Iniciativa Nacional
para a Gestão Patrimonial
de Infraestruturas

The iGPI collaborative project

– moving IAM from science to industry

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IWA International Water Association | Leading-Edge Strategic Asset Management

LABORATÓRIO NACIONAL DE ENGENHARIA CIVIL | INSTITUTO SUPERIOR TÉCNICO Universidade Técnica de Lisboa

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Presentation layout

- Context for the initiative
- IAM planning methodology
- A collaborative project: why and how
- The initiative in some detail
- IAM strategic and tactical plans
- Cases
- Concluding remarks

Context

- Portugal, 1970's-2000's: sharp rise in urban water service coverage and in service standards.
- Growth was not matched by adequate capital maintenance of the previously existing infrastructure.
- Although relevant structural reforms were undertaken as full coverage neared, the deficit in infrastructure asset management continued to deepen to the present day.

Reversing the trend

- Structuring regulation activities established in last 12 years, including a national PI regulatory system:
  - Initially for private operators
  - Now compulsory for all 350 utilities
- New 2009 legislation (effective 2013): utilities serving 30,000 and above must have an infrastructure asset management system in place.
- Several relevant development efforts:
  - LNEC/IST/ERSAR best practice IAM manuals
  - AWARE-P project

February 11, 2011

About the project

Project summary

The objective of AWARE-P is to develop and implement in water utilities a structured procedure for infrastructure asset management (IAM). Based on previous and new R&D results, an open-source, professional-grade computer application will be developed, along with manuals of best practice and learning materials.

The project aims at providing water utilities with the know-how and the tools needed for efficient decision-making. Other objectives include the incorporation within the industry of structured and technically sound approaches to system rehabilitation planning; the dissemination of structured IAM decision-making concepts among technical and political decision-makers; and the promotion of

January 20, 2011

The AWARE-P vision

AWARE-P aims at providing water and wastewater utilities with the know-how and tools needed for efficient decision-making in the scope of infrastructure asset management of urban water services.

