BEYOND ASSET VALUATION
AN ENGINEER'S PERSPECTIVE

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The title of this paper was suggested by the organisers of the CPA Local Government Intensive Day, Brisbane, 28 March 2003. I have therefore taken the liberty to presume that the organisers wish to hear the "perspectives" I have gain since my involvement [starting in 1997] with the valuation of Maroochy Water Services' assets and subsequent customisation and use of the MAXIMO asset management software system. Consequently, the "perspectives" and opinions expressed in this paper are my own and do not necessarily reflect the opinion or policy of Maroochy Water Services or Maroochy Shire Council.

1 HISTORY OF COMPUTERISED ASSET MANAGEMENT AT MAROOCHY WATER SERVICES

1.1 Background

Maroochy Shire Council purchased the MAXIMO[1] asset management software in late 1997 for the management of all Council's physical assets. Council's objective for asset management at that time was:

> *"To plan for, create or acquire, maintain, operate, rehabilitate, replace and dispose of assets in the most cost-effective manner at the required level of service for present and future generations."*[2]

Maroochy Water Services became a commercialised business unit of Maroochy Shire Council on 1 July 1999. Its principal role is to provide water supply and sewerage services to the residents of Maroochy Shire.

1.2 Major Milestones

Early 1990s	State Government Total Management Planning (TMP) initiative launched.
Jan 1995	*Advanced Asset Management Need Analysis Study – WS&S Infrastructure Assets* report by GHD prepared for Water Supply & Sewerage Branch.
1996	Imminent requirement to comply with AAS27[3] gives impetus to advertise for an asset management software system. Tender closed in October.
1997	MAXIMO selected and purchased. Implementation project team assembled in September from those areas of Council's operations that maintain assets. Major focus on establishing an asset database to meet the requirements of AAS27. Second focus on customising the software to match Council's needs.
Jul 1998	Maroochy Water Services' asset valuation officially adopted following approval by Queensland Audit Office.
Oct 1998	Completion of training for selected staff in the standard software package.
Nov 1998	MAXIMO (Version 3.02) goes live. Implementation project team disbanded.
Jun 1999	Personalised training in the customised software given to Maroochy Water Services staff and Council's mechanical and electrical staff.
Sep 1999	Upgrade of MAXIMO to Y2K compliant Version 3.03.

Oct 1999	Problems with accessing MAXIMO from remote locations resolved through the use of Meta[4] software.
Nov 2000	Upgrade of MAXIMO to Version 4.3.
Jan-Jun 00	The corporate Financial Management Information System (FMIS) Project includes a job costing component to integrate Finance One[5] to MAXIMO.
Jul 2000	Implementation of Finance One and CHRIS[6] [HR/payroll] software across Council including integration with MAXIMO work orders. Organisational restructure within Council results in mechanical fitters and electricians joining Maroochy Water Services. Sporadic use of MAXIMO by these staff ended with direction given to use MAXIMO exclusively.
Oct 00-Jul 01	Information Systems Branch leads project to further enhance MAXIMO (Asset Management Phase 2).
Sep 2001	The custom-built *Financial Management*[7] component of MAXIMO used for first time to calculate depreciation.
Dec 2001	Upgrade to Windows 2000 compliant Version 4i [Release 4.1.1].
Aug 2002	Trial link between MAXIMO and the Bentley Microstation Geographics[8] spatial information system developed.
Jan 2003	Integration with Council's service request software ProAct[9] completed.
Apr 2003	Target date to trial in-vehicle computing capability.
Jun 2003	Revaluation of Maroochy Water Services' passive assets (eg. pipes, manholes, etc.) expected to be complete using the integration to the spatial information system and the Asset Management Starter Kit[10] customisation of MAXIMO.
2005-2006	Target date to move to the web-based Version 5 of MAXIMO or another asset management software system.

1.3 Initial Implementation

In late 1997 sub-project managers from across Council prepared project management plans to guide the implementation of MAXIMO into their business areas. The following 'project statement' from Maroochy Water Services' Project Management Plan remains largely relevant today, although the timetable to implement many of these objectives has taken longer than was hoped for.

