A3
Management and maintenance

Sound asset management practices can improve service delivery, inform strategic planning of infrastructure (including demand management), increase value for money and reduce risk.

'Asset' refers to the physical components of a system, such as water, power or waste-management systems. Such components may be any piece of equipment or tool, or machinery used in the system's operation.

From an operational point of view, asset management can:

- inform suitable responses to changing service-delivery requirements
- assist with prioritisation of repair and replacement cycles
- provide evidence for changes in and choice of assets.

Effective asset management can, for example, provide data to support decisions relating to retaining or replacing assets and identifying weaknesses in products or their performance.

Asset management can improve maintenance by shifting the cycle from a situation of persistent crisis management to a strategic approach that focuses on service-delivery outcomes and long-term value for money. Overall, this approach includes life-cycle costing of assets, and supporting activities, such as training and education for staff and residents.

Asset management is government policy for the planning and management of state and Australian Government assets. In some states and territories, it is a regulatory requirement for water and sewerage service providers to prepare a strategic asset-management plan. This process ensures that the service provider has detailed knowledge of the system, and increases the likelihood of continuity of service.

Asset management challenges for Indigenous communities

The capacity for people resident in Indigenous communities to undertake and record asset management and maintenance varies considerably. In some cases, it is not possible to locate historical information on assets, such as warranties, or to find out why certain decisions have been made in the past. High staff turnover, changes in council or resident membership or transfer of assets from one owner to another, can also contribute to poor knowledge of the system.

Particular challenges for asset management in Indigenous communities include:

- fluctuating population levels and demand for services
- environmental issues
  - poor water quality and low water availability
  - climatic variations
  - dust
  - the presence of feral animals
  - poor access to services.

Successful asset management and planning assist with effective responses to emergencies, and with financial planning for strategic asset repair and replacement cycles. Most importantly, effective asset management can enable informed decision making in financial planning by Indigenous communities or councils.

Objectives of asset management

The purpose of asset management is to preserve and operate systems in a more cost-effective way, with improved asset performance. In remote areas, asset management can increase the reliability of asset performance by reducing the amount of breakdown time and increasing preparedness for system failure. An assessment or system analysis of failure can also direct future investment for improved asset performance and system reliability. Benefits include:

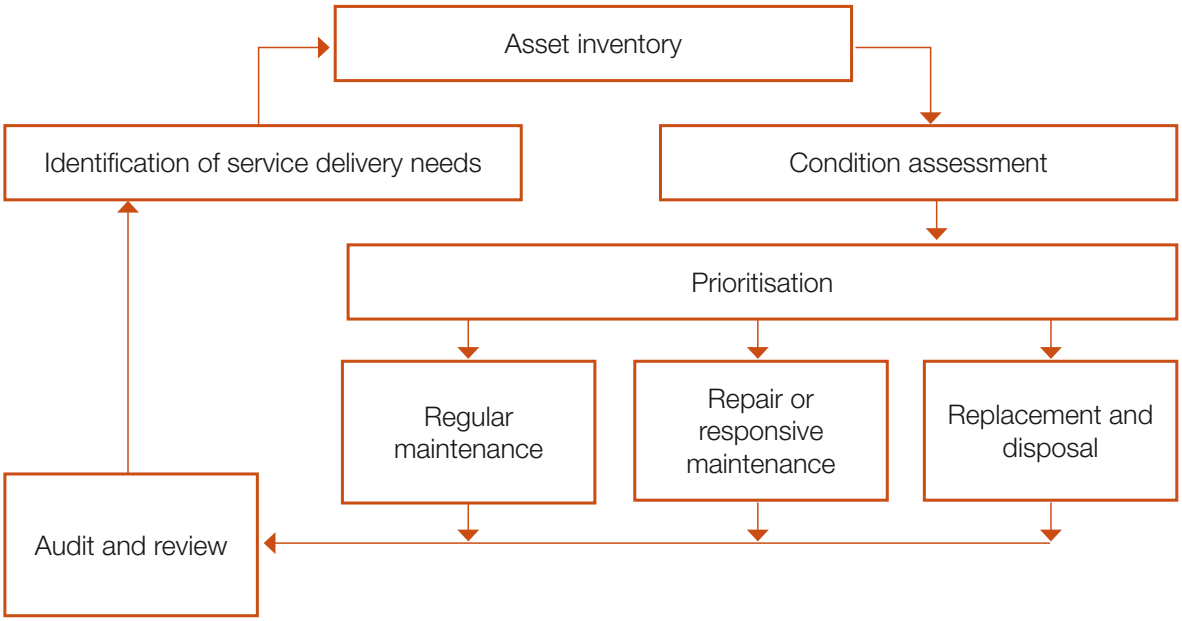
- maintaining services that meet the needs and aspirations of the residents
- maintaining and augmenting infrastructure assets
- satisfying obligations imposed by regulators (such as standards required for effluent discharges or water quality)
- delivering services efficiently so that the costs are effective
- improving credibility and accountability for decisions and expenditures.

