

Croatia Study Tour to Portugal

Reducing Non-revenue Water The experience of Águas de Cascais

April 27th, 2023

Águas de Cascais

Cascais



Tourism

1.445.194 overnight stays in 2022

<https://travelbi.turismodeportugal.pt/alojamento/dor-midas-por-municipio/>

Trade and Services



PORTUGAL



Population: 214.134



Families: 86.687



Housing: 110.412



Buildings: 44.429

Source: Census 2021

https://ine.pt/scripts/db_censos_2021.html



Águas de Cascais

Who we are

Since 2001, AdC - Águas de Cascais, S.A., has been the concessionaire of the Cascais Municipal Water Distribution and Sewage Drainage System

119.154 Customers

107.084 domestic customers

10.669 non domestic customers

1.401 municipality costumers

Certified in standards

NP EN ISO 9001:2015

NP EN ISO 14001:2015

NP ISO 45001:2019



Águas de Cascais

Concession Contract

Clause 9th

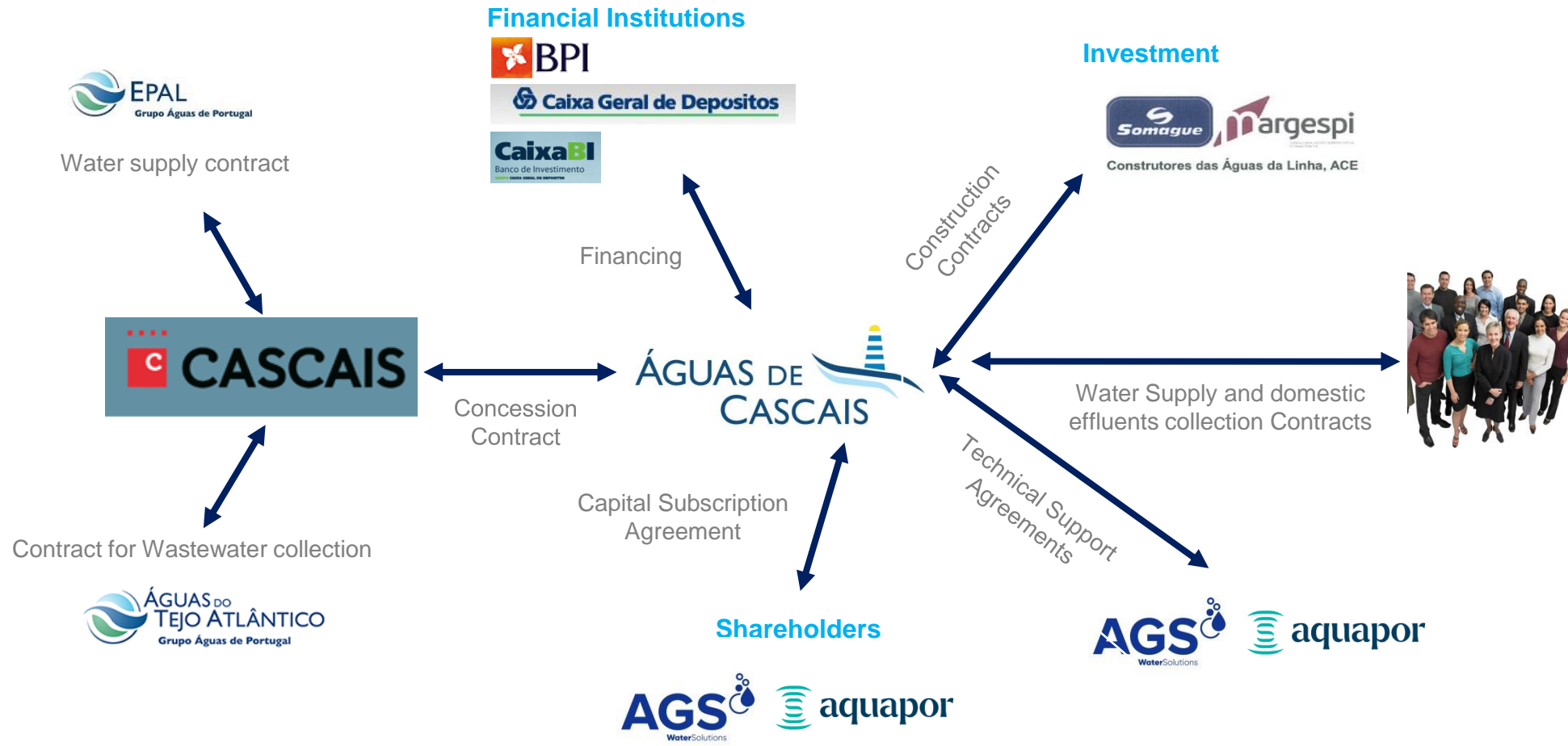
Purpose

*The purpose of the Concession is the Joint Exploration and Management of the **Maintenance of the Rainwater System**, and the Joint Exploration and **Management of municipal public services for the catchment, treatment and distribution of water for public consumption and the collection and rejection of domestic effluents** in the perimeter as defined in Clause 13 (Cascais Municipality), including the **construction, extension, repair, renovation, maintenance, and improvement of all Facilities, Infrastructures and Equipment** that make up the Water Supply and Sewage Systems, as well as all Works, In accordance with the Investment Plan, the Base Case and the Exploration Program.*



Águas de Cascais

Concession Contract

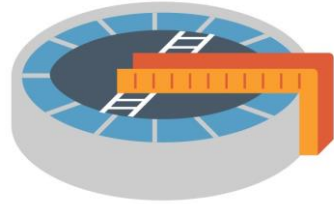


Águas de Cascais

Water Supply System



16 Own water sources:
- 15 ground water
- 1 surface water (Albufeira Rio da Mula)



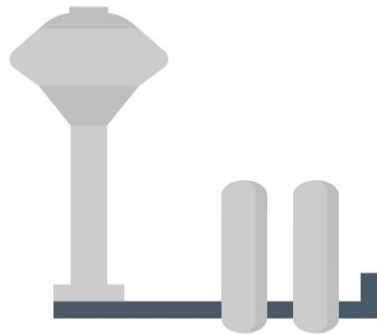
2 Water Treatment Plants (WTP)