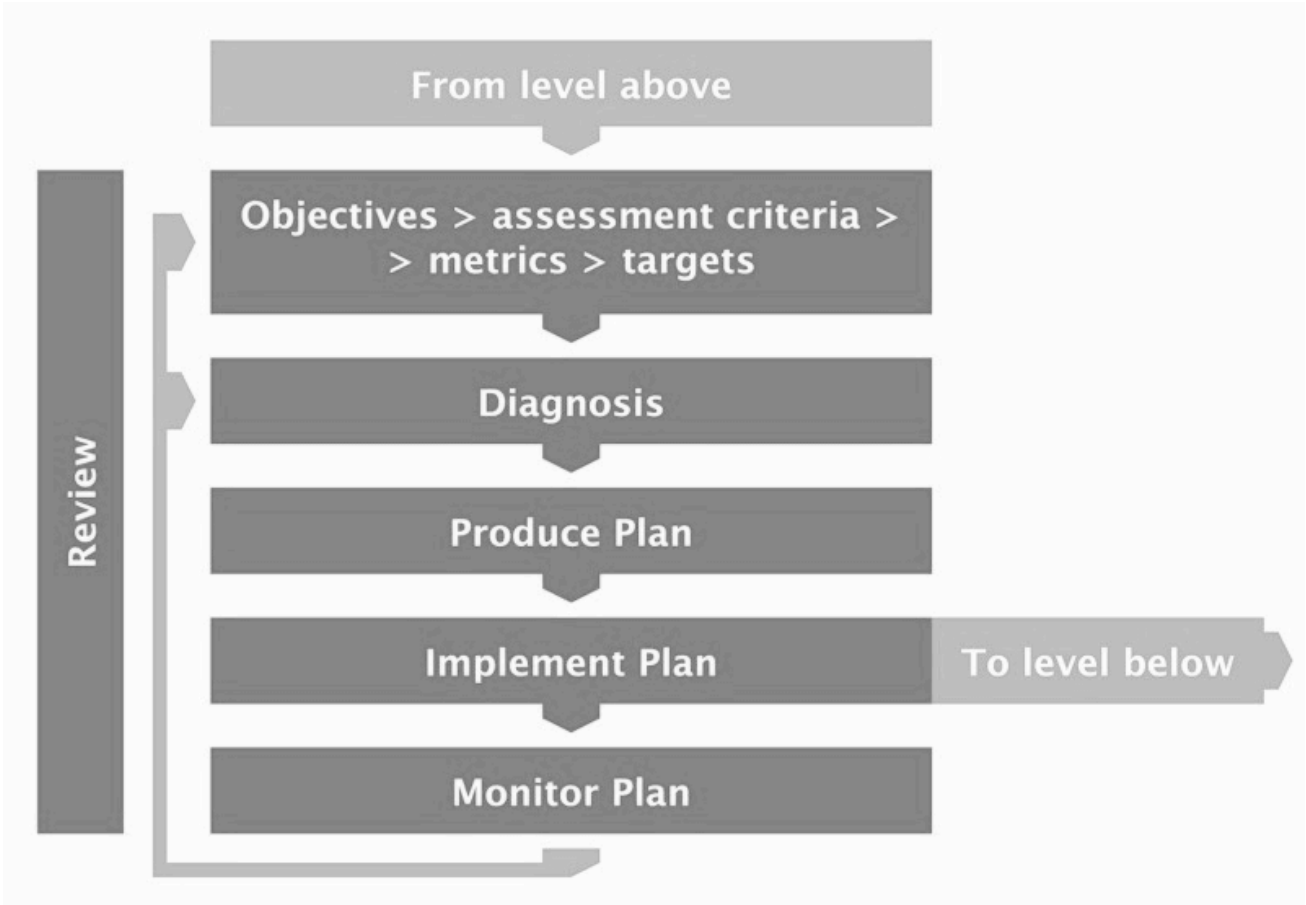
AWARE-P

- LNEC, IST, SINTEF, ERSAR, Addition, 4 utility partners
- A project aimed at providing water and wastewater utilities with the know-how and tools needed for efficient IAM decision-making.
  - methodologies, best practice manuals, software, training courses
- A direct successor to EU R&D projects CARE-W and CARE-S, trying from the outset to reach the industry and society with useable, effective products that can make a difference in capacity building and support to the planning process.

