



**The AWARE-P project –**  
Infrastructure asset management  
of urban water services

[www.aware-p.org](http://www.aware-p.org)

**Application to the Muelheim Water Award 2012**

AWARE-P - Infrastructure asset management of urban water services

[www.aware-p.org](http://www.aware-p.org)

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Application submitted to:

MUELHEIM WATER AWARD

Coordinating office of the Muelheim Water Award

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This document is the AWARE-P project's application to the Mulheim Water Award 2012. It is structured similarly to the pre-qualification forms.

The initial sections summarize the project partners and specification. Section 4 contains the description and achievements of the project. After the introduction, an overview of the project impact up to present is presented. The project involved three main axes of activity: R&D, tools development and capacity building. The text is organized in order to show how each of these axes contributes to the MWA assessment criteria: degree of innovation, transferability and applicability, quality and reliability, resource consumption and protection, and efficiency. Each subsection starts with an updated version of the summary submitted in the pre-qualification phase. The Annexes document the description, listing the publications, implementation cases, tools, keynotes and news articles. The accompanying CD contains an electronic version of this document and a copy of key products of the project.

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## 1. Leading applicant

LNEC - Laboratório Nacional de Engenharia Civil – *Project Coordinator, R&D, Training*

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## 2. Other applicants

Project partners and their roles, in alphabetical order (contacts and description in Annex A1):

**ADDITION** – *Technology partner, software development lead.*

**Stiftelsen SINTEF** – *R&D, technical support.*

**ERSAR** – Entidade Reguladora de Águas e Resíduos (National Water & Waste Services Regulator) – *Guidance, quality control, dissemination.*

**IST/CEHIDRO** - Instituto Superior Técnico - Centro de Estudos de Hidrossistemas – *R&D, training, end-user support.*

**AGS** - Administração e Gestão de Sistemas de Salubridade – *Water & wastewater group, end-user partner.*

**AdP Serviços** - Águas de Portugal, Serviços Ambientais, SA – *Water & wastewater group, end-user partner.*

**SMAS de Oeiras e Amadora** – *Water & wastewater utility, end-user partner.*

**VEOLIA ÁGUA** – Compagnie Générale des Eaux Portugal – *Water & wastewater utility, end-user partner.*

**YDREAMS Informática SA** – *Technology partner, e-learning development.*

## 3. Project specification

Title of the project: AWARE-P - Infrastructure asset management of urban water services

Duration of the project: 3 years (Grant approval 01-08.2008; contract signed 01.01.2009; project terminated 31.12.2011)

Number of persons involved in the project: 45 persons (17 R&D; 4 software development; 23 utility)

Financial amount of the project: 1 274 590,00 EUR

## 4. Project description

### 4.1 Introduction

As many urban water systems reach high levels of deferred maintenance and rehabilitation, the combined replacement value of such infrastructures is overwhelming, demanding judicious spending and efficient planning. However, the best possible use of manpower and financial resources in the long term is hardly ever ensured by conventional risk-based, component-centric asset management approaches. Effective decision-making requires integrated approaches that ensure the desired performance at an acceptable risk level, taking into consideration the costs of building, operating, maintaining and disposing of capital assets over their life cycles, and based on alignment, feedback and involvement across the organization.

The field has been the subject of increasing attention in R&D, with significant advances in the last 2 decades, namely in Australia, New Zealand and the USA, and in a sequence of European efforts that included such landmarks as the CARE-W/S projects (5<sup>th</sup> EU Framework Program), where members of the AWARE-P consortium played important roles.

The AWARE-P project culminated that process and was aimed at providing water and wastewater utilities with the know-how and the tools needed for efficient decision-making in infrastructural asset management (IAM) of urban water services. All project results – from best practice handbooks and software to business cases, training and e-learning materials – are freely available.

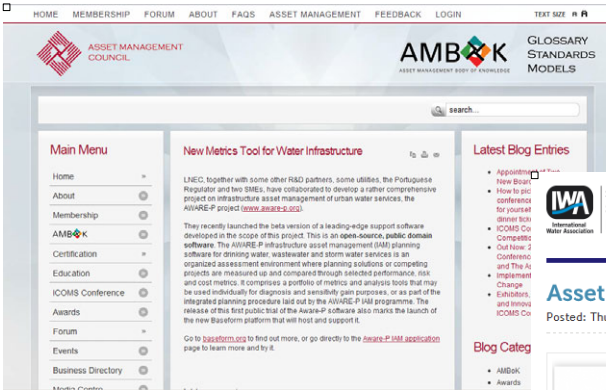
The project was designed along 3 main axes: (i) developing **ground-breaking R&D** while integrating the best available knowledge; (ii) translating it into **professional-grade tools**, for use by the industry; and (iii) making sure those were backed up by high levels of **awareness & capacity building**, on a global scale.

Overall, the project and its products have introduced substantial innovation, proven to be transferable and applicable, have achieved scientific and technological quality recognition, and contribute to the quality and reliability of urban water services, as well as to resource protection and efficiency of use. Table 1 illustrates the team's perception of that homogeneous response in terms of the MWA assessment criteria. Sections 4.3 to 4.5 document that perception, preceded by an overview of the project's current impact assessment in Section 4.2.

**Table 1. Axis of development of AWARE-P versus the MWA assessment criteria**

	Ground-breaking R&D	Professional-grade tools	Awareness & capacity building
Degree of innovation	+++	+++	++
Transferability / Applicability	++	+++	+++
Quality and reliability	+++	++	+++
Resource consumption and protection	+++	++	+++
Efficiency	+++	++	+++

## 4.2 Overview of impact assessment



The screenshot shows the AMBOK website with a navigation menu at the top. The main content area features a blog post titled "New Metrics Tool for Water Infrastructure" with a sub-header "LNEC together with some other R&D partners, some utilities, the Portuguese Regulator and two SMEs, have collaborated to develop a rather comprehensive project on infrastructure asset management of urban water networks, the AWARE-P project ([www.ambok.org](http://www.ambok.org))". The post text describes the development of a beta version of a leading-edge support software for drinking water, wastewater and storm water services. To the right, there is a "Latest Blog Entries" section and a "Blog Category" section.


Dear Dr. Helena Alegre,

I am Mr. Géza CSÖRNYEI from Budapest, Hungary. We met in Vienna the Utility Conference, when you presented IAM and later on IAM in practise. I would like to inform you that my college finished to translate your presentation to Hungarian.

I would like to ask your confirmation to **spread it to the most important Universities and Colleges** and we would like to add it (original translated) presentation to a local conference CD documentation in order to pay attention of all of participants of the conference.

**This IAM approach is very simpatic for us, so we would like to support to use this method in Hungary as well,** and certainly don't want to hurt any right of IWA or LNEC.

Thanks in advance!  
Csörnyei Géza (e-mail received 2012-06-11)



Meet AWARE-P, the first of a growing family of tools and applications for networked infrastructures. <http://baseform.org>

LNEC team launched AWARE-P software. The AWARE-P infrastructure asset management (IAM) planning software for drinking water, wastewater and storm water services is an organized assessment environment where planning solutions or competing projects are measured up and compared through selected performance, risk and cost metrics.

The quick facts listed below provide an overview assessment of the project's impact internationally, up to the present moment:

- 470 registered software beta testers from several dozen countries in 5 continents (as of May 2012, 3,5 months after launch).
- 350 water professionals trained with a minimum 15 hrs tuition, in several countries.
- 4 initial test utilities (Portugal, 2009-2011), 2 test utilities in Spain (2011-2012), 1 pilot utility in the USA under WERF/USEPA sponsorship, 19 utilities in the 2012 National IAM Initiative (Portugal, 2012-2013), 12 utilities in the AGS-AQUAPOR IAM programme (Portugal, 2012-2013).
- Baseform software platform adopted as a basis for software development under the TRUST 7FP project (2011-2014, 30 partners, 7M€) and in the Data4IAM FP7 proposal (under evaluation, 15 partners, 4M€).
- Software and methodology are under evaluation for pilot tests in the States of Gujarat and Maharashtra (India), in the scope of the Performance Assessment System project: [http://spcept.ac.in/pas\\_project.aspx?pg=pas&sub=pas](http://spcept.ac.in/pas_project.aspx?pg=pas&sub=pas).
- New AWARE-P software tools to be developed under the WERF/USEPA project INFR-2012 System Rehabilitation Component - "Visual Tool for Supporting Asset Management Performance, Risk and Cost Analysis" (2012-2013).
- Software included by the City of Montreal (Canada) in their on-going evaluation of IAM software, leading up to an RFP in late 2012.

- Endorsed by ERSAR, the Portuguese national water services regulator.
- Methodology and software included in the academic curriculum of the PhD program on Urban Water Systems at Instituto Superior Técnico (Technical University of Lisbon) from 2010-2011 onwards; increasing use by MsC and PhD students internationally.
- 1 Research Program (LNEC), 3 on-going PhD theses (Tech. Univ. of Lisbon/LNEC, Évora Univ.), 5 completed MSc theses (NTNU-Norway, IST, Minho Univ., Évora Univ.).
- 33 keynote addresses where the AWARE-P IAM approach was presented (Asia, Australia, Europe, Middle East, and South and North America, 2007-2012).
- Leadership of SAM Specialist Group of the International Water Association by project team members and active collaboration with the IWA O&M network.
- Wide recognition by the specialized media internationally (13 news articles, see Annex A4, p. 44).



## 4.3 Ground-breaking R&D

The AWARE-P methodology covers strategic, tactical and operational planning, ensuring cross-level alignment and feedback; it is service-oriented and objective-driven, promoting service quality & reliability, efficiency in the use of resources and service sustainability; it bases IAM analysis on a novel, metric-based framework for comparing intervention alternatives that expressly accounts for performance, risk and cost over the long-term, enabling life-cycle cost analysis in indefinite life infrastructures; it resolves the applicability constraints of previous AM methods for network-based infrastructures.

### 4.3.1 Degree of innovation

#### AWARE-P methodology

The AWARE-P methodology, illustrated by the cube in Figure 1, incorporates the values generally respected in IAM practice<sup>1, 2, 3, 4</sup>. It approaches IAM as a management process, based on plan-do-check-act (PDCA) principles and requiring full alignment between the organisation's strategic objectives and targets, and the actual priorities and actions implemented. However, it is innovative because it expressly takes into account that a networked infrastructure cannot be dealt with in the same way as other collections of physical assets: it has a dominant system behaviour (*i.e.*, the performance of individual assets is not independent from one another), and as a whole it does not have a finite life – it is not realistically replaceable in its entirety, only piecemeal. Pre-existing literature and implementations on asset management tend to ignore or under-estimate the importance of these.

The methodology is geared to the standardized assessment and comparison of intervention alternatives from the performance, cost and risk perspectives over the analysis horizon(s), given a set of previously-defined objectives and targets. This is also relevant innovation with regard to current practice. In a nutshell, the objective of the AWARE-P IAM approach is to assist water utilities in answering: *who are we at present? what infrastructures do we own or operate? what service do we deliver? where do we want to be in the long term? how do we get there?*

At each level of management and planning – strategic, tactical and operational – a structured loop is proposed that comprises the 5 stages shown in Figure 2. While several elements of this process are commonly in place, often missing is a review mechanism – a way to measure compliance with set goals – as well as an effective alignment between the different levels. One area of particular concern is the setting up of clear-cut objectives, assessment criteria, metrics and tar-

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<sup>1</sup> Hughes, D. (2002). *Assessing the future: Water utility infrastructure mgmt.* AWWA, USA (644 p.).

<sup>2</sup> INGENIUM, IPWEA (2006). *Internat. infrastructure manag. manual, vs 3.0.* Assoc. Local Govmt Eng. NZ Inc (INGENIUM) and Inst. Public Works Eng. of Australia (IPWEA), ISBN: 0-473-10685-X (360 p.).

<sup>3</sup> Sægrov, S. ed. (2006). *CARE-S - Computer Aided Rehab for Sewer and Stormwater Networks.* IWA Publ., ISBN: 1843391155, (140 p.).

<sup>4</sup> Sneesby, A. (2010). *Sustainable infrastructure management program learning environment (SIMPLE).* Sustainable Infrastructure & Asset Management Conf., Australian Water Assoc. 23-24 Nov. 2010, Sydney, Australia (CD).

gets, which are essential for unequivocal directions of action, as well as for accountability of results through timely review.

Further to the *organizational and management* process, this approach sees IAM as a *problem-driven* process, guiding and assisting the utility decision makers in addressing the key infrastructure-related issues by carrying out diagnoses, assessing and comparing alternative solution paths, and selecting the best performance, risk and cost trade-offs in view of the stated objectives.

Although AWARE-P has been developed for urban water services, the general principles and many of the tools are also applicable to other infrastructure, particularly if network-based, such as gas, roads, railways, and electricity.

