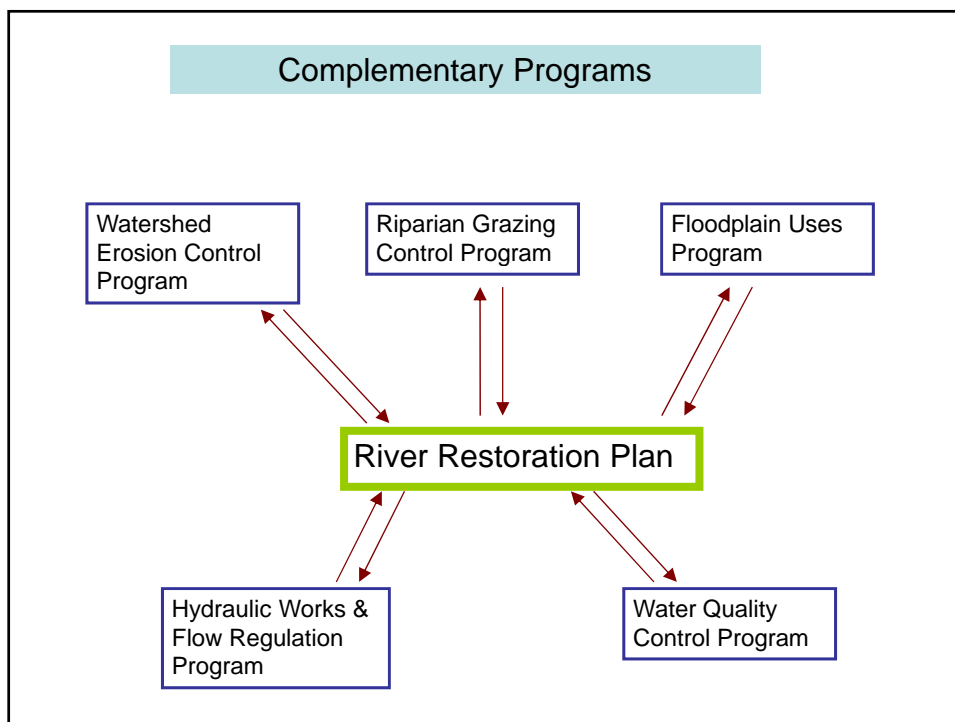
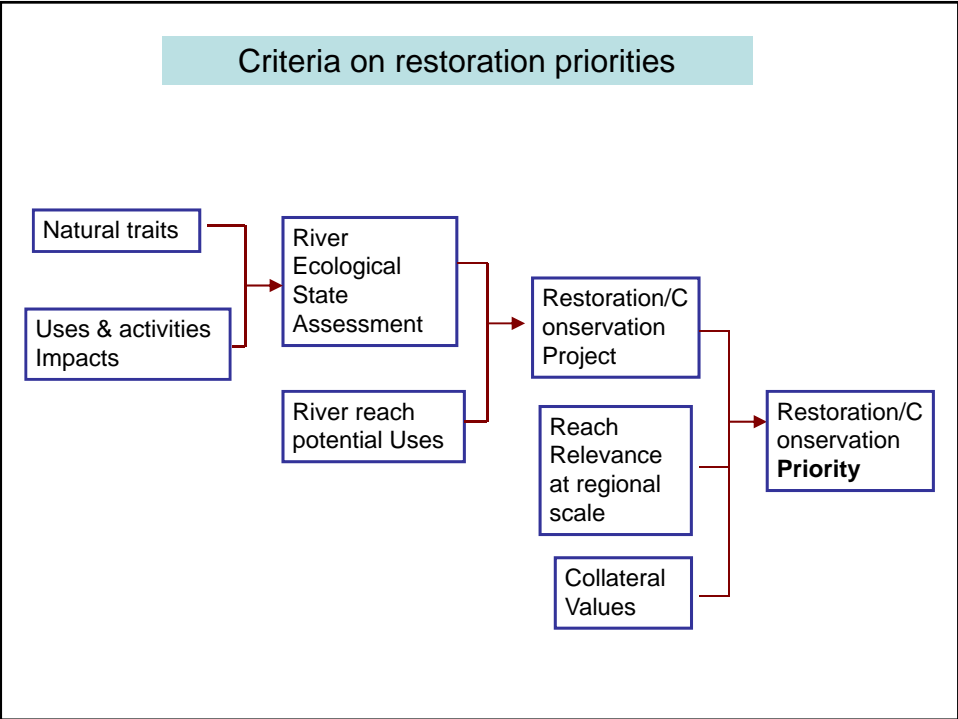
