The Bulletin of the European Water Resources Association

EWRA news

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EWRA – 6th International Symposium: 'Water Engineering and Management in a Changing Environment' (Catania, Sicily, 29 June – 2 July 2011)

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ewra2011.ewra.net &
www.ewra2011.dica.unict.it

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Technology – An Integral Part of Water Loss Reduction

Stuart Hamilton, Bambos Charalambous and Malcolm Farley

The world's population is increasing at a tremendous rate, the world's renewable water resources are reducing rapidly, the gap between water supply and demand is widening - with urbanisation and climate change making the gap even wider. In this article, the importance of technology and innovation to reduce the gap is outlined. This article describes the available technologies to help water utilities save water lost through leaking networks - and highlight the way forward for encouraging innovation.

Introduction

Losses from water distribution networks are a major issue worldwide. Leakage can vary from less than 10% of the water put into network systems in extremely good situations to over 60% in extremely poor situations.

To deal with such losses in an effective manner, particularly from networks in water scarce areas, water utility managers are increasingly turning to technology to reduce costs, increase efficiency and improve reliability. Companies that continuously invest in technology and innovation will see a positive return on investment in terms of improving daily operations and collection and analysis of network data for decision making and forward planning.

Current Technology

Methodologies for achieving the best results to reduce water losses are continuously evolving. Water companies and equipment manufacturers are increasingly working together in an effort to stretch the boundaries of current knowledge. This is leading to some innovative technologies and new product development to complement current methodologies (Figure 1).

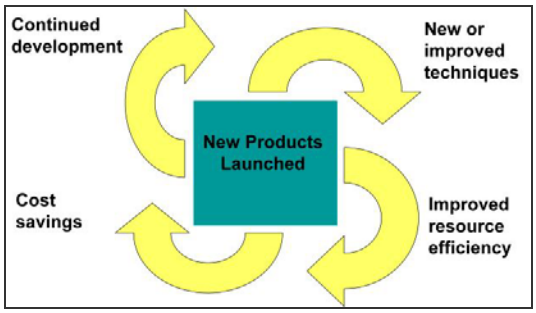

Figure 1. The continuous loop for product development

The IWA Water Loss Task Force has identified four main methodologies that have an influence on reducing real losses (leakage).

- Active Leakage Control
- Pressure Management
- Speed and Quality of Repairs
- Renewal of Pipelines

The available technology for each methodology is described below:

Active Leakage Control: Recent advances in equipment to help with location of leaks include correlating noise loggers, digital leak noise correlators with three sensors for better leak positioning and a ground microphone that can prioritise leaks by size and internal acoustic sensors for large diameter pipelines.

Other non acoustic technologies to assist in the location of leaks in the distribution system are being developed. One of these is software to localise leak positions using pressure drops and pressure variants in the network to locate the leak positions. Other software use statistical analysis of past data to try to calculate when and where a leak will occur next.

Another new technology is a system that measures flows through either permanent or temporary flow meters in the distribution system to indentify the area where an increase in flow has occurred, indicating a potential leak. Acoustic devices can be attached to the meter to help locate the leak position. This technology is seen by some companies as an alternative to investing in District Metered Areas (DMAs) – particularly in large zones and in those where closing in boundaries is hydraulically difficult.

There are several European Union co – funded research projects on technology currently in progress – with varying results and successes. Two such projects are 'Waterpipe' and 'Leaking'. The projects have similar objectives – to provide a non-intrusive leak location technology:

'Waterpipe' is a system where the leak is located by ground penetrating imaging radar. The objectives of the project were to investigate and develop a high resolution imaging ground penetrating radar for the detection of pipes, leaks and damages to underground infrastructure - and to provide imaging of the damaged region. A further enhancement was to produce an integrated system that will contain both the GPIR equipment and a Decision-Support-System (DSS) for the rehabilitation management of the underground water pipelines. This would use input from the inspections to assess, probabilistically, the time-dependent leakage and structural reliability of the pipelines and a risk-based

methodology for rehabilitation decisions that considers the overall risk, financial, social and environmental criteria

'Leaking' had objectives to investigate and develop an innovative leak inspection equipment for water pipelines based on microwave technology (a Continuous Wave Doppler radar, a Frequency Modulated Continuous Wave radar and a radiometer), and a decision support system, that stores available data on the pipe network, and receives input from leak inspections. It should be able to perform condition assessment to determine residual life time of the pipeline in question.