This chapter is based on a five-step process of continual improvement:

- identification of service delivery needs
- asset inventory
- condition assessment
- prioritisation
- audit and review.

Figure A3.1 depicts the basic process, which aims for efficiency, reliability, sustainability and affordability in service delivery.

Figure A3.1: The process of continual improvement in asset management



Source: Centre for Appropriate Technology, 2009

Background

Asset management occurs against a background of user demand, ownership (often changing) and legacy issues associated with assets, and occupational health and safety requirements.

Demand-side management

The underlying principle of demand-side management is that demand is moderated by the willingness of the user to pay. For example, demand can be reduced by changes in behaviour that actively manage the draw on supplies, such as turning off lights and fans when a room is unoccupied, or closing doors and windows when using air conditioners and heaters. Demand for power and water can be managed through employing more efficient hardware — fluorescent lighting, power-efficient appliances, leak-free tapware, dual-flush toilets and water-efficient shower heads.

Demand-side management is most simply achieved through pricing mechanisms such that the user contributes fully to the cost of supply. This simple model of 'user pays' rarely applies to Indigenous communities. Low income levels and the additional costs of living and transport associated with remote settlements mean that many Indigenous families struggle to meet weekly living costs and would find it difficult to afford the full cost of essential services.

Ownership and legacy issues

Responsibility for funding the acquisition, management and maintenance of infrastructure assets can vary between Australian, state and territory governments, which may have legacy and ongoing responsibilities depending on the variety of tenure arrangements in place. Many communities have infrastructure that was built at the time of land acquisition. The condition, function and appropriateness of this infrastructure can be highly variable. There are cases where state and territory governments have refused to take responsibility for the ongoing maintenance of infrastructure. When that is the case, responsibility falls back on the bodies that have acquired the land: Indigenous land trusts, councils, corporations and benevolent organisations.

Occupational health and safety issues

Occupational health and safety (OH&S) practices are directly relevant to asset management, as the health and wellbeing of residents and workers in communities may be compromised if assets are not well maintained or emergency responses are not implemented.

The OH&S issues may relate to:

- working in confined spaces
- hazardous facilities
- use of plant, machinery and equipment

- the management of hazardous substances and dangerous goods
- licensing for specific duties
- occupational noise.

The OH&S issues should be identified and remedial works or activities integrated into condition assessments and repair or replacement maintenance schedules. Integrating OH&S priorities improves the understanding of management, which is invaluable when purchasing goods and equipment.

Indigenous corporations need to comply with Australian OH&S laws operating in each jurisdiction. Compliance with the laws normally requires inspections of any works, depots or workshops and any equipment that community employees are required to use in their work. The laws are administered by OH&S authorities in each jurisdiction.

Asset management

To manage assets, begin by identifying service and delivery needs and making an inventory, then audit the inventory by assessing the condition of each of the assets.