25 Water Reservoirs (91.000 m³)

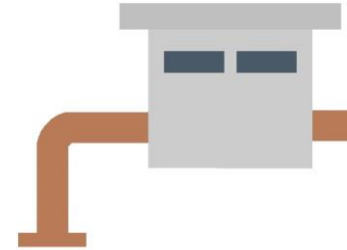


1.421 km Water Supply Network



24 Water supply pumping stations

Wastewater Drainage System



22 Domestic sewage pumping stations

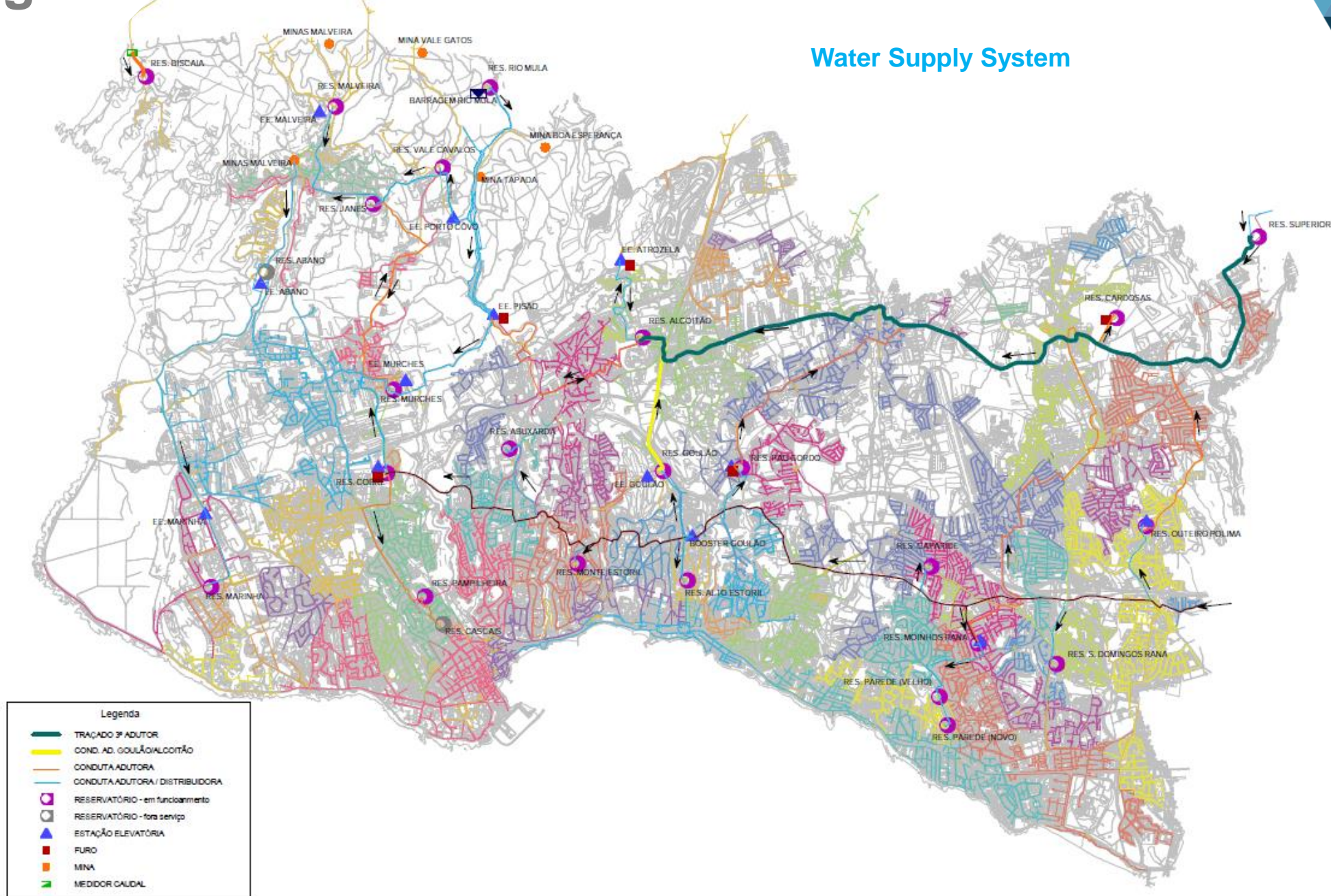


789 km Gravity sewage pipes



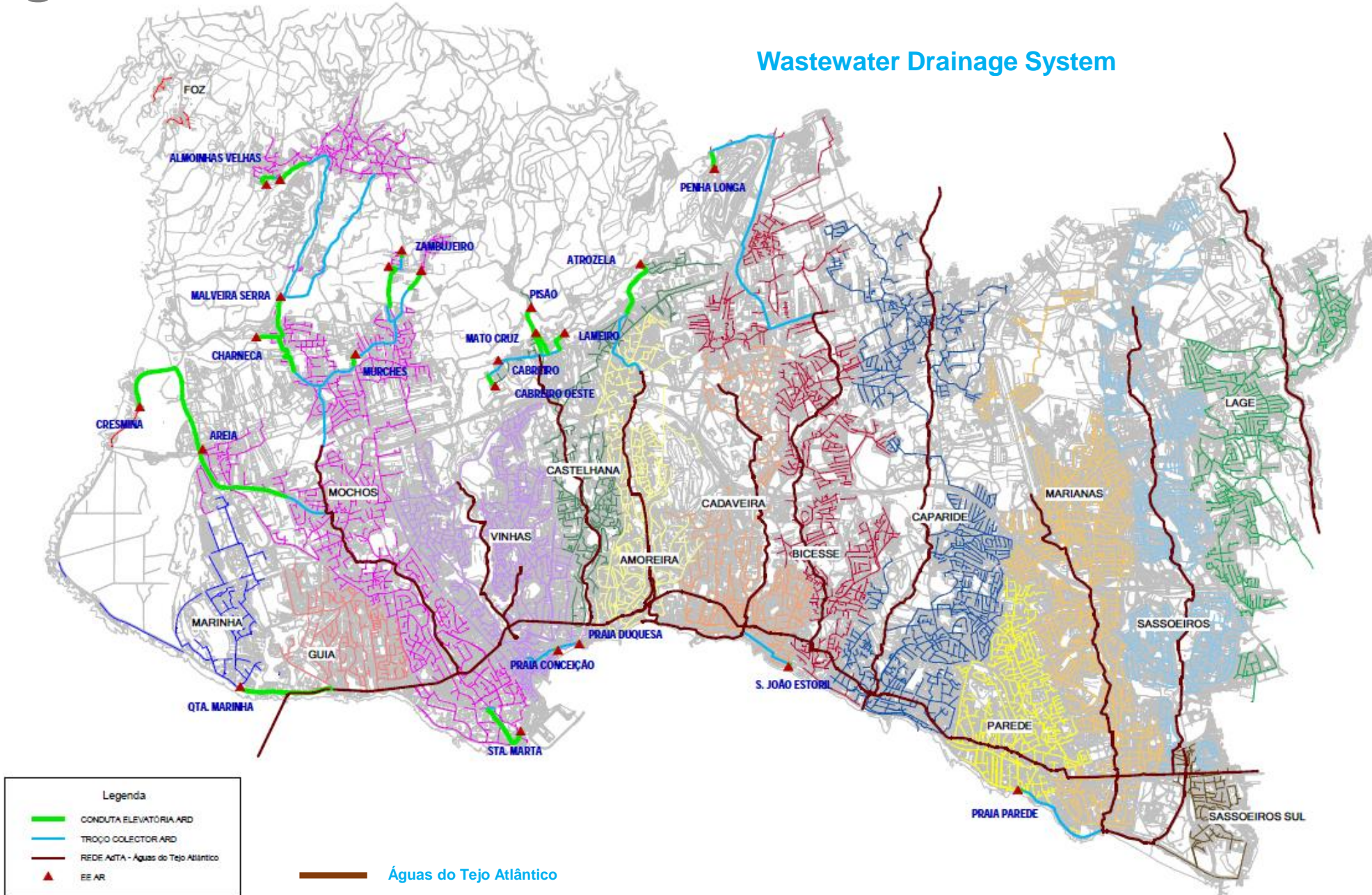
Águas de Cascais

Water Supply System



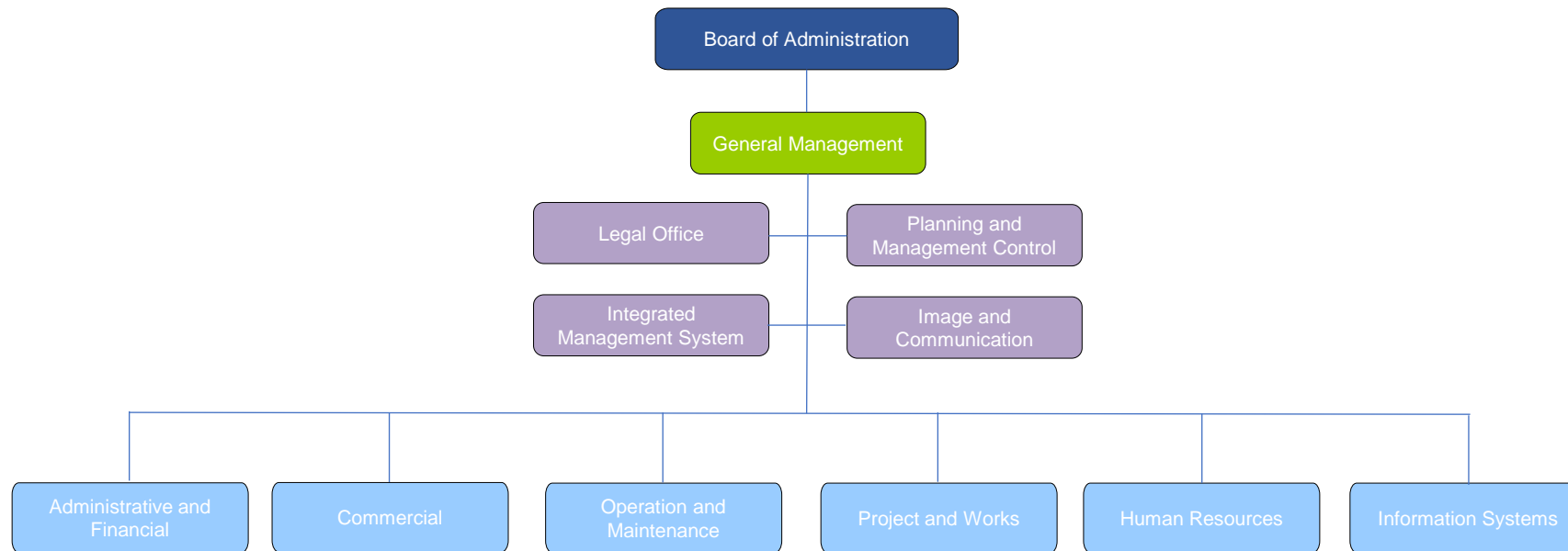
Águas de Cascais

Wastewater Drainage System

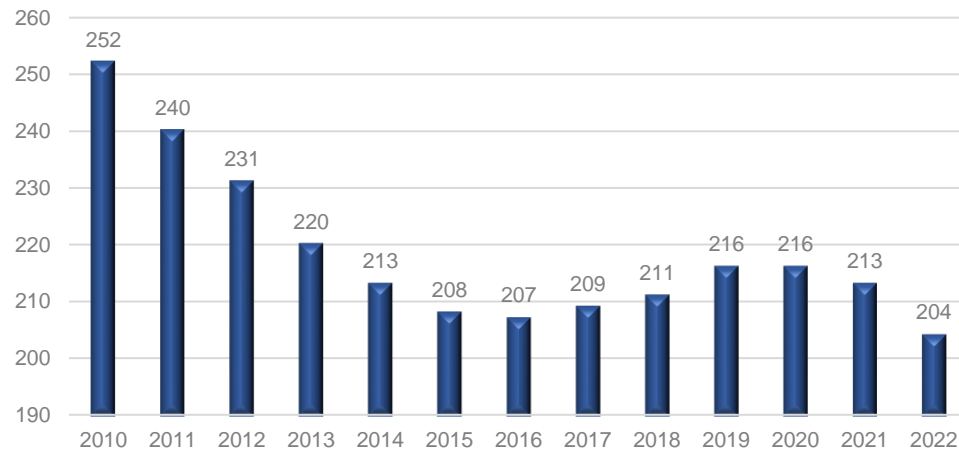


Águas de Cascais

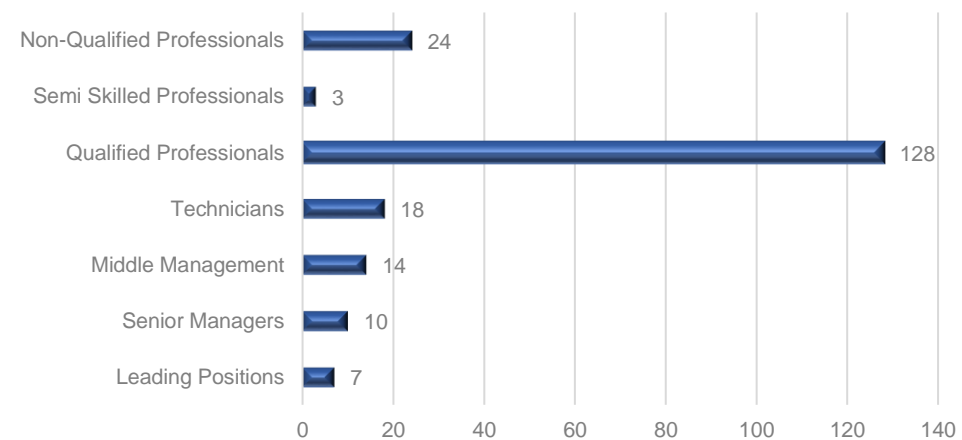
Organization chart / Human Resources