The findings from both projects will be available in 2010.

There are many other internationally funded projects – all of them are trying to achieve the breakthrough that would change the way Active Leakage Control is currently carried out. These initiatives are funded by Governments, universities, manufacturers, partnerships and water companies.

Pressure Management - The use of pressure reducing valves should always be the first point of investigation for cost-effective leakage reduction. Current pressure control techniques available are flow/time modulation, two point control (flow or pressure), critical point control (real time or through self learning algorithms). All of these provide solutions for networks with excess or varying pressure and will reduce losses. Innovations include using advanced programming to regulate the pressure valve so that the required pressure is always maintained at the control points, providing savings over and above those from a traditional pressure reducing valve.

Speed and Quality of Repairs – An innovation that is currently being investigated is self repairing pipes, where small particles or chemicals are introduced into the pipeline and the pipe 'repairs' itself from the inside. Another idea, for remote reporting of a leak occurrence and its position, is also being investigated.

Renewal of Pipelines – A perfect solution to leakage would be a pipe that doesn't leak. The pipes used today are designed to last 50+ years and be leak free; however, there is a major problem in that any joint that requires any sort of human intervention is unfortunately a source of a potential leak.

The question is often asked: 'Why hasn't the industry developed a pipe that is leak-free'? Many companies are in fact addressing this question - pipelines that are better protected against corrosion and at keeping the water clean. Other investigations deal with the insertion of sensors either constructed in the pipe or alongside the pipe which report back to a central computer when a leak occurs. This technology has to be introduced during the renewal of the pipeline, the major issue being that investment will be made in a system to locate water leaks on a pipe line that is designed to last for 50+ years. But this should not be the reason to reject such ideas - if the pipe fails for any reason prior to the end of its life of the pipe this will also be identified.

Methodologies in reducing Apparent Losses - thus increasing water utility revenues - have also been developed. Technologies to accurately measure water consumption and to reduce under-registration have recently been introduced and provide cost effective solutions.

Meter Error - Meter under Registration: the under registration of flows through a water meter is a source of revenue lost by the utility and several companies have developed and produced devices that allow very small flows to be recorded, meters that measure low flows and meters that have no moving parts. Other devices are available that can be added to an existing meter to allow for extremely low flows to be measured.

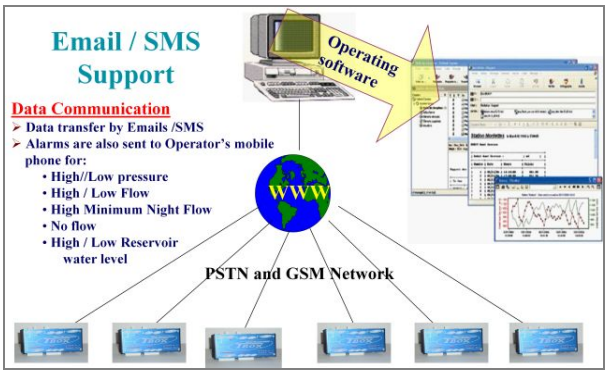

Figure 2. Typical set up for transfer of data collected and stored on critical site locations

Automatic Meter Reading - AMR is a way for the utility to read customer meters on a daily basis, sometimes continuously, allowing revenue to be collected using more frequent billing cycles. The company can also have a clear picture of the consumption by the household and indentify when a meter stops. This could indicate that the meter is broken or, for example, that a sole occupier is unwell. Conversely a higher than normal reading could indicate a leak on the service pipe. Current technology allows transfer of data from the water meter by 'fixed radio network' or while a meter reader walks or drives past the meter. Software is available to produce a bill which is delivered by the utility employee while at the property. One manufacturer has recently produced a drone aircraft that allows meters to be downloaded in remote locations by flying

over the water meter. Noise loggers combined with water meters to allow both the meter flows and potential leaks being downloaded daily is another recent introduction.