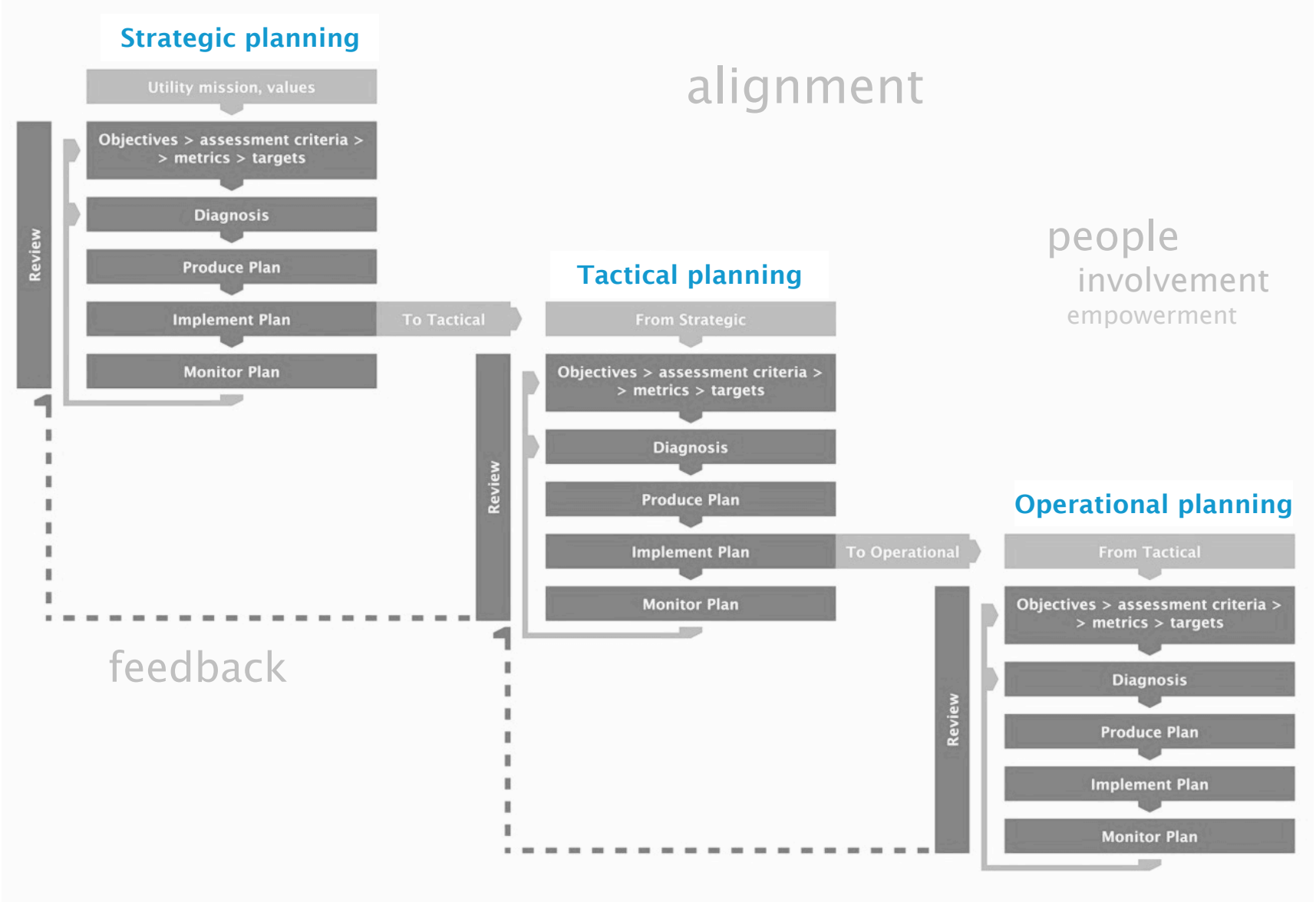
The AWARE-P IAM planning methodology

- IAM as an objective-driven, continuous improvement management process
- Service-oriented IAM planning for long-term sustainability
- Embedding key ISO 55000 requirements
- For the decision-makers: a transparent, defendable planning methodology to support the best choice of solutions, balancing performance, risk and cost

IAM at each planning level – a pdca loop



Through decisional levels…



iGPI — Portugal's National IAM Initiative

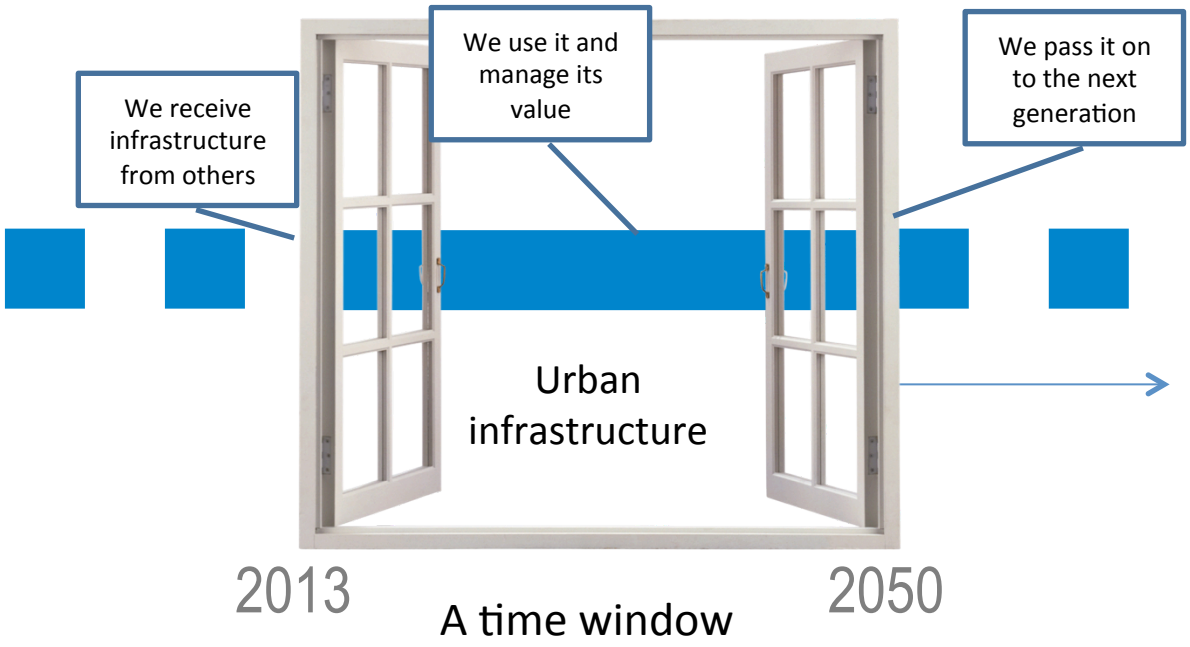
- April 2012 – October 2013
- Launched to help broaden the impact of those methodologies and products and reach out to utilities nationwide in a significant way.
- Used a tried and tested format at LNEC
- Aimed at assisting a representative sample of utilities of diverse size and context in developing their own IAM systems and plans through a joint training and capacitation program.