Number of employees

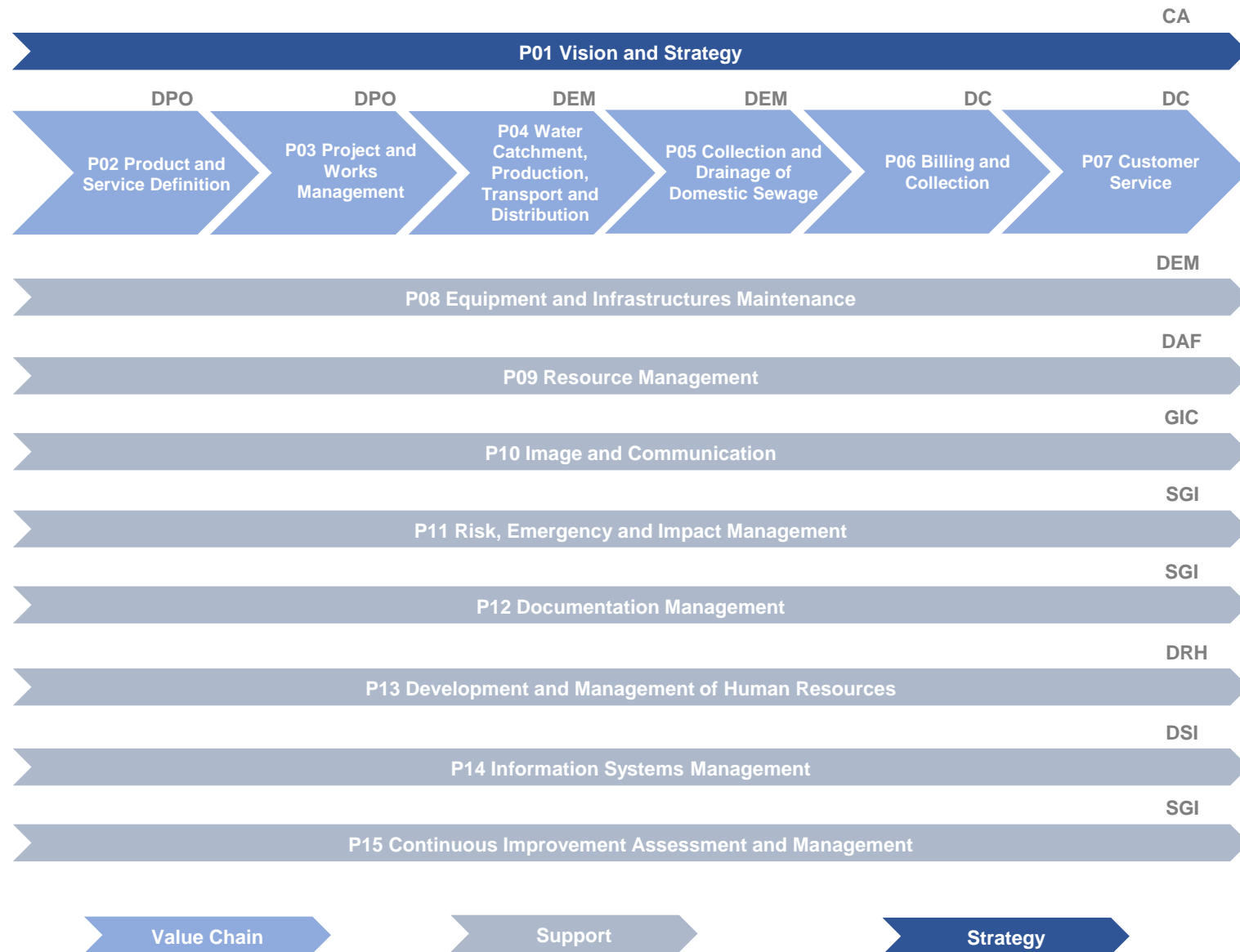


Employee qualifications



Águas de Cascais

Integrated Management System

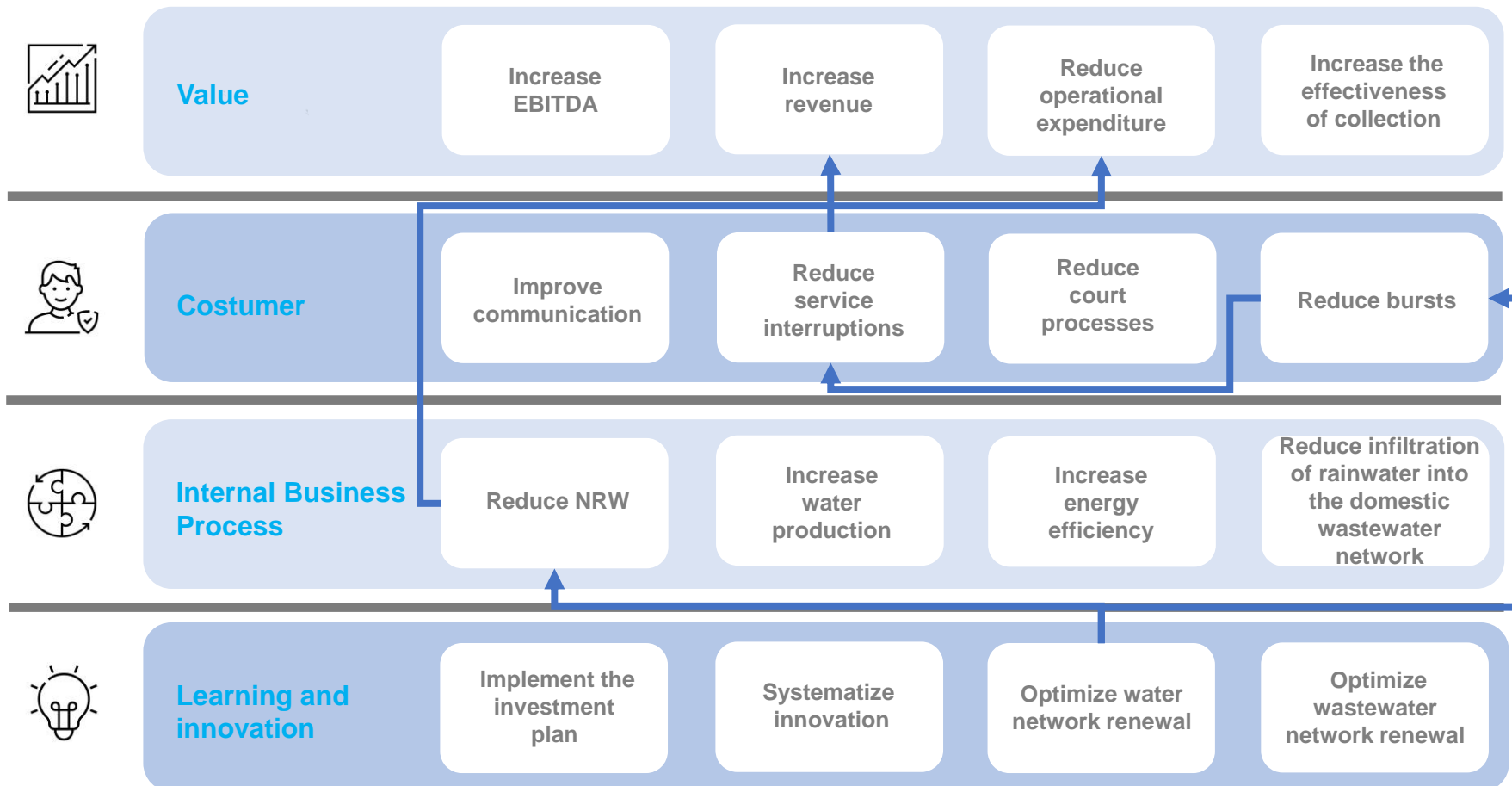


Águas de Cascais

Vision

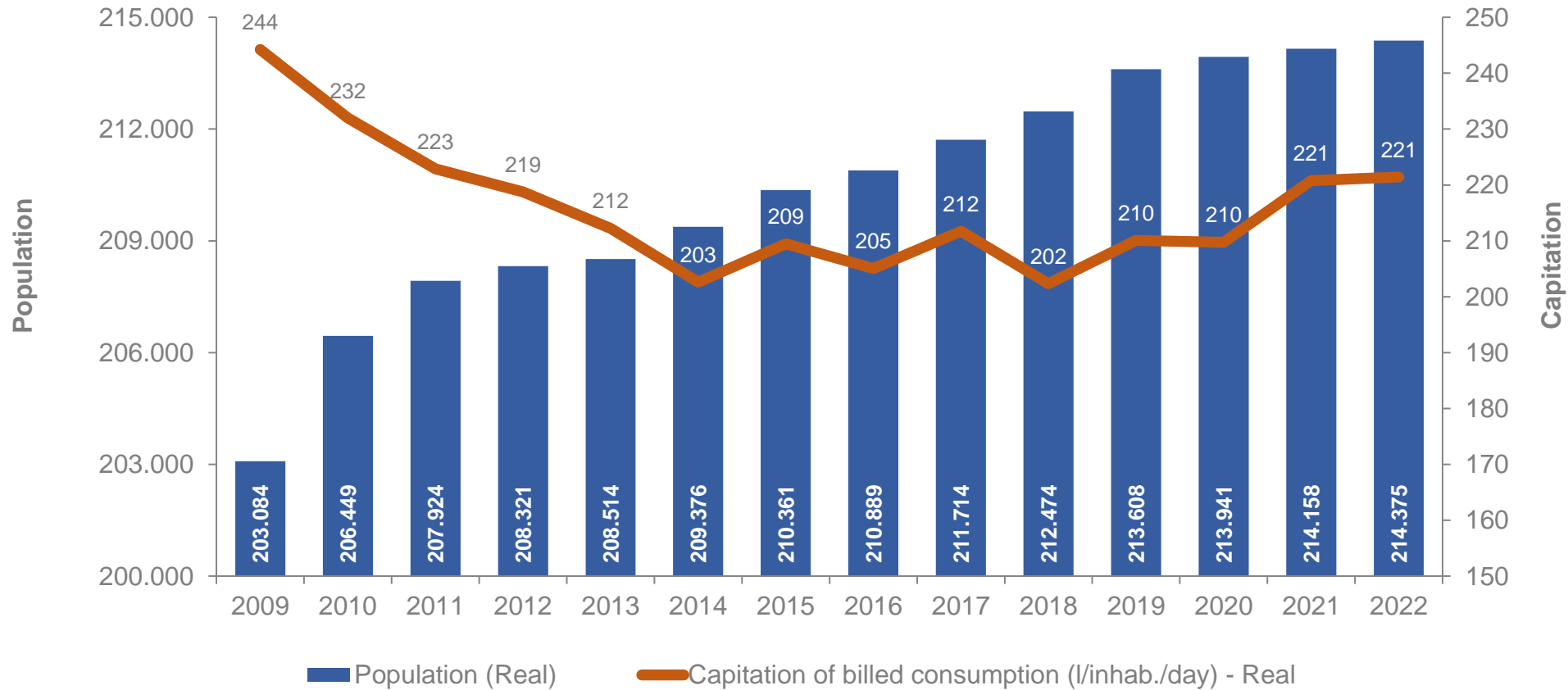
To be a reference company in the water and environment sector, having its excellence recognized by third party.

Strategy Map



Águas de Cascais

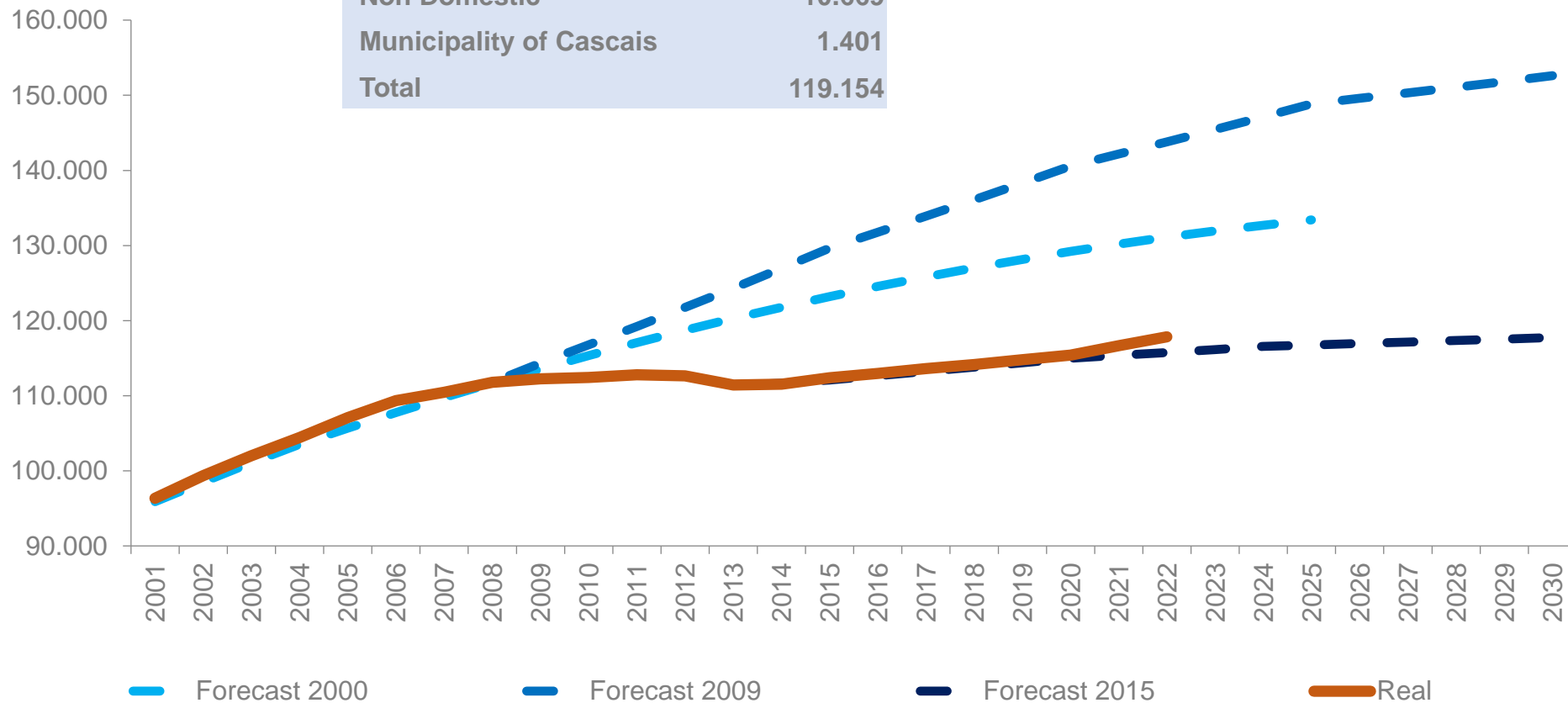
Population Served



Águas de Cascais

Clients

Clients	2022
Domestic	107.084
Non Domestic	10.669
Municipality of Cascais	1.401
Total	119.154