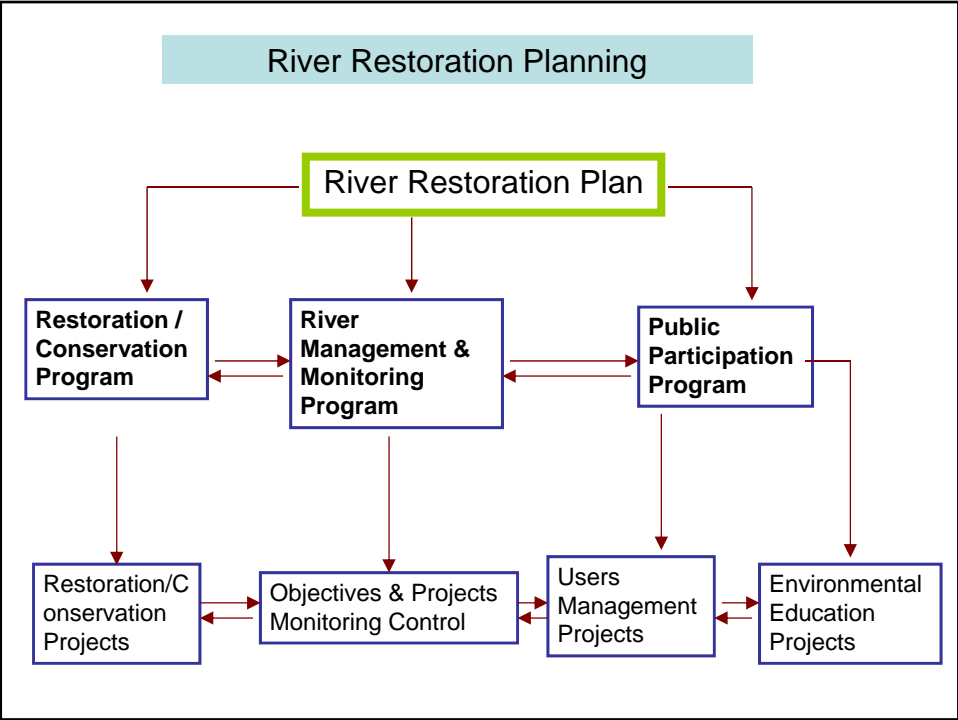