Communication Systems - Advanced communication systems and software applications are also playing an important role in distribution networks, allowing informed and timely decisions to be made. The current trend is to apply solutions which combine information technology and telecommunications networks using the World Wide Web or GSM networks for the transfer of data obtained from site devices such as flow meters and pressure sensors. Careful consideration and examination of the available technologies must be given in order to adopt an appropriate system with low capital expenditure as well as low operation and maintenance cost. A typical communication system for the storage and transfer of valuable information is shown diagrammatically in Figure 2 – this provides all the necessary information for the efficient and effective management of a water supply system.

Software Applications - Operating software provides an intelligent communication interface between the monitoring stations and the central control. This allows the operator to exploit the power of the internet - receiving data from the monitoring stations and transferring and exporting data to a data base. Most software incorporates powerful graphics to display data in the form of graphs and statistical tables as well as to Geographical Information Systems for further analysis.

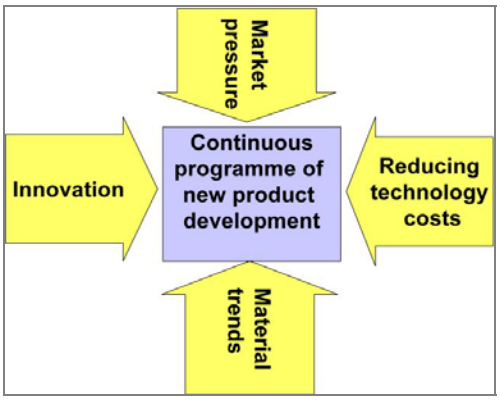

Figure 3. The Four drivers on the manufacturer

The pressing need to efficiently manage water distribution networks has highlighted the need to develop software tools that would assist in the integrated and automated management of the networks. Such asset management tools should assist the network owners to evaluate the condition of the water distribution network, assess historical incident data (leakage or breakage) and risk of failure, visualise areas of high risk, propose "repair or replace" strategies and prioritise the work based on the inherent risk and cost of action.

The risk assessment and management ("repair or replace") system is based on analytical and numerical modelling techniques and supplemented with geographical distribution systems (GIS). The goal is to enable water utilities to better manage condition assessment information, to process historical records with a number of analytical and numerical models, to identify underlying data patterns with artificial intelligence techniques and eventually to assess the corresponding risk of failure of each network element and to visually disseminate this information via geographical information systems.

Innovation in the Future

The prime drivers needed for a continuous programme of new product development are shown diagrammatically in Figure 3. There is a market demand for new and improved technologies at affordable prices, but innovation and new products must be capable of delivering results in a cost efficient way. For this to happen a joint effort is needed by utilities, manufacturers, and researchers to develop the next generation of technology for the water utilities.

It is illuminating to consider how far technology has moved forward in the past 10 years in one particular field - mobile telephones. Nowadays there are options for sound, vision, SMS, MMS, E-mail, internet, camera and radio – all of these in a small hand held device. These enhancements were developed to meet a market demand, but were also fuelled by competition.

All stakeholders should be willing to invest in solutions today – 'thinking outside the box' is an apt expression for moving forward with innovative technology for saving precious water in today's water scarce climate.

Sept. 2010

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The Great Mother destroys her home

George Tsakiris
National Technical University of Athens
Centre for the Assessment of Natural Hazards
& Proactive Planning

Recent floods in the Valley of Indus river have caused damages of biblical proportions. Bridges and roads were destroyed, thousands of hectares of productive land were washed away and countless houses and shops disappeared.

According to UN sources the humanitarian crisis is somewhat larger than the three natural disasters of the last decade together. These disasters include the tsunami in Indonesia and the earthquakes in Kasmir and Haiti. The toll of 1700 killed people in the Indus floods is rather misleading, hiding the real scale of the catastrophe which displaced more than 14 million people.