Identify service and delivery needs

Asset management should be broken down into the components of each infrastructure system, since individual parts will have a different operational or useful life. An asset management system can enable managers to make decisions about investments and management to meet the particular needs and aspirations for and within an Indigenous community. All systems lose operational capacity over time. Asset management includes reviewing the system regularly to assess the performance of the components and the effectiveness of the maintenance regime, and to consider options. The capacity of the community or residents to operate and maintain the technical services, particularly in more remote locations, is a critical aspect of asset management.

Typical questions for identifying service and delivery needs include the following:

- What services are currently delivered to the community?
- Are there any gaps in services?
- What services need to be delivered and what resources should be available to support the delivery of those services?
- How can essential service infrastructure maintenance and management be improved?
- What plans are in place and how can essential services be modified to meet the needs of the community?
- What resources are available to support an asset-management strategy?

Create a system inventory

A system inventory documents the location of an asset and its description. A basic system inventory will list all components and should include the following details:

- item description (make, model, size, design capacity)
- location
- condition
- age or year constructed
- service history and performance
- remaining operational life (see below)
- property title details.

Further information specific to water, power and waste services are outlined in the relevant chapters.

Assess the condition of assets

A system inventory is created by assessing the condition of each asset, including its components. A variety of methods can be used to assess the condition of assets in a community. The resources and skills available to the community will dictate the method of assessment. Table A3.1 lists some typical assets and flags the tests or measurements relevant to each. Where possible, assess the condition of an asset using a quantitative measurement or rating system or scale. A measurement is preferable to a qualitative judgment, because it is repeatable and less prone to individual interpretation. Some tests, such as power testing, should only be conducted by a licensed electrician.

Ideally, a condition assessment should occur during routine maintenance.

Consider:

- creating a rating system with defined criteria for the assessment of each type of asset.

A sample rating system is shown in Table A3.2.

Table A3.1: Examples of asset condition assessment tests and measurements

	Hours run	Last calibration date	Efficiency/Output capacity/Flow rate	Soil testing	Load test	Leak testing	Number of breakdowns	(Remaining) life expectancy	Visual assessment (corrosion, security risks, etc)	Number of complaints
Water mains						✓	✓	✓	✓	✓
Bore pump	✓		✓				✓	✓	✓	✓
Solar panels			✓		✓		✓	✓	✓	✓
Meters		✓					✓	✓	✓	✓
Electrical switches							✓	✓	✓	✓
Road surface						✓	✓	✓	✓	✓
Batteries			✓		✓		✓	✓	✓	✓
Generator	✓		✓		✓		✓	✓	✓	✓
Landfill				✓				✓	✓	✓

Table A3.2: A sample rating system for asset assessment

Excellent	As new; regular maintenance program required
Good	Minor repairs required in addition to regular maintenance program (up to 5% of asset requires refurbishment or replacement)
Fair	Needs major repairs in addition to regular maintenance program (10–20% of asset needs refurbishment or replacement)
Poor	Near end of operational/useful life, frequent breakdowns, frequent maintenance and surveillance required (20–40% of asset needs refurbishment or replacement)
Needs replacement	At end of operational/useful life (more than 50% of asset needs refurbishment or replacement)

Ratings systems should be based on data collected from maintenance records.

Ensure that:

- a robust and consistent ratings system is applied
- records of all services and details of contractors are kept
- a list of required parts is included
- manuals and supporting documentation are filed
- seasonal effects are taken into account (for example, batteries tested at a consistent ambient temperature, roads assessed at the same time of year, solar panels tested under consistent insolation conditions).

Consider:

- including asset values, maintenance and replacement costs in the asset inventory
- drawing a system inventory map so the system can be viewed as a whole by technical and non-technical audiences
- discussing installation and service histories with residents if records of service history are not available, and documenting the conversations
- creating a historical calendar of events including performance and longevity of assets, vulnerabilities (such as seasonal effects), maintenance regimes, costs and explanations of investment decisions
- developing an asset-management plan that strategically links maintenance with life cycle, including current, historical and future population levels
- recording the quality and reliability of service from contractors
- including survey information that can affect infrastructure, such as rainfall, topographical, cadastral or geotechnical information
- obtaining ‘as built’ maps of infrastructure. These show the configuration (location, form, contents and dimensions) of the infrastructure as actually installed, and incorporate changes that have been made since preparation of the original design documents
- obtaining a serviced land availability program map (SLAP map) of your community, containing planning, engineering and topographical information.