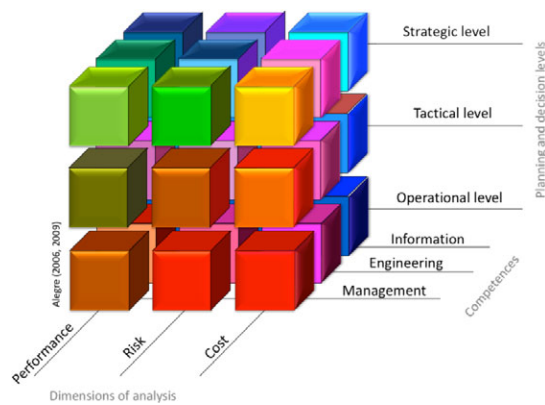


Figure 1 – The AWARE-P approach

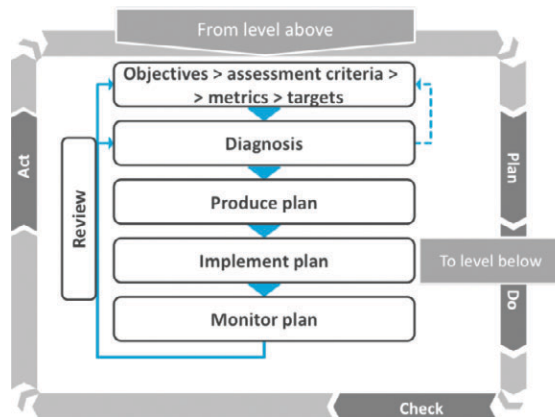


Figure 2 – The planning process (at each level)

## AWARE-P handbooks



**Figure 3 – The AWARE-P handbooks**

The AWARE-P methodology was materialized in two comprehensive handbooks, one for water supply services and the other for wastewater and storm water services (Figure 3). These handbooks explain the methodology and the planning process in detail. They also contain a quick reference guide and many examples throughout the text, illustrating how to apply.

Published by ERSAR, the Water Services Regulator of Portugal.

- Paperback version distributed by ERSAR to all Portuguese water and wastewater utilities and to other key water stakeholders.
- Electronic version freely available from the ERSAR and AWARE-P websites (included in the accompanying CD).

- Main target audience: utility planners and decision-makers; infrastructure asset managers; post-graduate students.
- The core of the approach will be incorporated into the manuals of best practice under development for IWA and for TRUST (in English).

## Scientific publications

Further to the 2 AWARE-P handbooks, and in addition to the theses mentioned below, 3 other books, 1 book chapter and 5 papers in scientific journals were published (or have been submitted for publication). The full listing is included in Annex A2 (p.32). Other types of publications are mentioned in section 4.5.

## Research programs, doctoral theses and master theses

AWARE-P was designed as a direct result of a strategic Research Program published at LNEC in 2008. Several MSc and PhD theses have been undertaken since then. Out of a total of 9, 5 MSc dissertations were developed and concluded during the course of the project and 3 PhD theses are under development. Two further MSc dissertations were inspired by the project but have been developed with a less direct relationship to it. The full listing is included in Annex A2 (p.32).

## Education and training of young water professionals

During the course of the project, the AWARE-P R&D team hosted 8 young water professionals in the scope of graduate, post-graduate and post-doctoral internships (Rodrigo Borba, Tiago Henriques, Kjersti Holte, Maria Santos Silva, André Martins, Nelson Carriço, Pedro Ramalho and João Paulo Leitão).

### 4.3.2 Transferability and applicability

The IAM approach is applicable to utilities of any size, development level or AM motivation; its core concepts are even transferable to others contexts, such as other networked infrastructures.

AWARE-P was jointly developed by researchers and practitioners from utilities of multiple sizes, contexts, drivers and scope. These included bulk and retail services; drinking water, wastewater and storm water systems; public and private operators. The complementarity of know-how and experiences in the team members ensured that the end-result is flexible and robust, transferable and applicable to a broad variety of situations. Making all project products freely available to the public allows for permanent testing and feedback by practitioners, leading to a continuous improvement process.

The IAM framework is the foundation for further R&DT, already under way on several fronts. The detailed algorithms developed to assist in the tactical planning are currently directed to the networks, with some bias towards water supply systems, and it is now necessary to redress the balance regarding wastewater systems. Current on-going developments also include IAM of treatment facilities.

### 4.3.3 Quality and reliability

- Quality and reliability of the project: the conceptual and methodological component of the AWARE-P IAM approach is based on a detailed state-of-the art analysis, complemented with a scientific development according to the methods and quality control procedures in place at LNEC, IST and SINTEF. Every product resulted from several iterative cycles of revision by the Water services Regulator and revision and testing by the utility partners. Journal publications are also a component of the quality control process.
- Contribution of the project to the quality and reliability of the urban water services: this is the very essence of IAM and the main objective of the methodologies proposed.

### 4.3.4 Resource consumption and protection

The key aim of AWARE-P is to actively contribute to the sustainability of the urban water services, recognising that infrastructure asset management plays a key role. To protect water and energy resources there is a need to control water losses, to minimize energy consumption, to minimize overflows of untreated water to the receiving bodies, to adequate treatment plants to the actual needs. These are examples of aspects that require that the infrastructure is adequately managed. Provided that resources consumption and protection are part of the objectives and metrics chosen, as recommended in the referred handbooks, AWARE-P provides the framework for comparing alternatives and selecting the best ones, in a long-term perspective.

### 4.3.5 Efficiency

For reasons similar to those pointed out in the previous section, it is believed that the R&D developed makes a significant contribution to promoting increased efficiency in the systems and in the organisations.

## 4.4 Professional-grade tools

The professionally-backed software is web-based and freely available (in English, easily translatable); designed for individual users or enterprise deployments alike; open-source, promoting broad validation.

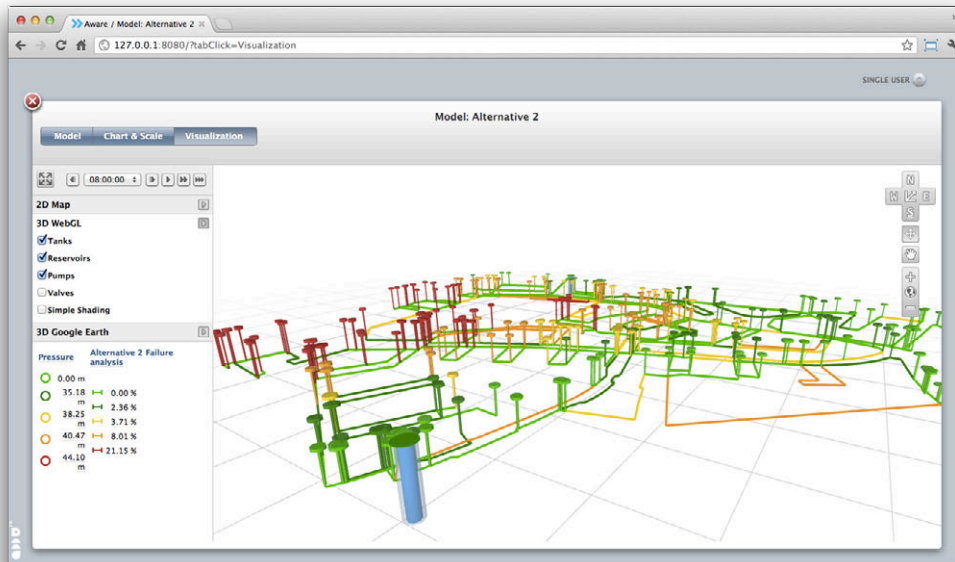


Figure 4 – The AWARE-P software

### 4.4.1 Degree of innovation

AWARE-P aimed from the outset to reach the water industry with useable, effective, professional-grade software, able to make a difference in capacity-building and support to the planning process.

AWARE-P's open-source IAM planning software is an innovative assessment environment where planning alternatives or competing solutions are measured up and compared through selected performance, risk and cost metrics. It comprises a portfolio of system metrics and analysis tools that May be used individually for diagnosis and sensitivity gain purposes, or as part of the AWARE-P IAM integrated planning process.

The software is a professionally designed and built solution, backed by a viable development system created around it (baseform.org), with a concrete roadmap for roll-out, expansion and support (see Annex A3). It materializes as an integrated, expandable suite of plug-in tools made available on the Baseform platform. It is platform-agnostic, running on Windows, Mac OS, Linux or any other Java-enabled OS.

The software is innovative from several angles:

- As an IAM assessment environment where all dimensions of cost, performance and risk May be balanced and compared in any time frame.

- As an integrated portfolio of data, technical and financial models for full convergence of asset management analysis workflows.
- As a software solution drawing on a web-based, multi-user, collaborative paradigm, deployable on public servers or on private corporate webs, as well as on individual machines, and supported by next-generation 2D/3D interfacing capabilities.
- As a freely expanding development software framework (baseform.org) where professional industry knowledge or R&D by groups around the world can be integrated and mutually leveraged.
- Among other contributions in various domains, the software includes state-of-the-art analysis models for pipe and sewer failure forecasting, criticality, and a completely rewritten, Java-based version of the hydraulic & water quality simulator Epanet with 3D mapping.

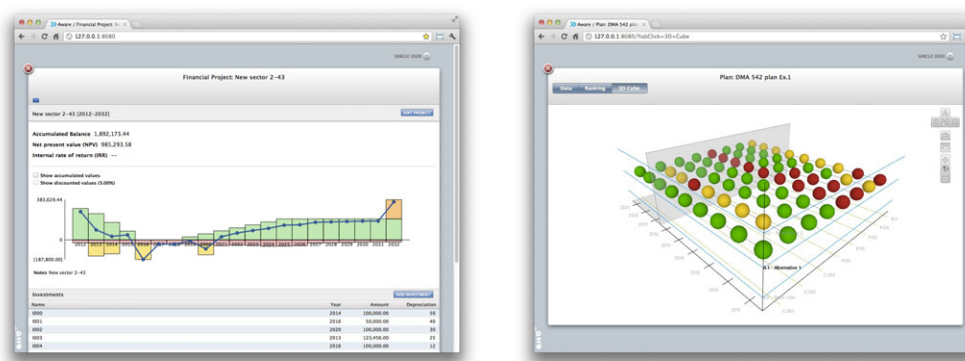


Figure 5 – AWARE-P software: the financial project tool and the planning environment

#### 4.4.2 Transferability and applicability

The AWARE-P software and the Baseform platform were conceived from the start as a proposition for urban water professionals all over the world, and with a global collaborative view. Distributed through a documented and supported website, it is backed by a range of supporting materials that facilitate user uptake, including video tutorials, user manual, examples and a guided walkthrough (see Annex A3; the materials are included in the accompanying CD).

The first 3 months of the current public beta test have rewarded that effort, with close to 500 registered testers from several dozen countries in all 5 continents, and over 5000 visits to the Baseform site. The variety of registered users, including utilities of all sizes, consultants and IAM experts, confirms the transferability and applicability of the software and the selected development paradigm.

On the other hand, the software and the methodology have been or are being used in pilot cases by over 40 utilities in several countries, as mentioned in Section 4.5.

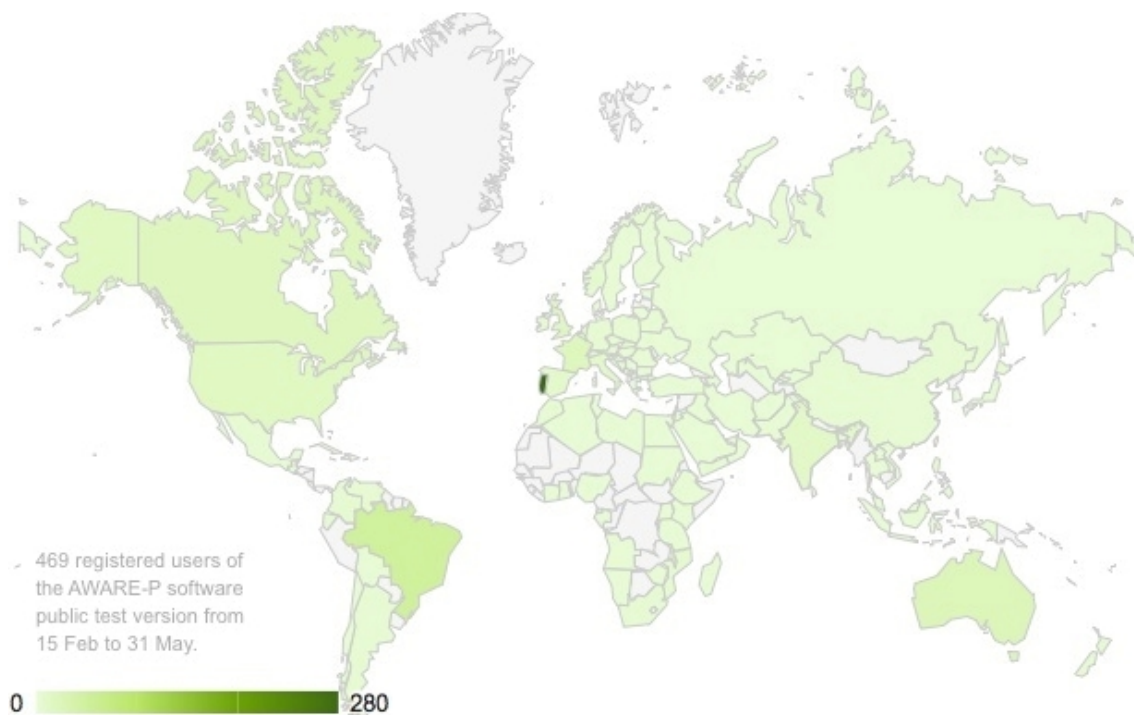


Figure 6 – Registered users of the AWARE-P software public beta test as of May 2012

#### 4.4.3 Quality and reliability

Besides worldwide availability, the most direct gain from using an open-source development paradigm is derived from the exposure to a large number of demanding users, and the opportunity to leverage their feedback.