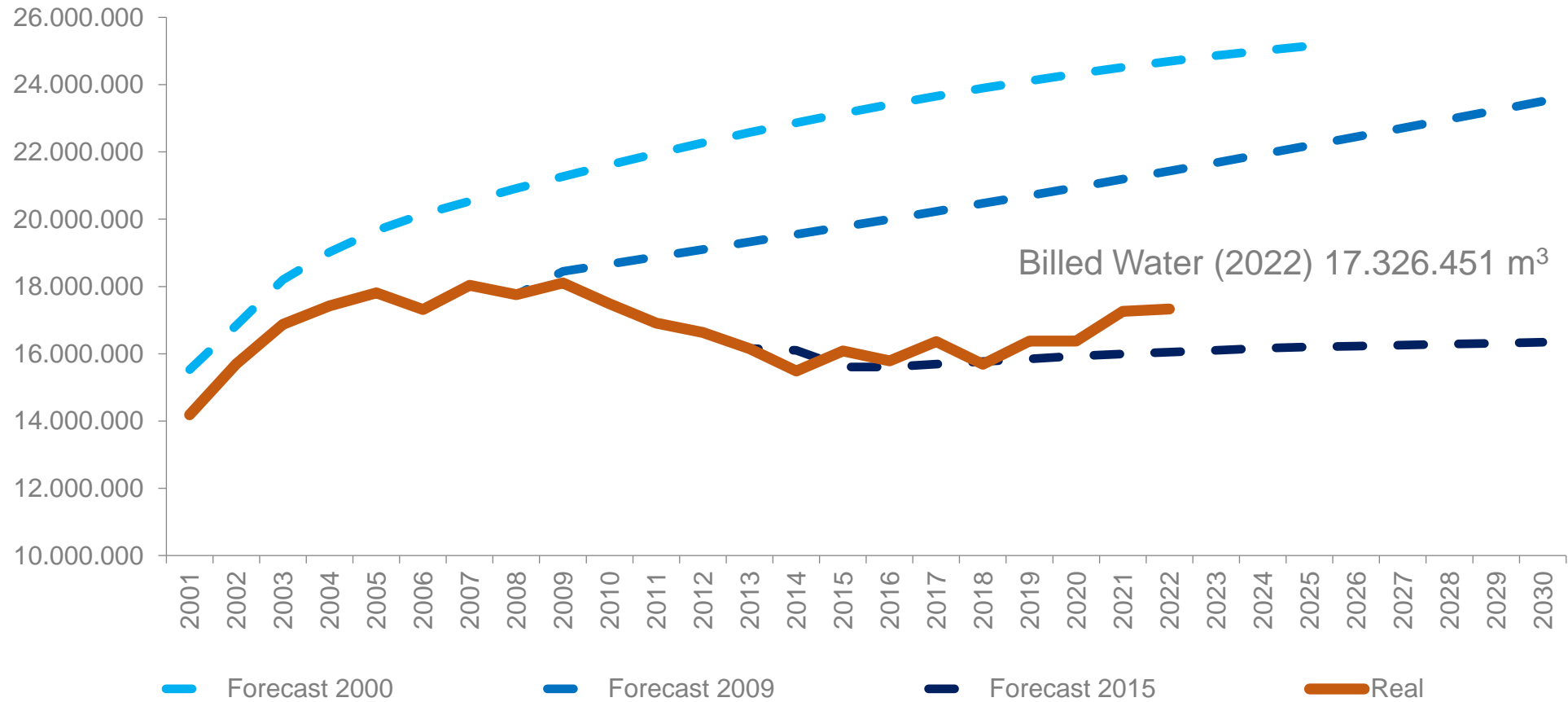


* Excludes customers exempt from fixed fees



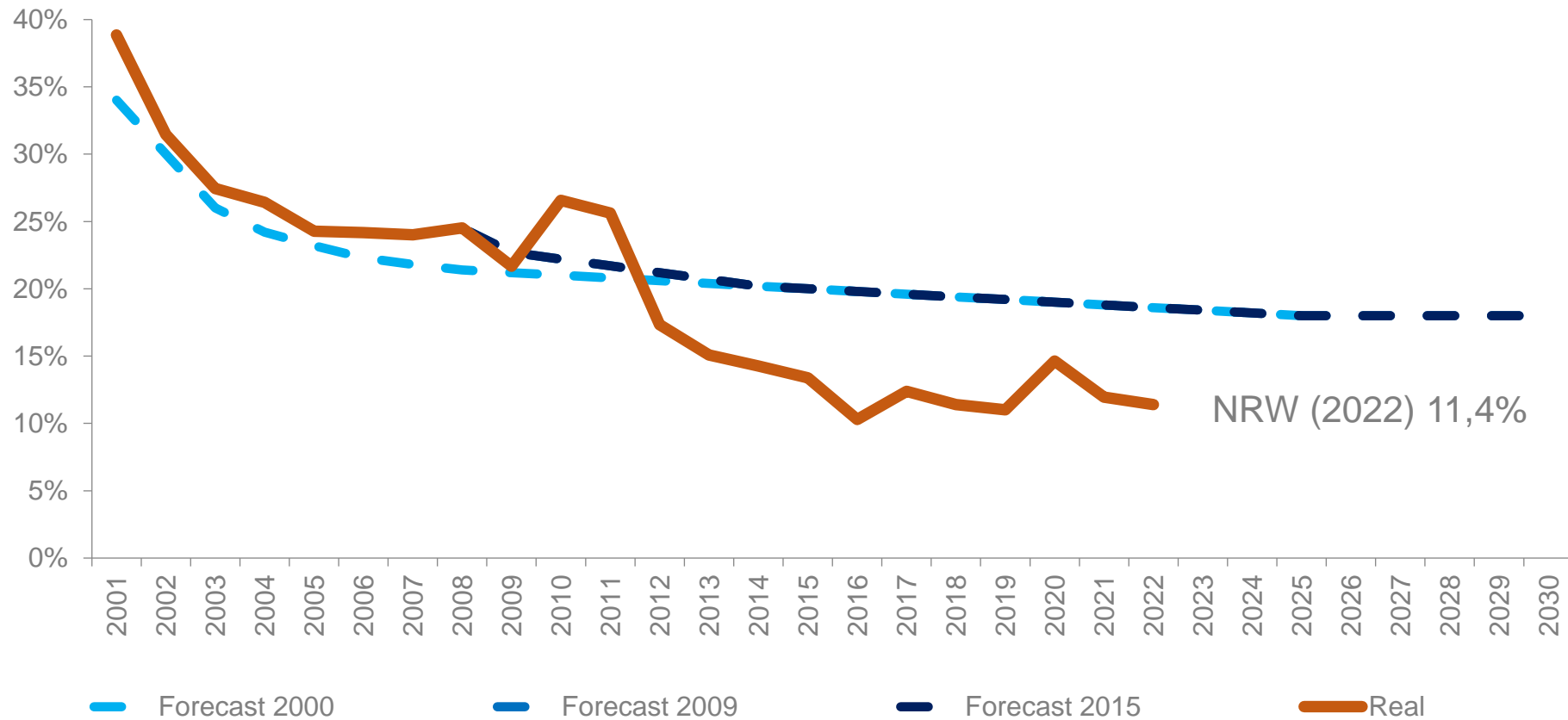
Águas de Cascais

Billed Water



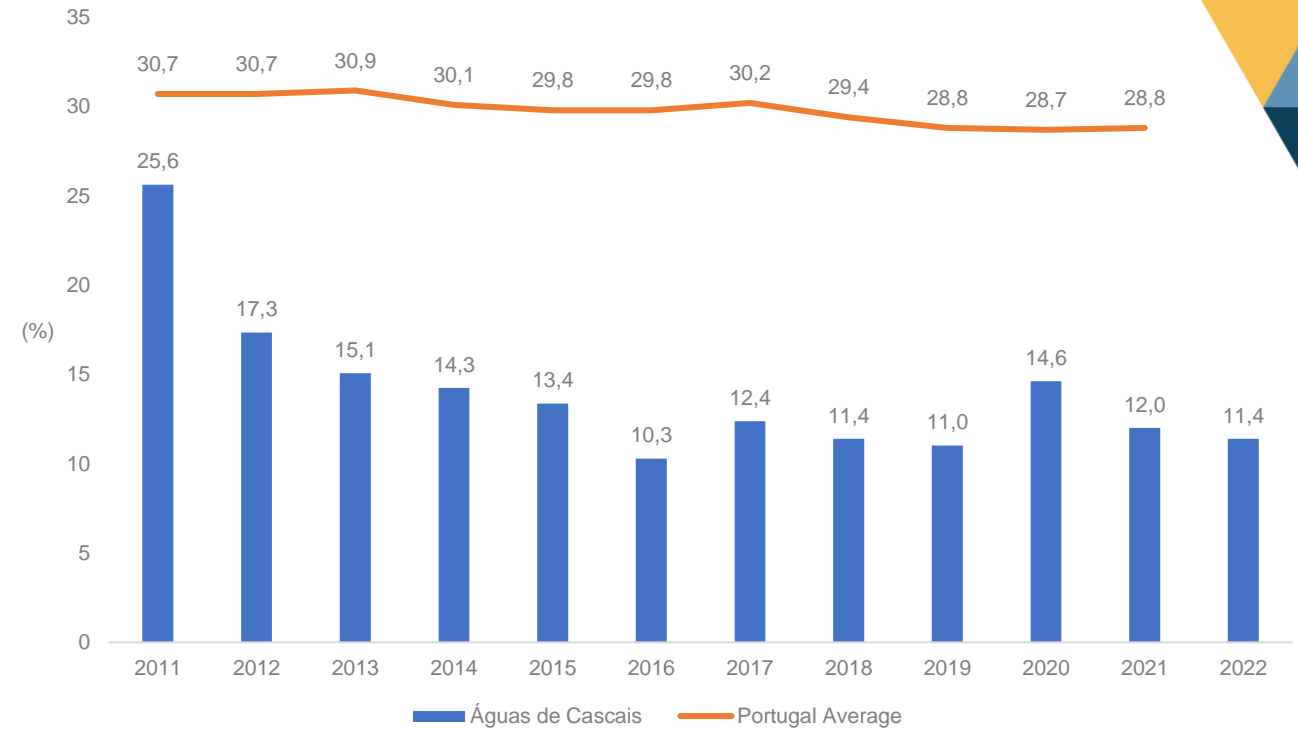
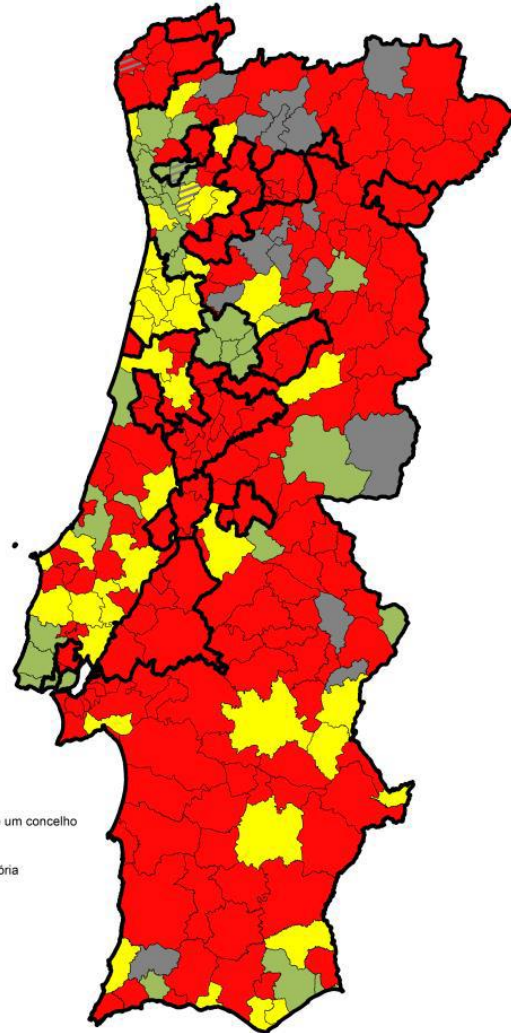
Águas de Cascais

