

URBAN STREAM REHABILITATION IN MADRID (SPAIN)

M. González del Tánago

E.T.S. Ingenieros de Montes, Universidad Politécnica de Madrid

J. Azcárate

*Concejalía de Medio Ambiente y Servicios a la Ciudad,
Ayuntamiento de Madrid*

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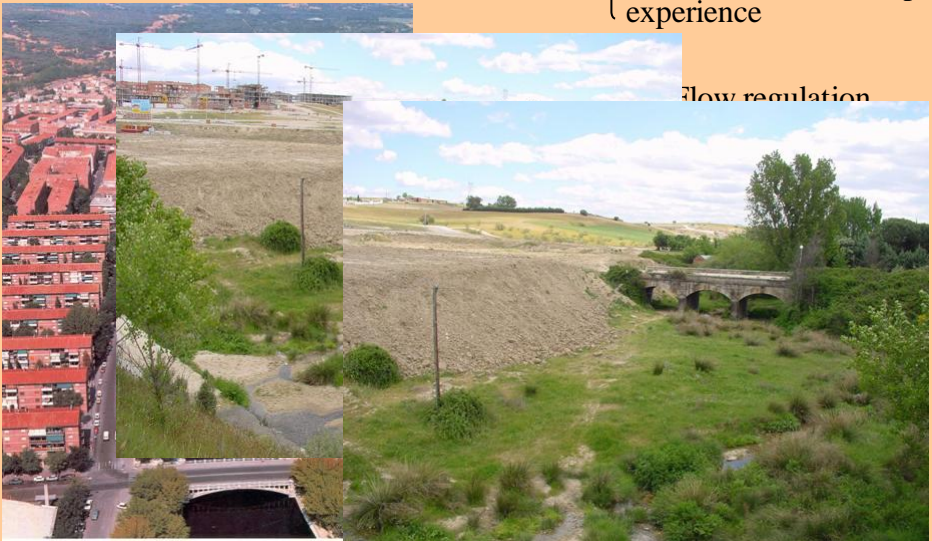
URBAN STREAMS IN MEDITERRANEAN AREAS

- Natural high variability of flow regime { Big canals without water



URBAN STREAMS IN MEDITERRANEAN AREAS

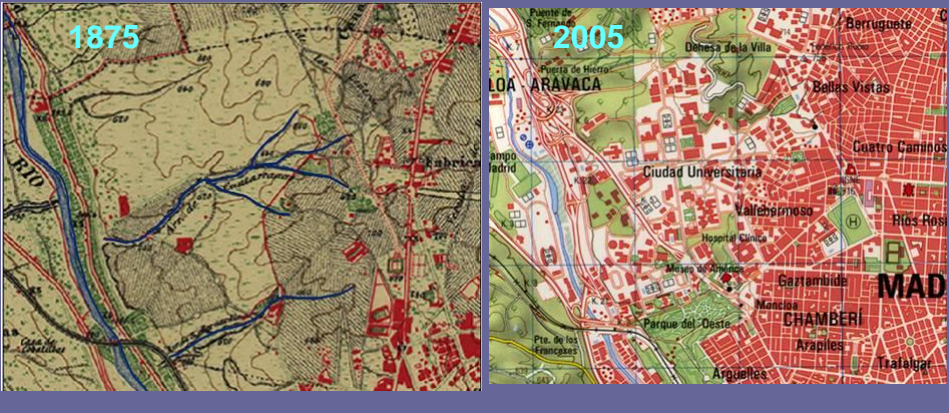
- Natural high variability of flow regime {
 - Artificial functioning
 - Loss of river landscape experience



flow regulation

STREAM CONDITIONS IN MADRID MUNICIPALITY

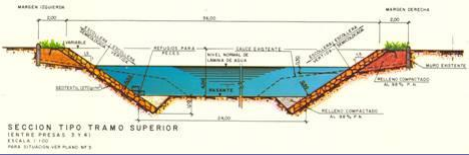
Before 1985: Increase of water quality problems in big rivers
Disappearance of small streams for urban development