This considerably impacts the quality of the solutions and the reliability and usability of the software. The current beta testing stage has already allowed for a significant number of improvements, both due to quality control by the users, and as a result of suggestions for new or improved features, many of those being included in the forthcoming July version.

#### 4.4.4 Resource consumption and protection

The AWARE-P software is designed to assist users in developing and selecting the most effective evolution paths for their urban water systems, placing particular emphasis on the ability to factor in the widest range of requirements on a comparable, quantified basis. This innovative approach allows for explicitly including criteria related to resource consumption and protection, such as drinking water leakage minimisation or the reduction of pumping energy consumption.

#### 4.4.5 Efficiency

Most of the models included in the AWARE-P software offer the capability to explore and develop efficiency gains in performance, risk control and financial planning. Above all, the decision-making environment offers the ability to select the best trade-offs in that respect also.

## 4.5 Awareness & capacity building

The project has a global dissemination strategy, using the Portuguese water market as broad-scale pilot and making most materials available in English; developed through collaborative work with 4 utility groups, it produced 8 business cases, 9 in-room training courses, e-learning courses and a web platform ([www.aware-p.org](http://www.aware-p.org)), as well as technical & scientific publications. Active promotion was also pursued through IWA and ISO.

**Project quality & reliability:** Aware-P relies on an international R&D core team as well as on the Portuguese water services regulator ERSAR and 4 end-user partners, fully engaged in the development effort. All products are subject to a demanding quality control process. The software's beta testing stages involved over 140 registered users in 4 continents.

### 4.5.1 Degree of innovation

AWARE-P was designed and tailored to create innovation, i.e., to create better and more effective ideas, processes and products that are readily available to urban water utilities and other stakeholders, such as policy-makers and consultants. This aim required that a significant effort has been put on the axis of awareness and capacity building activities, in innovative in itself.

The Portuguese water market presents a broad variety of situations, from very basic cases to mature and rather sophisticated utilities. Different institutional models coexist. Pressures and drivers are also very different between regions. It is therefore an ideal ground to be used as broad-scale pilot.

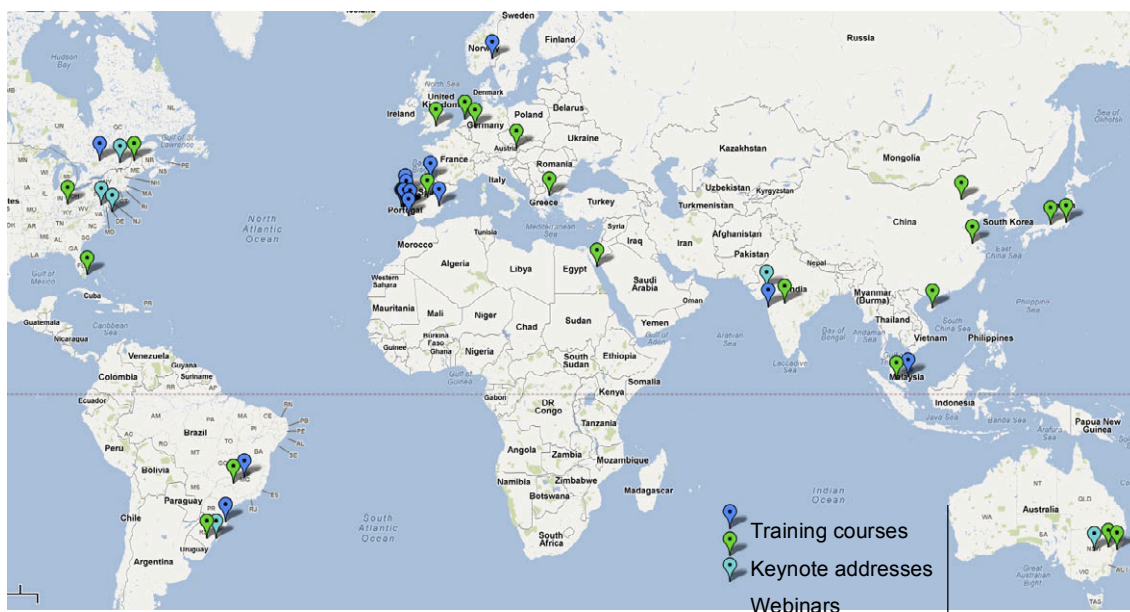
Four main levels of interaction were created: with the utility partners, with the participants in the training courses, with other utilities that voluntarily started to test and use the AWARE-P IAM approach, with the utilities in general who attended keynote addresses, seminars and conference presentations, or visited the AWARE-P and BASEFORM websites. The core of the work was jointly developed by all the partners, who collaborated in a cross-disciplinary way, complementing each other's know-how and experience. The feedback received from outside the project team was also crucial for a continuous improvement of the results.

To maximize the impact, all project products are freely available to any interested party. This was a requirement from the Portuguese Regulator and from the EEA Grant providers that perfectly fits the aim of all project partners. A very important advantage is the added impact of the project, including the possibility that the International Water Association and its members also benefit from the products. Another key advantage is the reliability and resilience of the deliverables, and particularly of the software. A world exposure allows to test it in very different conditions and environments, contributing to detect bugs, inconsistencies and identifying room for continuous improvement. In the future, open-source and non-open source will be offered, in order to insure the financial sustainability of the software provision.



## 4.5.2 Transferability and applicability

The procedures to ensure transferability included the organization of direct tuition training courses, workshops, and keynotes, of conference papers, and of promoting the implementation in as many utilities worldwide as feasible.



<https://maps.google.com/maps/ms?ie=UTF&msa=0&msid=21278333771180775826.0004c1fc4c72497f93b8e>

Figure 7 – IAM training courses, keynotes and webinars

### Keynotes

The AWARE-P team presented 33 keynote addresses on infrastructure asset management or specifically on AWARE-P. Annex A4 (p. 37) contains the full list of keynotes.

### Training courses, workshops and webinars

The AWARE-P IAM approach was presented in 16 training courses and workshops, totaling 342 hours of direct tuition, up to present (not including the IAM classes of the PhD programme at IST (Tech. Univ. Lisbon). New training courses are already scheduled.

Added to this, several workshops and webinars were also carried out, from Australia and India to Europe and to North and South America.

Annex A4 presents the full list of training courses, workshops and webinars.

### Conference papers

The AWARE-P IAM approach and tools have so far been presented in 21 conference papers, listed in Annex A4 (p. 37).

### Utility implementations

The first utility implementations were carried out during the project by the utility partners:

- AGS, S.A.: a private holding of water and wastewater service operators, running a number of municipal concessions ranging from pop. 7,000 to 200,000 (Portugal, Angola and Brazil). AGS took part in the project through one operator serving 55,000 p.
- AdP Serviços, S.A.: part of the AdP Group, which manages a large number of drinking water and wastewater multi-municipal systems across the country. AdP used two pilots in the project, a large bulk wastewater operator serving 700,000 p. and an industrial water supply system.
- SMAS Oeiras e Amadora: an administratively and financially independent public utility providing urban water services – drinking water, wastewater and storm water – to the municipalities of Oeiras and Amadora (pop. 350,000), in the suburbs of Lisbon;
- Veolia Águas de Mafra: a private operator serving a municipality of 76,000 with drinking water and wastewater services.

As soon as the project ended, LNEC, IST and ADDITION launched a new project, iGPI - National Initiative for Infrastructure Asset Management ([www.iniciativagpi.org](http://www.iniciativagpi.org)), a 17-month collaborative project that aims at capacitating the participating utilities in developing their own strategic and tactical plans. It combines group training and one-to-one assistance. 19 utilities participate. Annex A4 (p. 35) presents a short description of the participants. In parallel, AGS launched a twin project for 12 urban water companies of the AGS group, in order to maximize the capacity building capacity of the whole team.

Outside Portugal, several implementation cases are also emerging:

- 2 test utilities in Spain (2011-2012), in Bilbao and Castellon, under the coordination of ITA (Polytechnic University of Valencia) and the informal support of LNEC;
- 1-2 US wastewater utilities where the AWARE-P software will be tested, in the scope of the project "Visual Tool for Supporting Asset Management Performance, Risk and Cost Analysis", WERF/USEPA (2012-2013) (partners: GHD, LNEC, ADDITION, Virginia Tech, and IWA);
- 1-2 pilot tests in the States of Gujurat and Maharashtra, in India, in the scope of the 5-year project Performance Assessment System, coordinated by CEPT University (Prof. Dinesh Mehta) and funded by the Bill and Melinda Gates Foundation ([http://spcept.ac.in/pas\\_project.aspx?pg=pas&sub=pas](http://spcept.ac.in/pas_project.aspx?pg=pas&sub=pas)); LNEC and CEPT teams are working together in order to explore the possibilities and two workshops (one in each of the States) are scheduled for Jul. 2012.

### 4.5.3 Quality and reliability

All products were subjected to a demanding quality control process. Additionally, every training course was followed by a satisfaction survey, with consistently good results. Another measure of the quality and reliability was the good response to the call for participation in the national Initiative for IAM, in a context of reduced availability of funds for such projects within the industry (the participation fee was ca. 22 k Euro per utility). Not only the number of utilities that expressed an interest in taking part was higher than the planned capacity, but 4 of the 19 participants are not even required by the new legislation to implement and maintain IAM programs (applicable only to retail services serving more than 30,000 inhabitants). This demonstrates that they acknowledge the added value of participating, recognizing the quality and reliability of the work developed.

#### **4.5.4 Resource consumption and protection**

By creating awareness for the need of implementing a sound IAM process within the organisations, and by building the necessary capacities and support tools, the project contributes actively to a more rational use of the natural resources and to prevent pollution.

#### **4.5.5 Efficiency**

For the same reasons, the project contributes to added organization efficiency. The comparison and selection of the best intervention alternatives, based on the corresponding performance, risk and cost in the long term, leads to more efficient organisations and services.

One of the specific areas where there is plenty of room for improvement in the efficiency of the utilities is information management. Procedures to identify, collect, validate, integrate and wisely use the key support information were made available in AWARE-P. Due to the complexity and dimension of this problem, further research will be carried on in the follow-up projects.

## 4.6 Legacy and road map

As a project, AWARE-P took place between 2008 and 2011. However, it is part of a longer-term narrative that began over a decade ago with previous R&D efforts, such as the CARE-W/S, TECHNEAU and APUSS 5th-FP projects or the COST C18/C19 actions.

Having largely fulfilled its objectives, the project is also seen by its promoters as a new starting point for a roadmap that is well under way – a path that will leverage the currently available tools and the development system created, in order to improve the offer, benefit from even more collaborative R&D, and make it reach larger numbers of practitioners worldwide. Planned development will be driven by R&D or capacity-building projects such as:

- The 7th-FP project TRUST-Transitions to the Urban Water Services of Tomorrow ([www.trust-i.net](http://www.trust-i.net)), a large and very structured R&D effort (2011-2014), includes further expansion of the AWARE-P IAM methodology, documentation and tools, focusing on a wider variety of analysis models for risk and cost analysis in both water supply and drainage systems, as well as on the connection to urban-planning scale tools and on innovative collaborative decision-making. TRUST has adopted the Baseform platform for integrated software development in its centrepiece WA5, benefitting from contributions from a wide group of partners.
- The WERF/USEPA project INFR-2012 System Rehabilitation Component - "Visual Tool for Supporting Asset Management Performance, Risk and Cost Analysis" (2012-2013) will explore the applicability of the current software toolset to US utilities and specifically develop new open-source modules for modeling drainage system criticality and for sewer failure analysis.
- Data4IAM, a 7th-FP proposal currently under the final stages of evaluation, specifically addresses the issues of system and failure data collection, consistency and analysis, with the development of new open-source tools in those domains, in the Baseform system.
- iGPI, the National IAM Initiative (2012-2013) ([www.iniciativagpi.org](http://www.iniciativagpi.org)), already under way involving 19 utilities of varying sizes and institutional frameworks, and its sister programme promoted by the AGS consortium with a further 12 utilities, will deploy the AWARE-P methodology and tools with the explicit aim of producing strategic and tactical IAM plans for and by each organisation. Beyond the sheer capacity building value of such an undertaking, it will provide a systematic testing ground for the production and refinement of the second generation of the documentation materials available. It has also enabled the generation of funding for supporting the development of further software modules, namely those that may further bridge the gap between the participating utilities' own GIS and work order or maintenance systems, and specific analysis tools.
- Early-stage tests are being undertaken in India and Brazil, with the aim of setting up application projects for the methodology and tools in contexts that may be significantly different from those found in Europe and North America.

Software is an important part of AWARE-P's visibility and world impact, and the Baseform.org platform was created with the aim of achieving sustainability in supporting and expanding the current offer. It supports both open-source and commercial development, and it seeks to continue its association with leading-edge R&D organisations, as well as consultants and utilities seeking specific solutions, in order to guarantee the quality of its open-source offer but also its longevity and validation.

## 5. Submission

By delivering the application form and the accompanying application documents, I hereby enter the qualification for the Muelheim Water Award 2012. I am pleased to confirm my agreement that in the case of reward, my name as well as my organisation / institution will be notified publicly.

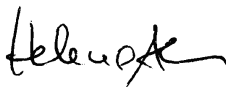
Furthermore, I agree that my name and submitted project title can be published via press coverage and on the website of the Muelheim Water Award.

