Construction (D&C)	⁵	A single company is responsible for both design and construction of the project, based on meeting explicit performance requirements. A service provider takes over and operates the infrastructure.
disinfection	¹	Inactivation or removal of pathogenic micro-organisms.
drinking water	¹⁵	Water that is suitable for human consumption, food preparation, utensil washing and oral hygiene. (Drinking water quality is defined by the <i>Australian Drinking Water Guidelines</i> ¹²)
dual reticulation		The supply of water from two separate sources, requiring two sets of pipes: one to provide drinking water (for drinking, cooking, bathing and laundry purposes); the other to provide appropriately treated non-drinking water (eg raw water or recycled water) for purposes such as toilet flushing, garden watering/irrigation and other external uses or industrial applications.
ecological footprint (EF)		Used to convey the environmental impacts associated with a development. It is a tool that calculates the area of land required to provide all energy and material resources consumed and includes all wastes discharged for each option.

ecological sustainable development	³	Principles of ecological sustainable development are: (a) decision-making processes should effectively integrate both long-term and short-term economic, environmental, social and equitable considerations; (b) if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation; (c) the present generation should ensure the health, diversity and productivity of the environmental is maintained or enhanced for the benefit of future generations; (d) the conservation of biological diversity and ecological integrity should be a fundamental consideration in decision making; (e) recognition of the need to develop a strong, growing and diversified economy that can enhance the capacity for environmental protection; and (f) decisions and actions should provide for broad community involvement in issues affecting them.
economic analysis		Assesses the overall impact of a project on the local, regional or state economy.
economically viable	³	Evaluation of whether the gains from a project outweigh the costs of a project. Economic evaluation is undertaken from the perspective of the economy as a whole and does not differentiate between winners and losers.
effluent	²	Treated or untreated liquid waste flowing from a sewage treatment plant or from agricultural and industrial processes.
Electrical Conductivity (EC)		A measure of the concentration of salts in a solution
environmental flow	²	The release of water from storage to a stream to maintain the healthy state of that stream.
environmental outcomes or impacts		These include efficient resource use, environmental impacts, and environmental compliance.
Equivalent Person (EP)		The water supply demand or the quantity and/or quality of sewage discharge for a person resident in a detached house. It is also applied to: <ul style="list-style-type: none">▪ The number of persons who would have a water demand equivalent to the establishment being considered.▪ The number of persons who would contribute the same quantity and/or quality of domestic sewage as the establishment being considered.
event	⁶	An incident or situation, which occurs in a particular place during a particular interval of time.
external recycling	²	The use of recycled water that has been produced by another organisation.

external water use / demand	¹¹	Water used externally in activities such as garden watering or irrigation, car washing, filling swimming pools.
externality	³	A benefit (positive externality) or cost (negative externality) borne by a third party (including the environment) who cannot pay or be compensated for the benefit or cost through the normal market mechanism.
financial analysis		Evaluates the financial viability of a project from the perspective of the service provider.
financial viability	³	A project is financially viable if the revenues from the project cover the project costs and earn a commercial return on investment. Financial evaluation is considered from the perspective of the project developer.
financial/economic outcomes or impacts		These include organisational financial performance, efficiency, dividend payments, return of assets, economic impacts on key stakeholders, e.g. customers, employees or developers.
greywater		Wastewater from the laundry, bathroom and kitchen that has not been in direct contact with toilet waste (blackwater).
groundwater		Subsurface water from which wells, springs, or bores are fed; strictly the term applies only to water below the water table.
groundwater infiltration		Groundwater (non-rainfall dependent infiltration). Generally exists for sewers laid below groundwater table. Groundwater infiltration enters the system via defective pipes or joints and leaking manhole walls.
hazard		A source of potential harm or a situation with a potential to cause loss.
health determinants		Health determinants are those factors that have either a positive or negative influence on health at the individual or population level. They include social support networks, employment and working, physical environments, education, personal health practices and coping skills, health services, biology and genetic, income and social status.
hurdle rate	³	The rate of return which is required to be demonstrated to be able to be met before a capital investment project should be commenced; ie. It is the level of profitability which the proposed project is required to exceed (or "hurdled") to be accepted for development.
influent	²	Liquid waste flowing into a treatment facility.
Interim Resource Operations Licence (IROL)		See Resource Operations Licence
internal rate of return	³	The discount rate at which a project has a net present value of zero.
internal water use / demand	¹¹	Water used internally in buildings and would also encompass any other water consumption that is not influenced by climate. This demand is assumed to remain unchanged by seasonal effects during the year.