Prioritisation of assets

The prioritisation of asset replacement is typically based on the remaining operational life of the components, although other decision-making processes such as gap analyses, life-cycle cost analyses and risk assessments may be more helpful in the (sometimes) unpredictable remote community context.

In the process to identify the most appropriate replacement or prioritisation system for an Indigenous or remote community, factor in:

- the importance of the component to the operation of the system
- the threat to public safety
- access to parts or servicing
- improvements in operations and efficiency.

Remaining operational life

Examples of the expected operational life of assets for fixtures of water, wastewater, power, waste, telecommunications/computing and transport systems are given in Table A3.3. The expected operational life of a component is only indicative and may vary in remote areas because of extreme climatic conditions. This measure provides a baseline for evaluating the current situation, assessing performance, and prioritising and planning the repairs or replacement of an asset.

Table A3.3: Examples of the expected operational life of assets

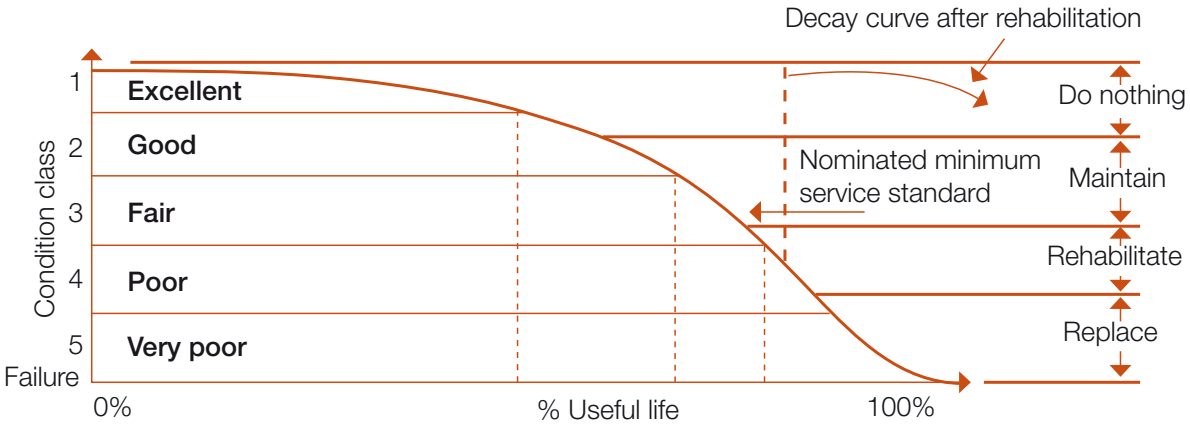
Asset	Expected operational life (years)
Potable and wastewater system fixture	
Absorption trenches	10–20
Backflow prevention devices	35–40
Bore casing	25
Bore pump	10–15
Float valves	5–10
Gravity sewer lines	80
Manholes	20–50
Meters	15
Pressure pump	5–7
Rainwater tank (polyethylene/galvanised iron)	35–40
Risers	25
Septic tank	20–30
Storage tank (concrete/polyethylene/fibreglass)	50
Tank stand	50
Taps	1–2
Power system fixture	
Batteries	7–8
Cabling or wiring	15–25
Charge control	6–10

(continued)

Circuit breakers	10–15
Generator	8–12
Inverter	6–10
Solar panels	25
Telemetry and instrumentation	10
Waste system fixture	
Landfill	20
Skip bins	10–15
Vehicles	6
Wheelie bins	25
Roads fixture	
Kerb and gutter	50–80
Footpaths	15–50
Pavement substructure	50–100
Wearing surfaces	10–15
Communications and computing systems fixture	
Computer network	5
Personal computer	3
Telecommunications cabling	10
Telephone handset	5

Assess remaining operational life by consulting tables such as Table A3.3 in conjunction with decay curves and known installation dates. Decay curves such as the one shown in Figure A3.2 are derived from statistical data and show that replacement of an asset should be planned to take place when it reaches approximately 80% of its expected operational/useful life. Based on this information, a community-specific table can be created to list the remaining operational life and the scheduled replacement date for each of its assets.

