MANNINGHAM
BALANCE OF CITY AND COUNTRY

Asset Management of Council's Drainage Infrastructure

Relationship between

Asset Depreciation & Condition Assessment

Discussion Paper

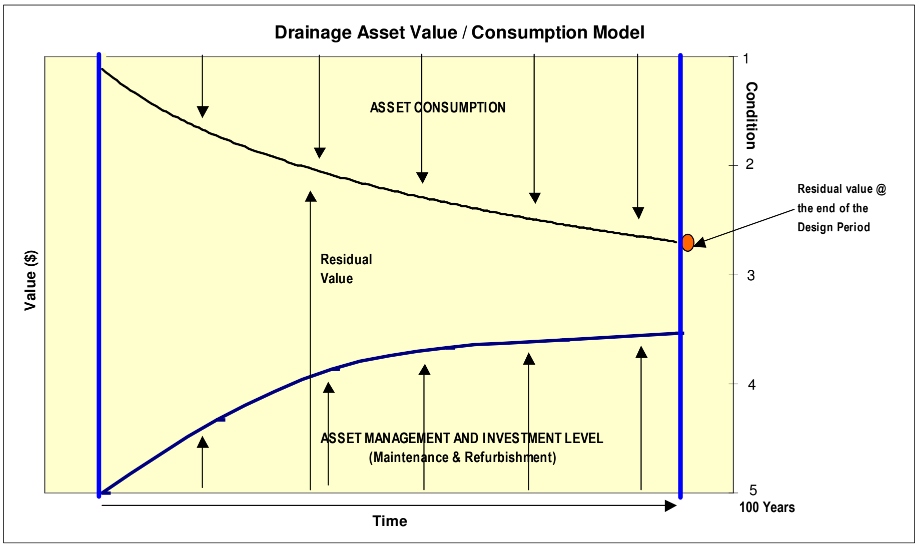
1. EXECUTIVE SUMMARY

Historically assets have been depreciated using the straight-line depreciation method with little to no regard for the actual condition and residual life of those assets.

Investigation and research into drainage asset condition over time indicates that drainage assets are not being consumed as fast as the depreciation rate forecasts. Research is also indicating that drainage assets have a residual life contrary to the AAS27 depreciation approach where drainage assets are assumed to have no value at the end of their depreciated life. Recent improvements in technology are also allowing these drainage assets to function far in excess of their "theoretical" life further confirming that drainage asset lives are being extended.

Condition assessments of Manningham's drainage assets reinforce this research and indicate that the majority of the underground drainage piped network to be in excellent condition and that the current depreciation approach is overstating the "true" picture. The evidence also suggests that the level of regular maintenance/refurbishment of Council's drainage assets does directly impact on the condition and "life" of these assets.

Having considered the research and outcomes of Manningham's assessment, other Council's and authorities approaches, it is proposed that the following "model" be adopted as it provides a clear relationship between management and maintenance/renewal of assets, asset consumption (value) and condition.



Model Chart

Further regular condition assessments of Council's drainage assets and reviewing the outcomes of industry research can then be progressively monitored and the model adjusted to reflect the "actual" asset deterioration/consumption. This in turn can then be reflected in the level of depreciation and shown in Council's profit/loss statement.

2. SETTING SCENE

Depreciated of the drainage network has been in accordance with the requirements of AAS27 using the straight-line depreciation method. The amount of depreciation has been calculated utilising the limited information available at that time with initially it being based on a ~ 3% sample of drainage plans. In 2002 an additional desktop exercise was undertaken using ~8% sample of construction plans to provide a more accurate estimate of the network. However the results from this later desktop assessment revealed significant differences with the original data. To overcome this discrepancy a detailed assessment of all construction plans has now been completed providing Manningham with an accurate and up to date asset register, to more accurately reflect the value and depreciation of these drainage assets.

In addition to updating its asset register, a sample condition audit of ~ 6% of the drainage network has also provided Council with a more accurate "picture" of these important assets. It has enabled Council to determine the value and effective remaining life of these drainage assets with greater confidence and to better meet the depreciation requirements of AAS27.

These actions were in recognition that the development of a comprehensive and advanced approach to the valuation of its drainage assets was essential in determining the quantity and quality of data needed to ensure compliance with the new Asset Accounting Standards.