> *The objective of this project is to develop a fully integrated user-friendly asset management system with trained staff that are keen to use the system because it makes their job easier.*
>
> *Features of the asset management system that will be developed during the project's initial contract period include:*
>
> - *MAXIMO software as the front-end to databases of all Council's principal assets.*
> - *Integration of all of Maroochy Shire Council's core business systems including the financial system and the spatial information system (SIS) in order to responsibly manage and derive best economic benefit from Council's assets.*
> - *Facility to monitor maintenance vs. replacement costs for individual assets and for assets groups.*
> - *An asset location hierarchy (similar to existing numbering systems) that allows users to query the management system in a logical and familiar manner.*
> - *A state-of-the-art preventative maintenance schedule.*
> - *An efficient works order facility.*
> - *A comprehensive automated report writing facility.*
> - *Reliable up-to-date financial information meeting the requirements of AAS27.*
> - *Flexibility that anticipates future needs and changes in technology.*

Maroochy Water's ultimate objective is to develop the MAXIMO software to its full potential. For example, this may include :

- *A "request for service" and complaints handling system.*
- *Integration with Council's SCADA system.*[11]

1.4 Financial Integration

In early 2000 Maroochy Shire Council prepared to implement a new financial system [Finance One] to take effect from 1 July of that year. A component of the Financial Management Information Systems (FMIS) Project was the Job Costing Sub-project.

The objective of the Job Costing Sub-Project was to integrate the key software systems of financial management, payroll and asset management with a view to providing job costing at asset level via single point data entry. It was anticipated that the majority of Council officers would need to use only one of the three major software systems to perform their duties. A minority of coordinators and financial officers would need to view two or more of the systems to ensure integrity between the various software systems.

In anticipation of the integration a set of 'Business Rules' was developed to guide and test the integration. Some of the guiding principles from this document relevant to the title of this paper are restated below.

GP3 MAXIMO is an asset management software system - it is not a financial system. Work Orders are written against individual items of equipment for three major reasons:

(i) to provide evidence of due diligence [financial information not required]

(ii) to facilitate efficient work scheduling and work performance (eg. equipment attributes are recorded alongside work requirement details) [financial information not required]

(iii) to assist long-term engineering decision-making regarding replacement versus refurbishment options [good financial information required, but not necessarily to full audit standard].

GP4 Financial information entered into Finance One will be at a high level and not at asset level. Reporting from Finance One will consequently be at a high level. Purchasing and Inventory Management will be undertaken within Finance One. Financial data in Finance One must be of guaranteed integrity.

GP5 The primary function of any Payroll system is calculating pays including award conditions etc. The new Payroll system [developed by Frontier Software] will be CHRIS (Complete Human Resource Information System). CHRIS is not an ideal job costing system but it can be made to perform that function. To use MAXIMO as a payroll system is even more restrictive[12]*.*

The integration of the three software systems was successful. Instead of putting account numbers on timesheets, workers are able to quote a work order number and the labour cost of the work is recorded against the asset specified in the work order. Likewise the cost of purchases that have followed the normal course through the financial system or via purchasing cards is captured against the work order and hence the asset. Internal billing between different teams within Council is operational and a detailed history of the purchase and maintenance costs of each asset is developing.

The integration presented many challenges and has tested software programmers and application administrators to anticipate all eventualities and to rectify the few errors that have occurred.

2 ASSET VALUATION

2.1 AAS27 – Why?

Complying with the requirements of AAS27, implementing and maintaining asset management software systems and paying licence and support fees is an expensive undertaking. So why do it?

Compliance with legislation is an easy response but does not answer the question of why legislators see the need to make AAS27 mandatory for public institutions that are not traded on the Stock Exchange.

A comparison of the water supply and sewerage industry with other industries reveals how capital intensive the former is. Every employee at Australia's largest water authority, Sydney Water[13], is responsible for on average $3.8M worth of Sydney Water's assets. Each employee at BHP Billiton[14] on the other hand looks after on average $1.1M of that company's assets.

Such a large investment in assets combined with relatively few staff to maintain them demands a strong focus on knowing as much as possible about the assets, getting the longest economic life possible out of them and being ready to replace them when necessary. AAS27 is one component of the asset management jigsaw.

2.2 AAS27 – How?

How valuations are decided for individual assets is outside the scope of this paper. The title of this paper indicates that valuation may be assumed complete. For the sake of completeness however, this section gives a very brief overview of the mechanics of how asset values and depreciation calculations in MAXIMO find their way from this asset management software to Council's financial management software (Finance One).

