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MINISTERUL MEDIULUI
AL REPUBLICII MOLDOVA



Thematic Workshop on Nature Based Solutions Experience Outside Moldova

NBS at City Scale- The Lisbon case study, Portugal

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“On line” Session on the 26 th April, 2023



Portuguese Water
Partnership

PRESENTATION CONTENT

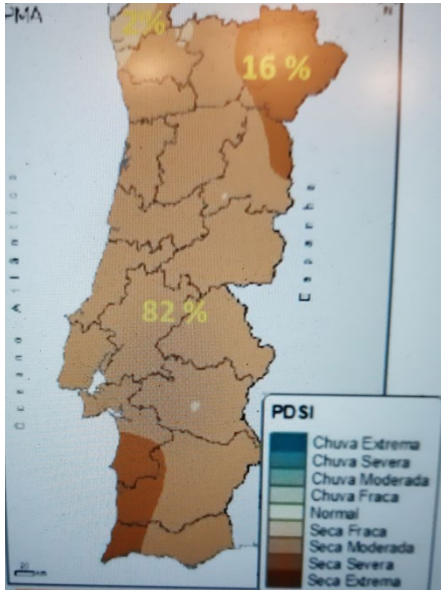
- INTRODUCTION – THE CONTEXT
- GLOBAL TRENDS AND SOLUTIONS
- LISBON DRAINAGE MASTER PLAN (2016-2030)
- LISBON WASTE WATER REUSE STRATEGIC PLAN –SUPPORTING NBS
- FINAL REMARKS



- DRAINAGE NBS (IMPLEMENTED)
- DRAINAGE NBS (UNDERWAY)



INTRODUCTION-THE CONTEXT



Portugal – A Mediterranean Country The Average Annual rainfall is about 900 mm, but with regions of less than 500 mm (and with a very irregular rainfall pattern, practically without rainfall in summer period- May to October)- 10.3 M inhab.

In March 2022 (figure) practically all the Country was in moderate or severe drought and still is. In december we have serious floods

Droughts are one of the main driving force for water reuse and floods for nature based solutions