I have read the statutes, the entry conditions and the application information and I agree to them. I confirm that all statements and information given in the application are complete and conform to truth.

I agree expressly to a detailed inspection of the submitted project.

The following documents are attached:

- 1 Description of applicants
- 2 List of main products related to “Ground-breaking R&D”
- 3 List of main products related to “Professional-grade tools”
- 4 List of main products related to “Awareness and capacity building”
- 5 Curriculum vitae of the applicant / leading applicant
- 6 Copies of the publications produced within AWARE-P (in the CD)



Helena Alegre  
Senior Research Officer  
Urban Water Division / Hydraulics and Environmental Department  
LNEC – National Civil Engineering Laboratory



## **ANNEXES**





## **A1. Description of applicants**

### **Leading applicant: LNEC, project coordinator**

#### **LNEC – National Civil Engineering Laboratory, Portugal**

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Project Manager: Dr. Sérgio T Coelho <stcoelho@lnec.pt>

Scientific Coordinator: Dr. Helena Alegre <halegre@lnec.pt>

Av. do Brasil, 101 – 1700-066 Lisboa – Portugal

www.lnec.pt

#### **General description**

LNEC is a leading applied research institute in the field of civil engineering and related environmental areas, based in Lisbon (Portugal), combining planned research with specialised consultancy and general support to the industry. LNEC's mission is to carry out problem-driven RTD and to contribute to best practice in civil engineering. LNEC's Urban Water Division (22 staff – 12 PhD, 6 doctoral assocs.) is dedicated to water supply, wastewater and storm water services RTD, and has leading-edge know-how in areas such as asset management of urban water infrastructures, performance assessment, efficient water and energy use, and advanced treatments. Its pool of expertise spans civil engineering hydraulics, systems analysis, geography, microbiology, chemistry, water quality and treatment processes.

#### **Main role in the project**

LNEC was the AWARE-P project coordinator, leading all the work packages and undertaking a substantial part of the project's mainstream R&D. LNEC was also lead contributor to the production of the training materials and e-learning content, the technical guides and the prototypes that tested the methods later incorporated into the software. LNEC provided technical support to the end-users in the development of their business cases, and ensured national and international dissemination, including within IWA and the ISO standardisation groups working in asset management (ISO/TC 224 / WG6; ISO/PC 251).

## Other applicants: project partners (in alphabetical order)

### ADDITION, Portugal

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Contact: Diogo Vitorino <diogo.vitorino@addition.pt> +351 912505021

Rua Borges Carneiro, 34 - R/C -- 1200-619 Lisboa – Portugal

www.addition.pt

#### General description

Addition is a software company, with a proven track record of building sophisticated online information systems and mobile applications since 1998. The company strives on continuous research and development, leading to next-generation infrastructure management, state-of-the-art web user interface guidelines and informed IT consulting. Addition has a significant experience in partnering with R&D and academic organisations in European projects such as EurOcean, Aware-P or TRUST.

#### Main role in the project

Addition led the team responsible for the architecture and development of the AWARE-P IAM software application, built on top of the Baseform integrated software platform, designed for hosting a growing family of tools and applications for networked infrastructures. Addition is also in charge of the web dissemination platform (www.aware-p.org) and oversaw all Aware-P product branding and design.

### AdP Serviços, SA, Portugal

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Contact: Luís Mamouros <l.mamouros@ADP.PT> +351 212469500

Rua Visconde de Seabra, 3 – 1700-421 Lisboa, Portugal

www.adp.pt

#### General description

AdP – Águas de Portugal, Serviços Ambientais, S.A. is a publicly owned company for the implementation of government environmental policies in Portugal (water supply and sanitation, including waste water and solid waste) and development aid in the water sector. AdP Services contributes actively to the technical development of AdP's operating companies in the fields of engineering, construction and operation of the water infrastructures, increasing process efficiency and creating technological practice synergies throughout the group.

#### Main role in the project

AdP Serviços was responsible for the partner utilities under the AdP group, including the water supply and wastewater pilot cases at SANEST and Sto. André (Portugal). AdP Serviços developed 3 business cases in conjunction with the utilities mentioned, took part in the R&D development work and tested the AWARE-P software from the early beta testing releases.

## **AGS - Administração e Gestão de Sistemas de Salubridade, Portugal**

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Contact: João Faria Feliciano <joao.feliciano@ags.pt> +351 219104542

Rua da Tapada da Quinta de Cima – Linhó – 2714-555 Sintra, Portugal

[www.ags.pt](http://www.ags.pt)

### **General description**

AGS is a leading Portuguese water services private operator founded in 1988, with activities in Portugal, Brazil and Angola and a business portfolio of 2000 M euros. AGS manages 14 water utilities in Portugal (municipal concessions and public-private partnerships), providing water and wastewater services to about 1 million people. Besides utility management, AGS is also a service provider in water and wastewater system management, operation and maintenance.

Infrastructure Asset Management (IAM) plays a crucial role at AGS, due to contract obligations, regulation and the need to optimise service quality, network performance and infrastructure life-time.

### **Main role in the project**

AGS was responsible for the end-user partner utilities under the AGS utility holding, including the water supply and wastewater pilot cases at Águas do Marco and at AGS-Paços de Ferreira (Portugal). AGS developed 2 business cases in conjunction with the utilities mentioned, took part in the R&D development work and tested the AWARE-P software from the early beta testing releases. In parallel, significant progress was made in terms of data collection and management.

## **IST/CEHIDRO - Instituto Superior Técnico (Technical Uni. Lisbon)**

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Contact: Dília Covas <didia.covas@civil.ist.utl.pt> +351 938457638

Av. Rovisco Pais – 1049-001 Lisboa, Portugal

[www.ist.utl.pt](http://www.ist.utl.pt)

### **General description**

Instituto Superior Técnico (IST) is the largest and one of the most reputed schools of engineering in Portugal. It has 8500 undergraduate and over 1500 graduate students and Faculty members include over 700 Professors (PhD) with a wide range of specialization fields.

CEHIDRO - Centro de Estudos de Hidrosistemas - carries out basic and applied research in hydraulics, water resources and environment; it participates in the establishment of science and technology policies of the Civil Engineering and Architecture Dept. of IST. The main strategic objectives of the Centre are: hydraulic and hydrologic security; support to the design and management of hydrosystems; water resources and society challenges; hydraulics and water resources for an improved environmental quality.

### **Main role in the project**

IST was a main contributor to the R&D effort in the project, with a particular emphasis on the development of the general IAM methodology, of the cost analysis models and of the multi-criteria decision-making methods. IST was a major contributor to the technical guide for water supply, and had an instrumental role in the training courses taught, as well as on support to the development of several of the utility cases.

### **ERSAR – Instituto Regulador de Águas e Resíduos, Portugal**

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Contact: David Alves <david.alves@ersar.pt> +351 210052200

Centro Empresarial Torres de Lisboa – Rua Tomás da Fonseca, Torre G - 8º – 1600-209 Lisboa Portugal

[www.ersar.pt](http://www.ersar.pt)

### **General description**

ERSAR is the Portuguese Water and Waste Services Regulation Authority, created in 1998 to regulate public water supply services, urban wastewater management services and municipal waste management services. It is also as the national authority for the assessment of drinking water quality. ERSAR has a staff of 65 and regulates a total of about 500 utilities.

### **Main role in the project**

ERSAR had a central advisory role in the project, providing guidance from a regulator's viewpoint, with a very proactive engagement in promoting sustainable infrastructure asset management of urban water services in Portugal. ERSAR has had a crucial role in the incorporation of IAM requirements into the regulatory procedures in recent years.

ERSAR also played a key role in creating public awareness and in the dissemination of the project and its outcomes, particularly as a publisher of the two technical guides and as a promoter of the training courses that were held. ERSAR equally contributed to quality control of the projects outcomes.

### **SMAS de Oeiras e Amadora, Portugal**

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Contact: Julieta Marques <mjmarques@smas-oeiras-amadora.pt> +351 214767942

Av. Dr. Francisco Sá Carneiro, 19 – Urb. Moinho das Antas – 2784 – 541 Oeiras Portugal

[www.smas-oeiras-amadora.pt](http://www.smas-oeiras-amadora.pt)

### **General description**

SMAS O&A (Serviços Municipalizados de Água e Saneamento de Oeiras & Amadora) is an administratively and financially independent public utility providing urban water services – drinking water, wastewater and stormwater – to the municipalities of Oeiras and Amadora, in the suburbs of Lisbon, covering approximately 70 km<sup>2</sup> and a population of about 350,000.

SMAS O&A has a strong motivation in joining international R&D projects related to asset management, as the organization strives to improve data collection and the management of its infrastructures. The main aim in joining AWARE-P was to have improved support in establishing reliable diagnoses and in using sounder decision-making methods.

### **Main role in the project**

SMAS O&A are conducting a detailed asset management analysis of their water supply, wastewater and stormwater systems based on the AWARE-P IAM approach. SMAS O&A were actively engaged in the development of the AWARE-P approach and are implementing it step-wise. The entire utility was considered at the strategic level of planning, and two pilot areas were explored (water supply, and wastewater and stormwater). In parallel, significant progress was made in terms of data collection and management. SMAS O&A also tested the AWARE-P software from the early beta testing releases.

### **Stiftelsen SINTEF, Norway**

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Contact: Rita Ugarelli <Rita.ugarelli@sintef.no> +47 73592429

Strindvegen 4 – NO-7465 Trondheim - Norway

[www.sintef.com](http://www.sintef.com)

### **General description**

SINTEF is a multidisciplinary private research institute that performs contract research and development for industry and the public sector. It is Scandinavia's largest independent research organisation with about 2000 employees of whom around 70% are researchers. Contracts for industry and the public sector generate more than 90% of income. SINTEF performs projects primarily within the technological area, but also in natural sciences, medicine, and social sciences. SINTEF collaborates closely with the Norwegian University of Science and Technology and the University of Oslo.

### **Main role in the project**

Sintef were main R&D partners, bringing into the consortium all their accumulated experience in the ground-breaking Care-W and Care-S projects and the subsequent application of their results to diverse case studies. Sintef collaborated intensively in defining the Aware-P framework and in studying specific data-related issues, and had a major contribution to data model design and geo-referenced infrastructure record system analysis, with a focus on the Norwegian Gemini system, through an exchange team member that joined the LNEC team.

### **Veolia Águas de Mafra, SA, Portugal**

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Contact: Pedro Pereira <pedro.pereira@veoliaagua.com.pt> +351 261816650

Av. Eng. Duarte Pacheco, 19 - 7º Dº – 1070-100 Lisboa

[www.veoliaagua.com.pt](http://www.veoliaagua.com.pt)

### **General description**

A private water and wastewater services operator, Águas de Mafra is a Veolia Water subsidiary whose main activity is the development of activities in the water business, namely studies & consulting services and the exploitation & management of water and waste water services for both the municipal and the industrial sectors, for the municipality of Mafra (pop. 55000).

### **Main role in the project**

Águas de Mafra was the end-user partner responsible for the water supply and wastewater pilot cases at the Mafra municipality. Águas de Mafra developed 2 business cases, took part in the R&D development work and tested the AWARE-P software from the early beta testing releases. In parallel, significant progress was made in terms of data collection and management.

### **YDreams Informática SA, Portugal**

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Contact: Mónica Pedro <monica.pedro@YDreams.com> +351 919930573

Edifício YDreams – Madan Parque – Sul – P-2829-149 Caparica

www.YDreams.com

### **General description**

YDreams is a computer technology company that is redefining the interactivity concept, working in interactive ambient architecture, products and developing intellectual property and proprietary technologies. YDreams is geared towards the Reality Computing paradigm: integrating the digital universe into the real world without wires and keyboards; creating systems that rely on user's senses and establish new patterns for interaction. The Lisbon-based company operates globally, with partners such as Adidas, Coca-Cola and Nokia.

### **Main role in the project**

The main role of YDreams was the coordination and development of the e-learning platform and materials, including the definition of a learning strategy, of learner profiles, of national and international market segments, and of a complete course structure, image and design, storyboards and content management.

### **Project funding**

The project had a total budget of 1,274,590 Euro, of which:

- 57% funded by the Financial Mechanism of the European Economic Area (Contract No. PT 0043);
- 18% funded by ERSAR and by the 4 end-user partners (AGS, SMAS O&A, Veolia Agua and AdP Serviços), in equal parts; and
- the remaining 25% were in-kind contribution by the development partners (LNEC, IST, SINTEF, YDreams and Addition).

## A2. Ground-breaking R&D

This Annex documents Section 4.3 of the main text. All items marked with \* are direct project results; a selection of those are included in the accompanying CD, as marked.