Non Revenue Water



WATER LOSS MANAGEMENT

NRW



Source: RASARP 2022 (Vol. 1) – Geographical Distribution of the NRW Indicator for the water distribution service



WATER LOSS MANAGEMENT

Motivation

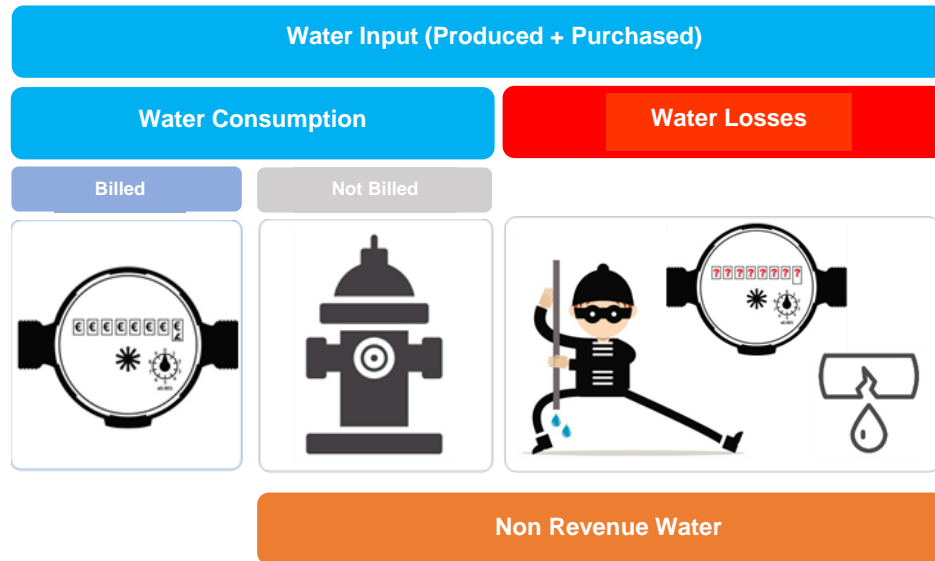
- ✓ Improvement of efficiency in the management of the water supply system (improvement of environmental and economic sustainability)
- ✓ Reduction in operating costs (AdC buys 85% to 90% of the water it distributes) and investment costs
- ✓ Improvement in water metering and billing processes
- ✓ Reducing damage to third-party infrastructure
- ✓ Reduction of inflows to drainage systems (domestic and rainwater), resulting from losses in the supply system
- ✓ Renovation of the water supply network
- ✓ Improved quality of customer service
- ✓ Promote user awareness for issues related to the scarcity of the water resource



WATER LOSS MANAGEMENT

Overall Strategy

Hydric balance



Actions to reduce apparent losses

- ✓ Illicit use of water
- ✓ Flowmeter measurement errors

Actions for active control of real losses

- ✓ Active leak research
- ✓ Fast and effective location and repair of leaks
- ✓ Remodelling of the water network
- ✓ Pressure management

Actions to improve the billing process

- ✓ Reading itineraries
- ✓ Readings
- ✓ Invoicing



WATER LOSS MANAGEMENT

Main Tools and Applications

Geographic Information System

Flowise

Aquamatrix

Aquafield

Remote Management

Meterwise

The dashboard displays a network map with various nodes and flow rates. Key nodes include Murches, Rio Mula, Alcoitão, Goulão, Cardosas, Vila Fria, Talaide, and Outeiro Polima. Flow rates are shown in m³/h, and pressures in bar.

Overview 122,601 Customer meters installed

	Renewal	Stopped	Sizing	Anomalous consumption	Data reliability
Alarm	12,296	4,356	77,846	2,799	125
Alert	9,870	1,464	1,676	1,789	122,476
Adequate	83,249	106,858	33,156	108,090	0
No Data	17,186	9,923	9,923	9,923	0

<p>Current</p> <p>Global error: -3.5%</p> <p>Age: 6.0 years</p>	<p>Under registration</p> <p>Monthly: 61,898 m³</p> <p>Annual: 557,550 m³</p>	<p>Goal</p> <p>Error: -3.0%</p>
	<p>Revenue loss</p> <p>Monthly: € 105,132</p> <p>Annual: € 960,097</p>	

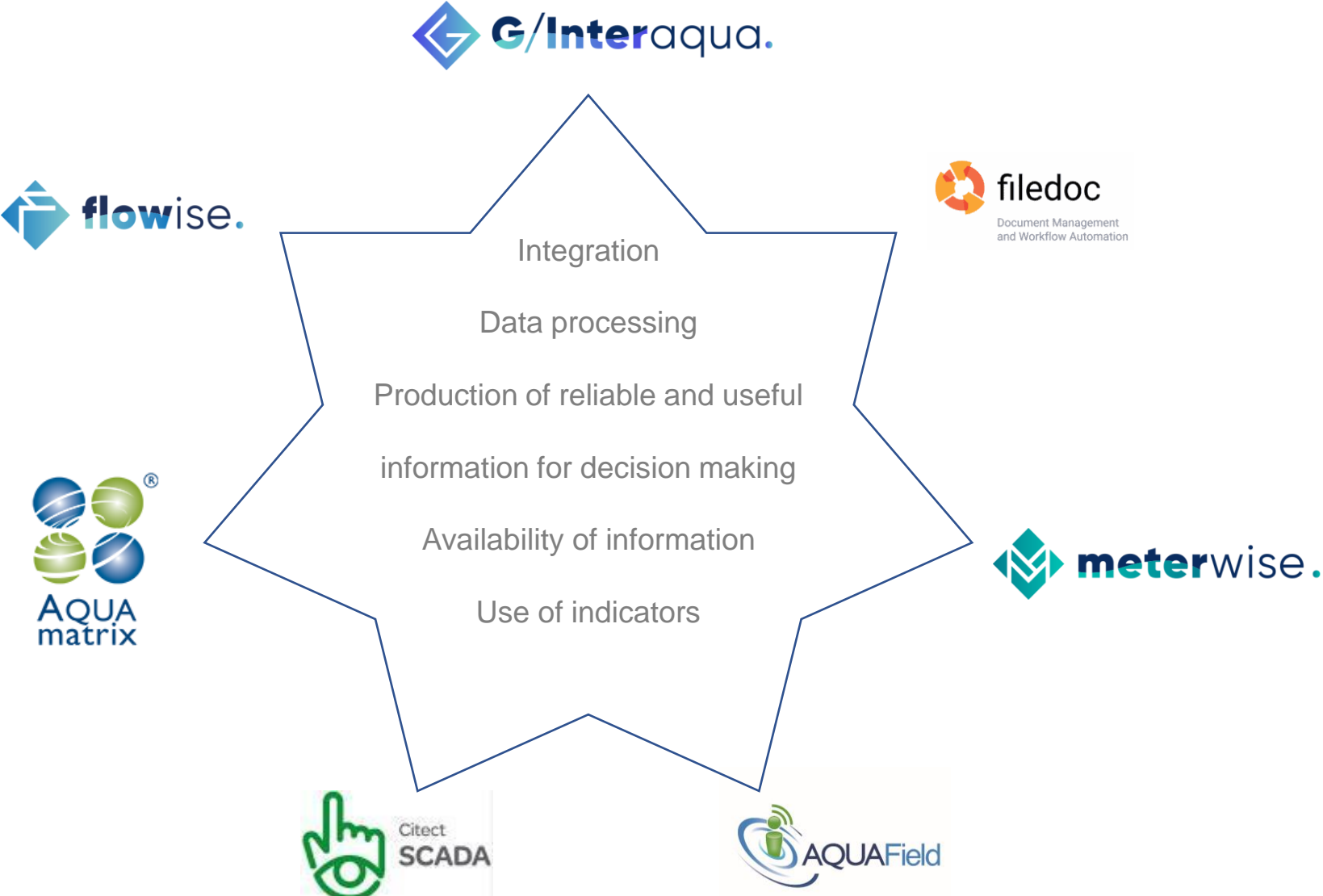
AGS © 2017

Escala 1:1 500 | X: -114035.643 | Y: -103768.993 | GPS Sinal



WATER LOSS MANAGEMENT

Main Tools and Applications



WATER LOSS MANAGEMENT

Billing Process

Reading itineraries

- ✓ Optimization of the billing process, minimizing unread locations, and considering reading dates, billing periods and the geographical proximity between the locations of consumption
- ✓ Periodic billing of consumption, resulting from cycle readings, foreseen in the zones/areas calendar
- ✓ More accurate invoicing, close to the actual volumes consumed
- ✓ Identification of abnormal situations, as illicit (damaged flowmeters, direct connections), stopped flowmeters, bursts in the building private network or public road
- ✓ Periodic review to adjust to the increase in the number of locations to be read, to keep the reader's daily work adequate

Readings

- ✓ The itineraries are established in such a way that each reader visits the same place of consumption every two months
- ✓ Team of 8 readers and 1 supervisor for approximately 119,000 customers
- ✓ Each reader visits an average of 310 consumption places per day

Invoicing

- ✓ Daily invoicing and automated process with automatic integration of readings



G/Interaqua.