All diferent but all equal

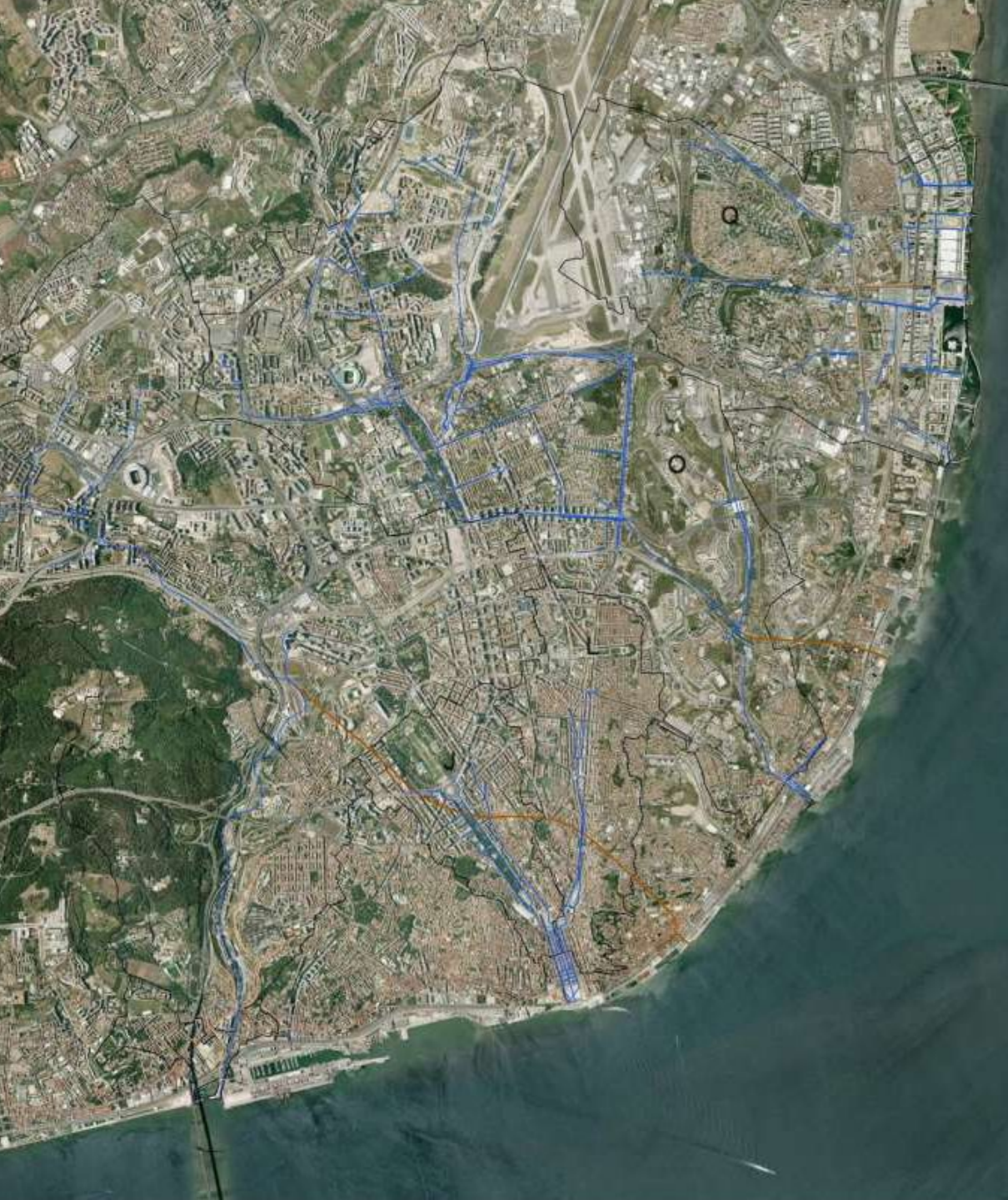


INTRODUCTION-THE CONTEXT

TENDENCIES OF WATER MANAGEMENT IN THE CITY

- ✓ Nature based solutions (i.e. means ponds, constructed wetlands, retention bassins, infiltration trenches, porous pavements, green roofs).
- ✓ Tendencial separation- wastewater from storm water
- ✓ Decentralization and local use of resources (REUSE)
- ✓ Relevance os services instaed of Infrastructures – **Infrastructures serving the services**
- ✓ Crucial Role of knowledge, innovation and intelgence to produce Value
- ✓ Concerns with increasing urban resilience



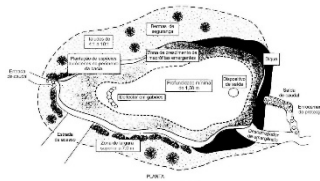


**Lisbon
Drainage
Master plan
2016-2030**

LISBON DRAINAGE MASTER PLAN 2016-2030

Approaches and solutions

- **Mitigation actions** (Peak flow reduction or attenuation, through storage and infiltration – decentralized source control techniques, NBS typically)
- **Adaptation actions** (based on increasing hydraulic capacity, new sewers, reahabilitation of assets, storage tanks and tunnels).
- ❑ **Decentralized solutions (“NBS”)**
- ❑ **Centralized solutions**
- **Physical Measures (Construction)**
- **Non Physical Measures** (Knowledge aquisition, capacity building, monitoring and warning systems, awerenes campaigns)