False-colour image of flooding along Indus river.
Source: NASA Earth Observatory

Indus river valley is the home of more than 100 million people who rely on it completely for drinking water, irrigation and other water consuming activities. For the people of the valley, Indus is the "Great Mother".

The statistics of recent natural catastrophes show that the number of events, the number of lives lost and the magnitude of damages in the infrastructure and the economy grow exponentially with time. Obviously each case has its own characteristics which influence mainly the vulnerability of the society and the environment to withstand or trigger the natural hazard.

However talking about floods, the two more or less common factors which cause catastrophic floods are:

a) The magnitude of the natural hazard that is the high intensity and the large depth of total precipitation. In the case of the Swat valley (within Indus river basin), a depth of several hundreds mm of torrential rain was recorded over a 5-day period which is an incredible amount of rain.

b) The mismanagement of Indus basin in which more than 100 million people live. As it is known, Indus is one of the great rivers of the world with a total length of 3200km starting from the Tibetan plateau and discharging into the Arabian Sea. It is also known that extensive deforestation has been taking place for decades leaving the slopes of the river unprotected. As a result, no obstacles can delay the surface runoff, creating conditions of uncontrolled floods in the low productive lands. There are reports for organized deforestation driven by a "timber mafia" according to a Guardian report from the area.

Therefore heavy rain and large amounts of sediment and mud created an incredible catastrophe. The concentration of sediment carried by the river is so high that the biggest earth-fill dam of the world, the Tarbella dam constructed on the Indus river, is gradually filled with sand so it practically works as a run-of-river structure.

As time goes by, it becomes evident that countries cannot afford to protect their people from natural hazards which are increasing in magnitude and frequency. The humanitarian crisis caused by the floods in Pakistan show that unexpected events with incredible magnitude can happen anywhere but they are more catastrophic in cases of environmental mismanagement and non-existent preparedness. Proactive planning of each country and well organized international cooperation is probably the fundamental efforts for preventing or mitigating natural disaster in an uncertain and probably worse future.

Sept. 2010

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EWRA – VI International Symposium 'Water Engineering and Management in a Changing Environment' (Catania, Sicily, 29 June – 2 July 2011)

The objective of the 6th International Symposium of the European Water Resources Association is to provide an open forum for analyzing the main challenges for an effective water resources management, also able to adapt to climate change impacts. Particular emphasis will be devoted to the developments in the application of EU policies on water resources management (i.e. Water Framework Directive 2000/60, Floods Directive 2007/60 and Water Scarcity and Droughts Strategy), as well as to the latest advancements in water engineering all over the world.

Sessions

- A session "Water resources management"
  - Evaluation of implementation of the EU Directives 2000/60 and 2007/60
- B session "Scientific Advances"
  - Advanced models and methods to improve the understanding and mitigation of hydrological extreme events
  - Recent approaches and tools for water resources management under global change
  - Technological and management innovations for water services
- C session "Specialised workshops"
  - Water quality, desalination and non-conventional water resources
  - Climate change, extreme events and water security
  - Water systems efficiency
  - Energy and technology

Important Dates

Submission of abstract: 31 December 2010
Notification of acceptance: 31 January 2011
Submission of full paper: 31 March 2011
Acceptance: 30 April 2011

Proceedings

A book of abstracts and a CD with the proceedings of the conference will be distributed to the participants. Selected papers will be published in special issues of EWRA journals "Water Resources Management" and "European Water".

Secretariat

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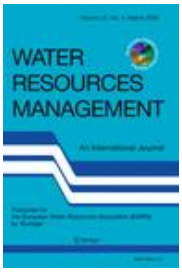
Top-ten journals in the subject category: WATER RESOURCES

D. Alexakis



The Water Resources Management journal published for EWRA by Springer is in the top-ten of the international technical journals in the field of water resources. The ISI indexes 60 scientific journals in the subject category of Water Resources. The Top-ten of the scientific journals for this subject category according to JCR is tabulated in Table 1 together with their impact factor.