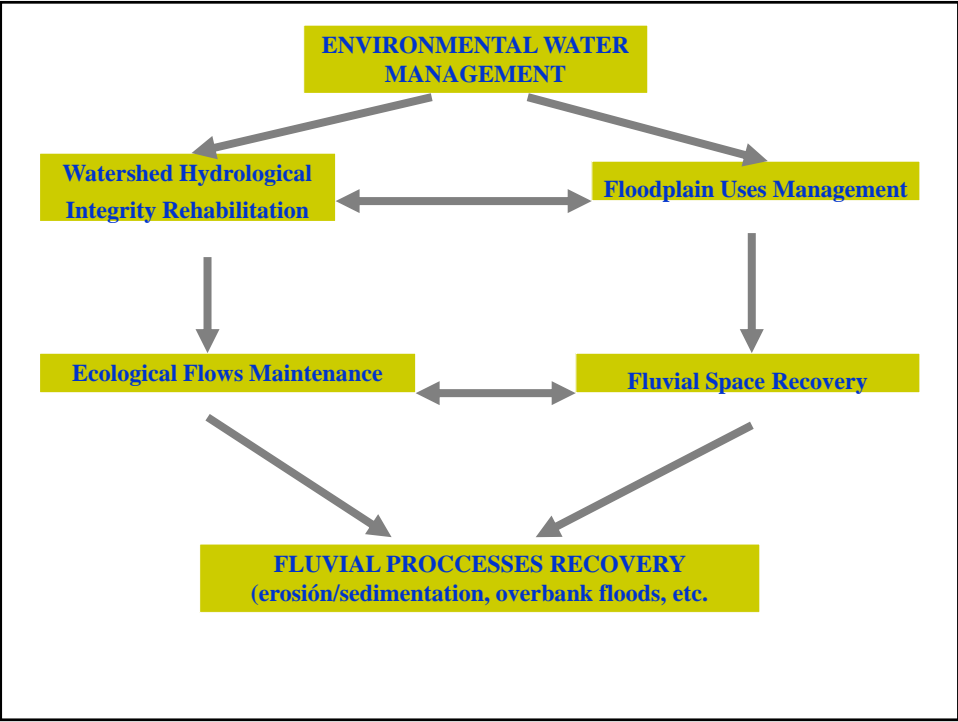
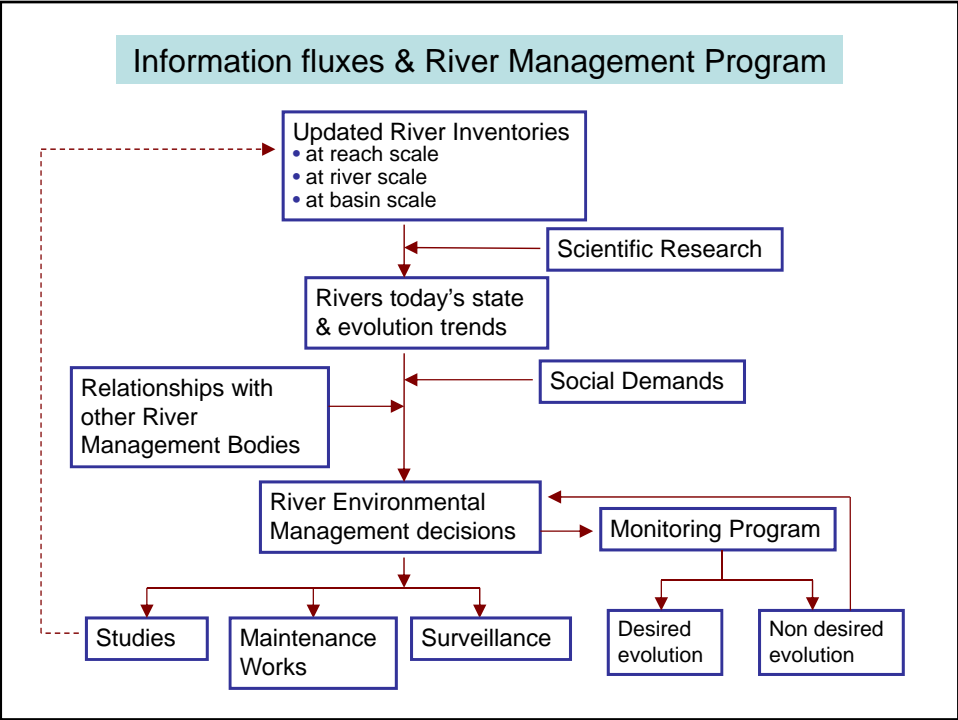