LISBON DRAINAGE MASTER PLAN 2016-2030

Lisbon orography

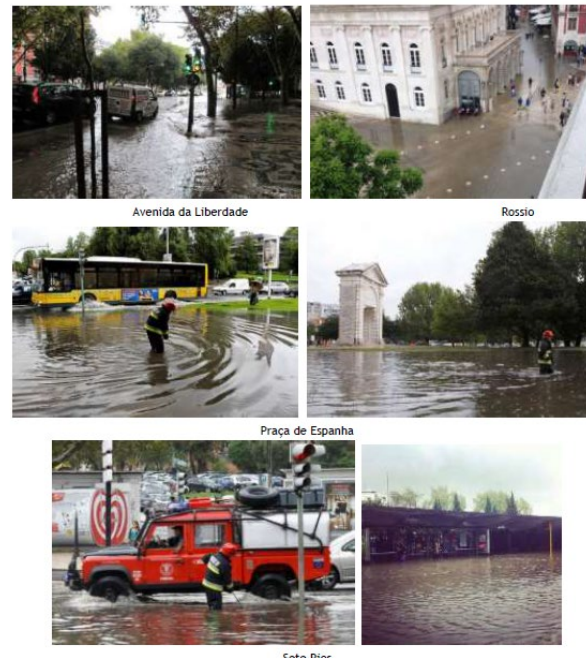
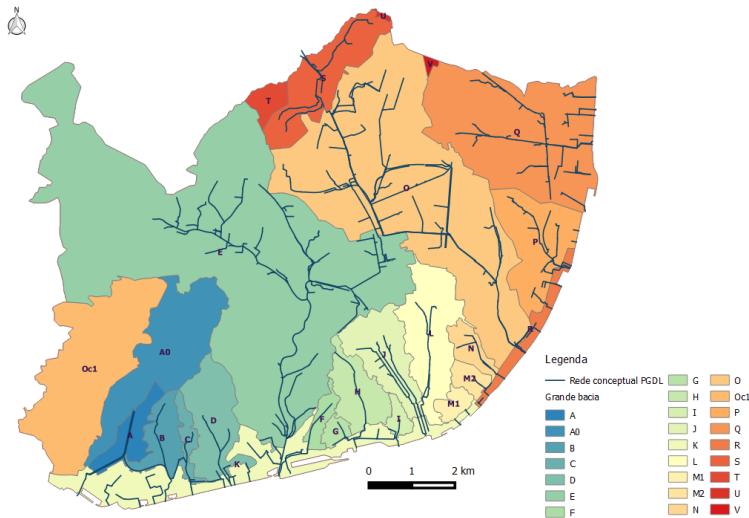
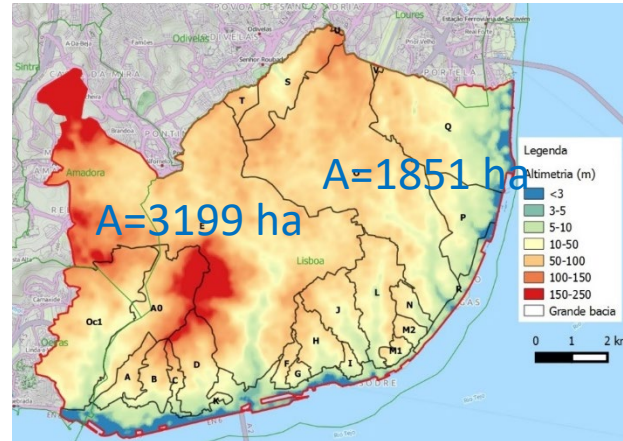
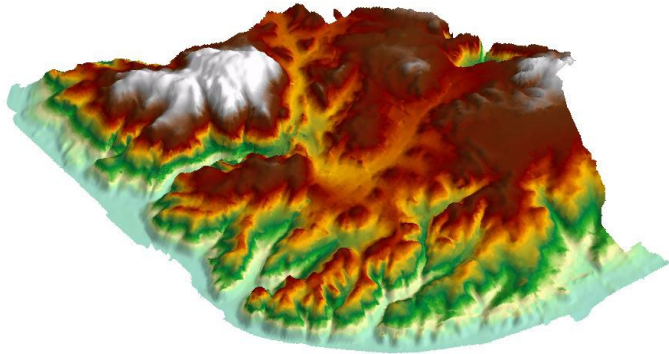


Figura 4.34 - Inundações em Lisboa, em 22/09/2014

LISBON DRAINAGE MASTER PLAN 2016-2030

Different components and solutions for flood control:

- ✓ Retention underground pre-treatment basins,
 - ✓ Source control techniques (NBS),
 - ✓ Flow control structures (NBS),
 - ✓ Rehabilitation and new sewers and outlets,
 - ✓ Rehabilitation of overflows and inlets
 - ✓ two major tunnels (“flow transfer”)
-
- ✓ Capacity Building
 - ✓ Monitoring and warning systems
 - ✓ Raising public awareness