Figure 1 shows the financial details recorded in MAXIMO for a typical asset. These details are accessed via MAXIMO's *Equipment* screen. These financial details are attributes of the asset in the same way as make, model and serial numbers and other physical attributes are (eg. size, material, capacity, function, etc). All these attributes are stored in the one database – MAXIMO.

The financial management (acquisition, depreciation, revaluation and disposal) of assets using MAXIMO is a customisation of the base software that was developed by John Wilson and Partners[15]. The customisation involves three new screens and twelve reports.

Maroochy Shire Council uses straight line depreciation but the customisation allows for diminishing value depreciation or manually entered year-to-date depreciation.

Reports can be run at any time (in report-only or update modes) for asset records selected by the user using any of the fields shown in Figure 1. Wildcards and structured query language (SQL) searches allow the user great flexibility. Reports are sorted based upon the *Financial Classification* field with additional break-up possible using the *Facility* field. The *Financial History* screen records details of each financial transaction for the asset.

For end-of-year financial reporting the *Depreciation* report is run in report-only mode and checked. Once the data has been verified the *Depreciation* report is run in update mode. This report resets the financial details on the *Asset Financial Details* screen (Figure 1) and sends the original details to the *Financial History* screen.

The *Annual Financial* report is run next. This report lists financial details by financial classification and GL account code. The report output shows separate details for assets recorded at historic cost and at current cost. An output file is generated for import to Finance One.

Other reports deal with revaluations, new assets, disposals, transaction reversals, etc.