What has been revealed from the condition assessment is that Council's drainage infrastructure is not being consumed as fast as the depreciation rate forecast and in fact Council is achieving significant longer life from these assets. *"Straight line depreciation is exaggerating the time consumption of service potential in infrastructure assets." (LGA South Australia "Infrastructure Asset Depreciation Project " GHD July 2001).*

Research from within the state/local government sector, private industry and manufacturing sector clearly indicates that drainage infrastructure does not depreciate in a straight line and in fact with continual maintenance being provided, asset "lives" in excess of 150 years + can be achieved. Further, in the majority of instances, drainage assets have a substantial residual value even though they may have reached the end of their "so called" physical life.

This report highlights the current shortcomings of straight line depreciation and highlights the benefits of an Infrastructure Asset Depreciation approach using regular condition assessments and providing timely maintenance and renewal of those assets.

3. ASSET REGISTER

One of the key requirements for achieving best practice asset management is to have an accurate and up to date asset register. Unfortunately up until June 2003, Council was not in this position, relying on previous estimations of drainage assets from desktop samples of construction plans to determine the quantity and subsequently the valuation of its drainage infrastructure.

3.1 PAST PRACTICES

In 1996, Council's drainage assets were valued based on an independent assessment of a small sample (~3%) of the drainage network using drainage construction plans. The results of the sample indicated ~ 18.3 kilometres of drain per square km which, was extrapolated across the urban areas of the municipality indicating a total drain length of 890 kilometres and 35,000 pits across the municipality. It was also estimated that average size of pipes to be between 300mm-375mm diameter and that pits were of a standard junction or side entry type.

A further "desk top" analysis was undertaken as part of the 2002 Audit using GIS information with a sample residential area of 4.4 square kilometres (~ 8%) of the residential area within Manningham. It was considered that this sample size was more representative and typical of the drainage network within the municipality. The length of drains and number of drainage pits within this typical sample area were then estimated and the quantities derived were then used to extrapolate quantities for both the rural and urban areas of the municipality. The assessment found that within the sample area there was ~ 97.6 km of drainage pipe and ~4406 drainage pits which when extrapolated across the municipality indicated ~1,177 km of drainage pipes and ~53,100 pits.

Again as in the initial survey, it was considered that predominant drain size within the municipality is on average 300mm-375mm diameter and that pits are of a standard junction or side entry type. Regardless, the inventory was only an estimate to provide a "holistic" overview, not a management tool for asset management.

3.2 CURRENT PRACTICE

As a result of the variance and uncertainty of the quantity, Auditors advice and findings from the 2002 Audit, immediate action was taken to embark on a drainage infrastructure program that would map all of Council's drainage network currently held in GIS and within the construction plans, loading all attribute information for the pipes and pits into the Hansen database.

The drainage network has been mapped with all appropriate attributes such as the size, location, age and type of drainage asset being identified. A total of 1024.9 km of pipeline and 45,615 pits have been mapped and attributed. A register of the drainage assets is attached as Appendix 1. **The validation of these assets in the field will progressively occur as maintenance is carried out and the information confirming assets appropriately entered into Council's asset database.**

A comparison and indication of the differences between the various drainage quantity estimates and the recent accurate assessment are contained in the following table:

Item	Prior to 2002	2002	2003
Drainage Pipes	~ 890 km	~1,177	1,024
Drainage Pits	~ 35,000	~ 53,100	45,615
Average Pipe size	300 – 375mm	300 – 375mm	Actual sizes

4. DEPRECIATION

Depreciation is a non-cash component and within a Profit/Loss reporting process if inaccurate, simply distorts the cash position of Council.

Accurately determining the consumption of asset value is of universal concern and Victorian practice is that AAS27 and various associated regulations/guidelines require Council to accurately depreciate its assets and to record that depreciation within its financial statement. The local government sector have continually raised concern over this approach and the majority believe that this form of depreciation does not accurately reflect the asset consumption and the "cash" requirements to maintain the integrity of the drainage assets so that it may continue to provide the required level of service.