Bacias de retenção/infiltração



Trincheiras de infiltração



Filtros de areia

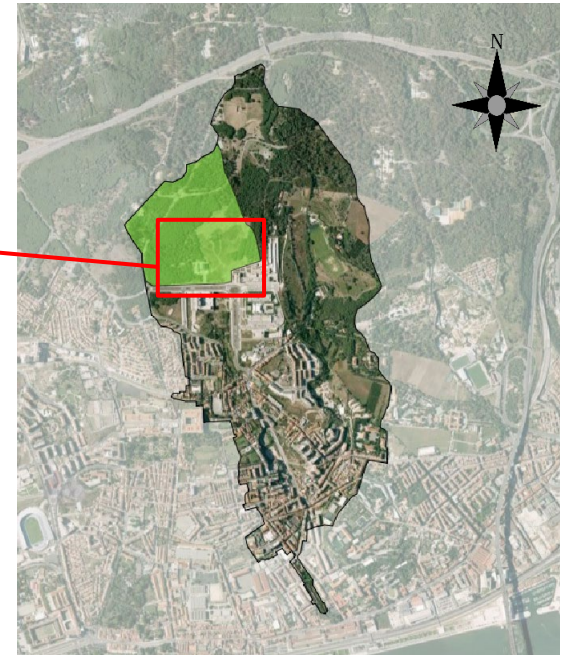
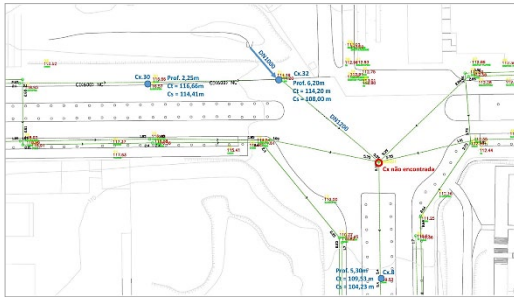