A national-level effort was needed

- To create awareness to the need for long-term sustainability through integrated IAM planning;
- To establish best practice principles and produce effective business cases for broader roll-out;
- To offer consistent training for the utilities;
- To emphasize the need for in-house development and involvement at all levels of the organization;
- To bring to evidence that long-term IAM planning is needed in larger and smaller utilities alike.

Why a collaborative industry-wide format?

- Generalized implementation of strategic infrastructure asset management of urban water systems requires a considerable shift in mind-set
  - For the water sector, but also for national or regional policy makers, politicians, the media, society.



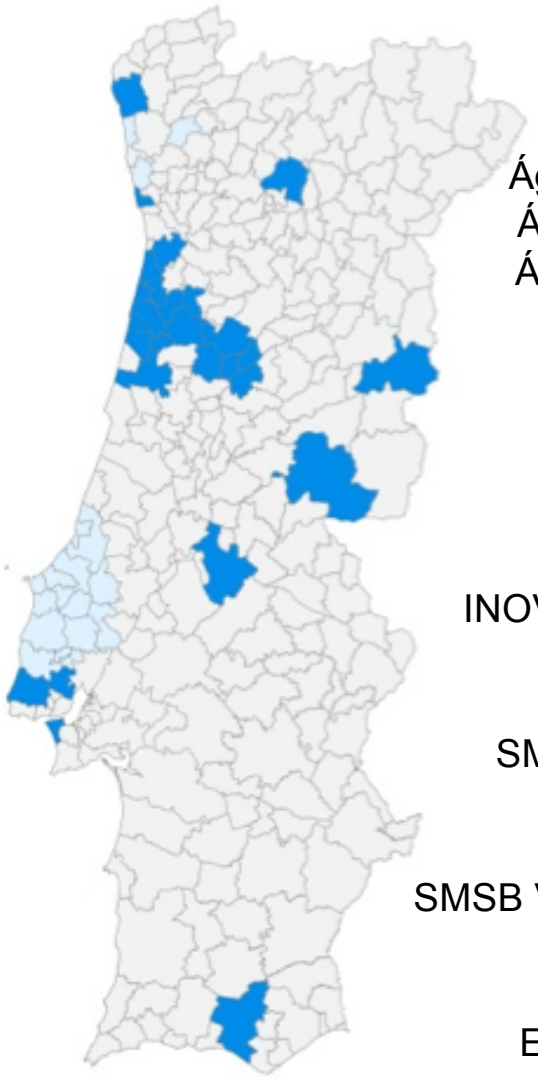
How does it work?

- A combination of strategic method/tool/process implementation with practical problem solving, and hands-on capacitation
- Large-scale, usually involving 10-20 utilities
- Multi-stakeholder R&D projects: joint teams of researchers, developers and users of the products
  - working 'with' instead of working 'for'
- The utilities follow a common program, each with a designated team that develops the work in-house, with support from LNEC/IST.
- A common phased schedule (4 x 4 months), with training and frequent group presentation of results.
- Strong networking effect.

An effective format

- Mutual validation and recognition from a peer group provides a greater comfort zone for early adopters.
- The scale of these projects ensures visibility and impact in national terms, contributing to creating the aimed awareness and appetite for the theme.
- The development of representative cases has a significant leverage impact, demonstrating applicability and allowing for further learn-by-example training.