The two recognised approaches within industry/government sector are:

- Accounting – (Straight Line) Depreciation; and
- Infrastructure Asset Depreciation

4.1 STRAIGHT LINE DEPRECIATION

AAS27 requires Council to record a depreciation expense statement on its infrastructure assets in its operating statement. It is assumed in this approach that deterioration of the *"service potential of the asset is uniform throughout its serviceable life, regardless of the conditions, performance and nature of the asset".*

Standards for the application of AAS27 are contained within AASB1021 Depreciation contained within the ICAA Members' Handbook June 2002 Issue. Extracts from the handbook are contained within Appendix 7. One of the key purposes of the standard is to require the recognition of assets with physical substance that are expected to be used during more than one financial year and for the *"depreciable amount of a depreciable asset" must be allocated on a systematic basis over its useful life*". The depreciation method applied to an asset must reflect the pattern in which the assets future economic benefits are consumed or lost by the entity. In determining useful life consideration needs to be given to such factors as potential physical life at a projected average rate of usage and assuming adequate maintenance, potential technical, commercial life.

The concept of "useful" life for public assets such as drains and roads is of concern. Practice by public Administrators is to ensure a "level of service" from an asset on an indefinite basis. Hence the term life is misleading. A depreciation or renewal period in which an asset is assessed would be more meaningful.

Historically the approach taken has been to straight line depreciate an assets consumption without recognition of any differences such as asset type, location, environment, extent and timing of loss of service. With the level of awareness of Asset Management and the technology to support information, it is appropriate to introduce additional standards and definitions to manage asset depreciation that more accurately assesses the assets "real" consumption.

4.2 INFRASTRUCTURE ASSET DEPRECIATION

Asset depreciation and deterioration (consumption) are elements that need to be consistent. Consequently the Infrastructure Asset Depreciation (IAD) approach is based on determining an asset performance over time by regularly assessing its condition to determine the consumption of service potential of an asset by developing "*an assets renewal cash flow necessary for the assets to continue to provide the levels of services required by customers and ratepayers*".

The report from GHD to the Local Government association of South Australia identifies that through the *IAD* approach *"the consumption (depreciation) of the asset is measured as the Renewal Annuity of the forward looking cash flow program.*

The approach requires the development of a comprehensive Drainage Asset Management Plan that includes a robust and auditable condition assessment process where future renewals can be justified and audited. It relies on the audited integrity of AM Plans and historical condition performance monitoring.

The review undertaken by GHD indicates that with the straight-line depreciation method variations of 20-60% in effective lives has been found. Most assets do not fail but rather components tend to fail first. With the advent of new technologies the research has also found that some assets can be rehabilitated at a much reduced level when compared to tradition replacement cost and still provide a satisfactory level of service. Further, at the end of the period considered the asset does have a residual value.

This IAD approach is accepted and used by the RTA (NSW) and Victorian Irrigation Industry to depreciate their assets and it suggested that this model be seriously considered.

4.3 MANNINGHAM APPROACH

Historically the straight-line approach of AAS27 has been followed within Manningham with adjustments made only to reflect changes in the value of the network. The estimated drainage quantities were multiplied by the appropriate construction rates provided by the Project Management Unit at that time to determine their value. Council has adopted the approach of assessing the quantity of its drainage assets and multiplying the percentage of life remaining for each asset by the replacement cost, which has been averaged out over the previous three-year period.

Following concerns about the significant variation of assets from the various desktop assessments, it was considered more appropriate to use the original desktop analysis. In the intervening period for the 2002 assessment and until an appropriate inventory was established, all new drainage assets that were created as part of the Capital Works Program since that time were added to the desktop inventory.

Replacement costs used have been determined from contract rates provided by the Project Management Unit, who supervise Capital Works projects within Manningham. A summary of the replacement rates is attached as Appendix 2.

4.3.1 Condition Assessment

In September 2000, an independent condition audit was undertaken of a small sample of drains. Refer Appendix 3. The results indicated that 80% of those drains surveyed were structurally sound with the majority of the remainder given a rating of 3, as they required "possible long-term action".