Valas com cobertura vegetal

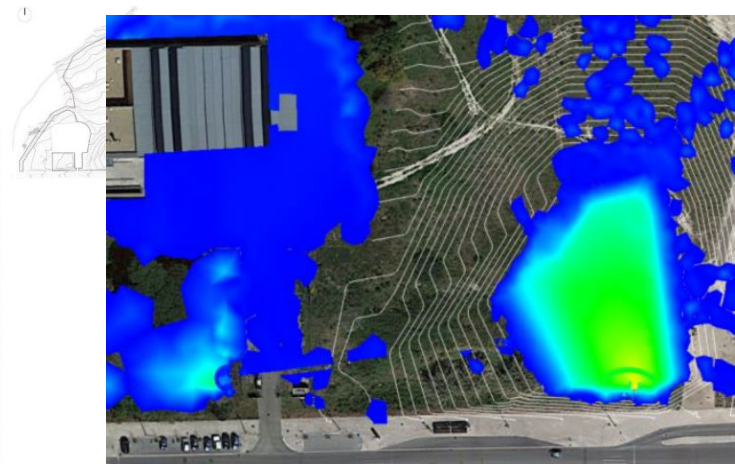


LISBON DRAINAGE MASTER PLAN 2016-2030

Ajuda detention pond - Flood control and gross solids retention



O FUTURO : VISTAS PARA SUL E PARA NORTE DO PARQUE DO ALTO DA AJUDA



LISBON DRAINAGE MASTER PLAN 2016-2030



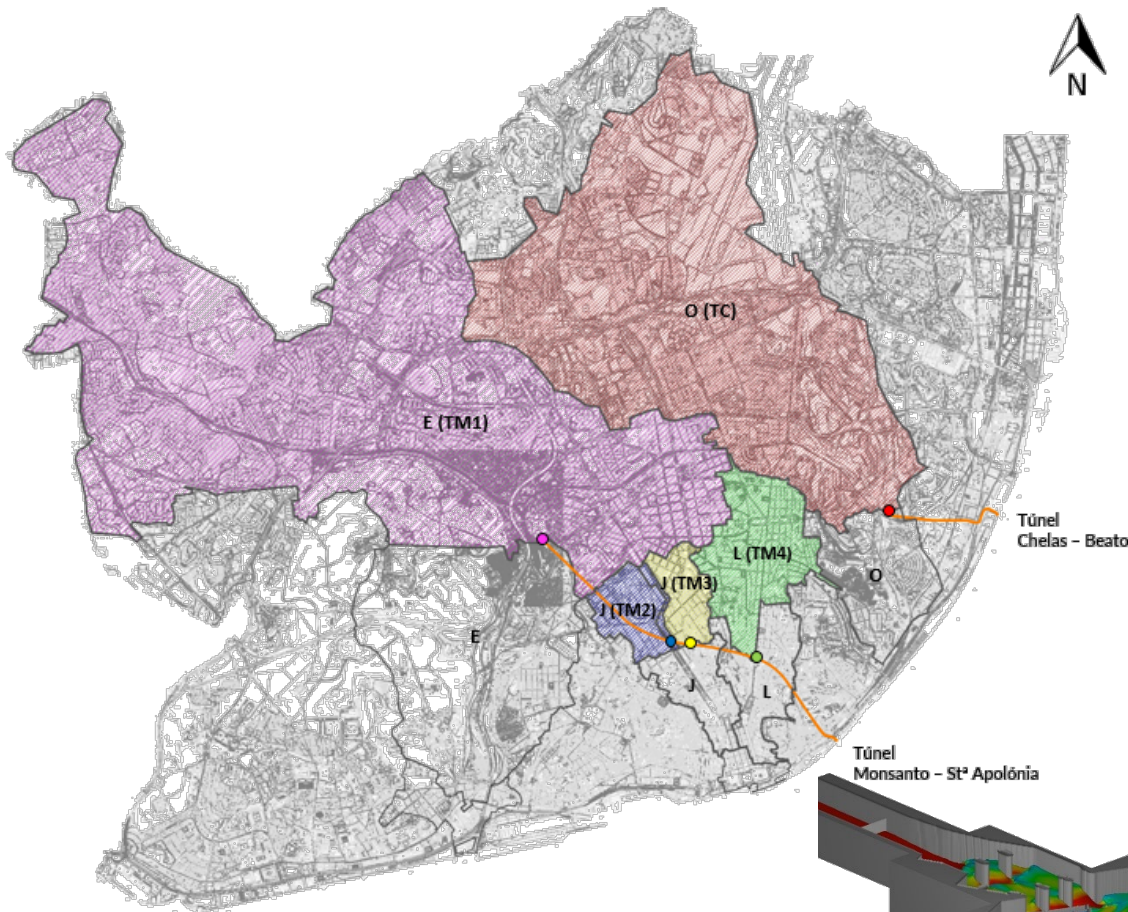
Lisbon retention basins, infiltration trenches and modular retention infrastructures. **Fast increase in green infrastructure implementation after 2008 (orange areas).**



Riverside Ribeira das Naus Wetland (Central Lisbon, touristical área) .

2 TUNNELS FOR DRAINAGE (GREY SOLUTIONS)

Túnnels



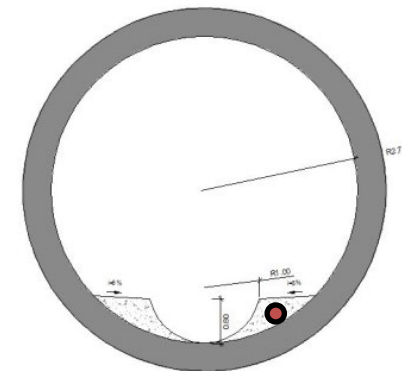
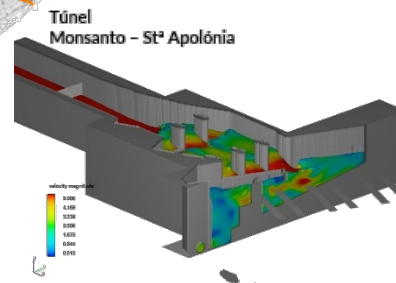
Túnel Monsanto – Stª Apolónia:

$L \approx 4,6$ km

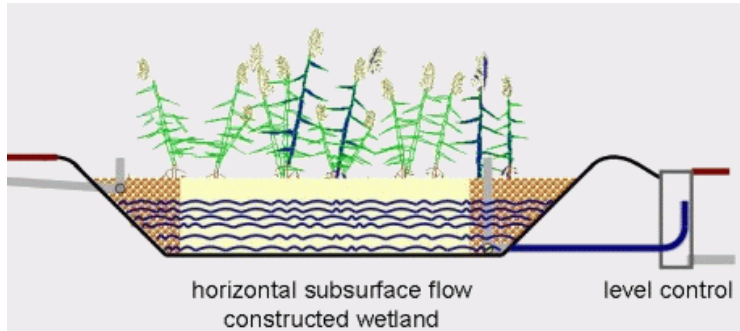
\varnothing 5500 mm

$i = 0,83\%$ e $0,45\%$

$F_{100} = 170$ m³/s



NBS for Pollution Control – WWTP



Probably more than 1/3 of the WWTP in Portugal are NBS: Ponding systems, **constructed wetlands (CW)**, **Land treatment systems** and hybrid solutions, principally CW (in general for < 1000 inh)