WATER LOSS MANAGEMENT

Reduction of Apparent Losses

Illicit use of water – Planning

- ✓ Videoscope campaigns (about 90 days a year)
- ✓ Simple inspection
- ✓ Selection of sites to inspect



WATER LOSS MANAGEMENT

Reduction of Apparent Losses

Illicit use of water – types of illicit activities detected

Direct Link



Fire Hydrant connection



Flowmeter violation



Not Visible Direct Link
T Before Flowmeter



WATER LOSS MANAGEMENT

Reduction of Apparent Losses

Illicit use of water – Analysis

Analysis of data from the Customer Management System

Tp	Data	Valor	Anomalia	Consumo	Og	TL	Cr	St	Serviço	Análise
	2019/04/22 18:15:23	887	00 SEM ERRO	221		LT	5	10		
	2019/02/27 10:00:51	666	04 DESVIO DE I	239		SV	5	10	2915137 LTC	CONFIRMAÇ
	2019/02/22 00:00:00	621	04 DESVIO DE I	194		CL	V	5	09	
	2018/12/24 10:07:58	427	11 DESVIO DE I	90		LT	5	10		
	2018/11/06 14:00:50	337	02 CONSUMO = 0			SV	5	09	2843446 FCA	FECHO DE Á
	2018/10/23 10:10:30	337	00 SEM ERRO	24		LT	5	10		
	2018/08/23 11:06:53	313	11 DESVIO DE I	8		LT	5	10		
	2018/08/23 00:00:00	310	11 DESVIO DE I	5		CL	V	5	09	
	2018/06/25 10:47:00	305	00 SEM ERRO	25		LT	5	10		
	2018/04/23 10:50:34	280	00 SEM ERRO	26		LT	5	10		

VI Consumo: 26 VI Cns Médio: 6 Estimativa: 10

After the detection and correction of the illicit
Consumption is slightly higher than 100 m³/ month

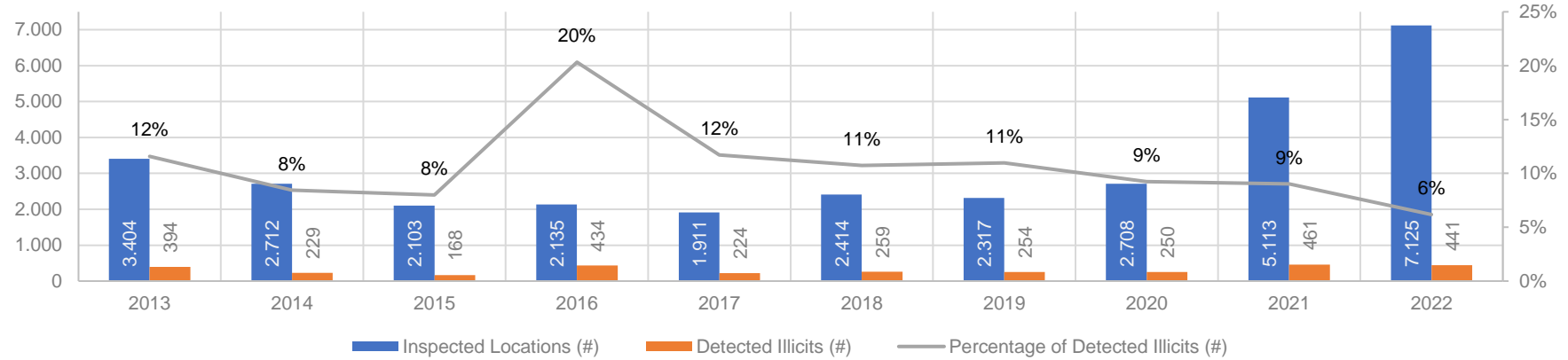
Before the detection of the illicit
Consumption was approximately 10 m³/month



WATER LOSS MANAGEMENT

Reduction of Apparent Losses

Illicit use of water – Evolution



Detected Illicit by Type (#)	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Building Network Change	145	34	64	23	16	24	28	12	32	41
Stopped Flowmeter	94	107	29	122	129	136	153	189	340	196
Non-Visible Direct Link	16	25	15	11	10	10	14	6	15	15
Visible Direct Link	27	34	24	11	17	35	24	11	46	87
Own Origins with Interconnection	36	12	15	14	2	1	3	2	1	5
Own Origins Without Interconnection	51	7	5	11	3	0	0	1	1	2
Branch Burst	3	2	0	5	7	4	5	4	0	5
Building Network Breakdown	1	0	0	6	8	6	4	8	4	16
Others	1	0	10	5	20	24	15	11	19	70
Own origin in Location without contract (Unbilled ARD Drainage)	20	8	6	1	1	0	1	1	0	4
Stolen Flowmeter	0	0	0	166	8	14	4	4	3	0
Stolen Flowmeter and Visible Direct Link	0	0	0	59	3	5	3	1	0	0
Total	394	229	168	434	224	259	254	250	461	441



WATER LOSS MANAGEMENT

Reduction of Apparent Losses

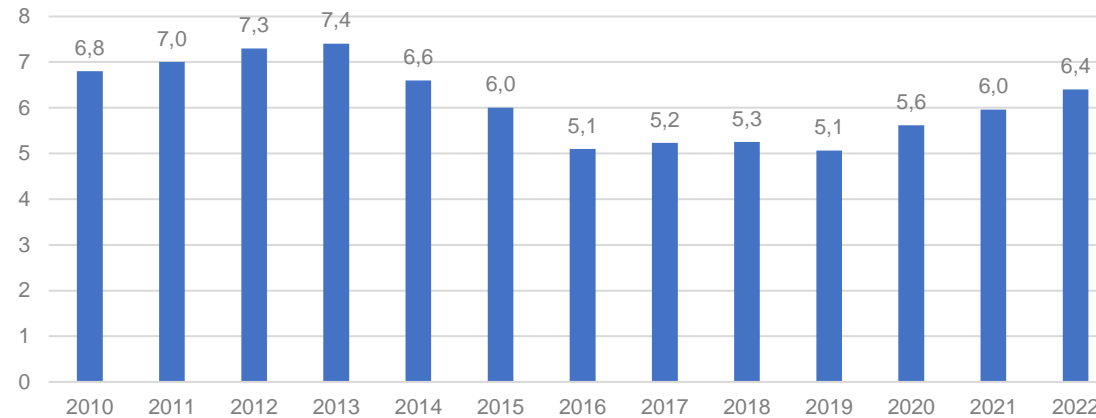
Flowmeter measurement errors

- ✓ Flowmeter park replacement program

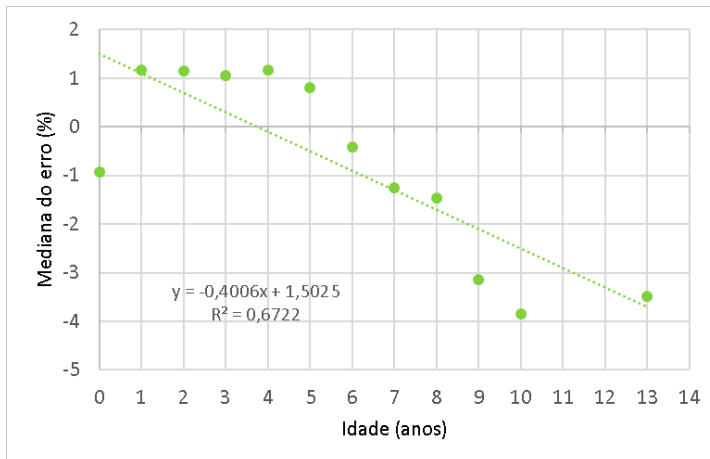


- ✓ Carrying out tests to determine the average error of the flowmeter park

Mean age of flowmeter park (years)



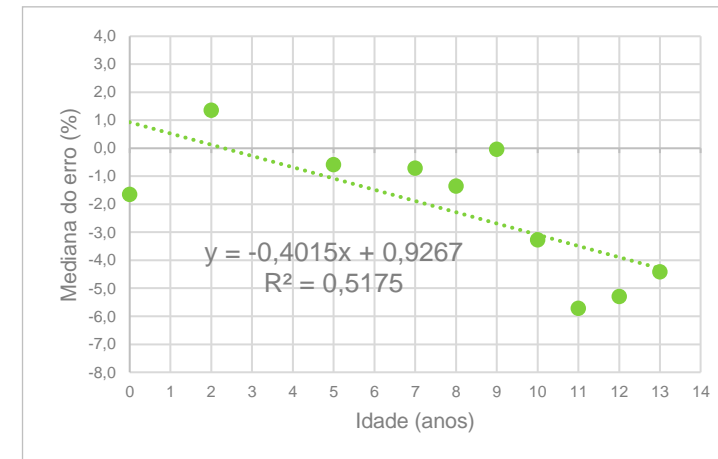
DN15



Initial Error -0,93%
 Degradation Rate -0,40%

Total Error -3,30%

DN20



Initial Error -1,65%
 Degradation Rate -0,40%



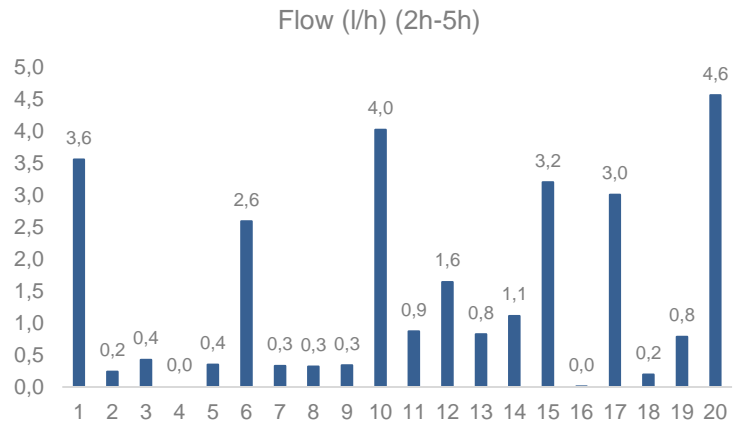
WATER LOSS MANAGEMENT

Reduction of Apparent Losses

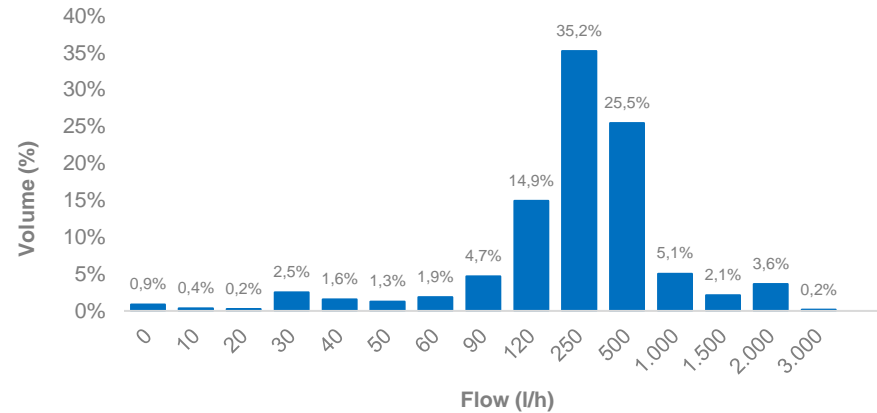
Consumption Analysis

Large customers with datalogger

Night Consumption



Histogram



WATER LOSS MANAGEMENT

Reduction of Real Losses

Active Leak Search

Systematic inspection of the water distribution network:

- ✓ Early detection of leaks
- ✓ Increase the number of anomalies detected
- ✓ Reduction of time to detect leaks
- ✓ Records update



WATER LOSS MANAGEMENT

Reduction of Real Losses

Water Supply Network Monitoring

(Total: 1 events)

#29108

Burst

Zone/ Area / Meter
Moinhos Rana/ MR 13 - Moinhos Rana (Mortal/ -

Start: 2019-05-07 03:45:00
Volume: 437

Responsible: João Cary
Status: Closed
Last comment: Rotura comunicada.