Figure A3.2: Typical condition decay curve for infrastructure assets



Source: Queensland Department of Environment and Resource Management (2002)

Case study 1 — A simple process for asset-replacement planning

A community in South Australia used a remaining operational life table to prioritise their water system assets. A simple table was drawn up that listed all the assets with the best available information about age or installation dates.

Using the information from the table, a timeline was created with anticipated replacement dates. The timeline was used by the community board members to plan finances and set aside funds for asset management.

The simple timeline enabled the board members to discuss maintenance and management options, and understand future asset-replacement requirements for the whole of the water system. Funds were set aside to replace assets of high priority and consideration was given to planning the refurbishment or replacement of assets that were nearing the end of their operational life.

Gap analysis

Gap analysis is a comparison between the actual level of performance of an asset and the required level of performance. The difference between the two is the gap that informs the action. Gap analysis involves understanding whether an asset is suitable and can perform the task adequately. The analysis may examine key aspects or measures of performance, including:

- operational functions
- maintenance
- reliability
- affordability
- staff capacity
- resource use.

It is preferable that the performance criteria are measurable, rather than based on personal perceptions, although these should also be considered. An action plan resulting from the outcomes of the analysis should be developed to address any shortcomings in service provision.

Life-cycle cost analysis

Life-cycle cost analysis can be used to compare options. It is a total cost comparison for different equipment, system design, construction, and operating cost and maintenance alternatives, including the up-front costs and all other relevant costs that occur during the operational life of an asset. Life-cycle cost analysis includes the demands and effects of maintenance activities and cost of disposal at the end of the life of an asset.

Costs incurred after installation should be converted to their present-day value, as various maintenance, repair and replacement activities take place at different times for different options. Life-cycle costing relies on predicting how rapidly components of the system will deteriorate and when intervention may be required, and depends on numerous assumptions. Life-cycle costing can also take environmental considerations into account (see Chapter B5 Energy).

Risk management

Risk management is a way to identify and mitigate the risks to the specified performance of an asset throughout its operational life. The prioritisation process and operation and replacement cycles of assets may be determined by the level of risk, which can be expressed as the impact an asset failure would have on the community, combined with the likelihood of it occurring. The types of risks that may be relevant for an Indigenous community include:

- safety issues
- public health matters
- environmental issues
- insufficient prior investment
- inadequate community consultation
- inadequate funds for preferred investment
- inappropriate design
- contractual disputes.

Ensure that:

- the prioritisation assessment is checked against historical data.

Although it is likely that there will be data gaps, important information can be identified, such as past mistakes in selecting an asset based only on lowest cost. Historical data may also provide justification for the purchase of alternative equipment. For example, a seemingly oversized bore pump may be justified if historical data show that previous pumps cannot perform the task because of fluctuations in demand.

Calculate the remaining operational life of an asset by subtracting its age from its expected operational life (see Table A3.3). Be conservative in your estimate, so that preparations can be made for the replacement of the asset.

Consider:

- whole-of-life-cycle cost
- including environmental disposal processes, such as engaging scrap metal merchants or recyclers to remove rubbish
- engaging a professional engineer or seeking assistance from an environmental health officer to assess the strategies, procedures and actions for maintaining compliance to any required service standards (such as specifications for water quality guidelines or power supply standards)
- planning the anticipated replacement cycles of components to be less than the anticipated overall service life of the system.