Ponte dos Leites WWTP, Hybrid NBS system: Ponding and constructed wetlands , Brazil (200 l/s, 140 000 inh)

For Africa, Angola, Cap Vert and Mozambique I have been proposing NBS (hybrid systems) for WWTP of large cities WWTP



LISBON WASTE WATER REUSE STRATEGIC PLAN –SUPPORTING NBS



INTRODUCTION- LISBON CASE STUDY-REUSE AT CITY SCALE

The **Strategic Plan for Water Reuse of the Lisbon City** was developed in 2018/2020 for Aguas do Tejo Atlantico (AdTA) , the utility that manages the bulk wastewater system of the Lisbon area and surroundings, and for the Lisbon Municipality (EU Green Capital 2020), that manages the retailed sewer system. Population of Lisbon is around half a million.

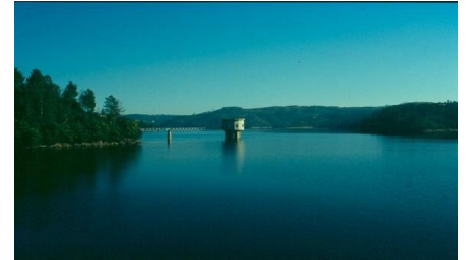


INTRODUCTION- LISBON CASE STUDY-REUSE AT CITY SCALE

Objective –100 % of the water for urban cleaning and irrigation of the parks and NBS of the city, supplied with water reused by 2030.

Benefits of water reuse

- Supply of natural fertilizers
- Not dependent on climate uncertainty, being an alternative source for various uses, including in context of water crisis
- "Release" water with high quality for human consumption, reducing the pressure on water sources/water bodies (Castelo do Bode reservoir, about 140 km far from Lisbon).
- Economical, social and environmental benefits

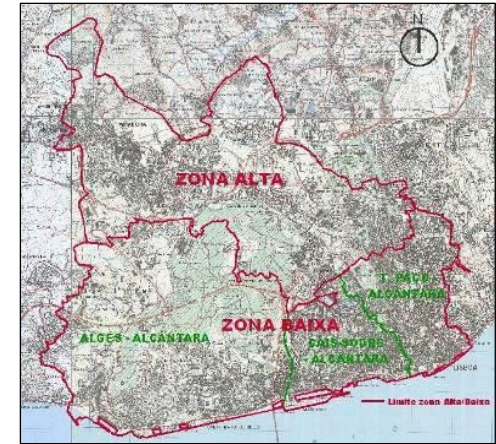


POTENTIAL OF WATER REUSE

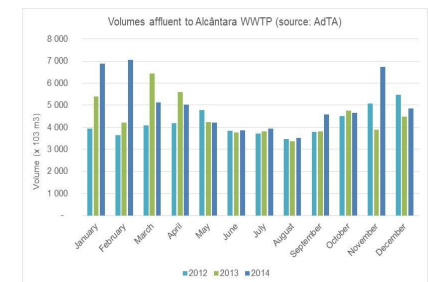
- Potential uses in Lisbon region
 - For irrigation of green spaces (main use)
 - For industry cooling purposes (IKEA) supplied by (Frielas WWTP) (in operation)
 - Sweeping of sewers, washing of roads, washing of equipment and vehicles, and for construction Recreational and environmental uses



3 WATER SOURCES (The WWTP)



3 main catchments and 3 WWTP- Alcantara, Beirolas and Chelas.



Alcantara WWTP (600 000 inh)(not just Lisbon Inh)- The larger green roof in Iberian Peninsula - about 2,7 ha