### Books and book chapters

- [A2B01\*] Almeida, M.C., Leitão, J.P., Coelho, S.T. (2011). Gestão do risco em infraestruturas urbanas de água: Aplicação a sistemas de águas e de águas residuais (Risk management in urban water infrastructures: application to water and wastewater systems). In Almeida, B., *Gestão da Água, Incertezas e Riscos: Conceptualização operacional (Water management, uncertainty and risks: operational conceptualisation)*. Esfera do Caos, Lisbon, Portugal (in Portuguese) (pdf in CD)
- [A2B02] Alegre, H., Matos, R., Neves, E. B., Cardoso, A., Duarte, P., Baptista, J. M., Pássaro, D. A., Pires, J. S., Freixial, P., Lobo, F., Simas, L., Ribeiro, A., Aleixo, C., Ferreira, R., Rodrigues, R., Moinante, M. J., Mira, F., Franco, M. J., Ramos, R., Nunes, M., Lopes, R., Silva, J., Costa, A., Ramos, L., Rodrigues, C., Ruivo, F., Alexandre, C., Pedro Gonçalves, P., Andrade, I. and Alves, D. (2011). *Guia de avaliação da qualidade dos serviços de águas e resíduos prestados aos utilizadores. 2.ª Geração do sistema de avaliação (Guide for the assessment of the quality of water and waste services. Second generation of the performance assessment systems for regulation (version 3.0))*. ERSAR and LNEC, (261 p., in Portuguese) (electronic version available at [www.ersar.pt](http://www.ersar.pt)).
- [A2B03\*] Almeida, M.C. and Cardoso, M.A. (2010). Gestão Patrimonial de Infraestruturas de águas residuais e pluviais (Infrastructure asset management of wastewater and stormwater services). ERSAR, LNEC, Series “ERSAR Technical Guides, Vol. 17, Lisbon, Portugal. ISBN: 978-989-8360-05-2 (348 p., in Portuguese) (electronic version available at [www.ersar.pt](http://www.ersar.pt)) (pdf in CD)
- [A2B04\*] Alegre, H. and Covas, D. (2010). Gestão Patrimonial de Infraestruturas de águas residuais e pluviais (Infrastructure asset management of water transmission and distribution systems). ERSAR, LNEC & IST, Series “ERSAR Technical Guides, Vol. 16, Lisbon, Portugal. ISBN 978-989-8360-04-5 (505 p., in Portuguese) (electronic version available at [www.ersar.pt](http://www.ersar.pt)) (pdf in CD)
- [A2B05] Alegre, H., Matos, R., Neves, E.B., Cardoso, M.A., Duarte, P., Baptista, J.M., Pássaro, D., Santos, R.F., Pires, J.S., Fernandes, T., Almeida, J., Escudeiro, H., Lobo, F.; Nunes, M., Silva, J., Costa, A., Lopes, R., Ribeiro, A., Silva, J.C., Neves, T., Freixial, P., Ferreira, R., Ramos, R. and Rodrigues, R. (2009). *Sistema de avaliação da qualidade dos serviços de águas e resíduos prestados aos utilizadores - 1.ª Geração do sistema de indicadores de qualidade de serviço (Quality assessment system for the regulation of the water and waste services. First generation of the performance indicators system)*. Series “ERSAR Technical Guides” Vol. 12, IRAR e LNEC, ISBN 978-989-95392-8-0 (175 p., in Portuguese) (electronic version available at [www.ersar.pt](http://www.ersar.pt)).

- [A2B06] Alegre, H. and Almeida, M.C. (eds.) (2009). *Strategic Asset Management of water and wastewater infrastructures*, IWA Publishing, ISBN 97843391869 (536 p.)

## Papers in scientific journals

- [A2P01] Martins, A., Leitão, J.P. and Amado, C. (submitted, under review). A comparative study of three stochastic models for prediction of pipe failures in water supply systems. *Journal of Infrastructure Systems*
- [A2P02] Cardoso, M.A., Santos Silva, M., Coelho, S.T., Almeida, M.C., Covas, D. (submitted, under review). Urban water infrastructure asset management - structured approach in four Portuguese water utilities. *Water Science and Technology*
- [A2P03] Carriço, N., Covas, D., Almeida, M.C., Leitão, J.P. and Alegre, H. (2012, in press). Prioritization of rehabilitation interventions for urban water assets using multiple criteria decision-aid. *Water Science and Technology*
- [A2P04\*] Alegre, H., Almeida, M.C., Covas, D., Cardoso, M.A., Coelho, S.T. (2010). Gestão patrimonial de infra-estruturas em sistemas urbanos de água. Uma metodologia estruturada (Urban water infrastructure asset management. A structured methodology). *Águas & Resíduos*, série III, 14, Sep./Dec., 40-52 (in Portuguese) (pdf in CD)
- [A2P05\*] Alegre, H. (2009). Is strategic asset management applicable to small and medium utilities? *Water Science and Technology*, 62(9), 2051-2058 (pdf in CD)

## Research programs, PhD and Master Theses

- [A2T01] Feliciano, J. (under development). Gestão patrimonial de infraestruturas de serviços de águas em entidades gestoras de pequena e média dimensão – uma metodologia adaptativa (Asset management of urban water infrastructures of small- and medium-size utilities - an adaptative methodology). PhD thesis, Instituto Superior Técnico, Technical Univ. Lisbon, Portugal.
- [A2T02] Santos Silva, M. (under development). Efficient information management in urban water utilities. PhD thesis, University of Évora, Portugal.
- [A2T03] Carriço, N. (under development). Reabilitação de redes de distribuição de água: estabelecimento de prioridades com base em desempenho, custo e risco (Rehabilitation of water distribution networks. Establishment of priorities based on performance, cost and risk). PhD thesis, Instituto Superior Técnico, Technical Univ. Lisbon, Portugal.
- [A2T04\*] Martins, A. (2011). Stochastic models for prediction of pipe failures in water supply systems. MSc thesis, Instituto Superior Técnico, Technical Univ. Lisbon, Portugal (pdf in CD)
- [A2T05] Mira, F. (2011). Planeamento da reabilitação de infra-estruturas de abastecimento de água (Planning and rehabilitation of water supply infrastructures), MSc thesis. University of Évora, Portugal.



- [A2T06] Faria, P. (2010). Aplicação do modelo de hierarquia fuzzy no apoio à decisão de reabilitação em sistemas de abastecimento de água (Application of the fuzzy hierarchy model for decision to support in water supply systems rehabilitation), MSc thesis. University of Évora, Portugal (in Portuguese).
- [A2T07\*] Holte, K. (2010). Use and collection of data in Gemini VA in asset management. MSc thesis, NTNU – Norwegian University of Science and Technology, Trondheim, Norway (pdf in CD).
- [A2T08\*] Santos Silva, M. (2010). Avaliação de Desempenho na Gestão Patrimonial de Infraestruturas Urbanas de Água (Performance evaluation in urban water infrastructure asset management). Internship report, Ordem dos Engenheiros (Portuguese Association of Engineers – Civil engineering), Lisbon, Portugal (in Portuguese) (pdf in CD).
- [A2T09\*] Barata, P. (2008). Construção de um modelo de gestão patrimonial de infraestruturas de abastecimento público de água (Construction of a model to manage public water supply infrastructure assets). MSc thesis. University of Minho, Braga, Portugal (in Portuguese) (pdf in CD).
- [A2T10\*] Alegre, H. (2008). Water infrastructure asset management. Research Program, Series «Thesis and Research Programmes», LNEC, Lisbon, Portugal, ISBN 9789724921341 (385 p.) (in Portuguese).

## A3. Professional-grade tools

This Annex documents Section 4.4 of the main text. All items are direct project results.

### The Baseform website: [www.baseform.org](http://www.baseform.org)



## Software supporting materials

A complete set of software supporting materials is available in the Support section of the site. All items are included in the CD provided with this document: software manual; 5-step quick walkthrough; complete usage example based on an existing water utility's business case; and 7 video tutorials

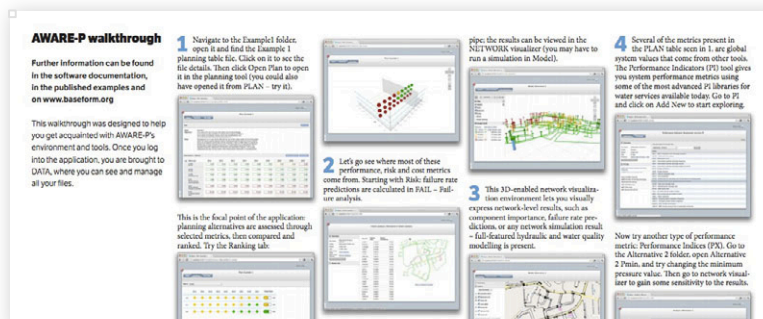


Figure 8 – A 5-step quick walkthrough

## A4. Awareness & capacity building

This Annex documents Sections 4.2 and 4.5 of the main text. All items marked with \* are direct project results; a selection of those are further marked out as included in the accompanying CD.

### Implementations by the AWARE-P utility partners

Implementations by the AWARE-P utility partners Águas de Portugal Serviços, S.A. (AdP), AGS, S.A., SMAS Oeiras e Amadora, and Veolia, Águas de Mafra included the use of pilot areas for testing the more detailed methods and tools. The pilot cases are summarised in Table 2 below.

**Table 2. Case study systems: features and diagnosed problems**

Type of System	System reference	Features	Diagnosed problems
Water Supply	WS1	Rural/ peri-urban; 478 customers; 39 km pipe length; 278 service connections	<ul style="list-style-type: none"> <li>- High water losses</li> <li>- Inadequate running costs coverage</li> <li>- High non-revenue water</li> <li>- Inadequate pressure</li> <li>- Occurrence of pipe failures</li> </ul>
	WS2	Rural/ peri-urban; 220 customers; 3 km pipe length; 114 service connections	<ul style="list-style-type: none"> <li>- Insufficient storage capacity</li> <li>- High water losses</li> <li>- Inadequate running costs coverage</li> <li>- High non-revenue water</li> <li>- Inadequate pressure</li> <li>- Occurrence of pipe failures</li> </ul>
	WS3	Industrial; service started 1980; supplied by one 10 km water main; 17 km pipe length; 10 <sup>7</sup> m <sup>3</sup> /year	<ul style="list-style-type: none"> <li>- Water losses</li> <li>- Corrosion in metallic components</li> <li>- Future increase of supply needs</li> <li>- Need for system redundancy</li> </ul>
	WS4	Urban; 4388 customers; 12.5 km pipe length; 40% of asbestos cement	<ul style="list-style-type: none"> <li>- High water losses</li> <li>- Pressure and velocity problems</li> <li>- Pipe failures, mainly in asbestos cement</li> <li>- Service interruptions</li> </ul>
Wastewater	WW1	Rural/ peri-urban; 1.1 km <sup>2</sup> catchment area; separate domestic; 9.5 km sewers; 280 manholes; 85 customers; 128 723 m <sup>3</sup> /year of collected wastewater	<ul style="list-style-type: none"> <li>- Insufficient inventory data</li> <li>- Insufficient monitoring data</li> <li>- High inflow/infiltration flows</li> </ul>
	WW2	Domestic interceptor system; close to coastal bathing waters; 220 km <sup>2</sup> contributing area; 140 km sewer length; 798 000 p.e.; 155 000 m <sup>3</sup> /day of collected wastewater; 11 pumping stations; monitored system	<ul style="list-style-type: none"> <li>- Poor structural condition of particular sewers</li> <li>- High inflow/infiltration flows (mainly received from upstream municipal sewers)</li> </ul>
	WW3	Urban; separate system (domestic + storm water); 3.4 km domestic sewer length; 3.5 km stormwater sewer length	<ul style="list-style-type: none"> <li>- Root intrusion</li> <li>- High inflow/infiltration flows</li> <li>- Poor structural condition of some sewers</li> </ul>
	WW4	Rural/ peri-urban; separate domestic system; 360 km sewer length; hilly topography	<ul style="list-style-type: none"> <li>- Insufficient service physical accessibility</li> <li>- Insufficient service coverage</li> </ul>

## Implementations by utilities taking part in the National Initiative for Infrastructure Asset Management

Table 3. Utilities in the National Initiative ([www.iniciativagpi.org](http://www.iniciativagpi.org))

Utility partners	Short description
AGERE - Braga	A public company operating in water supply, wastewater and solid waste services in the municipality of Braga, Portugal.
Águas de Coimbra	A public company and provide water distribution and sewerage and drainage services in the Municipality of Coimbra, Portugal. It serves approximately 83,000 inhabitants.
Águas do Oeste	A private company (owned by AdP, the West inter-municipality association and 14 municipalities where it operates) that provides water supply and wastewater services to 156,000 p. in 15 municipalities located in the west of Portugal.
Águas da Região de Aveiro (AdRA)	A Public partnership of AdP and 10 municipalities where it operates. AdRA provides water supply and wastewater services to approx.. 350,000 p.
AQUAPOR – Águas do Planalto	A private utility operating in the municipalities of Carregal do Sal, Mortágua, Sta. Comba Dão, Tábua and Tondela (Portugal). It provides water supply services (incl. abstraction, treatment, transport and distribution) to 76,000 p.
CM Sabugal	A municipality that, among all other municipal management activities, operates the water supply and wastewater and storm water systems for approx. 12,500 inhabitants.
EMAR Vila Real	An administratively and financially independent public utility providing urban water services drinking water, wastewater and storm water ñ to the municipality of Vila Real, in the north of Portugal.
EAmb - Esposende	An administratively and financially independent public utility providing drinking water, wastewater and storm water services to the municipality of Esposende.
INDAQUA – Matosinhos	A private utility that provides urban water services to the Municipality of Matosinhos. It serves about 170,000 inhabitants.
Infralobo/ Inframoura/ Infracuinta	Infralobo, Inframoura, Infracuinta provide water supply, wastewater and solid waste services to the resorts of Vale de Lobo, Vilamoura and Qta do Lago.
INOVA – Cantanhede	INOVA is a private company fully owned by the Municipality of Cantanhede. It provides water supply, wastewater and stormwater services, among other services oriented to the increase of the quality of public life in Cantanhede.
SMAS Almada	An administratively and financially independent public utility providing urban water services, namely drinking water, wastewater and storm water, to the municipality of Almada, in the south of Lisbon.
SMAS Loures	An administratively and financially independent public utility providing water supply, wastewater, storm water and domestic waste to the municipalities of Loures and Odivelas (approximately 170,000 inhabitants).
SMAS Sintra	An administratively and financially independent public utility providing water supply, wastewater and stormwater to 370,000 p. in the Sintra municipality.
SM Abrantes	An administratively and financially independent public utility providing water supply, wastewater, storm water and domestic waste to the municipality of Abrantes. In 2011, 92% of the inhabitants of the whole Municipality of Abrantes were already covered .
SM Castelo Branco	An administratively and financially independent public utility providing water supply, wastewater, storm water and domestic waste to the municipality of Castelo Branco (a city in the East of Portugal with approximately 40,000 p).
SMSB Viana do Castelo	An administratively and financially independent public utility providing water supply, wastewater, storm water and domestic waste to the municipality of Viana do Castelo, located in the north of Portugal. It supplies water to around 37,000 inhabitants and collects and treats wastewater to approx. 26,000 p.