Those within rating 3 category is predominately caused by the intrusion of roots /blockages with a small percentage due to pipe deterioration. The following condition rating and remaining level of functionality has been determined:

Rating	**Condition**	**%**	**Years Life Remaining**
1	Visibly Structurally Sound	78.7	100
2	Minor Problems Not Requiring Action	0.7	90
3	Requires Possible Long term Action	20.6	70
4	Requires Possible Action in Near Future	Nil	50
5	Requires Immediate Action	Nil	20

The above results indicate that the overall average condition of the network to be ~ 94% and based on the theoretical life of 100 years, there is a further 94 years "life" remaining.

Based on contract costs and the above assumptions the following table summarises the valuations for pipes and pits adopting the approach of assessing the quantity and condition of the assets and applying the "fair value" principle. Fair value being determined by the percentage of life remaining or residual value for each asset based on the condition of that asset and multiplying that value by the replacement cost. The details are summarised in the following table:

DRAINAGE DATA 2003					
Condition Rating	% Condition Rating	Pipe length km	Full Replacement Cost $	% Life Remaining	$ Fair Value
Drainage Pipes					
1	78.7	806.6	$148,943,351	100	$148,943,351
2	0.7	7.2	$1,324,782	90	$1,192,304
3	20.6	211.1	$38,986,443	70	$27,290,510
4	0	0	$0	50	$0
5	0	0	$0	20	$0
Total	100%	1,024.9	$189,254,576		$177,426,165
Drainage Pits					
Condition Rating	% Condition Rating	No Pits	Full Replacement Cost $	% Life Remaining	$ Fair Value
2	100	45,615	$45,951,240	90	$41,356,116

The majority of drainage pits have been assessed as being either visibly sound or some minor problems not requiring any immediate action.

On that basis all pits have therefore been assessed as having a condition rating of 2 with 90 years of life remaining.

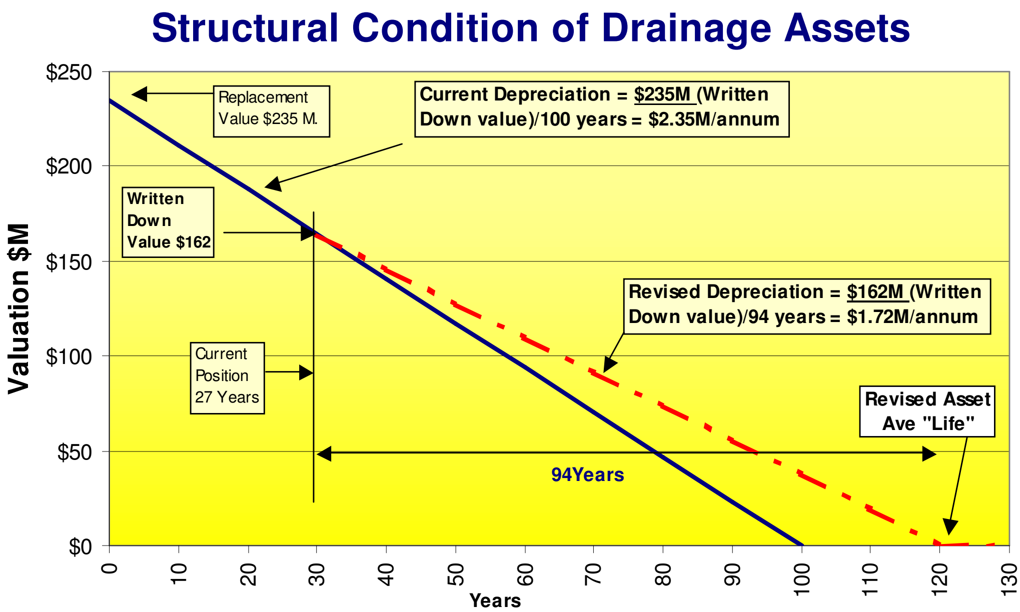
The overall financial impact of the drainage revaluation for 2002/2003 resulted in a re-classification of the replacement and written down values for the drainage assets. The values were adjusted to a factor of 80% of current prices on the basis that Council currently has an extensive asset base and would therefore not have to construct an entire new drainage network.