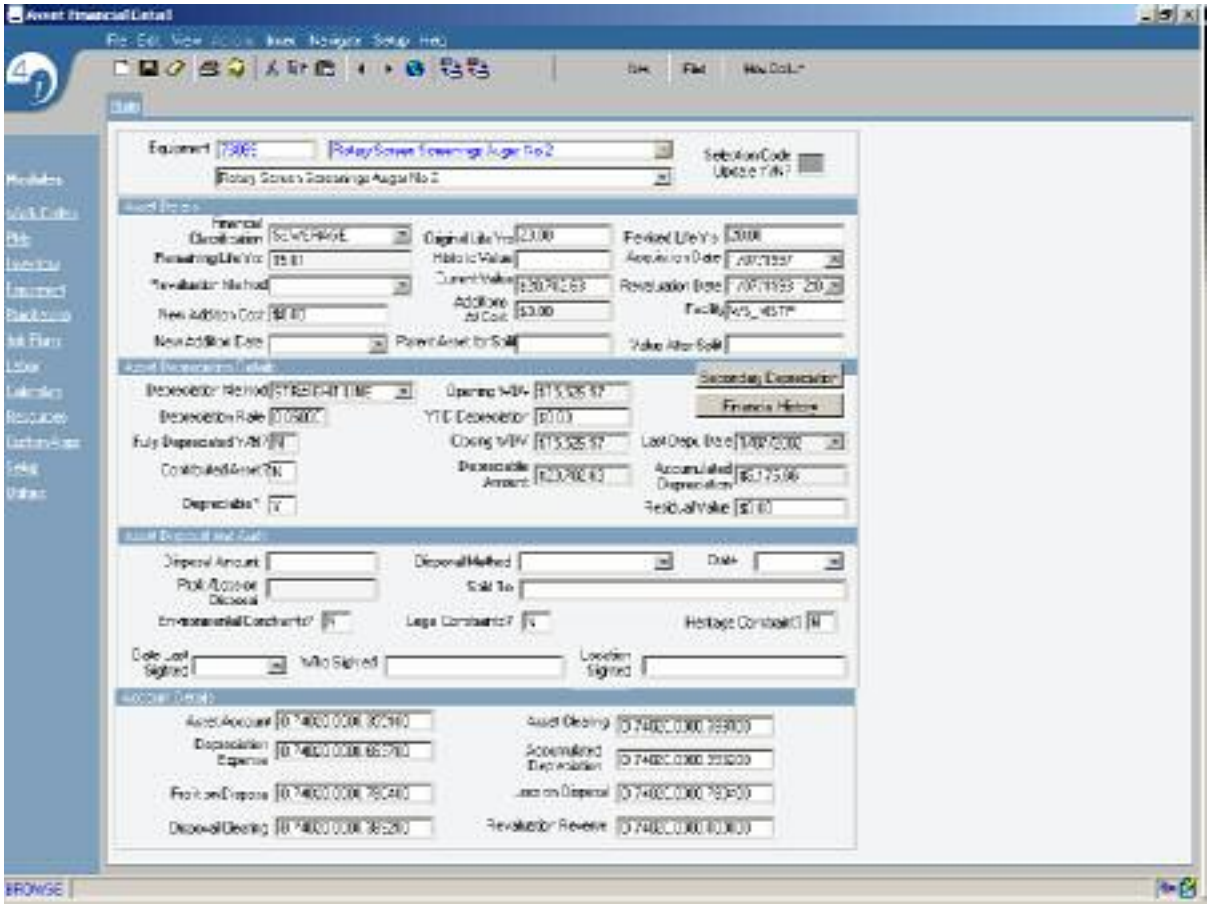


Figure 1 Asset Financial Detail Screen for Equipment No. 76089

3 BEYOND ASSET VALUATION

The next six subsections highlight opportunities to add value to the ***data*** collected for asset valuation purposes and convert it to ***information***. Following this are another two subsections dealing with issues that go "beyond asset valuation".

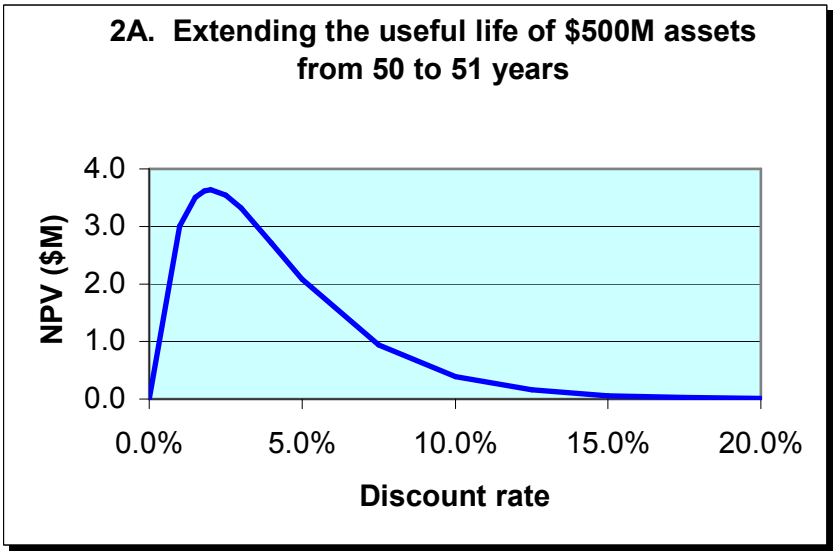
3.1 Justification of Staff Levels

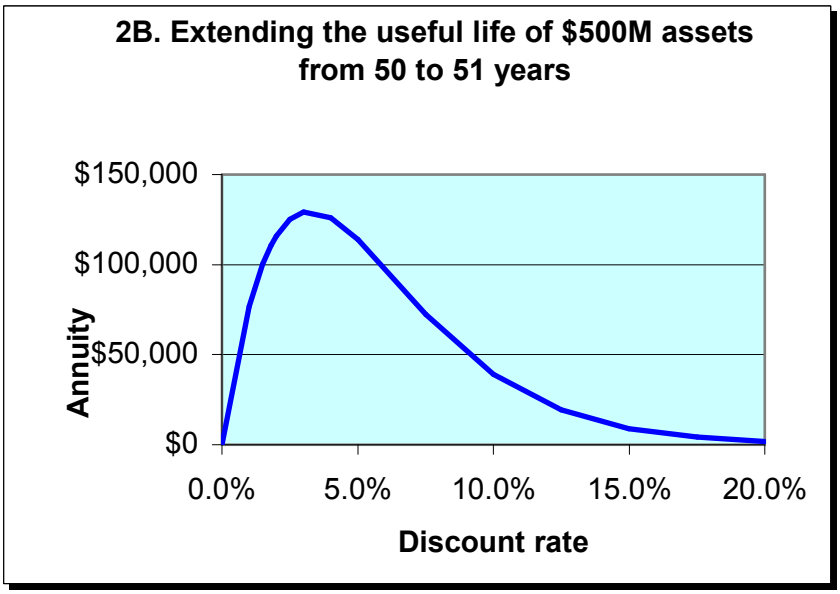
The comparison of asset value versus employee numbers (Section 2.1) reveals just how capital intensive the water supply and sewerage industry really is. The same ratio for Maroochy Shire Council is $0.8 M per employee. For Maroochy Water Services the ratio is $2.7 M per employee.