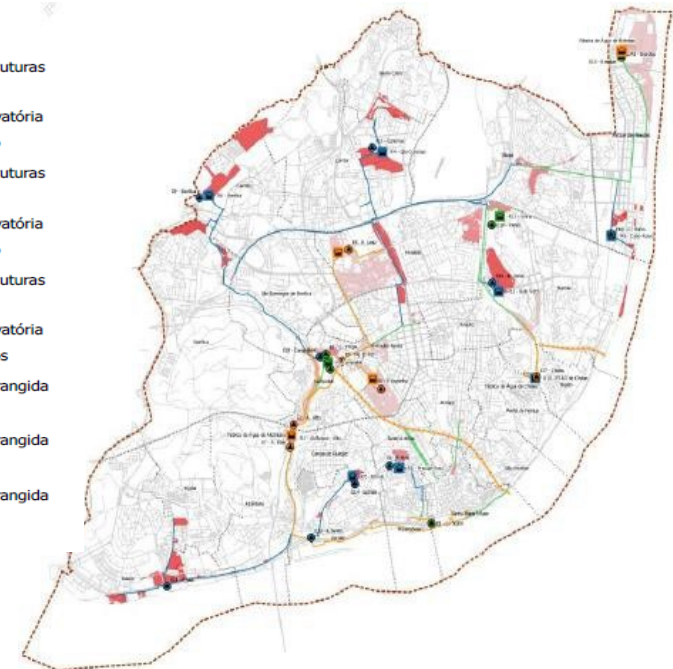
PROPOSED SOLUTION AND PHASING

(16 M Eur) (Pumping systems, rising mains, storage tanks along the city)

- **Alcântara Sub-system:** Estrela, Príncipe Real, Belém, Ajuda, Benfica e Campo Grande - Quinta das Conchas.
- **Chelas Sub-system :** Bela Vista.
- **Beirolas Sub-system :** Cabo Ruivo.

System	Subsyste m/ Infrastructu re	Capacity		Elevation			Mains (m)	Irigation areas (ha)	Volum e (m³/ano)	
		Id	Vol. (m³)	Id	Q (l/s)	H (m)				
Alcântara	ETAR Alcântara	R1	1000					8.32	49 914	
	P. Espanha							5.16	30 944	
	Santos							0.42	2 493	
	Cais Sodré							1.47	8 828	
	Campo das Cebolas							0.23	1 406	
	Cidade Univ.							12.94	77 652	
	Pq. Eduardo VII							19.09	114 546	
	Campo Pequeno							0.71	4 243	
	Campolide				E10	40	40		5.54	33 266
	Camões								0.03	203
	Av. Liberdade								0.71	4 281
	Almirante de Reis								0.37	2 245
	Fecho de malha								-	-
	Estrela	R7	150		E14 E13	8 6	40 60	1 658	3.43	20 591
	P. Real	R5	150		E8	7	40	1 485	2.83	16 995
	Belém							4 199	11.40	68 398
	Ajuda				E12	16	60	1 402	6.45	38 713
Benfica	R6	900		E9	46	40	5 287	21.37	128 217	
C. Grande / Qt. Conchas	R4	800		E11	41	40	5 151	25.58	153 490	
Chelas	ETAR de Chelas	R10	450					-	-	
	Vale da Montanha							9.59	57 527	
	Vinha							9.71	58 237	
Bela Vista	R12	400		E19	19	30	835	7.69	46 126	
Beirolas	ETAR de Beirolas							-	-	
	Parque Tejo							23.28	139 680	
	Vale do Silêncio							9.67	58 042	
	Cabo Ruivo			E16	25	100	1 603	5.12	30 701	
Fecho de Malha							7 172	-		
Total								191.12	1 146 735	

- Fase 1 - Infraestruturas
 - Rede
 - Estação Elevatória
 - Reservatório
- Fase 2 - Infraestruturas
 - Rede
 - Estação Elevatória
 - Reservatório
- Fase 3 - Infraestruturas
 - Rede
 - Estação Elevatória
 - Reservatórios
- Fase 1 - Área Abrangida
 - Usos Rega
- Fase 2 - Área Abrangida
 - Usos Rega
- Fase 3 - Área Abrangida
 - Usos Rega



WORKS IN PLACE



Parque das Nações: 300 000
m3/year; 295 000 m2



Climatization

Parque das Nações: 1st system with a license issued by APA (Portuguese Environmental Agency), after 2 years of discussion

WORKS IN PLACE-A VALUABLE BRANDING PRODUCT

CERVEJA ARTESANAL
PRODUZIDA COM
ÁGUA RECICLADA

VIRA



VIRA (“TURN”), is an artisanal beer created from wastewater (WWTP), (Water+), with additional treatment through ozonization and reverse osmosis-intensively controlled - 100% safe.



FINAL REMAKS



Final Remarks

- Importance of sharing and partnerships

Whatever we possess becomes of double value when we have the opportunity of sharing it with others ! *JEAN-NICOLAS BOUILLY (1763-1842)*

- Invitation to Lisbon, to visit different NBS and drink a special beer ,The “Vira”, on the Alcantara WWTP green roof bar.





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Thank you

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