Table 1. Top-ten scientific journals in the subject category of Water Resources (ranking is based on the impact factor).

Rank	Abbreviated Journal Title	Impact Factor	5-Year Impact Factor
1	WATER RES	4.355	4.828
2	HYDROL EARTH SYST SC	2.462	2.670
3	WATER RESOUR RES	2.447	2.902
4	J HYDROL	2.433	3.171
5	ADV WATER RESOUR	2.354	2.725
6	DESALINATION	2.034	2.051
7	AGR WATER MANAGE	2.016	2.464
8	WATER RESOUR MANAG	2.013	2.218
9	J CONTAM HYDROL	2.010	2.345
10	VADOSE ZONE J	1.991	2.127

All the information was obtained from the following web address: http://admin-apps.isiknowledge.com/JCR/JCR

Sept. 2010

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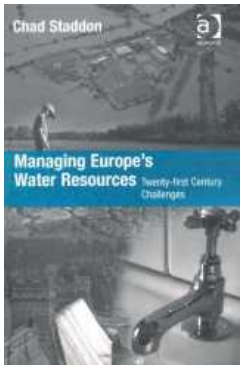
Managing Europe's Water Resources

Staddon C.

Publication Year: 2010
Published by: Ashgate Publishing Group
ISBN: 0754673219
Binding: Hardback
Pages: 256



This title provides a detailed and comprehensive introduction to water management issues from a European perspective. It begins with a brief history of water management, followed by a consideration of the major frameworks used for managing water in its qualitative and quantitative aspects. Several chapters treat key water management issues, including: climate change, privatization, hydropolitics and finally provides a synoptic treatment of major water management issues across Europe's geographical regions.

Water Resources and Development

Agnew C., Woodhouse P.

Publication Year: 2010
Published by: Taylor & Francis Ltd
ISBN: 041545137X
Binding: Hardback
Pages: 336

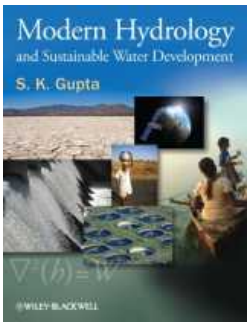
Water Resources and Development explores water management strategies through scientific, social and political perspectives, and uses case studies to exemplify four key development challenges: economic growth, poverty reduction, competition and conflict over water and adaptation to climate change.

Modern Hydrology and Sustainable Water Development

Gupta S.

Publication Year: 2010
Published by: John Wiley and Sons Ltd
ISBN: 1405171243
Binding: Hardback
Pages: 472

The material of this book will derive its scientific under-pinning from basics of geology, soil science, mathematics, physics, chemistry, meteorology, engineering and related disciplines and will provide sufficient breadth and depth of understanding in each sub-section of hydrology. Chapters on 'global change' and 'water and



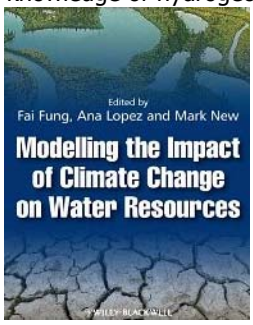
ethics' aim respectively to emphasize the central role of hydrological cycle and its quantitative understanding and monitoring for human well being and to familiarize the readers with complex issues of equity and justice in large scale water resource development process. Modern Hydrology for Sustainable Development is intended not only as a textbook for students in earth and environmental science and civil engineering degree courses, but also as a reference for professionals in fields as diverse as environmental planning, civil engineering, municipal and industrial water supply, irrigation and catchment management.

Modelling the Impact of Climate Change on Water Resources

Fung C., Lopez A., New M.

Publication Year: 2010
Published by: John Wiley and Sons Ltd
ISBN: 1405196718
Binding: Hardback
Pages: 288

The quantitative assessment of the impact of climate change on water resources management requires knowledge of hydrogeological - hydrological, climate and water resources models and particularly the relationships between each of them. This book treats each of the subjects in turn with the water resources modeller in mind. This book shows how new modelling techniques can elucidate links between water resources, hydrology and climate.