The magnitude of this ratio suggests that there might be cause to consider whether staff numbers are sufficient. Typically in both the water industry and in local government when staff levels are compared it is done solely within the industry sector and is calculated in terms of the number of properties served. Whilst this forms a valid appraisal it can tend to gloss over differences between organisations and totally ignores the possibility that the industry sector as a whole is under staffed.

There seems to be a negative attitude in the public service towards employing more staff. It is seen as a political issue when it should be a service delivery issue. AAS27 has given local governments opportunity to assess just how valuable are the assets they maintain. It is sensible that staff levels should be assessed (at least in part) based on the value of the asset base and its anticipated useful life under various maintenance regimes.

A simple net present value analysis is shown in Figures 2A and 2B. It shows the effect of extending the useful life of an asset base of $500 M by one year from 50 to 51 years. The result is shown as a net present value and as an annuity.





Figures 2A & 2B Effect of Extending the Useful Lives of Assets

This type of analysis would be a useful adjunct to staffing comparisons within and between industries. The mathematics behind Figures 2A and 2B is not difficult. The challenging part of the equation is convincing those who have control over the budget that you have an engineering solution that will deliver a benefit at some point in the future that justifies an expense today!

3.2 Engineering Decision Making

Maroochy Water Services has been using MAXIMO for a number of years collecting a history of maintenance costs for individual assets. The replacement value of these assets is also stored in MAXIMO. Hence it is possible to query the database, calculate the following ratio and then sort it from highest to lowest. For simplicity this ratio has been called the 'Decision Required Ratio'.

$$DRR = \frac{\text{Maintenance Expenditure \$}}{\text{Replacement Cost \$}}$$

This is a useful ratio to highlight those assets that deserve further investigation. The software allows thousands of records to be considered and the results condensed to a manageable number.

Even for those assets with a high DRR the decision to replace or to continue maintenance will not always be straight forward. Replacing an asset that has a history of high maintenance expenditure with a new asset of the same type will not solve the problem if that type of asset is a poor choice to begin with. On the other hand, if a different asset type is selected then very often it won't fit the hole left behind by the old asset and requires modifications to assets networked to the original. In the latter case the replacement cost used by the software may be an underestimate.

Assets with a low DRR are obviously functioning very well from a maintenance and financial point of view. However, there may be other reasons why the asset should be replaced. A threat to personal safety would be one of the more common reasons.

The DRR is a very simple ratio. MAXIMO and other asset management software systems offer much more sophisticated analysis tools[16]. However, there is often a lot of work required to establish the raw input data for these tools and often the elegance of the tool itself blinds the user to the coarseness of the input data.

3.3 Price Justification

One of the main drivers for AAS27 was for local governments to obtain a clearer picture of the full cost of ownership of their asset base. If local governments are not to leave an adverse financial legacy for future generations then the prices charged for services today should include a component for asset depreciation.

The National Competition Policy is driving the water supply and sewerage industry in the same direction. For such a capital intensive industry depreciation represents a large and necessary component of prices. Any significant undervaluation of assets or underpricing may be the seed of a future problem.

3.4 Cross-subsidy Analysis

The eighteen largest local governments in Queensland are subject to a prices oversight regime administered by the Queensland Competition Authority (QCA). In addition to comparing prices with other service providers the QCA may investigate internal price subsidisation. Section 783 of the *Local Government Act 1993* also imposes an obligation on local governments to identify and disclose cross-subsidies between "*classes of consumers*" of relevant water supply and sewerage services.

"*Classes of consumers*" could be residential/commercial/industrial, water supply/sewerage or it could be consumers in different water supply areas or customers in different sewerage catchments.

Maroochy Water Services is using the *Facility* field on the *Asset Financial Detail* screen (Figure 1) to record in which water supply or sewerage catchment each asset lies. MAXIMO reports can be run to summarise the value of assets in that catchment and their annual depreciation expense. This information is a key input for an analysis of possible cross-subsidisation between customers in different catchments.

3.5 Insurance

By linking Maroochy Water Services' insurance schedule with its valuation data it is possible to keep the two in tune. Minimising the number of databases is an operational imperative.