Participating utilities



	# Households served	Water supply	Wastewater	Storm water	Other public services	Bulk	Retail	Municipal service	Municipal company	Multi-municipal company	Private concession
Águas de Coimbra	73,927	■	■	■	■		■		■		
Ág. Região Aveiro	131,694	■	■			■	■			■	
Águas do Planalto	30,738	■				■	■				■
CM Sabugal	11,929	■	■	■	■	■	■	■			
EMAR Vila Real	24,612	■	■	■	■	■	■		■		
INDAQUA	172,375	■	■			■	■				■
Infraquinta	1,315	■	■	■	■		■		■		
Inframoura	12,874	■	■	■	■		■		■		
Infralobo	1,822	■	■	■	■	■	■		■		
INOVA - Cantanhede	17,580	■	■	■	■	■	■		■		
SM Abrantes	22,143	■			■	■	■	■			
SMAS Almada	94,968	■	■	■		■	■	■			
SM Castelo Branco	33,679	■	■	■	■	■	■	■			
SM Loures	153,754	■	■	■	■		■	■			
SMAS Sintra	170,378	■	■	■		■	■	■			
SMSB Viana do Castelo	37,128	■	■		■	■	■	■			
Águas do Oeste	138,136	■	■			■				■	
AGERE	69,086	■	■	■	■	■	■		■		
EAmb Esposende	16,488	■	■	■	■		■		■		

Project plan

	Objectives	Outcomes
Phase 0 M0	Warm-up; project set-up; beginning of baseline data collection	• Detailed planning of activities; • Definition of teams and project managers for each participant water utility; • Definition of information to be collected.
Phase 1 M1-M4	**Strategic** & **tactical** planning levels: Objectives and diagnosis	• Concise report containing: objectives, assessment criteria, metrics and targets to strategic and tactical planning (macro) levels; • Strategic level diagnosis; • Data survey priorities.
Phase 2 M4-M8	**Strategic** & **tactical** planning levels: Plan development	• Full version of strategic IAM plan; • Prioritization of network sectors at the tactical intervention level.
Phase 3 M8-M12	**Tactical** planning level: Formulation of IAM alternatives for pilots	• First draft of the detailed IAM tactical plan containing: – objectives, criteria, metrics and goals; – diagnosis of priority area(s); – identification of infrastructural and non-infrastructural alternative solutions.
Phase 4 M12-M16	**Tactical** planning level: Evaluation and comparison of alternatives	• Full version of tactical IAM plan, including detail tactical planning for the priority (pilot) area(s); • Procedures for the collection, organization and quality control of data relevant to IAM: e.g. GIS, work orders, condition assessment / inspections, accounting data.

A strategic IAM plan template

1. Vision and mission
2. Existing planning frameworks
3. Planning horizon
4. Strategic objectives, metrics and targets
5. Scenarios
6. Strategic diagnosis
7. Development of strategies
8. Assessment of resources
9. Monitoring and reviewing procedure

A tactical IAM plan template – global level

1. Summary of strategies and strategic objectives
2. Time horizons – planning horizon and impact horizon
3. Tactical objectives, metrics and targets
4. Scenarios
5. System-wide tactical diagnosis
   i. System sectorization
   ii. Base case assessment through time horizon, using metrics selected
   iii. Priorization of system sectors
   iv. Branch off to individual sector tactical plan
6. Development of general tactical interventions
7. Assessment of resources
8. Monitoring and reviewing procedure

A tactical IAM plan at individual sector level

(from general tactical plan)

I. Summary of tactical objectives, metrics and targets

II. Sector-level metrics and targets

III. Detailed sector-level tactical diagnosis

IV. Technical development of tactical intervention alternatives

V. Assessment of base case and intervention alternatives through metrics and targets selected

VI. Comparison and selection of tactical intervention

VII. Detailed formulation of tactical intervention

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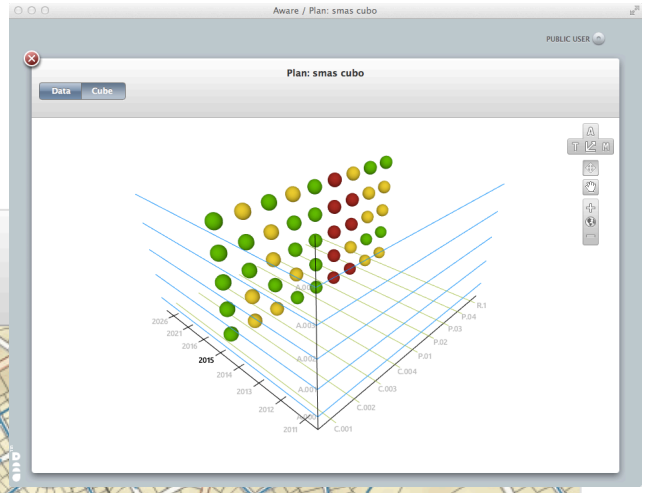
16 strategic IAM plans