The adjusted drainage values are set out in the following table:

	Replacement Cost $	Written Down value $	Fair Value $
Drainage Pipes and Pits	$189,907,664	$128,189,612	$175,025,825

The impact of this analysis is that the amount of deterioration and depreciation (asset consumption) is less than originally provided thereby reducing the "bottom line" on Council's financial statement as indicated in the following chart. The "theoretical" drainage life used for depreciation purposes appears to be overstating the level of depreciation. Based on research within the industry and the analysis of Council's initial condition assessment results, the average life of drainage pipes are estimated to be greater than 120 years. Clearly further analysis over a longer period of time will provide a better indication of depreciated life and actual asset consumption.

Alternatively, consideration of a residual value for the asset at the end of a 100-year period may be a preferred assessment process for public infrastructure assets such as drainage. The outcomes of research to date suggest a 50% residual value for drains after a 100-year period.



A further observation from the above chart is that at the end of the theoretical "life" of 100 years, the assets have a residual value.

4.4 RESEARCH

Based on the initial results from the Manningham condition assessment further investigation was undertaken to ascertain whether any research or experience from other sectors could provide substantiation to the Manningham results.

Our literature research strongly identified that the life of the Council's drainage assets will last beyond the 100 years currently stated in policy documents. The attached discussion paper Appendix 4 outlines details regarding alternate treatments and approaches for sewer rehabilitation methods, which can also be applied to stormwater drains. The paper highlights significant cost savings through the implementation of many of the spot repair techniques that are identified in the paper.

4.4.1 University of Newcastle

The University of Newcastle, refer Appendix 5, has undertaken substantial research into the deterioration, depreciation and serviceability of stormwater pipes by studying the condition and performance of stormwater pipes. The research found that the assumed useful lives adopted for financial reporting requirements for stormwater drains are significantly different to those in the study. The depreciation requirements of Australian Accounting Standards were shown to significantly overestimate the actual depreciation of stormwater pipes when fixed over the assumed life of the asset.

The study has presented a model that has shown, both conceptually and through statistical analysis, to be an appropriate model for stormwater deterioration. Various pipe characteristics were found to influence the deterioration process such as, pipe diameter, construction material, soil type and exposure classification.

The Newcastle study suggests that for depreciation purposes the expected structural condition of the assets have a residual value and the "Markov" Model suggests that the residual value at the end of 100 years is 50% and therefore still had a significant functionality and usefulness beyond the depreciated period. The discussion paper by Coomes, Micevski and Kuczera states that for Newcastle *"the actual condition for the 60 year old assets had deteriorated 40% and that the written down value was $109 M, replacement value $145 M. indicating a deterioration of $36 M over 60 years or 0.6 M. per annum"*.

The Newcastle study also revealed that the level of service provided by a pipe is not necessarily related to the structural condition of the pipe and was therefore not found to affect its deterioration. The serviceability of condition is based on defects that affect the hydraulic, not structural, performance of the pipe irrespective of its age.

4.4.2 Melbourne Water Corporation

Melbourne Water has also carried out a number of sample audits on their drainage network and it was found that the majority of assets built after 1960 were found to be in a structurally sound condition. Some of their older assets are 80-100 years old and are still considered to be in a reasonable condition requiring ongoing maintenance only. They have developed a risk assessment process as part of the maintenance program that involves annual inspections being carried out on high risk areas or known problem areas.

Melbourne Water suggests that the 'Spun' reinforced concrete pipes technology introduced in the 1950's onwards has significantly improved that longevity. They currently have structural concerns with early drainage culverts, usually of brick construction, rather than any structural or degradation of concrete pipes.

Discussions with officers of Melbourne Water Corporation indicate that based on their key findings and extensive drainage management experience, a risk management approach has been adopted in managing its drainage assets. Priority being a sophisticated condition ratings system with actions scheduled in accordance with prescribed risk adverse intervention standards.

Melbourne Water Corporation generally supports the view that a more rational approach to assessing depreciation would be to base it on structural condition rather than straight-line depreciation.

4.4.3 Pipe Manufacturing Industry

In determining the potential life of drainage assets it is imperative that consideration be given to the substantial improvements in technology, construction materials and laying techniques of drainage pipes that have evolved over time.

In Manningham's case the majority of its drainage network was developed since 1960, at a time where pipe manufacturing was greatly improved and where the construction standards and supervision are very high. Further, the requirement for use of rubber-ringed pipes and a significant high level of compliance inspection, ensures a long lasting community asset is achieved.