Also, because assets have been valued at a low level, Maroochy Water Services is able to insure only the most appropriate assets. Only those above-ground assets subject to fire or theft and of value greater than the excess limit of the industrial special risks policy are insured.

3.6 Lifecycle costing

The longer the costed maintenance history in MAXIMO becomes the better the software will be in refining useful life estimates and depreciation calculations. In the future it will be possible to consider using condition based depreciation with some degree of assurance.

Ratios such as the DRR (Section 3.2) and other SQL queries allow the user to compare manufacturers and suppliers and calculate equivalent annual costs. It will be possible to reliably compare a low cost asset with a history of high maintenance expenditure with other assets costing more to purchase but requiring less maintenance. This will better inform decision-makers.

It is critical to recognise the link between valuations and maintenance expenditure. Both are needed to complete the asset management financial picture.

3.7 Environmental Economics

An issue worth considering that goes "beyond asset valuation" is whether environmental costs should be included in asset valuations. We tend to appreciate the value of the environment (clean air, clean water, plants and animals) when they are gone. Today we recognise that global warming and loss of species diversity are real and threatening problems. Asset valuation could include a component related to environmental values forgone.

We value the environment in qualitative ways but we could value it in quantitative ways. Environmental economists have developed numerous methods of estimating a dollar value to the environment[17]. It is an evolving field of research and will never be an exact science – but it is something that deserves greater attention. Triple bottom line reporting is a good start but a lot more needs to be done "*to build ecological thinking into all social and economic planning*"[18].

3.8 Revaluation

"Beyond asset valuation" is of course revaluation at regular intervals. It can be an expensive process and seem like an endless treadmill. It is important therefore to try to make it as painless as possible.

For water supply and sewerage authorities, 70% of the value of their assets is buried pipelines. Maroochy Water Services is currently implementing another customisation[19] of MAXIMO to efficiently value and revalue these assets.

This customisation (developed by John Wilson and Partners) is based on the formula:

Value = Quantity x Rate x Location Factor x Overhead Factor

where typically:

- Quantity = 'each', 'metres', 'square metres', 'metres cubed', or 'tonnes', etc.
- Rate = $/Quantity
- Location Factor = multiplication factor (eg. rural = 0.8, suburban = 1.0, CBD = 1.2)
- Overhead Factor = 'oncost' or 'margin', etc.

Figure 3 shows the new *Unit Rate Valuation Rate* screen. Of note in Figure 3 is that water mains of the same diameter but different material types have their own rates specified. For sewers the depth of the pipe will also be factored into the rates.

Figure 3 Unit Valuation Rate Screen

One of the reports in this new customisation allows the user to rapidly increase the rates in Figure 3 by a uniform amount (eg. CPI, Building Cost Index, etc.) without the manhours of a typical revaluation. This aspect of the customisation will need to be accepted by Maroochy Shire Council's auditors before it is put to full use.

4 BEYOND THE LIMITS

Section 3 dealt with attractive destinations "beyond asset valuation". It is appropriate in this section therefore to state those place that go "beyond the limits" set by good asset valuation practice.

4.1 Accuracy

Understand the accuracy of the data that forms the valuation and don't expend energy drawing conclusions that go beyond the limits of the data.

Figure 4 shows three possible depreciation methodologies. The shaded area represents the inherent knowledge bounds that all valuers confront when determining the value and the useful life of assets.

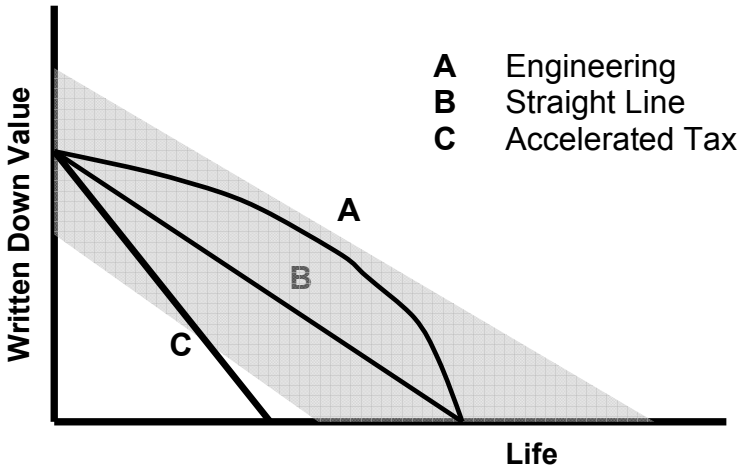


Figure 4 Depreciation Methodologies

It is recognised that straight line depreciation (**B**) generally understates the true value of the asset. However, in its favour can be listed its ease of calculation and the fact that it lies within the shaded bounds of certainty.