Tools: the AWARE-P software



File: SewerGravityMains05012013.shp.zip

Viewer | Data

Layers

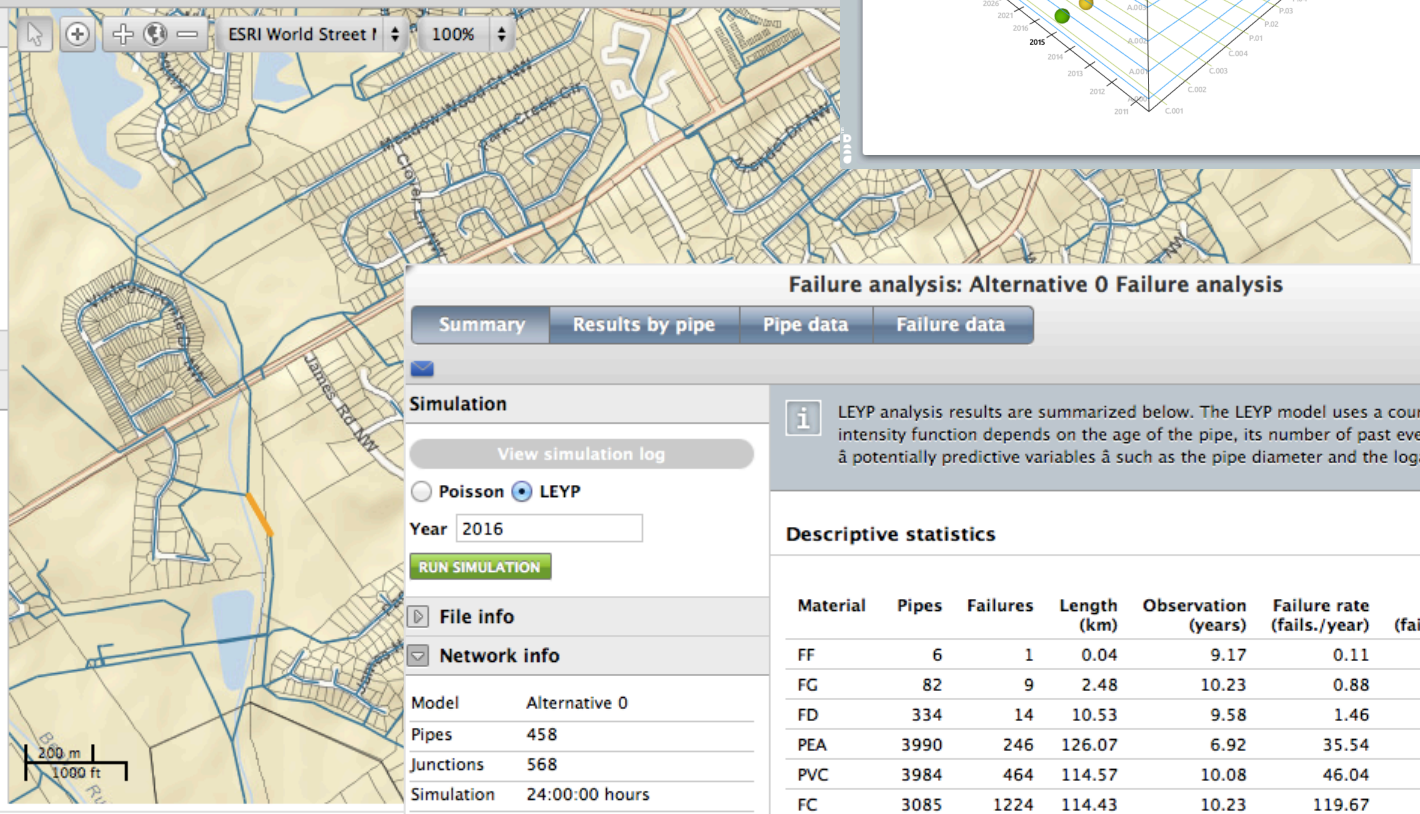
- SewerGravityMains05012013.shp.zip (75868)
- SewerServiceAreas05012013.shp.zip (225) [remove] [open]
- Parcels05012013.shp.zip (268904) [remove] [open]