## Implementations by utilities taking part in the AGS Initiative

The AGS holding of urban water & waste services ([www.ags.pt](http://www.ags.pt)) was a member of the AWARE-P consortium, and has launched an IAM collaborative project (a twin of the above National Initiative) for the water and wastewater companies where they hold positions in Portugal: AGS – Paços de Ferreira; Águas de Alenquer, Águas de Barcelos, Águas da Covilhã; Águas de Cascais, Águas da Figueira; Águas de Gondomar, Águas do Marco, Águas do Sado, Águas da Serra, Icovi and Tratave.

## The AWARE-P website

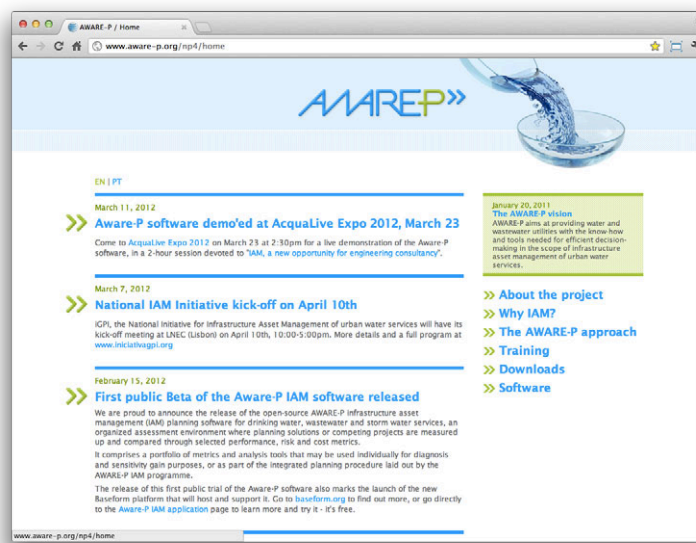


Figure 9 – [www.aware-p.org](http://www.aware-p.org)

## Conference papers

- [A4CP01\*] Carriço, N. J. G., Covas, D. I. C., Almeida, M. C., Alegre, H. (accepted). Selection of the best rehabilitation solution using multicriteria decision analysis. In *IWA World Water Congress & Exhibition*, 16-21 Sep., Busan, Korea. (pdf in CD)
- [A4CP02\*] Alegre, H., Coelho, S.T. and Leitão, J.P. (accepted). Infrastructure asset management of urban water systems. In *Jornadas de Investigação e Inovação LNEC 2012 - Cidades e Desenvolvimento*, 18-20 Jun., Lisbon, Portugal. (pdf in CD)
- [A4CP03\*] Coelho, S.T. and Vitorino, D. (accepted). AWARE-P: a software for urban networked infrastructure planning. In *Jornadas de Investigação e Inovação LNEC 2012 - Cidades e Desenvolvimento*, 18-20 Jun., Lisbon, Portugal. (pdf in CD)
- [A4CP04\*] Coelho, S.T., Vitorino, D., Alegre, H. (2012). A system-centric approach to infrastructure asset management planning. In *World Env. & Water Resources Congress*, ASCE, 20-24 May, Albuquerque, New Mexico, USA. (pdf in CD)

- [A4CP05\*] Carriço, N., Covas, D., Leitão, J. P., Almeida, M. C., Alegre, H., Mamouros, L., Lopes, N., Mendes, D. (2012). Seleção de opções de reabilitação em infraestruturas urbanas de água: caso de estudo (Selection of rehabilitation options for urban water infrastructures: case study). In *11º Congresso da Água*, 6-20 Feb., Porto, Portugal (in Portuguese). (pdf in CD)
- [A4CP06\*] Almeida, M.C., Leitão, J.P., Santos Silva, M. (2011). Avaliação da condição estrutural de colectores: inspeção visual com CCTV, requisitos e uso de dados (Evaluation of sewer pipes structural condition: visual inspection with CCTV). In *ENEG 2011*, 22-24 Nov., Santarém, Portugal (in Portuguese). (pdf in CD)
- [A4CP07\*] Cardoso, M.A., Santos Silva, M., Coelho, S.T., Almeida, M.C, Covas, D. (2011). Gestão Patrimonial de Infra-estruturas Urbanas de Água – Uma abordagem estruturada aplicada a quatro entidades gestoras (Urban water infrastructure asset management - structured approach in four Portuguese water utilities). In *ENEG 2011*, 22-24 Nov., Santarém, Portugal (in Portuguese) (pdf in CD).
- [A4CP08\*] Alegre, H., Almeida, M.C., Covas, D.I.C., Cardoso, M.A., Coelho, S.T. (2011). An integrated approach for infrastructure asset management of urban water systems. In *4<sup>th</sup> LESAM*, 27-30 Sep., Mülheim an der Ruhr, Germany (pdf in CD).
- [A4CP09] Beleza, J., Feliciano, J., Maia, J., Ganhão, A., Almeida, R., Santos, A., Coelho, J. (2011). Integrated information tools for strategic asset management. In *4<sup>th</sup> LESAM*, 27-30 Sep., Mülheim an der Ruhr, Germany (pdf in CD).
- [A4CP10\*] Cardoso, M.A., Santos Silva, M., Coelho, S.T., Almeida, M.C., Covas, D. (2011). Urban water infrastructure asset management - structured approach in four Portuguese water utilities. In *4<sup>th</sup> LESAM*, 27-30 Sep., Mülheim an der Ruhr, Germany (pdf in CD).
- [A4CP11\*] Carriço, N., Covas, D., Almeida, M. C., Leitão, J. P., Alegre, H. (2011). Prioritization of rehabilitation interventions for urban water assets using multiple criteria decision-aid. In *4<sup>th</sup> LESAM*, 27-30 Sep., Mülheim an der Ruhr, Germany (pdf in CD).
- [A4CP12\*] Coelho, S.T. and Vitorino, D. (2011). AWARE-P: a collaborative, system-based IAM planning software. In *4<sup>th</sup> LESAM*, 27-30 Sep., Mülheim an der Ruhr, Germany (pdf in CD).
- [A4CP13\*] Marques, M.J., Saramago, A.P., Silva, M.H., Paiva, C., Coelho, S., Pina, A., Oliveira, S.C., Teixeira, J.P., Camacho, P.C., Leitão, J.P., Coelho, S.T. (2011). Rehabilitation in Oeiras & Amadora: a practical approach. In *4<sup>th</sup> LESAM*, 27-30 Sep., Mülheim an der Ruhr, Germany (pdf in CD).
- [A4CP14\*] Carriço, N., Covas, D., Almeida, M. C., Leitão, J. P., Alegre, H. (2011). Rehabilitation interventions in urban water supply assets using the multicriteria decision tool ELECTRE III. In *11<sup>th</sup> CCWI*, 5-7 Sep., Exeter, United Kingdom (pdf in CD).
- [A4CP15\*] Carriço, N., Covas, D., Almeida, M.C., Alegre, H. (2011). Análise multicritério para a priorização de intervenções de reabilitação em sistemas de distribuição de água (Multicriteria analysis for water systems rehabilitation interventions prioritization). In *X Seminario Iberoamericano de Planificación, Proyecto y Operación de Sistemas de Abastecimiento de Agua (SEREA)*, 10-14 Jan., Morelia, Michoacán, Mexico (in Portuguese) (pdf in CD).

- [A4CP16\*] Carriço, N., Covas, D., Alegre, H., Almeida, M. C., Leitão, J.P. (2010). Estabelecimento de prioridades de reabilitação em redes de distribuição de água. Uma ferramenta multicritério de apoio à decisão (Establishment of rehabilitation priorities in water distribution networks). In *14º Encontro Nacional de Saneamento Básico*, 26-29 Oct., Porto, Portugal (in Portuguese) (pdf in CD).
- [A4CP17\*] Alegre, H.; Almeida, M.C.; Covas, D.; Cardoso, M.A.; Coelho, S.T. (2010). Gestão patrimonial de infra-estruturas em sistemas urbanos de água. Uma metodologia estruturada (Urban water infrastructural asset management – a structured methodology). In *14º Encontro Nacional de Saneamento Básico*, 26-29 Oct., Porto, Portugal (in Portuguese) (pdf in CD).  
(Also included in A2 under papers in scientific journals).
- [A4CP18\*] Santos Silva, M.; Cardoso, M.A.; Alegre, H. (2010). Avaliação do Desempenho na Gestão Patrimonial de Infra-Estruturas de Abastecimento Água e Águas Residuais e Pluviais (Performance assessment for water and wastewater infrastructures asset management). In *14º Encontro Nacional de Saneamento Básico*, 26-29 Oct., Porto, Portugal (in Portuguese) (pdf in CD).
- [A4CP19] Alegre, H. (2009). Current drivers, challenges and trends in infrastructure asset management. In *Seminar on Asset Management Program, Japan Sewage Works Association*, 28 Jul., Tokyo, Japan (pdf in CD).
- [A4CP20] Alegre, H. (2009). *Is strategic asset management applicable to small and medium utilities?* In *Asset Management of Small and Medium Wastewater Utilities* (ed. V.A. Tsihrintsis; K.P. Tsagarakis), Lab. Ecological Eng. and Tech., Dept. Env. Eng., Democritus Uni. of Thrace – Conference “Strategic Asset Management of Small and Medium Wastewater Utilities” e “2nd International Conference on Water Economics, Statistics and Finance”, International Water Association, Alexandroupolis, Greece, June 3-4 (pdf in CD).  
(Also included in A2 under papers in scientific journals).
- [A4CP21\*] Duarte, P., Covas, D., Alegre, H. (2009). PI for assessing effectiveness of energy management processes in water supply systems. In *PI09 Benchmarking water services - the way forward*, International Water Association, 12-13 Mar., Amsterdam, The Netherlands (pdf in CD).

## Keynotes

- [A4K01] Alegre H., (2012). Asset managers, policy makers and customers talking the same language – a key for moving our infrastructures into the future, IWA European Utility Conference Vienna’12, 18-20 Apr., Vienna, Austria (invited by Walter Kling, President of the organizing committee).
- [A4K02] Alegre, H. (2012). *A Gestão Patrimonial de Infraestruturas na IWA (Infrastructural Asset Management in IWA)*, XV SILUBESA - Simpósio Luso-Brasileiro de Engenharia Sanitária e Ambiental, 18-21 Mar., Belo Horizonte, Brazil (opening keynote of panel 1: Gestão de Infraestrutura (Asset Management): Uma Ferramenta para a Excelência da Gestão) (in Portuguese).