New Comment

COMMENT

Rotura comunicada/reparada-OS4162413-Rua Cidade Viana Castelo-B. 7 Castelos
João Cary @ 2019-05-07 09:52:02

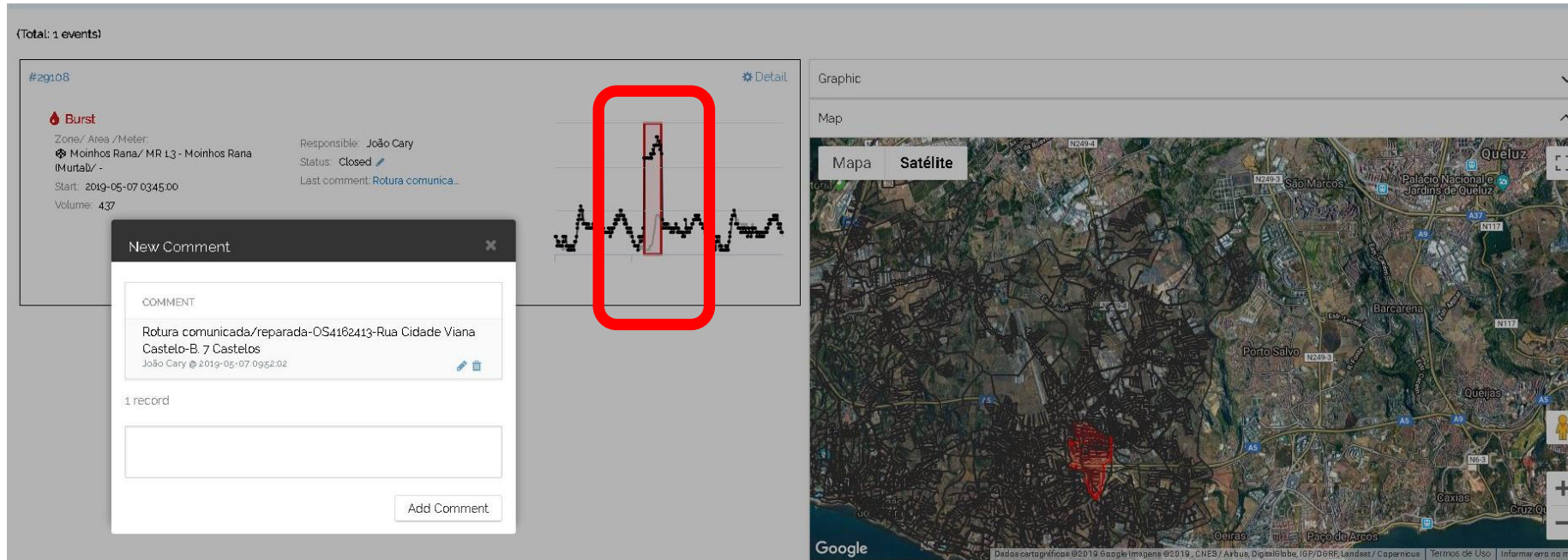
1 record

Add Comment

Graphic

Map

Mapa Satélite



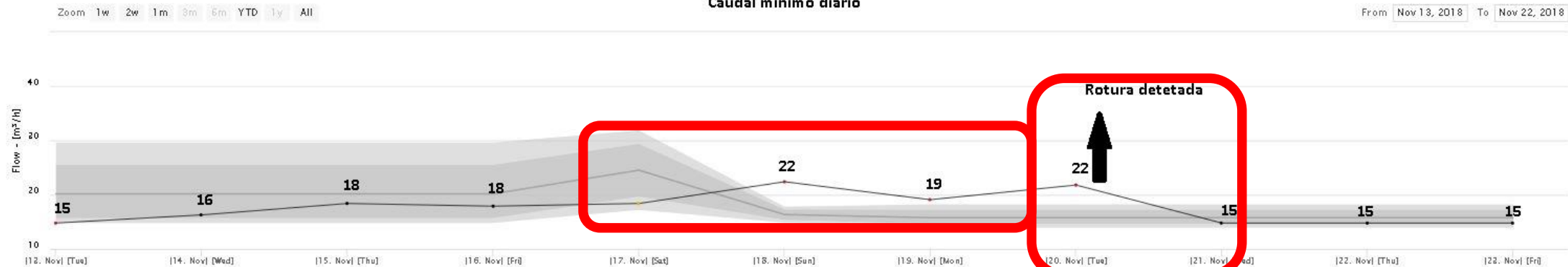
Previous Area

Next Area

Pau Gordo - PG 1.2 - Pau Gordo - [m³/h]

Caudal mínimo diário

From Nov 13, 2018 To Nov 22, 2018

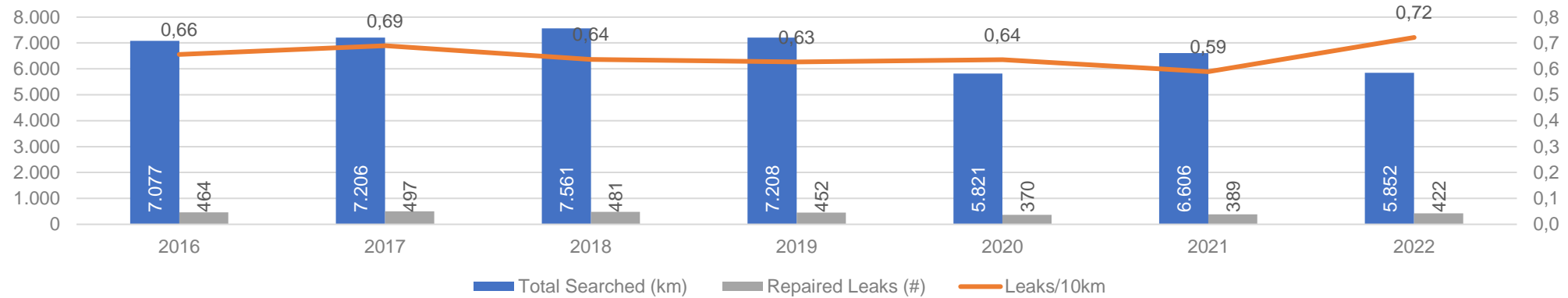


MOD 10001 R02

WATER LOSS MANAGEMENT

Reduction of Real Losses

Active search for leaks - Evolution



Searches by Parish	2016		2017		2018		2019		2020		2021		2022								
	(m)	Leaks/10km	(m)	Leaks/10km	(m)	Leaks/10km	(m)	Leaks/10km	(m)	Leaks/10km	(m)	Leaks/10km	(m)	Leaks/10km							
ALCABIDECHE	1.379.251	0,7	19%	1.351.922	0,6	19%	1.527.736	0,6	20%	1.270.070	0,5	18%	1.128.847	0,5	19%	1.272.756	0,5	19%	1.036.320	0,6	18%
CARCAVELOS	502.175	0,6	7%	454.192	0,9	6%	501.004	0,9	7%	558.792	0,7	8%	493.522	0,5	8%	441.211	0,4	7%	472.152	0,8	8%
CASCAIS	1.612.866	0,5	23%	1.364.429	0,7	19%	1.472.687	0,7	19%	1.708.902	0,5	24%	1.118.094	0,8	19%	1.517.972	0,5	23%	1.219.823	0,6	21%
ESTORIL	1.040.744	0,8	15%	1.187.506	0,7	16%	1.190.597	0,7	16%	1.225.544	0,7	17%	958.225	0,7	16%	1.102.156	0,7	17%	1.162.133	0,9	20%
PAREDE	685.036	1,0	10%	869.853	1,0	12%	726.308	0,8	10%	767.666	1,0	11%	581.951	0,6	10%	733.575	0,9	11%	549.955	1,1	9%
S.DOMINGOS RANA	1.857.366	0,5	26%	1.978.449	0,5	27%	2.142.908	0,5	28%	1.677.421	0,6	23%	1.540.273	0,6	27%	1.538.026	0,5	23%	1.411.149	0,6	24%
Total (km)	7,077		-4%	7,206		2%	7,561		5%	7,208		-5%	5,821		-19%	6,606		13%	5,852		-11%



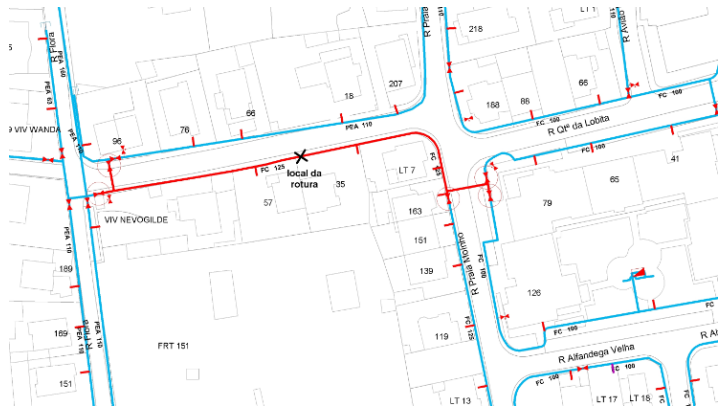
WATER LOSS MANAGEMENT

Reduction of Real Losses

Fast and effective location and repair of leaks

Teams with the mission of moving very quickly to the location and, after assessing, proceeding to interrupt the loss with the least possible impact on supply.

	2017	2018	2019	2020	2021	2022
Average Time to close (min)	40:45	43:51	43:04	44:32	49:59	52:25
Average Interruption Time (hh:mm:ss)	3:42:37	3:52:01	3:52:44	3:31:48	3:51:25	4:15:38



The registration of service orders is carried out in real time and directly in the GIS.

Consulting the service orders in the GIS makes it possible to understand the course of the intervention from the beginning to the closure, characterize the locations, manage the information in the customer system, optimize the closing of valves, etc.