STREAM CONDITIONS IN MADRID MUNICIPALITY

1985-1995: **IPSIM** (First International Plan for the River) Main objective: Water quality improvement in the river (sewage treatment)

Manzanares River



- Dredging and Widening the channel
- Lateral revetments

STREAM CONDITIONS IN MADRID MUNICIPALITY

1985-1995: I PSIM (First Integral Waste Water Treatment Plan of Madrid)

Main objective: Water quality improvement in the Manzanares river (sewage treatment plants, river regulation)

1995-2002: II PSIM to improve sewer system and treatment plants

Construction of bigger main sewers along the stream network to cope with expected urban development
Stream rehabilitation (Case studies)

2002- : Maintenance of previous works and facilities

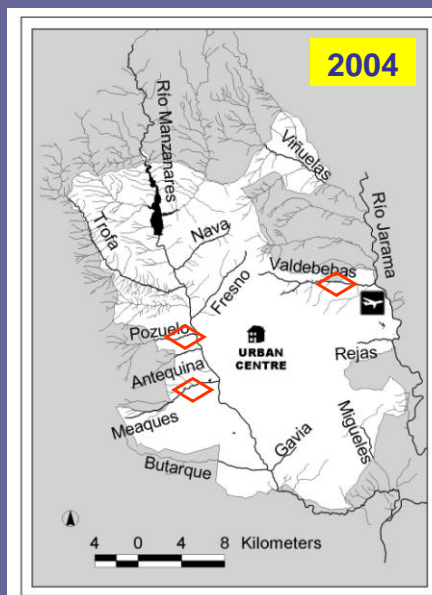
New interventions in stream reaches linked to urban developing plans

STREAM CONDITIONS IN MADRID MUNICIPALITY

Disappearance of small streams for urban development ended by 1995 (II PSIM)

Rehabilitation case studies:

- Arroyo Meaques
- Arroyo de Pozuelo
- Arroyo de Valdebebas

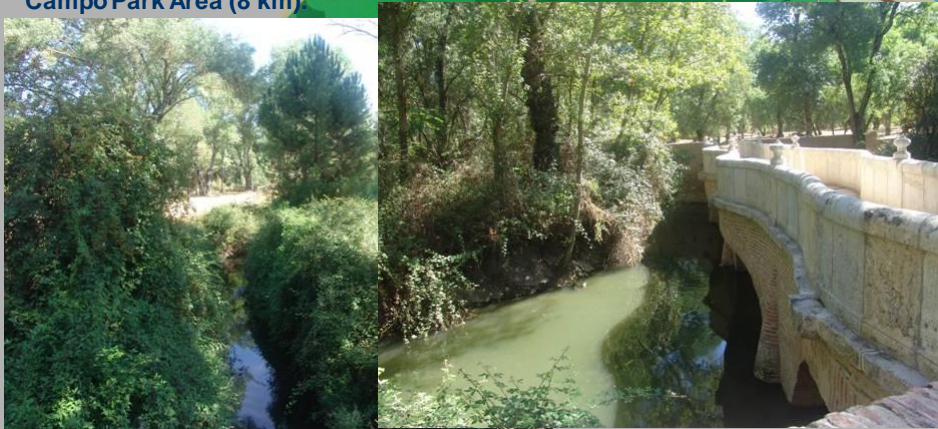


1995-2002: II PSIM. CASE STUDIES

REHABILITATION WORKS IN THE ARROYO DE MEAQUES

•Total length: 10,5 km

•Rehabilitation works in the lower reach that runs within the Casa de Campo Park Area (8 km).