In assessing drainage pipe and pit "life spans" and on the ground serviceability, the following aspects need to be considered:

- Manufacture of pipes is through quality assured framework. *The Concrete Pipe Association of Australia – Technical Bulletin – Designing Permanent Pipelines indicates that the 1st concrete pipe built in 1842 is still in excellent condition. Evidence indicates that service and design life can* ***conservatively*** *be set at 100 years.* The issue being that the "design life" is a design period for the purposes of calculation, it does not necessarily reflect the actual period of the assets functionality.
- Construction practices have significantly improved with majority of contractor's quality accredited. (AS 3725 installation)
- Pipes condition is at greatest risk due to construction loadings and consequently having a QA approach to construction and audits processes as undertaken in Manningham, this aspect is minimised.
- Life of the pipe is indefinite unless highly acidic environment or high abrasion due to heavy sediment on steep grades, which is not evident within Manningham.
- Manningham excellent quality controls via its Project Management Unit that ensures construction (pipe laying) standards are adhered to and therefore ensuring long levity of pipe life.

In addition to the above, the recent focus on stormwater quality and the removal of sediment from our waterways and drainage systems also enhances the longevity of the drainage network and reinforces the argument of increased drainage "life".

4.4.4 Other Councils

Investigations into how other local authorities "depreciate" and manage their drainage assets indicates that the majority follow the standard AAS27 depreciation method without any regard to the condition of the pipe network and the corresponding remaining life. Attached as Appendix 6 is the results of a literature survey of other municipalities on how they review and assess the useful life of drainage assets.

Of the 9 municipalities reviewed Port Philip, Hobart, Moreland and Dandenong have undertaken extensive condition assessments and are using these results to influence the valuation of those assets and their level of asset consumption.

A condition audit of ~ 20% of the drainage network within the City of Port Phillip found that the majority of pipes to be in good condition and have performed well, their response was: "*The earlier concrete pipes have survived quite well where they have sufficient cover, are not subjected to contaminants, have not been attacked or displaced by tree roots and are not subjected to tidal influence*". The majority of the required actions were due to litter cleaning and tree root infiltration. The City of Port Phillip depreciates drains on a straight line assuming a 1% annual consumption.

The City of Hobart has a total of 300 km of drains with 1903 being the oldest. Condition assessments have been based on reactive maintenance profiles supported by CCTV with the results of the condition assessments indicating that the majority of the pipe network was in good condition. Due primarily to asset performance (results of condition assessments) the economic age of their storm water system has increased from 100 to 120 years and this is reflected in determining remaining life and asset consumption.

The City of Yarra, whereas it currently using straight line depreciation, are currently undertaken extensive condition assessment of its pipe network especially when considering that some of their pipe network is over 100 years old.

Condition based valuation is used by the City of Moreland with the results of their condition assessments indicating that pipes over 100 years old are still in operation. Similar to Manningham's approach the written down value of the pipes is established based on the current replacement cost apportioned to the remaining useful life (based on the condition assessment) and then depreciated in a straight line with no residual value.

The City of Dandenong has a comprehensive system of Asset Management and regularly undertakes condition assessments of their drainage network. In the majority of cases the results indicate that the valuation based on condition assessments to be higher than the predicted value using the straight-line depreciation method therefore implying that their assets are being "over-depreciated". They address this inconsistency by putting any differences in valuation into an "Asset Revaluation

Reserve". In a similar manner to that of Moreland and Manningham for instance, they adjust the expected remaining life of the drains according to the condition report with the depreciation (life remaining) adjusted according to the straight-line depreciation method.

5. CONCLUSIONS

AAS27 and AASB1021 Depreciation requirements utilise straight-line depreciation and they do provide the mechanism for regular auditable and consistent condition assessment to impact on the valuation and to more accurately predict remaining drain life (asset consumption). Therefore if the drainage network continues to remain in good condition the depreciation rate can be reduced indicating reduced asset consumption for a period until further condition assessments are undertaken.

Given the pipe characteristics for Manningham it is expected that similar results to those found in the Newcastle study would be achieved. This is supported by the results of the sample audit of Council's drains, which show that 80% of the drains are structurally sound and have not deteriorated (consumed) to the extent indicated for financial reporting purposes.