Case study 2 — The value of life-cycle costing and risk analysis

A community in northern Australia had electricity supplied to its submersible bore pump from the community mains. The power was supplied by underground wiring. The water supply failed because an exotic pest, the Singapore ant (Monomorium destructor)*, had chewed through the electrical cable.*

The resource agency responsible for capital upgrades conducted an asset prioritisation process involving a cost analysis to compare the alternatives of repair or replacement of the electrical cable. Simple repair of the cable was expensive because the cables needed to be dug up and the risk of another ant attack was high. A comparative life-cycle cost analysis demonstrated that a small, stand-alone solar energy supply connected directly to the existing pump would reduce the risk of future Singapore ant attacks, as the length of electrical cabling would be significantly reduced. An additional benefit was the provision of a cheaper, more sustainable supply.

The cost of switching to a solar system was equal to the cost of repairing the underground cabling. However, the long-term savings in diesel, combined with the reduced risk of another ant attack, made the proposition worthwhile.

The asset-management cost analysis provided the evidence to seek financial support to proceed with the capital works program.

Maintenance scheduling

Routine maintenance tasks need to be carried out at regular, predefined intervals, in addition to unplanned or responsive maintenance due to emergencies, breakdowns or accidents. A scheduled approach to maintenance might include routines that take place on a weekly, monthly, 6-monthly, annual, 3-yearly or other basis. A scheduled approach enables:

- scheduled servicing and repairs
- the incorporation of OH&S aspects
- cost contributions from residents towards community services or rents.

Consider creating a table with the frequencies of preventive (routine) maintenance tasks for systems under everyday operation (Table A3.4). While elapsed time determines the maintenance interval for most assets, the interval for machinery such as generators, pumps and motors should be based on actual machine operating hours.

Table A3.4: Sample preventive maintenance (routine) tasks

Time interval between maintenance actions	System	Activity	Skills required
1 month	Power	Clean solar panels	No particular skills required
6 months or 250 hours	Power	Service diesel generator	Mechanic
6 months	Water	Measure standing water level in bore	Community work crew
12 months	Water and power	Electrical maintenance	Electrician
12 months	Sewerage	De-sludging septic tanks	Community work crew

Repairs or responsive maintenance should be informed by the condition assessment and conducted on a needs basis.

Ensure that:

- the maintenance schedule fits in with local community commitments
- seasonal changes, such as population fluctuations and rainfall affecting access, are allowed for
- roles and responsibilities for all parties (asset owners and operators) are agreed and linked to emergency, responsive and routine maintenance
- management and maintenance is adaptable for times of low and high rates of occupancy
- asset performance shortcomings are addressed through ongoing management until capital funds are available to replace the asset.

Consider:

- where a community, building or the associated assets are expected to be unoccupied or unused for an extended period, the assets should be ‘moth-balled’ (that is, appropriately protected and secured).

Replacement and disposal

Disposal and replacement of an asset should occur when it is no longer performing adequately or when its condition has deteriorated beyond repair.

When disposing of an asset **consider**:

- safety
- salvage value
- environmental considerations (such as recycling, correct disposal).

In Indigenous communities, budget asset reporting tends to be completed on an annual basis, rather than over the life of the asset. As a rule of thumb, replacement and disposal of an asset is required when the annual maintenance and running costs exceed half the purchase or replacement costs. Often no budget allocation is made for replacement of any one asset item over the life of the asset. Instead, a sum of money is put aside for emergency replacement. To comply with accounting standards, however, each asset item must have:

- a maintenance allocation
- a depreciation allocation
- a planned replacement budget using the saved depreciation amounts
- an emergency replacement allocation for all assets for unforeseen replacement.

Standard accounting practices allow for the replacement of the asset items through depreciation. Prediction of the costs for the life of an asset (including replacement costs) is consistent with accounting standards for government assets. Asset management of government assets by government bodies and agencies must comply with the relevant accounting standards (*Australian Accounting Standards Board AASB 102 — Inventories, AAS 29 — Financial reporting by government departments*).