REHABILITATION WORKS IN THE ARROYO DE MEAQUES

Main problems:

- High Flood risk (last event in June 1995, affecting big roads)
- Intensive public use (Casa de Campo Park), demanding visual biodiversity and gardening aesthetics
- High sediment load transported by the stream to the Lake

Rehabilitation works:

- Construction of a dam for flood defense upstream Casa de Campo Park
- Hydraulic by-passes in critical points (Zoo)
- Construction of four check-dams with associated pools and flow recirculation pumping systems, to promote visual aquatic fauna
- Diversion system at Lake arrival to avoid sediment entrance during floods

REHABILITATION WORKS IN THE ARROYO DE MEAQUES

Rehabilitation works:



REHABILITATION WORKS IN THE ARROYO DE MEAQUES

Present conditions:

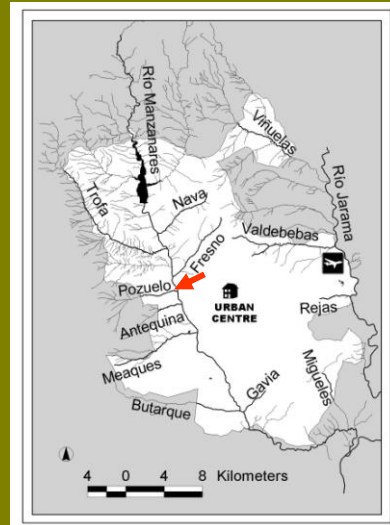
- Macrophyte invasion in the artificial ponds
- Concrete structures seem out of place in the natural environment



1995-2002: II PSIM. CASE STUDIES

REHABILITATION WORKS IN THE ARROYO DE POZUELO

- Total length: 9,2 km
- Rehabilitation works done in 2 km of the lower reach, in urban areas
- Upper parts of the catchment belongs to another municipality and have been urbanized and the stream has been



REHABILITATION WORKS IN THE ARROYO DE POZUELO

Main problems:

- Small, channelized ditch-type channel, normally dry
- Very poor riparian vegetation, dominated by weeds
- Presence of debris and obstacles, unwanted aesthetic



REHABILITATION WORKS IN THE ARROYO DE POZUELO

Rehabilitation works

- Construction of a new main sewer with environmental constraints



REHABILITATION WORKS IN THE ARROYO DE POZUELO

Present conditions:

illuted effluents in the channel and macrophyte

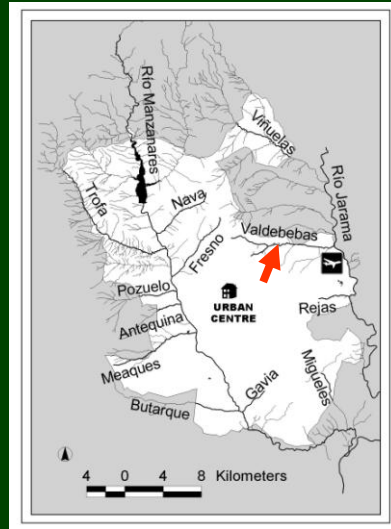


1995-2002: II PSIM. CASE STUDIES

REHABILITATION WORKS IN THE ARROYO DE VALDEBEBAS

General characteristics:

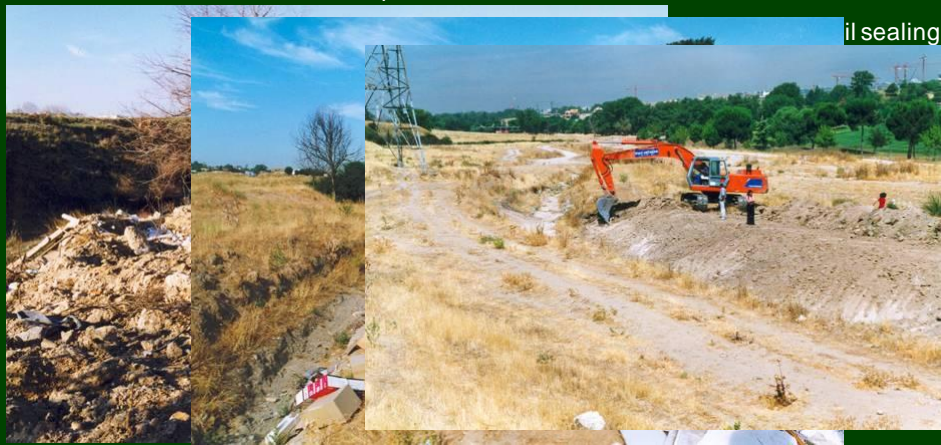
- Total length: 11,8 km
- Rehabilitation works done in the middle reaches crossing an agricultural area, along 2 km
- Upper parts of the catchment urbanized, and lower part of the channel hardly channelized crossing the Madrid airport