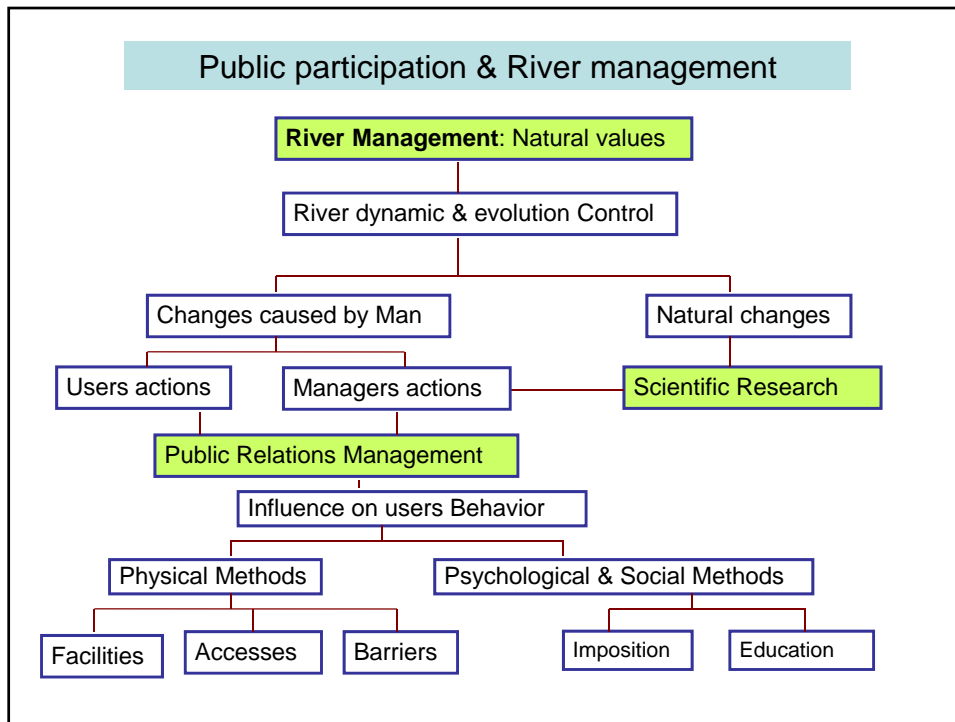
# River Restoration Planning

Diego García de Jalón  
Marta González del Tánago









## River Restoration Projects: Documents

- I. Report
- II. Maps
- III. Technical Specifications Sheet
- IV. Budget

# Report

1. **Antecedents**
2. **Objectives**
3. **Project Bases**
  31. Environment Study
  32. Fluvial Segment Study
  33. Problematic Diagnose
4. **Project Engineering**
  - A. Instream Flows
  - B. Fluvial Processes
  - C. Water Quality
  - D. Fluvial Morphology
  - E. Fluvial Biology
  - F. Riparian Systems & Floodplains

## 3.1. Environment Study

- Geographic situation
- Watershed Analysis
  - Climate
  - Geology and Soils
  - Relief
  - Vegetation & Land Uses
  - Drainage Network
- Socio-Economic Environment
  - Population census
  - Riparian Landownership & Water Rights properties
  - Economic Analysis

## 3.2. Fluvial Reach Study

- Hydrology & [Flow Regime](#)
- River Morphology & Dynamics
  - [Cross Sections](#)
  - [Longitudinal profile](#)
  - [Plan view sketch](#)
  - [Channel Dimensions](#)
  - **Substrate & sediment dynamics**
- Riparian riverside Study
  - Longitudinal Continuity
  - Dimensions
  - Vegetation composition & structure
  - Woody vegetation natural regeneration
  - Bank Condition
  - Transversal Connectivity
  - Substrate Permeability & soil degradation
- Aquatic Fauna
- Pressures & Impacts

## 3.3. Problematic Diagnose

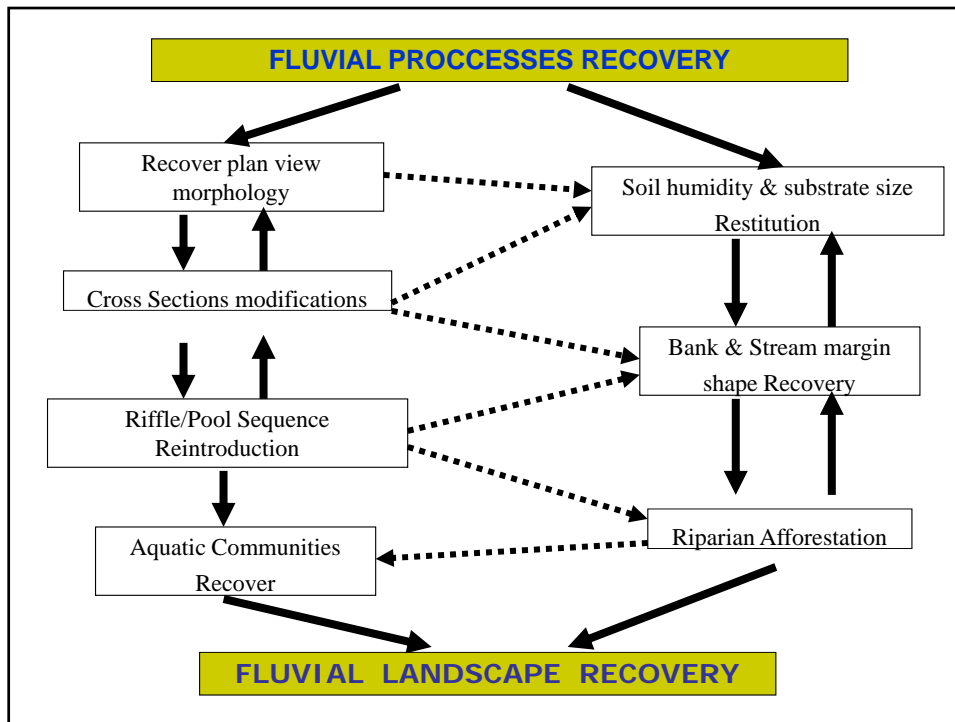
- Accumulated Effects at basin scale
  - Diffuse Pollution
  - Flow Regulation
  - Land Uses
- Local Impacts Effects
  - Spills
  - Channel Dredging
  - Dams & Water Transfers
  - Fluvial Space Occupation
- River Historical Reconstruction
- Present state Interpretation
- Limiting Factors hierarchical detection