Audit and review

The level of detail required for annual audits should be assessed according to the size of the community and the scale of the services provided. A basic audit reviews the documentation, logbooks and service reports, with an inspection of the infrastructure. A thorough audit includes the identification of any maintenance deficiencies and, if possible, some testing.

A thorough maintenance audit may include:

- review and analysis of maintenance systems
- risk assessment
- condition assessment

- safety review
- assessment of training needs for operators
- review of funding strategies.

Depending on the resources available, an audit may also include a summary of operation and maintenance costs. The costs may include infrastructure costs and social costs, such as the cost of being without the service during periods of breakdown.

Ensure that:

- time and costs for an audit are included in the budget
- potential for overcharging by contractors is identified, particularly for maintenance of infrastructure that is well designed and low risk
- findings and recommendations of the audit are summarised and reported back to the council or community, and are included in the annual report.

Consider:

- scheduling the audit for seasonality
- planning the audit within a maintenance schedule that coordinates with other communities in the region
- including an engineering assessment of infrastructure and the provision of services.

Regular audits and reviews assist managers in identifying service-delivery needs. Regardless of the size and complexity of the system, regular audits and asset management can improve community infrastructure and services in a strategic and step-wise process.

Relevant Australian guidelines and standards

The relevant accounting standards are available from the Australian Accounting Standards Board.

Standard	Topic
AASB 102	Inventories
AAS 29	Financial reporting by government departments

Source: www.aasb.gov.au

Safety codes of practice (such as the *National Standard for Plant NOHSC: 1010 (1994)*) are available for download from the Safe Work Australia website; refer to the Index of National Standards Codes of Practice (www.safeworkaustralia.gov.au/swa/HealthSafety/OHSStandards).

Useful terms

AASB	Australian Accounting Standards Board
AAS	Australian Accounting Standards
'As built' documents	Plans, maps or drawings that show the configuration (location, form, contents and dimensions) of infrastructure as actually installed. As built documents incorporate changes that have been made since preparation of the original design documents.
Assets	The physical components of a system, such as water, power or waste management systems.
Cadastral information	Mapping information showing land property boundaries and ownership status.
Disposal costs	The expected costs or return from the disposal of the asset.
Expected operational life/useful life	The period from the time an asset is first put into service until it requires replacement due to normal wear and tear, assuming that regular maintenance has been undertaken on the asset during this period.
Geotechnical information	Mapping information showing the condition, material and properties of the underlying soil and rock of an area.
Legacy issues	Unresolved issues or continuing responsibilities that are passed on to a new owner or responsible person. These may simply be transferred responsibilities, but may also be problems, such as high rates of service failure due to the obsolescence or inadequate maintenance of equipment.
Maintenance and operation costs	The funds required to ensure the asset meets the expected life expectancy. The costs include regular maintenance activities, running costs such as energy requirements, and unscheduled replacement of parts.
OH&S	occupational health and safety
Remaining operational life/useful life	The period remaining until an asset requires replacement due to normal wear and tear, assuming that regular maintenance has been undertaken on the asset to date, and will continue during this period.
Risk	The chance of something happening that will have an impact upon the service delivery. It is measured in terms of likelihood and consequences.

Further reading

ANAO (Australian National Audit Office) (2001). *Life-Cycle Costing Better Practice Guide*, ANAO, Canberra. www.anao.gov.au

Queensland Government Department of Environment and Resource Management (2002). Asset Management: *Asset Evaluation and Renewal Implementation Guide*, DERM, Brisbane.

Safe Work Australia is an independent body supporting the Safe Work Australia Council, and is responsible for developing, issuing and maintaining standards, codes and guidance about safe work practices. www.ascc.gov.au

The Australian Accounting Standards Board (AASB) is the Australian Government agency responsible for developing, issuing and maintaining accounting standards that apply under Australian company law. www.aasb.gov.au

The New South Wales Government Asset Management Committee brings together government agencies and asset experts to ensure a whole-of-government approach to asset management and office accommodation planning. www.gamc.nsw.gov.au