- [A4K03] Maia, J.M. (2012). *Gestão Patrimonial de Infraestruturas – AGS (Infrastructural Asset Management – AGS)*. XV SILUBESA - Simpósio Luso-Brasileiro de Engenharia Sanitária e Ambiental, 18-21 Mar., Belo Horizonte, Brazil. (Keynote address of panel 1: Gestão de Infraestrutura (Asset Management): Uma Ferramenta para a Excelência da Gestão) (in Portuguese).
- [A4K04] Coelho, S.T.; Alegre, H. (2012). *AWARE-P, keynote and demonstration of the AWARE-P software for the staff of the national water services regulator*, ERSAR, 17 Feb., Lisbon, Portugal (invited by the president of ERSAR) (in Portuguese).
- [A4K05] Alegre, H. (2012). On the pathway to water utilities mission: Focus on Asset Management and Customer relations. 7<sup>th</sup> IWA Regional Workshop - Sustainability of Infrastructure Towards Customer Awareness and Satisfaction in Water Utilities, International Water Association (IWA), Japan Water Works Association (JWWA) and Yokohama Water Works Bureau (YWWB), 2-3 Feb., Yokohama, Japan (opening address).
- [A4K06] Alegre, H. (2012). *Asset managers, policy makers and customers talking the same language – a key for moving our infrastructures into the future*. 7<sup>th</sup> IWA Regional Workshop - Sustainability of Infrastructure Towards Customer Awareness and Satisfaction in Water Utilities, International Water Association (IWA), Japan Water Works Association (JWWA) and Yokohama Water Works Bureau (YWWB), 2-3 Feb., Yokohama, Japan (invited by the President of the organizing committee).
- [A4K07] Feliciano, J. (2011). *Strategic Asset Management and its role in Utilities reform*. In ACWUA's 4<sup>th</sup> Best Practices Conference, 7-8 Dec., Sharm El Sheikh, Egypt.
- [A4K08] Feliciano, J. (2011). *Strategic Asset Management in low and middle income countries*. In 2<sup>nd</sup> IWA Development Congress and Exhibition, 21-24 Nov., Kuala Lumpur, Malaysia.
- [A4K09] Coelho, S.T. (2011). *Infrastructure asset management – the AWARE-P approach and software*. Keynote for the US Environmental Protection Agency, Apr. 27, Cincinnati, Ohio (Invited by USEPA).
- [A4K10] Feliciano, J. (2011). *Gestão Patrimonial de Infraestruturas: Mudança de paradigma para assegurar a qualidade e a sustentabilidade do sector (Infrastructure Asset Management: paradigm shift to ensure quality and sustainability of the water industry)*, 5<sup>a</sup> Expo Conferência da Água, 19-21 Oct., Lisbon, Portugal (in Portuguese).
- [A4K11] Alegre, H. (2011). *What makes asset management of urban water infrastructures so important in a more challenging world?* Workshop at National Taiwan University, 29 Sep., Taipei, Taiwan.
- [A4K12] Alegre, H. (2011). *Strategic Asset Management: Still Leading-Edge? An appetizer for 4<sup>th</sup> LESAM*. In 4<sup>th</sup> LESAM, 27 Sep., Mülheim an der Ruhr, Germany (opening session as Chair of the SAM SG).
- [A4K13] Maia, J.M. (2011). *GPI – Gestão Patrimonial de Infraestrutura – a experiência de Portugal em asset management (Infrastructural Asset Management – the Portuguese experience in asset management)*. In 26<sup>o</sup> Congresso Brasileiro de Engenharia



Sanitária e Ambiental, 25-29 Sep., Porto Alegre, Brazil (invited by Cassilda Teixeira, President of ABES) (in Portuguese).

- [A4K14] Alegre, H. (2011). *What makes asset management of urban water infrastructures so special?* 4<sup>th</sup> Developments in Water Treatment and Supply Conference, 7-8 Jun., Cheltenham, UK (invited by Professor John Bridgeman, President of the organizing committee).
- [A4K15] Alegre, H. (2011). *Are Australia and Portugal as distant as it may seem?* Information Days 2, Project Aus-Access4eu, 25 May, Madrid, Spain (invited by British Council, project coordinator).
- [A4K16] Alegre, H. and Coelho, S.T. (2011). *The ARC Infrastructure Asset Management Group (ARC IAM Group)*. ARC-VAV workshop, 4 Apr., Oslo, Norway.
- [A4K17] Alegre, H. and Coelho, S.T. (2011). *The AWARE-P Project*. ARC-VAV workshop, 4 Apr., Oslo, Norway.
- [A4K18] Alegre, H. (2011). *Sustaining Benchmarking at national/state level*. Workshop on Performance assessment of urban water and sanitation in India, CEPT University and All India Institute of Local Government, 28 Feb.-1 Mar., Mumbai, India (invited by Professor Dinesh Metha of CEPT University).
- [A4K19] Alegre, H. (2011). *The role of performance assessment: how have utilities around the world evolved*. Utility Leaders Forum - Exploring the Challenges of Sustainable Metropolitan Water Utilities, International Water Association and Indian Water Association, 3-4 Mar., Mumbai, India (invited by the organizers).
- [A4K20] Alegre, H. (2011). *A gestão patrimonial de infra-estruturas de serviços de águas no contexto do novo regime jurídico dos serviços de titularidade municipal (Decreto-Lei n.º 194/2009, 20 Aug.) (Infrastructure asset management of urban water services under the new law (Decreto-Lei n.º 194/2009, 20 Aug.))*. Keynote for the members of Advisory Board of ERSAR, 9 Feb., Lisbon (invited by the Advisory Board of ERSAR) (in Portuguese).
- [A4K21] Alegre, H. (2010). *AM and sustainability: a European perspective*. In SIAM 2010 - Sustainable Infrastructure and Asset Management National Conference 2010, Australian Water Association (AWA) and Water Services Association of Australia (WSAA), 23-24 Nov., Sydney, Australia (invited by the organizers).
- [A4K22] Alegre, H. (2010). *ISO standard on asset management systems: ISO/TC224/WG6, Workshop ISO/PC251. Asset Management – views and priorities*. Water Services Association of Australia (WSAA), 22 Nov., Sydney, Australia (invited by WSAA).
- [A4K23] Alegre, H. (2010). *Strategic Asset Management Specialist Group*. In Peak Bodies Meeting of the Australian Water Associations AM Specialist Network, 22 Nov., Sydney, Australia (invited by Chris Adams, WSAA).
- [A4K24] Alegre, H. (2010). *CARE-W & CARE-S overview, Industry forum – Halcrow*. In World Water Congress, International Water Association, 20-24 Sep., Montreal, Canada (invited by Will Williams, Halcrow).

- [A4K25] Alegre, H. (2009). *3<sup>rd</sup> Leading Edge Conference on Strategic Asset Management – opening address*. In 3<sup>rd</sup>, American Water Association and International Water Association, 11-13 Nov. Miami, USA (opening session as Chair of the SAM SG).
- [A4K26] Alegre, H. (2009). *Current drivers, challenges and trends of infrastructure asset management*. Keynote at the Seminar on Asset Management Program, Japan Sewage Works Association, 28 Jul., Tokyo, Japan.
- [A4K27] Alegre, H. (2009). *Asset Management of Medium and Small Wastewater Utilities*. IWA, 3-4 Jun., Alexandroupolis, Greece (opening session as Chair of the SAM SG).
- [A4K28] Alegre, H. (2007). *Gestão Patrimonial de Infraestruturas: preocupação antiga, discussão renovada (Infrastructure asset management: old concern, renovated discussion)*. Round table, ENEG 2007, APDA – Associação Portuguesa de Distribuição e Drenagem de Águas, 8 Nov., Lisbon, Portugal (invited by Frederico Mello Franco, President of the organizing committee) (in Portuguese).
- [A4K29] Alegre, H. (2007). *Asset management for a safe water: The need for an integrated management approach within utilities*. Techneau end-users workshop, 22-23 Oct., Lisbon, Portugal.
- [A4K30] Alegre, H. (2007). *Introduction to LNEC's activities and plans related to urban water infrastructures asset management*. Workshop WSSTP Pilot 2, Working Group: Asset Management, Water and Sanitation Technological Platform, 20 Oct., Lisbon, Portugal.
- [A4K31] Alegre, H. (2007). *Water infrastructure asset management: challenges and opportunities*. Workshop on Which knowledge for designing and managing 'critical infrastructures?', MIT-Portugal and OECD's Future Program, 26 Jun., Lisbon, Portugal (invited by the organizers).
- [A4K32] Alegre, H. (2007). *Case Study of Brandoa: Implementing an asset monitoring programme*. Managing Infrastructure Assets Conference, The Adam Smith Institute, 5-6 Jun., Amsterdam, The Netherlands (invited by the organizers).
- [A4K33] Alegre, H. (2007). *Performance assessment: a key step towards sustainable asset management Water*. Malaysia 2007 - Toward sustainable water management & use, The Malaysian Water Association, 14-16 May, Kuala Lumpur, Malaysia.

## Training courses and workshops

- [A4CW01] *iGPI - National Initiative for Infrastructure asset management of urban water services* (2012). Course 1 (7h), 10 Apr., Lisbon, Portugal and Course 2 (2 editions of 12h each), 8-9 May, Lisbon, Portugal; 10-11 May, Porto, Portugal. Promoted by LNEC/IST, Portugal (in Portuguese).
- [A4CW02] *Infrastructure asset management of urban water services – AWARE-P methodology and software* (2012) (2 editions, 30h per edition). Promoted by LNEC. 6-8 and 26-28 Mar., Lisbon, Portugal (in Portuguese).

- [A4CW03] *Infrastructure asset management and the DL 194/2009 – an opportunity for the Portuguese consulting companies* (2012) (5h). AWARE-P project Seminar, Promoted by LNEC, AcquaLifeExpo 2012, 23 Mar., Lisbon, Portugal (in Portuguese).
- [A4CW04] *Infrastructure asset management of urban water services* (2012) (15h), AWARE-P project. Promoted by LNEC/IWA/ABES/COPASA, 15-16 Mar., Belo Horizonte, Brazil (in Portuguese).
- [A4CW5] *The AWARE-P software and methodology* (2011) (15h). A workshop for the City of Montreal Water Department, 5-7 Dec., Montreal, Canada.
- [A4CW06] *Workshop on the AWARE-P IAM approach and software* (2011) (15h), Facsa and Udeal Sareak, 3-4 Oct., Bilbao, Spain.
- [A4CW07] *Infrastructure asset management of urban water services* (2011) (30h), AWARE-P project. Promoted by ERSAR and LNEC. 24-25 Mar., 31 Mar.-1 Apr. Mar., Porto, Portugal (in Portuguese).
- [A4CW08] *Infrastructure asset management of urban water services* (2011) (30h). Promoted by ERSAR and LNEC. 22-23 and 29-30 Mar., Coimbra, Portugal (in Portuguese).
- [A4CW09] *Infrastructure asset management of urban water services* (2011) (30h). Promoted by ERSAR and LNEC. 3-4 and 10-11 Feb., Évora, Portugal (in Portuguese).
- [A4CW010] *Infrastructure asset management of urban water services* (2011) (30h). Promoted by ERSAR and LNEC. 1-2 and 8-9 Feb., Faro, Portugal (in Portuguese).
- [A4CW11] *Infrastructure asset management of urban water services* (2011) (30h). Promoted by ERSAR and LNEC. 19-20 and 27-28 Jan., Lisbon, Portugal (in Portuguese).
- [A4CW12] *Infrastructure asset management of urban water services* (2009) (30h). “Agua y Ciudad” network, CYTED program, 30 Nov.-4 Dec., Florianópolis, Brazil.
- [A4CW13] *Infrastructure asset management of urban water services* (2009) (7h). AWARE-P project, 13 Oct., Lisbon, Portugal (in Portuguese).
- [A4CW14] *ISO 24500 standards: a tool to support urban water services management* (2009) (15h), ABES – Associação Brasileira de Engenharia Sanitária e Ambiental & SABESP, 18-19 Sep., São Paulo, Brazil (in Portuguese)
- [A4CW15] *ISO 24500 standards: a tool to support urban water services management* (2009) (15h). Promoted by LNEC / APESB / APRH / APDA – 1<sup>st</sup> ed.: 10-11 Mar.; 2<sup>nd</sup> ed.: 23-24 Mar., Lisbon, Portugal (in Portuguese).
- [A4CW16] *Infrastructure asset management of urban water services* (2007) (7h). LNEC. Course for the top and intermedium managers of AGS. AGS training programme 2006-2007, 19 Jun., Linhó, Portugal (in Portuguese).

## Webinars

- [A4W01] *AWARE-P IAM approach and software* (2012). Webinar for Magna Engenharia, 29 May, Porto Alegre, Brazil (in Portuguese).

- [A4W02] *AWARE-P IAM approach and software* (2012). Webinar for AM Peak Bodies Meeting, 8 Mar., Australia.
- [A4W03] *AWARE-P IAM approach and software* (2012). PAS project team, webinar for CEPT University, 18 Mar., Ahmedabad, India.
- [A4W04] *AWARE-P IAM approach and software* (2012). Webinar for USEPA (Steve Allbee) and WERF (Walter Graf), 15 Feb., Washington DC, USA.
- [A4W05] *AWARE-P IAM approach and software* (2012). Webinar for GHD, 23 and 28 Feb., Baltimore, USA.

## **AWARE-P in the media**

- [A4M01] Adams, C. (2012). New Metrics Tool for Water Infrastructure, Article for AM Council blog, Water Services Association of Australia, Apr..  
<http://www.amcouncil.com.au/news/343-new-metrics-tool-for-water-infrastructure.html>
- [A4M02] Li, H. (2012). News of the AWARE-P software launch, IWA website/Performance Assessment and Benchmarking Specialist Group:  
<http://www.iwahq.org/8j/networks/specialist-groups/list-of-groups/strategic-asset-management.html>
- [A4M03] Li, H. (2012). News of the AWARE-P software launch, IWA website/Strategic Asset Management Specialist Group: <http://www.iwahq.org/8j/networks/specialist-groups/list-of-groups/strategic-asset-management.html>
- [A4M04] Cheung, P. (2012). Asset management software. SAM SG website:  
<http://www.iwasam.org>
- [A4M05] WAMI (2012). AWARE-P asset management planning software released, interview, *WAMI - Water Asset Management International*, Mar., Vol 8, Issue 1, IWA Publishing (p. 20) (pdf in CD).
- [A4M06] WUMI (2012). AWARE-P asset management planning software released for public trial, interview, *WUMI - Water Utility Management International*, Mar., Vol 7, Issue 1, IWA Publishing (p. 23) (pdf in CD).
- [A4M07] The Suido Koron (2012). Interview in the scope of the 7<sup>th</sup> IWA Regional Workshop Sustainability of Infrastructure toward Customer Awareness and Satisfaction in Water Utilities, Vol.48, N.º 3 – 2012, (p. 37-38) (in Japanese) ISSN 1343-6007.
- [A4M08] Water 21 (2011). Leading the way on strategic asset management. *Helena Alegre interviewed by Keith Haywarth*, Water 21 Magazine of the International Water Association, Jun. (p. 50) (pdf in CD).
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LNEC team launched AWARE-P software. The AWARE-P infrastructure asset management (IAM) planning software for drinking water, wastewater and storm water services is an organized assessment environment where planning solutions or competing projects are measured up and compared through selected performance, risk and cost metrics. [read more »](#)

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Internationally, the water industry has acquired a major role in delivering cost-effective services to customers. In order to fulfil this role, the water industry is developing and applying sound asset management practice and focusing investors' attention on its value to the overall water utility. [read more »](#)

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**Asset Management Software**

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LNEC team launched AWARE-P software. The AWARE-P infrastructure asset management (IAM) planning software for drinking water, wastewater and storm water services is an organized assessment environment where planning solutions or competing projects are measured up and compared through selected performance, risk and cost metrics.