## 4. Project Engineering

41. Alternatives Assessment
42. Actions Proposal & Justification
43. Environmental Impact Assessment
44. Works Design & Quantifications
45. Revegetation design and Quantification
46. Execution & Maintenance Plan
47. Monitoring Plan

### The project





## 4.4. Actions Design

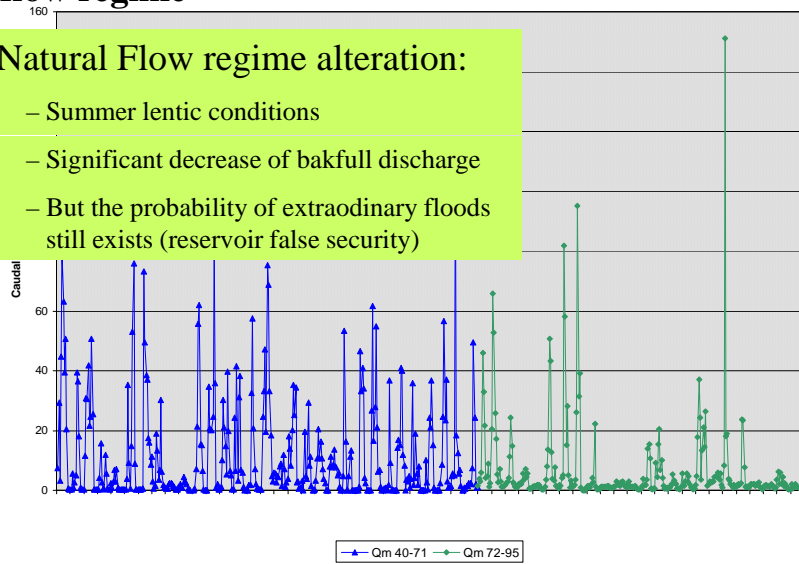
- Based on:
  - Problematic Diagnose
  - Objectives Formulation
- **Works Definition to be done:**
  1. Floodplain and Riparian land Uses Planning
  2. Ecological Flow Regime Impementation & Pollution Control
  3. Channel Morphology Recover
  4. Riparian Zones Recovery
  5. Preparation for foresee Uses
- Cronogramme and Localization
- Maintenance and ecoogical state Monitoring



## River Jarama flow regime

- Natural Flow regime alteration:

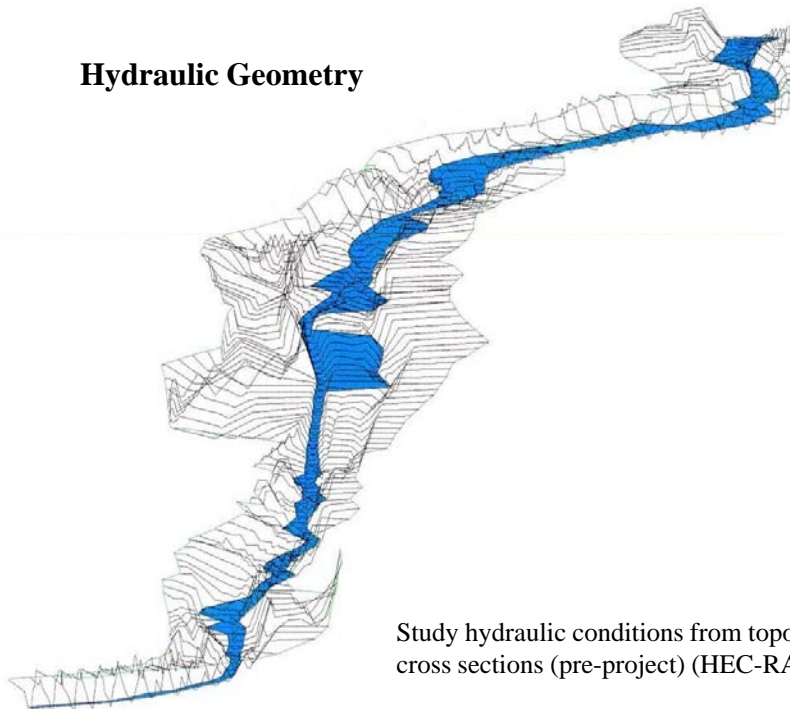
- Summer lentic conditions
- Significant decrease of bankfull discharge
- But the probability of extraordinary floods still exists (reservoir false security)



River Jarama Mean monthly flow values from 1940-95. Blue line before the construction of large reservoirs (El Atazar, Pinilla & El Vado)



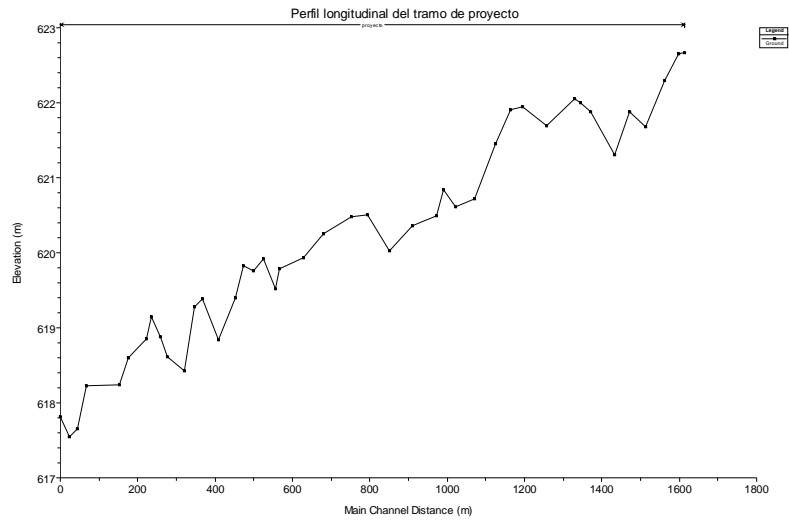
## Hydraulic Geometry



Study hydraulic conditions from topographic cross sections (pre-project) (HEC-RAS).

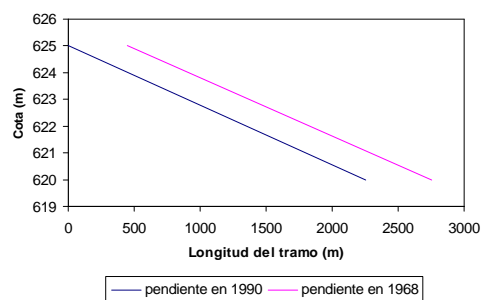


Longitudinal profile of the project reach (43 sections)