irrigation	²	The watering of crops, pasture, golf courses, parks, gardens and open spaces, which may involve using different applications (eg. drip, trickle, spray and flood).
knowledge management	⁴	A multi-disciplined approach to achieving organisational objectives by making best use of knowledge. It involves the design, review and implementation of both social and technological processes to improve the application of knowledge, in the collective interest of stakeholders. Two types of knowledge exist, namely <ul style="list-style-type: none"> (i) Explicit knowledge – knowledge that has been recorded as information in a document or some other medium; and (ii) Tacit knowledge – information that resides in a person’s mind and may include aspects of culture or “ways of doing things”.
lamphole	¹	Small diameter flushing and rodding point which does not provide for operator access to a sewer.
least cost planning	¹¹	Least Cost Planning or Integrated Resource Planning aims to identify an appropriate balance between system operation/capacity expansion costs and the savings associated with programs aimed at increasing the efficiency of water use.
lifecycle assessment (LCA)		An environmental assessment of the overall mass balance of an option, from the production of raw materials to the ultimate disposal of all wastes.
likelihood	⁶	Used as a qualitative description of probability or frequency.
maintenance hole		See access chamber.
manhole		See access chamber.
mean day maximum month		Highest 30 day moving average daily water demand during a year.
modified conventional sewerage	¹	Similar to conventional gravity sewerage but with extensive use of access chamber lift pumping to reduce excavation, replacing access chambers with lampholes, using small diameter reticulation mains and adopting flatter sewer grades.
multi-criteria analysis		A means of ranking options based on financial and non-financial criteria.
net present value	³	The discounted value of the expected benefits of a project, less the discounted value of the expected costs.
nitrification	¹	Transformation of inorganic ammonium into nitrate.
non-drinking water		Any water other than drinking water.
nutrients	¹	Elements essential for sustained plant or animal growth e.g. nitrogen, phosphorous and potassium.
non-revenue water	¹⁴	Components include real and apparent water losses and unbilled authorised consumption. Refer to IWA “best practice” standard approach to water balance calculations.
optimism bias	¹⁰	A tendency for under-estimation of costs and project duration and over estimation of benefits.

pathogens	¹	Micro-organisms that are potentially disease-causing; include bacteria, protozoa and viruses.
peak day demand	¹	Maximum demand in any one day of the year.
peak dry weather flow	⁷	The most likely peak sanitary flow in a sewer during a normal day. It exhibits a regular diurnal pattern with morning and evening peaks.
peak hour demand		Peak hourly demand a system will be called on to supply.
peak wet weather flow		Includes peak dry weather flow, groundwater infiltration and rainfall dependent infiltration.
pH	¹	A measure of hydrogen ion concentration (0 – acid, 14 – alkaline, 7 – neutral).
point of use treatment		Supplementary treatment provided by consumer at the point of use (eg kitchen tap).
Public Private Partnership (PPP)		A PPP is a risk-sharing relationship between the public and private sectors to deliver timely public infrastructure and services. Objectives include: <ul style="list-style-type: none"> ▪ Delivery of improved services and better value for money through appropriate risk-sharing. ▪ Encouraging private sector innovation. ▪ Optimising asset utilisation. ▪ Integrating whole-of-life management of public infrastructure.
rainfall dependent inflow & infiltration		Peak (rainfall dependent) inflow and infiltration. This includes flow discharges into the sewer from: <ul style="list-style-type: none"> ▪ unauthorised roof, ground or stormwater drainage ▪ leaking manhole covers ▪ disconnected sewers ▪ low disconnector traps. ▪ indirect infiltration of rainwater entering defective pipes and joints from the surrounding soil.
rainwater tanks	²	Tanks used to collect and store rainfall from household roofs for beneficial use.
raw water		Water that forms the source supply for drinking water before it has been treated.
recycled water	²	Appropriately treated effluent and stormwater.
Resource Operations Licence (ROL)		Licence issued under a Resource Operations Plan (ROP). It includes details of the water infrastructure, such as dams and weirs, covered by the licence and the conditions that the holder of the licence must comply with, including operating arrangements and water supply requirements. http://www.nrm.qld.gov.au/water/management/rols.html
Resource Operations Plan (ROP)		A Resource Operations Plan (ROP) details how the objectives of a Water Resource Plan (WRP) will be achieved and provides operational rules to ensure security of water supply and environmental objectives are met.