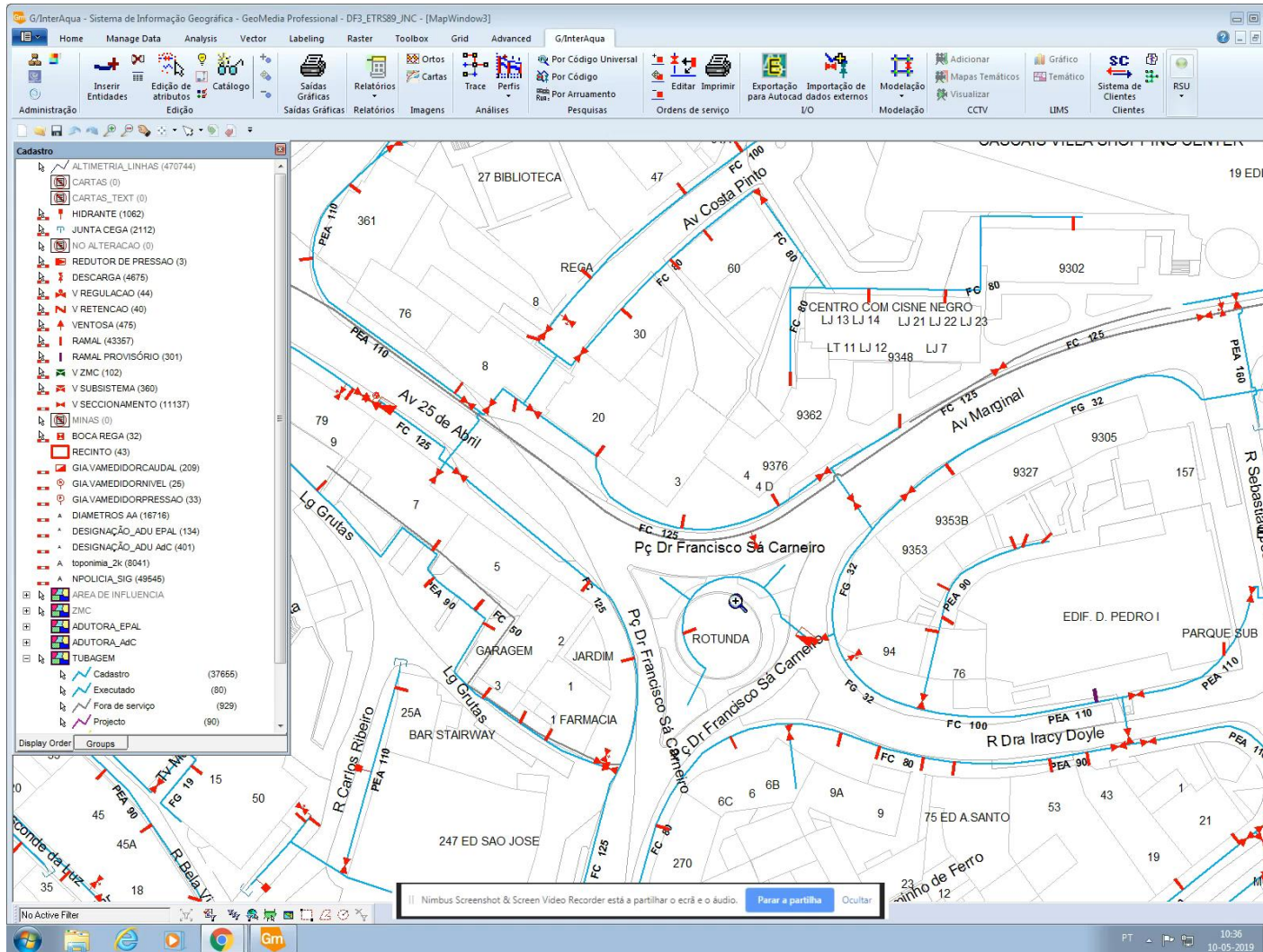


WATER LOSS MANAGEMENT

Reduction of Real Losses

Network Analysis

Traditional Analysis vs Hydraulic Analysis



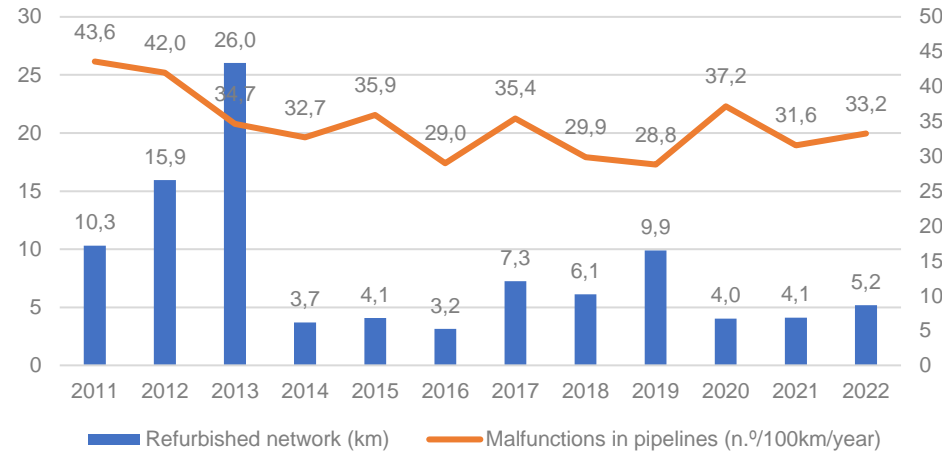
WATER LOSS MANAGEMENT

Reduction of Real Losses

Renewal of the water network

Probably the most effective action in reducing water loss (it eliminates silent leaks or Background Leaks and reduces bursts).

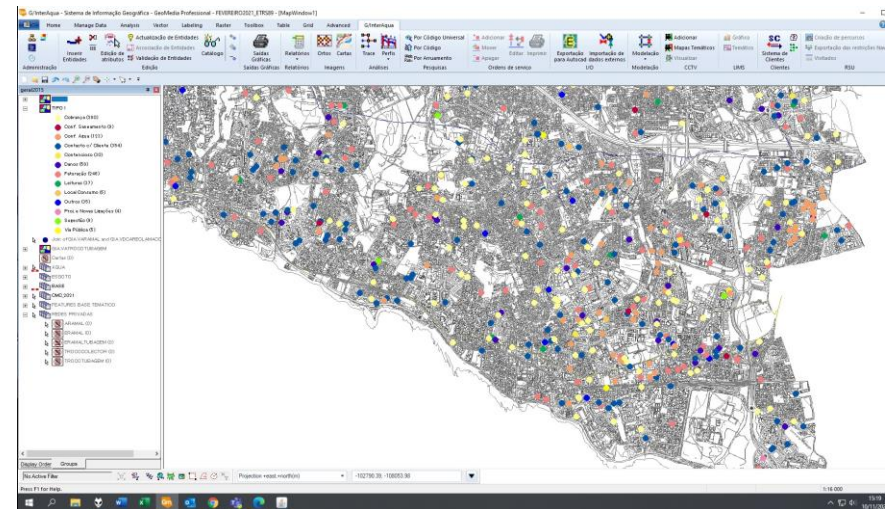
Carried out following an economic and risk assessment.



Localidade	N.º	Rua	Diâmetro (mm)	Remodelação Extensão (ml)	Prev. Roturas/Ano	Custo Ano Oportunidade	Inv. Pr. Correntes	Inv. Pr. 11/1999	Payback (# anos)	Risco (1 a 25)
AREIA	696	S Braz,Lg	100	151	2	1.155 €	14.703 €	10.002 €	12	16

Complaints Management

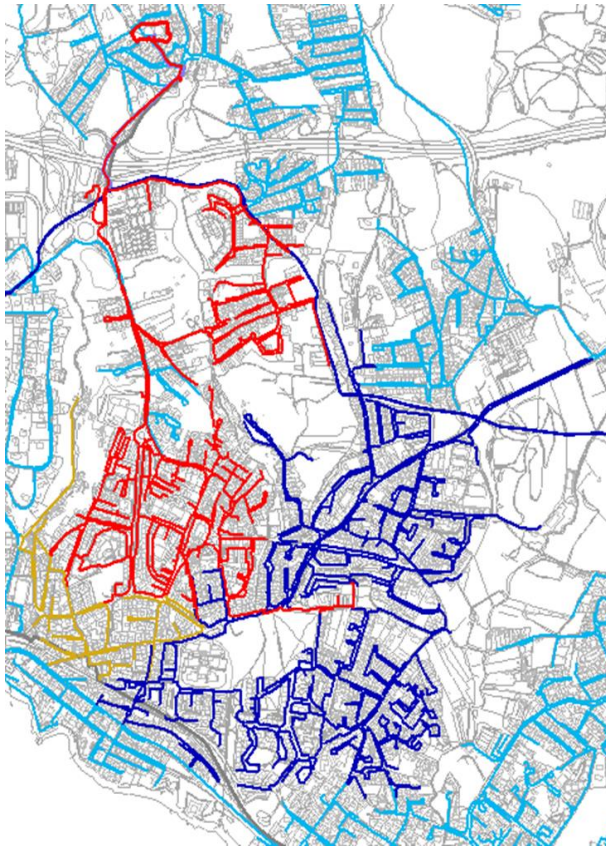
- ✓ Integration between data from the Commercial Department and representation in the GIS
- ✓ Geographic representation of complaints in detail and by type of complaint (example: water quality, pressure, among others)
- ✓ Identification of the geographic incidence of complaints



WATER LOSS MANAGEMENT

Reduction of Real Losses

Pressure management



Description

- Three Measuring and Control Area (MCA) - PG1.1, PG1.2 and PG1.3
- 2 Flowmeters
- 2 Pressure Reducing Valves
- Expansion of water distribution network and installation of 10 sectioning valves

Works developed

- Pressure reduction of 10 metres water column (phased and above regulatory minimums)
- Monitoring of pressures along the MCA (Data Base)
- Leak Log (data analysis)
- Survey of atypical behaviours / consumption (washes, fire use, hotel maintenance (reservoirs, swimming pools), watering (municipality))

Main Results

- An average pressure reduction of around 17% (mean reduction of 10 mwc) resulted in a reduction of about 16% in the minimum overnight flow.
- This reduction also resulted in a 42% reduction in the number of leaks in the project area



WATER LOSS MANAGEMENT

Monitoring

Inventário do cadastro INDICADORES DE CADASTRO AA (BAIXA)

Indicadores ERSAR

dAA15b - Comprimento total de condutas (km)	Quant. [un]	Comp. [Km]
Conduitas (Km)	38197	1371.8184

dAA16b - Comprimento médio das condutas	Quant. [un]	Comp. [Km]
Conduitas com mais de 10 anos	1015	32.9102

AA17b - Conduitas reabilitadas nos últimos 5 anos	Quant. [un]	Comp. [Km]
Conduitas reabilitadas (km)	659	19.2194

dAA18b - Ramais de ligação (RF)	Quant. [un]	Comp. [Km]
Ramais	43511	

dAA19b - Captações de água subterrânea (nº)	Quant. [un]	Comp. [Km]
Captações de água subterrânea	2	

dAA20b - Captações de água superficial (nº)	Quant. [un]	Comp. [Km]
Captações de água superficial	0	

dAA22b - Estações de Tratamento de Água	Quant. [un]	Comp. [Km]
ETA	0	

dAA21b - Estações Elevatórias (RF)	Quant. [un]	Comp. [Km]
Estações Elevatórias	2	

dAA24b - Posto de Recloração (RF)	Quant. [un]	Comp. [Km]
Posto de recloração	0	

dAA25b - Reservatórios (RF)	Quant. [un]	Comp. [Km]
Reservatórios (Nº)	22	

dAA26b - Capacidade de Reserva (m3)	Vol. [m3]
Capacidade de Reserva	99245

dAA30b - Capacidade total das ETA (m3)	Vol. [m3]

Designação	Unidades	dez/22	nov/22		dez/21		Orç./Prev. 12/2022	
Avarias em Conduitas e Ramais (AA) - últ 12 meses	n.º (exclui pesquisa e terceiros)	741	736	1%	581	28%	524	41%
Água não Faturada (AA) - Mês	%	8,05	2,27	254%	4,7	73%	0,7	975%
Água não Faturada (AA) - últ 12 meses	%	14,63	14,42	1%	11,0	33%	11,4	28%
Avarias em Ramais (AA) - últ 12 meses	n.º (exclui pesquisa e terceiros)	223	223	0%	180	24%	155	44%
Avarias em Conduitas (AA) - últ 12 meses	n.º (exclui pesquisa e terceiros)	518	513	1%	401	29%	369	40%
Pesquisa de Fugas - Anomalias não visíveis detetadas (AA) - últ 12 meses	n.º	370	379	-2%	453	18%	466	21%
Pesquisa de Fugas - Total de anomalias detetadas (AA) - últ 12 meses	n.º	690	717	-4%	895	23%	950	27%
Roturas na Rede (AA) - últ 12 meses	n.º/100 km/ano (inclui pesquisa e terceiros)	50,0	49,0	2%	43,2	16%	42,1	19%
Roturas em Ramais (AA) - últ 12 meses	n.º/1000 ramais/ano (inclui pesquisa e terceiros)	7,0	7,0	0%	6,3	12%	5,9	20%
Falhas no abastecimento >6h (inclui pesquisa, ramais e provocadas) (AA) - últ 12 meses	n.º/1.000 ramais/ano	3,216	2,7468	17%	2,345	37%	2,167	48%
Falhas no abastecimento >6h (exclui pesquisa, ramais e provocadas) (AA) - últ 12 meses	n.º/1.000 ramais/ano	2,542	2,094	21%	1,412	80%	1,597	59%



Final Notes

- ✓ Importance of a proactive approach to managing water losses
- ✓ Creation of integrated dynamics between the various areas of the company
- ✓ Increased knowledge of water supply systems
- ✓ Overall improvement in the efficiency of water supply systems
- ✓ Contribution to improving the resilience of water supply systems
- ✓ Mitigation of water scarcity and reduction of pressure on storage, collection and treatment systems for water supply
- ✓ Making investments, p. e.g., in the renewal of networks, replacement of meters, installation of VRP for pressure management, acquisition of computer applications or training of human resources
- ✓ Importance of having competent, motivated, coordinated and objective-focused teams



Thank you for your attention!

April 27th, 2023