## PROJECT REACH STUDY

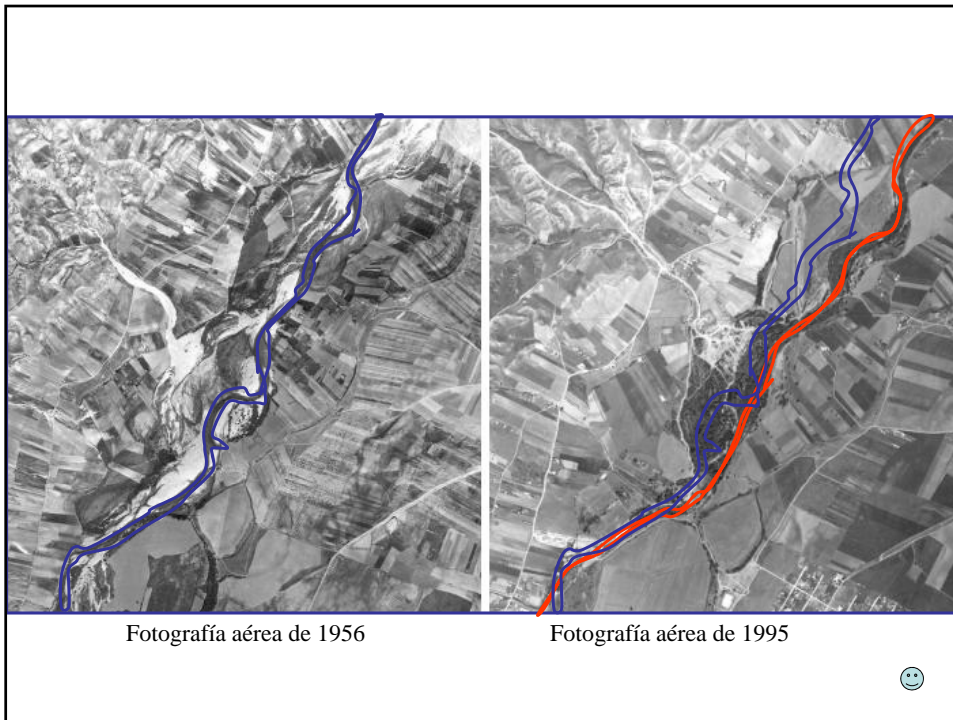
### Longitudinal Profile



River Jarama base level lowered due to:

- Gravel extractions directly from river bed, and also from the riparian system
- Decrease of bed load and transported sediments





## Geomorphology and Fluvial Dynamics

### STUDY OF A LONG RIVER SEGMENT

Longitudinal profile

Valley morphology

Plant view

### ANALYSIS OF PROJECT REACH

Longitudinal profile

Plant view

Hydraulic Geometry

## Long river segment

Comparison between river Jarama reference condition (1956) and actual (1995)

photo	1956 Area (Ha)	1995 Area(Ha)	Balance	1956 Width (m)	1995 Width (m)
1	28.24	10.1	-18.14	72.4	36.2
2	35.87	15.87	-20	95	36.7
3	30.21	14.55	-15.66	72	38.5
4	15.57	10.14	-5.43	52	35
5	25.18	21.21	-3.97	60	56
6	29.2	21.6	-7.6	65	50
7	26.58	13.14	-13.44	59	30.4
8	20.99	15.26	-5.73	70	48.4
9	14.43	10.32	-4.11	37	26
10	26.76	11.29	-15.47	81	31.2
11	19.74	11.41	-8.33	73	42.2
12	22.5	19.4	-3.1	90	72
13	33.55	15.2	-18.35	93	42.2
<b>Total</b>	<b>329</b>	<b>189.5</b>	<b>-139.3</b>	<b>70.7</b>	<b>41.9</b>

River Jarama Sinuosity (Leopold & Wolman): Comparison between 1956 and 1995.

TRAMO	Coficiente de sinuosidad (56)	Clasificación
A	1.9	Meandriforme
B	1.4	Sinuoso
C	1.7	Meandriforme
D	1.5	Sinuoso
Media	1.6	Meandriforme

TRAMO	Coficiente de sinuosidad (95)	Clasificación
A	1.5	Meandriforme
B	1.1	Sinuoso
C	1.3	Sinuoso
D	1.2	Sinuoso
Media	1.3	Sinuoso

## Project reach Plant view

Historical evolution:

- Sinuosity
- Surface
- Channel width

Años	Sinuosidad	Longitud (m)	Superficie (ha)	Anchura del cauce (m)
1956	1.2	3500	18.69	53.39
1968	1.125	3100	9.154	29.53
1990	1.04	3000	11.72	39

Planta presentada por el cauce en el tramo de estudio en 1956, 1968 y 1990 a través de los planos 1:5.000 de 1990 y 1968 y la fotografía aérea de 1956.

