Losses in Water Distribution Networks

A Practitioner's Guide to Assessment, Monitoring and Control

Malcolm Farley and Stuart Trow





Contents

	Preface The authors		ix
			xi
	Ack	nowledgements	xiii
1	Introduction		1
	1.1	Understanding the network	1
	1.2	A strategy for water loss	2
2	Assessing losses		6
	2.1	Defining water loss and leakage	6
	2.2	Comparisons of water losses	8
	2.3	Experience of the UK water industry	8
	2.4	Water balance – UK methodology	10
	2.5	The IWA international standard	10
	2.6	An example water balance calculation	18
	2.7	Measuring or estimating the components of water balance	20
	2.8	Techniques for reviewing the network operating practices	24
	2.9	Techniques for quantifying leakage	25
3	International comparisons		35
	3.1	Performance indicators and target setting	35
	3.2	The IWA performance measures structure	36
	3.3	Non-revenue water: financial performance indicators	36
	3.4	Apparent losses	39
	3.5	Real losses	39
	3.6	Performance indicators in England and Wales	45

4	Deve	eloping a strategy	48
		Introduction	48
	4.2	Economics of water loss	50
	4.3	Economic level of leakage	54
	4.4	Setting targets for leakage	59
	4.5	The impact of regulation on the water industry	61
	4.6	A practical approach	62
		Computer models to assess lossess	70
		Designing and introducing a strategy	78
5	Upgrading the network		
		Introduction	82
	5.2	The zoning concept	82
	5.3	Flow metering	84
		Zonal metering	86
		Network records and recording systems	90
	5.6	Surveying the network	91
	5.7	Pilot study areas	92
	5.8	Mains renewal and rehabilitation to reduce leakage	95
6	6 Leakage monitoring and control		100
	6.1	Criteria and choice of methodology	100
	6.2	Sectorisation and zonal monitoring	102
	6.3	Leak detection and location in DMAs	109
	6.4	Leak detection policies and procedures	122
	6.5	Choice of leak detection technique	124
	6.6	Types of contract	130
	6.7	Management of leakage detection operations	134
	6.8	Repair techniques	137
	6.9	Leak detection in networks with intermittent supply	140
7	Pressure management		14:
	7.1	Introduction	14:
	7.2	Benefits of pressure management	140
	7.3	Potential problems	15
		The relative importance of pressure management	15
		Pressure/leakage relationships	15:
		Economics and cost-benefit analysis	15:
		Policy issues	15
	7.8	Design of pressure management schemes	16

Contents	vi
7.9 Operation of PRVs	165
7.10 Flow modulation	171
7.11 Factors restricting the scope for pressure reduction	173
7.12 Cavitation	174
7.13 PRV installation	176
7.14 Predicting a pressure-managed regime	179
7.15 Hour to day factors	180
Changing policies	183
8.1 Customer demand	184
8.2 Options for meeting increasing demand	185
8.3 Demand management policies	187
8.4 Customer metering	192
8.5 Case studies	193
Ensuring sustainability	206
9.1 Staffing levels	207
9.2 Education and training	209
9.3 Operation and maintenance	214

8.5	Case studies	193
Ens	uring sustainability	206
9.1	Staffing levels	207
9.2	Education and training	209
9.3	Operation and maintenance	214
9.4	Assessing and monitoring performance	216
Case study 1: An evaluation of the water distribution system for system losses in Sarina Shire Council, Australia Case study 2: Leakage control in southern Europe (Italy)		221
Casi	e study 2. Leakage control in southern Europe (traiy)	233
	e Study 3: Leakage control and unaccounted-for water ysis – Water Works Corporation, Malta	241
anai	ysis – water works Corporation, Maita	241
App	endix A: Potential savings from leakage management	254
App	endix B: Meter installation design and schedule of materials	257

for system losses in Sarina Shire Council, Australia	
Case study 2: Leakage control in southern Europe (Italy)	
Case Study 3: Leakage control and unaccounted-for water analysis – Water Works Corporation, Malta	241
Appendix A: Potential savings from leakage management	254
Appendix B: Meter installation design and schedule of materials	257
for a zone/DMA meter	
Appendix C: Network records Appendix D: Conducting a water use audit	
Index	273