A depreciation methodology based on the physical condition of the asset (**A**) will extend above the shaded area if a replacement value or useful life is selected from the upper end of estimates. This suggests that the upper limit of the knowledge boundary is not straight as shown in Figure 4 but is convex. The confidence that can be placed in written down values is even less than that shown in Figure 4!

Accelerated tax depreciation (**C**) and other depreciation methodologies such as depreciated optimised replacement cost (DORC) have their benefits but also have costs. Those costs include having staff (or consultants) employed collecting data, manipulating spreadsheets and maintaining systems that may be based on a framework of best guesses. Before undertaking such depreciation projects consideration should be made whether these resources could be better employed and whether reliable information will be the end product.

About 70% of the value of the asset base of water supply and sewerage service providers is represented by buried pipes. The valuation of water pipes is generally via a unit rate per metre based on the pipe's material type and diameter. For sewage pipes depth is also a major factor. The many other variables affecting construction costs are smaller in magnitude but contribute to the range of uncertainty.

A comparison[20] of the unit rates used for valuation purposes for ductile iron cement lined water pipes by four councils in South East Queensland revealed a range of values in the order of 34%. The useful lives that have been adopted range from 60 to 100 years. If written down values are considered then the inconsistency increases as the assets approach the end of their useful lives.

A comparison of each council's asset value per property, if it is based solely on information taken annual reports, will not give any indication that this performance indicator has a range of uncertainty in excess of 34%. This particular performance indicator also fails to recognize differences in service levels and operating constraints.

Water supply pipelines are being constructed every day. Assets like that shown in Figure 1 are not common. Valuers are obliged to make assumptions when valuing such assets. Every valuer has his or her own set of assumptions that define the shaded area in Figure 4.

4.2 Appropriateness

An even greater folly than overextending the valuation data is to use the data inappropriately. It is not possible to list all the options for misuse of valuation data but one should be awake to the possibility that mixing valuations with other parameters may not produce a valid result.

One example that regularly appears in government circles relates to debt. Governments should not shy away from acquiring new assets because the media has a tendency to focus on the debt rather than the value of proposed acquisitions. Ratios such as debt per ratepayer and debt per head of population are not as appropriate or rigorous as the debt servicing ratio.

4.3 Other issues

Return on investment is a useful ratio that is often quoted and made use of. However, return on investment should not be the sole determinant of dividends and prices.

The dividend quantum set by local governments on their water supply and sewerage service providers is often linked to a target return on investment rate. This rate needs be modified by consideration of the service provider's ability to maintain public health within budget constraints. Maintaining public health by preventing outbreaks of water-borne disease is the core mission of water supply and sewerage providers. Access to high quality drinking water and the proper sanitation afforded by modern sewage treatment is the principal reason why people in the first world enjoy a significantly higher life expectancy than those in the developing world.

Water supply and sewerage prices are often also dependent in some part on the target return on investment rate. Pricing decisions should also be modified by consideration of public health. Other matters fundamental to pricing decisions include:

- Supply and demand (like every other economic good). Droughts have a significant impact on the supply – so why not increase prices during droughts to protect a scarce essential resource?
- Ability to pay. The water supply and sewerage industry in Queensland is a collection of public monopolies. Prices should not be so high that they impair access to such a vital resource by any sector in the community.
- Ecologically sustainable development. What impact will prices have on the behaviour of customers and the service provider?

5 CONCLUSION

There are many good and practical ways that asset valuation '*data*' can be converted into '*information*'. Valuations are a vital piece of the asset management jigsaw. Other non-financial pieces of the jigsaw include operations management, workplace safety, community wellbeing and environmental protection.

Accountants (and engineers!) need to be aware of the accuracy limits and appropriateness of valuation data. Elegant software and hours spent on the job don't guarantee success. Careful planning and considered judgement are better indicators of the likely success of an asset management program.

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