ADD LAYER

Style

Info

OBJECTID	30419
STRUCT_TYP	SI
INVERT_IN	836.04
INVERT_OUT	835.36
LENGTH	402.12
DIAMETER	48
SLOPE	0
DATE_APPRO	1899-12-30T00:00:00.000+0000
PROJECT_NU	S1977C0056
WATERTYPE	Sewage
MATERIAL	RCP
SUBTYPE	3



Failure analysis: Alternative 0 Failure analysis

Summary | Results by pipe | Pipe data | Failure data

Simulation

View simulation log

Poisson / LEYP

Year 2016

RUN SIMULATION

File info

Network info

Model	Alternative 0
Pipes	458
Junctions	568
Simulation	24:00:00 hours
Hydraulic Step	00:15:00
Units	SI
Headloss Formula	HW

CHANGE

LEYP analysis results are summarized below. The LEYP model uses a counting process wh
intensity function depends on the age of the pipe, its number of past events and a vector
â potentially predictive variables â such as the pipe diameter and the logarithm of pipe le

Descriptive statistics

Material	Pipes	Failures	Length (km)	Observation (years)	Failure rate (fails./year)	Failure rate (fails./km/year)
FF	6	1	0.04	9.17	0.11	3.11
FG	82	9	2.48	10.23	0.88	0.35
FD	334	14	10.53	9.58	1.46	0.14
PEA	3990	246	126.07	6.92	35.54	0.28
PVC	3984	464	114.57	10.08	46.04	0.40
FC	3085	1224	114.43	10.23	119.67	1.05
	11481	1958	368.11	8.94	218.92	0.59

LEYP aggregated results, estimated parameters and significance test

Material	Predicted failure rates (fails./year)	Predicted failure rates (fails./km/year)	α	δ	β_0	β_{diam}
FF	0.00	0.00	0.0000	0.0000	94.3181	-0.6156	-59

CASE #1 – Midsize utility

A tech-developed utility; well trained staff; good inventory; full coverage, reliable GIS; good monitoring systems; calibrated hydraulic models available for entire water supply system.

- The availability of large amounts of reliable information allowed for the use of sophisticated, data-demanding metrics to address aspects such as pressure adequacy and low velocities.
- Automated procedures have been implemented in order to calculate the selected metrics.
- Some metrics at the strategic level result from the aggregation of more detailed metrics adopted at the tactical level.
- Work orders information unsuitable for reliability analysis.
- With an IAM metrics system in place, the automation of a significant part of the process reduces the time and manpower needed for detail diagnosis — more sectors could be addressed.

CASE #4 – Large multi-municipal utility

A recent merger of 10 municipal water & wastewater services; diverse contexts, challenges, and data availability/ quality; certified BSC management system; uneven, incomplete GIS.

- iGPI was seen by the utility as an opportunity to help establish sound organizational processes.
- Challenge: *prioritize the municipal systems with higher rehabilitation needs, in a defendable, accountable way.*
- The IAM metrics system developed helped address this challenge.
- The existing BSC implementation did not address long-term effects. Several new metrics have been included and a transition process has been devised towards a fully satisfactory BSC implementation.
- iGPI also gave rise to multiple new data collection procedures (GIS, work orders), and harmonization among information systems.

Concluding remarks #1

- IAM is progressing rapidly and with steady steps in Portugal's urban water services.
- There is a long way to go — it's a long-term journey towards infrastructural sustainability.
- It is about customers, but above all, their grandchildren

Concluding remarks #2

- AWARE-P and other efforts helped initiate the process: a structured IAM approach, technical guides, training courses, open-source software.
- Learnings from countries such as Australia and New Zealand were crucial in this process.
- The above methods helped lay the foundations for new regulatory requirements and for launching the iGPI collaborative effort.

Concluding remarks #3

- The results achieved have had, and will continue to have, a significant impact on the participating utilities, and on the country's industry as a whole.
- The variety of contexts successfully addressed is a credit to systematic, well-devised IAM processes
- The collaborative project format has proven to be particularly suited to the task: quicker and more effective cultural change, technical uptake and process implementation.

iGPI directly involves over 100 people, among utility project teams, tech support, R&D and consultancy professionals.

The authors wish to thank the outstanding contributions from all the utilities, organizations and individuals that take part in the project.

Thank you

www.iniciativaGPI.org