reticulated water supply	¹	Water supply network that provides a piped water supply to each dwelling, commercial or industrial premises.
risk	⁶	The chance of something happening that will have an impact upon objectives. It is measured in terms of consequences and likelihood.
risk analysis	⁶	A systematic use of available information to determine how often specified events may occur and the magnitude of their consequences.
risk assessment	⁶	The overall process of risk analysis and risk evaluation.
risk level	⁶	The level of risk calculated as a function of likelihood and consequence.
risk management	⁶	The culture, processes and structures that are directed towards the effective management of potential opportunities and adverse effects.
risk reduction	⁶	A selective application of appropriate techniques and management principles to reduce either likelihood of occurrence or its consequences, or both.
risk treatment	⁶	Selection and implementation of appropriate options for dealing with risk.
septic tank	¹	Sewage treatment device providing a form of primary treatment of sewage comprising sedimentation of settable solids, flotation of oils and fats, and anaerobic digestion of sludge.
septic tank effluent pumping (STEP)	¹	A system in which the effluent from septic tanks is pumped to a treatment works using small diameter pipes; also known as common effluent pumping.
septic tank/soil absorption system	¹	A household sewage treatment and effluent management system involving sedimentation in an underground tank followed by percolation of the effluent into the soil from a subsurface distribution system.
sequential design & construction	⁵	Involves separate stages for design and construction. These stages could be undertaken by in-house teams or external contractors.
sewage	²	The used water of a community or industry, containing dissolved and suspended matter (also called wastewater).
sewer mining	²	Diversion and treatment of raw sewage for on-site purposes such as irrigation. Treatment process waste is returned to the sewer.
sewerage		The sewerage system comprises the pipes, pumps and plant needed to collect, transport and treat sewage.
sewerage reticulation	¹	Sewage collection and transport network.
sludge		The unstabilised concentrated solids produced during a wastewater treatment process. Sludge can be beneficially used after further treatment to produce biosolids.
smart sewers		Systems designed to modified design criteria which take advantage of modern materials and design and construction approaches to produce a lower cost collection system without any loss in the quality of service to customers.

social outcomes or impacts		These include customer service, a health determinant impact on the community, employee work conditions and health and safety.
stakeholders		<p>Stakeholders include persons or groups who will define, constrain, influence or decide on planning options and all those affected through implementation of the planning recommendations to those using or receiving the resulting services.</p> <p>Key stakeholder groups will include customers, business owners, and regulators. For most planning exercises, “environmental representatives”, the “community” and the “service provider” will be stakeholders. A “stakeholder” may also be defined as anyone who directly or indirectly receives the benefit, or sustains the costs, resulting from the implementation of a project. Primary stakeholders are those stakeholders that will be closely linked to a particular aspect or phase of the planning or asset lifecycle. These primary stakeholders may change over the planning or asset lifecycle.</p>
standpipe	1	A pipe structure with a control valve and overhead outlet used for filling water tankers.
stormwater	2	All surface water runoff from rainfall, predominantly in urban catchments. Such areas may include rural residential zones.
sullage	1	Refer to greywater.
suspended solids (SS)	1	Solids retained after filtration through a glass fibre filter paper.
trade waste	9	Water borne waste from business, trade or manufacturing premises other than waste that is a prohibited substance or human waste or stormwater.
treated effluent		Aqueous waste flowing from sewage treatment plants or agriculture and industry processes, that has been treated to improve its quality.
triple bottom line		An integrated approach to the achievement of environmental, social and economic outcomes.
vacuum sewerage (VS)	1	A system in which all sewage is conveyed by a vacuum in the sewage collection network.
variable grade sewers (VGS)	1	A system with inflective grades allowing construction in undulating areas. Parts of the sewer will always be full.
wastewater	1	Refer to sewage.
water losses		Refer to non-revenue water
water mining		Refer to sewer mining.
water quality	2	The chemical, physical and biological condition of water.
water recycling	2	Use of appropriately treated wastewater and urban stormwater for further beneficial purposes.
water resource	2	The sources of supply of ground and surface water in a given area.

Water Resource Plan (WRP)

A Water Resource Plan (WRP) is prepared by the State Government as a requirement of the *Water Act 2000*. A WRP provides a framework for sustainable management of water in a catchment in terms of social, economic and environmental needs including water allocation for human use (urban, industry, agriculture, mining) and for the preservation of the health of the aquatic environment. A Water Resource Plan may also establish the basis for water allocations to be traded on a permanent basis. Water Resource Plans are published as subordinate legislation to the *Water Act 2000* and implemented through a Resource Operations Plan (ROP).
(<http://www.nrm.qld.gov.au/wrp/index.html>)

weighted average cost of capital (WACC)

³ The method for calculating the cost of capital of a business, which comprises both the cost of debt and the cost of equity, weighted according to their respective significance in the organisation's capital structure.

wet composting toilet

¹ Treats all household sewage and putrescible household food and other organic solid wastes. Uses aerobic composting to break down the solid waste. The treated effluent requires management in an on-site (eg. land application system) or off-site (eg. CED) effluent management system.