Design with Water

Watson D., Adams M.

Publication Year: 2010
Published by: John Wiley and Sons Ltd
ISBN: 0470475641
Binding: Hardback
Pages: 272

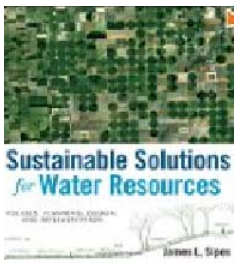
This title provides a comprehensive primer to planning and design to achieve sustainable water resources--often called water security-- applicable to regional planning, architecture landscape design and storm water engineering. It focuses upon management of watersheds as natural and designed hydrologic systems

to optimize conservation and improvement of water as a resource. It compiles illustrated technical data for rainwater collection, storage, and management appropriate for both flooding and arid conditions. Special conditions of coastal flood hazard mitigation are also included because many similar principles and techniques apply.

Sustainable Solutions for Water Resources

James L. Sipes

Publication Year: 2010
Published by: John Wiley and Sons Ltd
ISBN: 0470529628
Binding: Hardback
Pages: 368



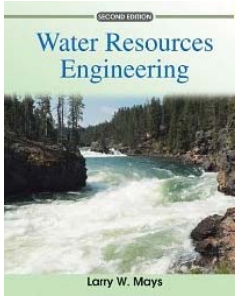
This title provides a basic overview of water resources, hydrology, current problems involving water resources, and the potential impact of climate change and global warming. Covers watershed planning, Best Management Practices and potential design and planning solutions. Offers a concise overview of the issues affecting water use and management. Includes a full chapter dedicated to planning issues, and a full chapter covering site planning, design, and implementation. Sustainable Solutions for Water Resources takes a practical approach to head off a global water catastrophe by offering sensible measures that can be put in place immediately to promote a clean, plentiful flow of the Earth's most precious resource.

Water Resources Engineering

Mays L.

Publication Year: 2010
Published by: John Wiley and Sons Ltd
ISBN: 0470460644
Binding: Hardback
Pages: 890

Environmental engineers continue to rely on the



leading resource in the field on the principles and practice of water resources engineering. This edition now provides them with the most up-to-date information along with a remarkable range and depth of coverage. Two new chapters have been added that explore water resources sustainability and water resources management for sustainability. New and updated graphics have also been integrated throughout the chapters to reinforce important concepts. Additional end-of-chapter questions have been added as well to build understanding. Environmental engineers will refer to this book throughout their careers.

Urgent Announcement: Invitation to join the permanent working groups

As known the main aims of EWRA are to promote research and application of scientific knowledge to practical water related activities, to promote the exchange of scientific knowledge in the field of water resources between scientists and water professionals and to contribute to the dissemination of results of scientific, technical and practical advances in the field of water resources.

Within the above framework EWRA has established the following Working Groups:

- Water Quality, Desalination and Non-Conventional Water Resources under George Tsakiris
- Water Resources Management under Rodrigo Maia
- Climate Change, Extreme Events and Water Security under Antonio Cancelliere
- Water Systems Efficiency under Bambos Charalambous
- Energy and Technology under Stuart Hamilton

Interested individuals who wish to join the above Working Groups are invited to submit their contact details together with a short bio to the Secretary General of EWRA B.Charalambous (bcharalambous@cytanet.com.cy) by 31 December 2010. The activities and progress of work in each Group will be overseen by a member of the Executive Committee (EC) of EWRA as detailed above.

Individuals are encouraged to submit short proposals, not more than 1000 words, on issues that they are interested to investigate by 31 December 2010. The EC of EWRA will evaluate these and facilitate upon selection of a proposal the set up of a team under the relevant Working Group for carrying out the task. Deliverables will be submitted to the EC for review and results presented at EWRA's symposia and conferences. Dissemination of the output from the Working Groups will be through EWRA's journals and magazines.

EWRA is committed to investigate cutting edge issues which will be of value to the water industry inspiring and involving both academics and professionals in a continuous strive to advance knowledge in the field of water resources.