It comprises a portfolio of metrics and analysis tools that may be used individually for diagnosis and sensitivity gain purposes, or as part of the integrated planning procedure laid out by the AWARE-P IAM programme. This portfolio is fully aligned with the IWA performance assessment and benchmarking materials.

The release of this first public trial of the AWARE-P software also marks the launch of the new Baseform platform that will host and support it. Go to [baseform.org](http://baseform.org) to find out more, or go directly to the [AWARE-P IAM application](#) page to learn more and try it.

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- [A4M11] Água&Ambiente (2011). Software de gestão patrimonial de infra-estruturas quase a ser lançado (IAM software about to be launched). *Helena Alegre & Sérgio Coelho interviewed by Diana Catarino*, n.º 147, Feb. 2011, Year XIII (p. 24) (in Portuguese) (pdf in CD).
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- [A4M13] Alegre, H.; Matos, R. (2009). Improving infrastructure management, *Water 21, section "Research and Development"*, Aug. 2009, IWA Publishing (p. 56) (pdf in CD).



## A5. CV of Helena Alegre



**Helena Alegre**

**QUALIFICATIONS** University Degree: Civil Engineering, Hydraulics, from 1975/1976 to 1979/80, Instituto Superior Técnico, Lisbon.

PhD: Civil Engineering, 1992, Instituto Superior Técnico, Lisbon. Thesis Title: *Decision Support Tools for Technical Management of Water Distribution Systems*.

“Investigadora Habilitada”, 2008, LNEC – Laboratório Nacional de Engenharia Civil

Senior Research Officer, National R&D Career (with “R&D coordinator” degree)

Senior member of the Portuguese Corp of Engineers

Specialist on Urban Water Engineering by the Portuguese Corp of Engineers

**AWARDS** 1<sup>st</sup> prize of the 1992-1993 Award of the Portuguese Water Resources Association (for thesis or other research publications);

Maarten Schalekamp Award 1995 of the International Water Supply Association with the paper “Paving the way to excellence in water supply systems - a national framework for levels-of-service assessment based on consumer satisfaction”.

**AFFILIATIONS** International Water Association (IWA) – individual member and LNEC’s and country representative;

American Water Works Association (AWWA) - individual member (1998 &1999) and LNEC’s representative (1996-);

Portuguese Association of Water Resources (APRH);

Portuguese Corp. of Engineers (OE);

Portuguese Association of Water Supply and Sewerage (APESB);

Member of The Institute of Asset Management (MIAM) (UK) (2007-2009).

### CURRENT ACTIVITY

Helena is the Senior Vice-President of the International Water Association (IWA) and Senior Research Officer at the Urban Water Division of LNEC, the National Civil Engineering Laboratory of Portugal (2002-).

She heads the Portuguese Standardisation Committee for Water Supply and Sanitation (2002-), and represents Portugal at the European Standardization Committee CEN/TC164 - *Water Supply* and at the International Standardization Committees ISO/TC224 – *Service activities relating to drinking water supply and sewerage* (2002- ) and ISO/PC 251 – *Asset management* (2010- ). She is a member of the Advisory

Board of ERSAR, Portugal's Regulator for Water and Solid Waste Services (2004-). She is in the editorial board of IWA Journal AQUA (2001-) and *Águas e Resíduos* (2005-).

She has wide national and international experience in R&D on urban water systems, particularly in the fields of performance assessment and strategic asset management; she was scientific coordinator of AWARE-P (1,2 M Euro, [www.aware-p.org](http://www.aware-p.org), 2008- Jan. 2012) and has high level responsibilities in the coordination of two major on-going projects on planning and management of urban water systems: TRUST (7FP of the EU, 31 partners, 7 M Euro from the EU, [www.trust-i.net](http://www.trust-i.net), 2011-2015) and the National Initiative on infrastructure asset management ([www.iniciativaGPI.org](http://www.iniciativaGPI.org)) (2012-2013). She is "senior international consultant" of the Chinese National Project "Study and demonstration of performance assessment of water utilities", coordinated by Beijing Capital Co.

She has other relevant roles within IWA: she chairs the IWA Specialist Group on Strategic Asset Management (2007- ), is member of the Financial and Investment Committee, of the Board of Directors, of the Strategic Council (2010- ) and of the Management Committee of the Specialist Group on Benchmarking and Performance Assessment (2010- ); she has just been appointed as series editor (with Enrique Cabrera) of the Manuals of Best Practice of IWA Publishing.

She is an occasional lecturer of post-graduate courses at various Portuguese Universities. She currently supervises 2 PhD thesis on infrastructure asset management of urban water services. She regularly teaches short training courses on topics such as water losses, water networks modelling, asset management, performance indicators and ISO 24500 standards.

## HIGHLIGHTS OF PAST ACTIVITY

Helena was the head of LNEC's Urban Water Division (Hydraulics and Environment Dept.) between 2002 and 2010, until her election as IWA Senior Vice-President.

Helena's professional activity has always been related to urban water services and infrastructure asset management: applied research and consultancy projects in the field of analysis, diagnosis, design and decision support for water distribution systems, including strategic planning, system rehabilitation water losses control. She developed and is implementing a comprehensive research program on Water Infrastructure Asset Management and she prepared a one-year advanced course on technical management of water systems for Portugal and for Latin America (Water & City Network, CYTED).

Among many other national and international projects she participated in, she lead several initiatives in the scope of performance indicators of water services: "PI international field test" (2000-2004), an IWA project; "PI-Waters – National initiative for testing and implementing the IWA PI Systems in Portugal", a collaborative project financed by the participating utilities (2001-2004); "Quality of service assessment system for drinking water, wastewater and urban waste services", a project contracted by ERSAR for the elaboration of the 1<sup>st</sup> generation of the regulatory assessment system, in place since 2005; "2<sup>nd</sup> generation of the ERSAR quality of service assessment system" (2010), a similar project for the revision and consolidation of the 1<sup>st</sup> generation system. She has often participated as adviser, training provider or keynote speaker in Europe, South and North America, Africa, India, Asia Pacific and Australia.

She chaired the EU Research Network Cost Action C18 - Performance assessment of urban infrastructure services: the case of water supply, wastewater and solid waste (2004-2008). She was a member of the Advisory Group of WHO/UNICEF Joint Monitoring Program for water supply and sanitation. (1998-2005) and the president of the Environment Advisory Board of EPAL, S.A. (Lisbon Waterworks) (2003-2011).



She has been a very active member of the International Water Association (IWA) and its predecessor IWSA since 1988, when she participated as OC member of IWSA First Regional European Conference. She was the first female member of the Executive Committee (currently the Board of Directors) of IWSA/IAWQ/IWA (1999-2001). She was a member of the Governing Assembly of IWA (1997-2007); president of the Portuguese National Committee of IWA (1999-2007); member of the “Scientific and Technical and Technical Council Core Group” (1999-2002); secretary of the IWSA/IWA Distribution Division and of the Planning & Construction, the Operations & Maintenance and the Materials & Corrosion Standing Committees (1995-2001). She was the founder and leader of the IWA project on “*Performance indicators*” since its 1997 inception to its conclusion in 2006, and the main responsible for the establishment of the IWA performance indicators systems, today an international water industry reference. She was president of the Scientific and Program Committee (STC) and member of the Organising Committee (OC) of LESAM 2009 – 3<sup>rd</sup> IWA Leading Edge Conference on Strategic Asset Management (Miami, USA, Nov. 2009) and of LESAM 2011 (Mülheim an der Ruhr, Germany, Sept. 2011), OC member and SPC president of the IWA Conference “SAM of small and medium water utilities”, Alexandroupolis, Greece, 2009, and president of the OC and of the SPC of LESAM 2007 (Lisbon, Oct. 2007). Helena also organised several workshops and panel discussions related to asset management, such as “Paving the way for a sustainable asset management of urban water infrastructures: research challenges and opportunities” session at 5th WWF (OC president, Mar. 2009), Vienna WWC Workshop on Strategic Asset Management – Phase II (OC president, Sept. 2008), She published three books and several articles in IWA Publishing, related to performance indicators systems and to strategic asset management of urban water systems. Helena has (co-)organised more than 20 workshops in the scope of the IWA PI task force and was a SPC member of the Conferences PI 08 (Mar. 2008) and PI2011 (Mar. 2011).

She has supervised 4 PhD thesis and several master theses already concluded. In total, she (co-)organised more than 50 international and 30 national technical and scientific meetings.

## BOOKS

Helena is the author or co-author of about 400 publications, including the following books:

Alegre, H., Matos, R., Neves, E. B., Cardoso, A., Duarte, P., Baptista, J. M., Pássaro, D. A., Pires, J. S., Freixial, P., Lobo, F., Simas, L., Ribeiro, A., Aleixo, C., Ferreira, R., Rodrigues, R., Moinante, M. j., Mira, F., Franco, M. J., Ramos, R., Nunes, M., Lopes, R., Silva, J., Costa, A., Ramos, I., Rodrigues, C., Ruivo, F., Alexandre, C., Pedro Gonçalves, P., Andrade, I., Alves, D. (2011). Guide for the assessment of the quality of water and waste services. Second generation of the performance assessment systems for regulation (version 3.0). ERSAR and LNEC, (261 p., in Portuguese) (electronic version available at [www.ersar.pt](http://www.ersar.pt)).

Alegre, H.; Covas, D. (2010). Guide for the infrastructure asset management of water transmission and distribution systems, ERSAR, LNEC & IST, Series “ERSAR Technical Guides, Vol. 16, ISBN 978-989-8360-04-5 (505 p., in Portuguese) (electronic version available at [www.ersar.pt](http://www.ersar.pt)).

Alegre, H.; Matos, R.; Neves, E.B.; Cardoso, M.A.; Duarte, P.; Baptista, J.M.; Pássaro, D.; Santos, R.F.; Pires, J.S.; Fernandes, T.; Almeida, J.; Escudeiro, H.; Lobo, F.; Nunes, M.; Silva, J.; Costa, A.; Lopes, R.; Ribeiro, A.; Silva, J.C.; Neves, T.; Freixial, P.; Ferreira, R.; Ramos, R.; Rodrigues, R. (2009). Quality assessment system for the regulation of the water and waste services. First generation of the performance indicators system. Series “ERSAR Technical Guides” Vol. 12, IRAR e LNEC, ISBN 978-989-95392-8-0 (175 p., in Portuguese) (electronic version available at [www.ersar.pt](http://www.ersar.pt)).

Alegre, H.; Almeida, M.C. (eds.) (2009) . Strategic asset management of urban water infrastructures, IWA Publishing, ISBN 97843391869 (536 p.).

Alegre, H. (2008). Water infrastructure asset management, Research Program, Series «Thesis and Research Programmes», LNEC, Lisbon, ISBN 9789724921341 (385 p.) (in Portuguese).

Alegre, H.; Baptista, J.M.; Cabrera JR., E., Cubillo, F.; Duarte, P.; Hirner, W.; Merkel, W.; Parena, R. (2006). Performance indicators for water supply services, Second Edition, Manual of Best Practice Series, IWA Publishing, London, ISBN 1843390515 (310 pp.) (also published in Portuguese, French, German (adapted), Iranian language and Chinese).

Coelho, S.T.; Loureiro, D., Alegre, H. (2005). *Modelling and analysis of water supply systems*, IRAR & LNEC, ISBN 972-99354-8-3 (335 pp., in Portuguese).

Alegre, H.; Coelho, S.T.; Almeida, M.C.; Vieira, P. (2005). *Water losses control in drinking water distribution systems*, IRAR, INAG & LNEC, ISBN 972-99354-4-0 (306 pp., in Portuguese).

Alegre, H.; Hirner, W. Baptista, J.M.; Parena, R. (2000). *Performance indicators for water supply services*, 1st edition, Manual of Best Practice Series, IWA Publishing, London, ISBN 1 900222 272 (160 pp.) (published also in French, Chinese, German, Portuguese and Iranian; informally translated into Spanish, Czech language and Japanese).

Alegre, H. (1992). Decision support tools for technical management of water distribution systems, PhD Thesis, Vol. 1, Series “Thesis and Research Programmes”, LNEC, Lisbon (598 pp., in Portuguese).

Alegre, H.; Almeida, M.C. (1994) - Framework for the assessment of levels-of-service, Vol. 12, Series “Management of water supply, waste water and solid waste systems”, J.M.Baptista & R. Matos (eds.), LNEC, Lisbon (167 pp., in Portuguese).