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- ¹ *Water Services Association of Australia (WSAA), Affordable Water Supply & Sewerage for Small Communities.*
- ² *Environmental Protection Agency, Queensland Government, Queensland Water Recycling Guidelines.*
- ³ *Queensland Government, Guidelines for Financial and Economic Evaluation of New Water Infrastructure in Queensland.*
- ⁴ *Interim Australian Standard AS5037 (Int) – 2003*
- ⁵ *Adapted from Water and Sewerage Infrastructure Delivery Options, Department of Land and Water Conservation (DLWC), Local Government and Shires Association, NSW, 1999.*
- ⁶ *AS/NZS4360:1999. Risk Management.*
- ⁷ *Water Services Association of Australia, 2002, Sewerage Code of Australia (WSA02 – 2002).*
- ⁸ *ANZECC/ARMCANZ 2000, Australian and New Zealand Guidelines for Fresh and Marine Water Quality.*
- ⁹ *Water Act 2000.*
- ¹⁰ *HM Treasury, Supplementary Green Book Guidance – Optimism Bias.*
- ¹¹ *Department of Natural Resources & Mines (Qld), 2000, Improving Water Use Efficiency in Queensland's Urban Communities.*
- ¹² *NHMRC/NRMMC 2004, Australian Drinking Water Guidelines.*
- ¹³ *Guidelines for Preparing Strategic Asset Management Plans" NR&M, 2002*
- ¹⁴ *International Water Association, 2000, Losses from Water Supply Systems: Standard Terminology and Recommended Performance Measures*
- ¹⁵ *Water Services Association of Australia, 2002, Water Supply Code of Australia*

4.0 Abbreviations

ABS	Australian Bureau of Statistics
AD	average day demand
ADWF	average dry weather flow
ANZECC	Australian and New Zealand Environment and Conservation Council
ARI	average recurrence interval
ARMCANZ	Agriculture and Resource Management Council of Australia and New Zealand
AS/NZS	Australian Standard/New Zealand Standard
BNR	biological nutrient reduction
BOD	biochemical oxygen demand
BOO	build, own, operate
BOOT	build, own, operate, transfer
BTO	build, transfer, operate
BWL	bottom water level
°C	degrees Celsius
CED	common effluent drainage
CSO	community service obligation
CSS	customer service standard
D&C	design and construction
DPI&F	Department of Primary Industries and Fisheries (Qld)
EIS	environmental impact statement
EF	ecological footprint
EP	equivalent person
EPA	Environmental Protection Agency
ERA	environmentally relevant activity
GFA	gross floor area
GIS	geographical information system
GW	groundwater infiltration
ha	hectares
HU	Hazen units of colour
IDAS	integrated development assessment system
I/I	Infiltration/inflow
IIF	rainfall dependent inflow and infiltration
IROL	interim resource operations licence
IRR	internal rate of return
ISO	International Standards Organisation
kL	kilolitres
IWA	International Water Association
kPa	kilopascals
kWh	kilowatt-hours
LCA	life cycle assessment
LCP	least cost planning
L/s	litres per second
m	metres
MCS	modified conventional sewerage with lift pumping
MD	maximum day demand
MDMM	mean day maximum month demand
mg/L	milligrams per litre
MH	maximum hour demand
ML	megalitres
mL	millilitre
ML/a	megalitres per annum

ML/d	megalitres per day
mm	millimetre
N	nitrogen
NHMRC	National Health and Medical Research Council
NPV	net present value
NRMMC	Natural Resource Management Ministerial Council
NR&M	Department of Natural Resources & Mines (Qld)
NRW	non-revenue water
NTU	nephelometric turbidity units
NWQMS	National Water Quality Management Strategy
O&M	operation and maintenance
OMA	operation, maintenance and administration
P	phosphorous
PD	peak day demand
PDF	peak daily flow
PDWF	peak dry weather flow
pH	hydrogen ion activity
PH	peak hour demand
PPP	public private partnership
PV	present value
PWWF	peak wet weather flow
QWRS	Queensland water recycling strategy
ROL	resource operations licence
ROP	resource operations plan
RTU	remote terminal unit
SAMP	strategic asset management plan
SCADA	supervisory control and data acquisition
SS	suspended solids
STEP	septic tank effluent pumping, also known as common effluent pumping (CEP)
STP	sewerage treatment plant
TWL	top water level
UV	ultra-violet radiation
VGS	variable grade sewerage
VPO	vegetation protection order
VS	vacuum sewerage
WRP	water resource plan
WSAA	Water Services Association of Australia