The conclusion that can be drawn is that at the end of the 100 years depreciation period, the drainage asset will be functional and further have a residual value. The magnitude of the residual value appears to be the issue and how to determine this quantum. Experience and current technology suggest that any drainage system will not be replaced using current technology or contemporary construction methods.

In recent years, technologies used in the Sewer Industry and other pipe laying sectors have introduced pipe lining with a range of 'systems' and also pipe cracking which utilises the existing alignment but enables size upgrade. These techniques significantly reduce the costs of conventional methods of construction by 50% to 80%. Hence, a thesis of a residual value is sustainable, and the issue is the value and the appropriate process to determine this value. Given that full replacement can be argued to be significantly less than the initial installation it would be appropriate to suggest that a residual value of 40% to 60% is reasonable. Further, this value will also hinge on the service levels and maintenance/ replacement standards set.

In the first instance, maintenance is regularly carried out on the network and the functionality of the drainage system is maintained. Refurbishment, pipe collapse and structural issues are dealt with as an ongoing issue and consequently the longevity is impacted with these practices. Hence, there appears to be a clear anomaly between the condition of the system or deterioration and the straight-line depreciation model and further this model fails to recognise the benefit of extending the asset functionality period as a result of regular interventions and repairs.

We strongly suggest that condition based reporting be a tool that should be used to determine the residual value. The work on condition of the system at Manningham suggests that the average age of the assets at 26 years, deterioration is less than 20%. In the case of Newcastle, the 60-year-old assets were rated at 40% deterioration or consumption.

The Markov curve predicts 50% deterioration after 100 years. GHD, in its assessment of asset values has also indicated its view that it could be expected that drainage assets after a 100-year period would have a residual value of 50%.

It is asserted that deterioration and value of the drainage asset needs to be considered when determining the depreciation of the asset. In essence, the proposition is that deterioration is 0.5% p.a. not 1% p.a. as suggested by the "100" year life which suggests a zero residual value. There is simply no evidence that drainage assets have zero value at the end of the 100-year period.

Municipalities are not providing replacement reserves, but rather investing regularly, by funding various works as an asset management technique to preserve these assets. This approach clearly suggests that ongoing maintenance is working, the issue is whether these public assets are being preserved appropriately and management is adequate to maintain the level of service and mitigate against risk of failure of the asset and the drainage system.

The City of Manningham has completed its Best Value Review and aligned services to community's expectations. Through its ongoing community surveys, attitudes and performance are continually monitored and further it undertakes regular maintenance activities, which include repairs and replacement of sections of pipes and pits. The condition reports confirm that the level of maintenance is appropriate. . With regard to the issue of deterioration and depreciation alignment the answer is 'no'. Whereas the recent revaluation by 80% of Council's drainage assets attempted to correct this realignment it is apparent that the depreciation of drainage assets is still over-stated or alternatively the fair value or replacement value is overstated.

Preference is for a model that suggests a residual value and depreciation and deterioration mirrored to reflect this model.

6. NEXT STEPS

On the basis of the literature research to date and evidence from various condition assessments undertaken to date, there clearly needs to be a better alignment of "accounting" depreciation and the real asset consumption.

Further condition assessments of drainage infrastructure within Manningham is strongly recommended and the results from these assessments compared to previous work and the corresponding changes in projected remaining life or functionality be determined and subsequent changes to valuation undertaken.

We advocate that the method of assessing the condition of the drainage (pipe and pit) network be undertaken on an industry wide basis that can be easily audited and will withstand scrutiny from the engineering and accounting profession. The accounting profession and ultimately the Auditor General, need to have confidence that local government is accurately reflecting asset consumption and that the financial statements provide an accurate picture of the asset worth. Any model derived for this purpose needs to take into account the amount of maintenance and renewal expenditure in conjunction with the condition analysis and ultimately to developing and implementing an appropriate Drainage Asset Management Plan.

Overall the following chart depicts the model proposed. Within the chart the clear relationship between management and maintenance/renewal, asset consumption (value) and condition can be evidenced. We conclude that standards and codes of practice can be modified or prepared to suit this model and provide a consistent, auditable process.