1995-2002: II PSIM. CASE STUDIES

REHABILITATION WORKS IN THE ARROYO DE VALDEBEBAS

- Main problems:**
- Physical ocupance of the stream by marginal constructions, debris disposals, etc.



1995-2002: II PSIM. CASE STUDIES

REHABILITATION WORKS IN THE ARROYO DE VALDEBEBAS

Rehabilitation works: • Channel morphology improvement and widening



REHABILITATION WORKS IN THE ARROYO DE VALDEBEBAS

Present conditions: • Dissapearance of riparian plantations
• Riparian space free of debris disposal



STREAM REHABILITATION IN MADRID CONSIDERATIONS FROM THE EXPERIENCE

- In mediterranean areas, urban development increases the dryness of the urban streams, making difficult their ecological recovery.
- The presence of humidity from effluents exacerbates the macrophyte growth inside the channel, increasing the flooding risk
- Artificialization of the streams with hard engineering devices follows design criteria that get old-fashioned in time, requiring high maintenance costs.
- A more natural, dynamic and self-designed river morphology allows fluvial processes, improving the landscape aesthetics with minimum maintenance.

STREAM REHABILITATION IN MADRID CONSIDERATIONS FROM THE EXPERIENCE

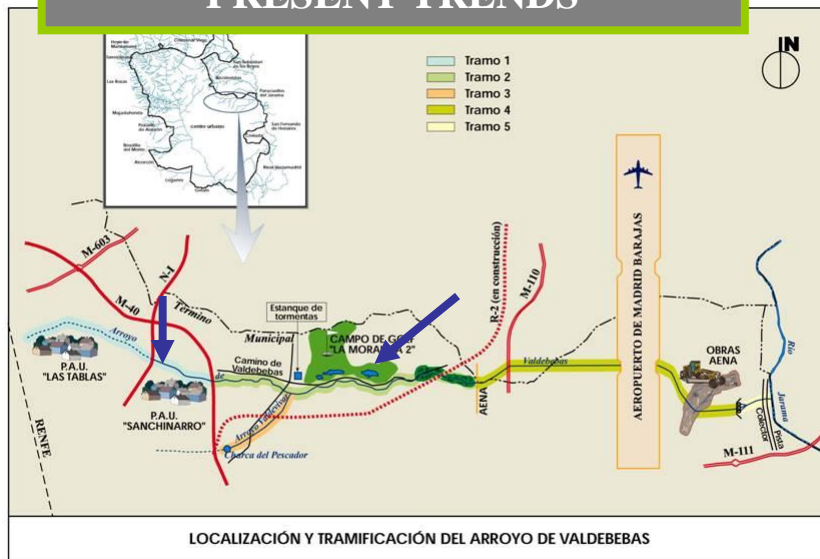
- Rehabilitation works should attend the recovery or improvement of the flowing water regime, as the main factor allowing self-maintenance fluvial structure (fauna and flora)
- Rehabilitation projects made at local scale should be included in restoration programs at catchment scale, where urban landscape planning and future infrastructure construction are mutually coordinated

STREAM REHABILITATION IN MADRID PRESENT TRENDS

New urban development undertaken in big parcels, fragmentating the streams. Channel design according to the different urbanization criteria of each parcel.



STREAM REHABILITATION IN MADRID PRESENT TRENDS



**STREAM REHABILITATION IN MADRID
PRESENT TRENDS**

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THANK YOU FOR YOUR ATTENTION;