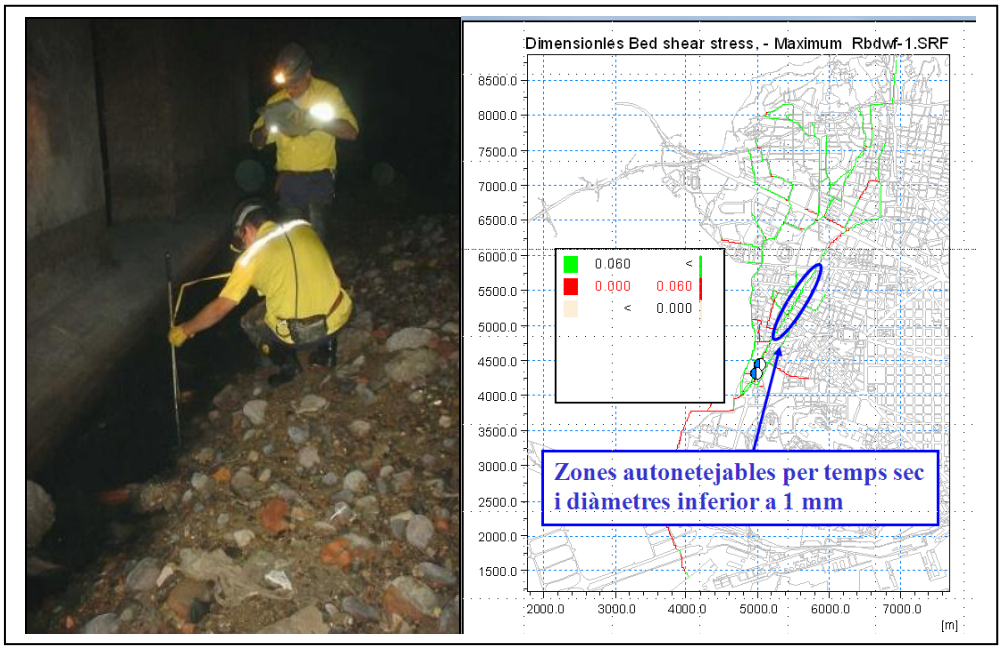
Demonstration Plan Outline Demonstration 1.3.3 in Barcelona: Sediment monitoring and modelling



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Title
Demonstration Plan Outline. Demonstration 1.3.3 in Barcelona: Sediment monitoring and modelling

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Author(s)
David Suñer (CLABSA)
Anna Massagué (CETAQUA)

Quality Assurance
By Gesche Grützmacher (KWB)
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PP = Restricted to other programme participants (including the Commission Services).

Document history

Version	Team member	Status	Date update	Comments
1	David Suñer	Draft		
2	David Suñer	Final	07/12/2011	Added inputs from Gesche

Contents

1 Introduction

Barcelona with a population of 1.6 Mio inhabitants within its administrative limits on a land area of 101.4 km² (15,980 inhab./km²) is located on the Northeast coast of Spain, facing the Mediterranean Sea, on a plateau limited by the mountain range of Collserola, the Llobregat river to the south-west and the Besòs river to the north east. The city benefits from a classic Mediterranean weather and occasionally suffers heavy rainfalls of great intensities and flash floods events. The yearly average rainfall is 600 mm, but the maximum intensity in 5 min, corresponding to a return period of 10 years, is 204.7 mm/h and it is not rare that 50 % of the annual precipitation occurs during two or three rainfall events.

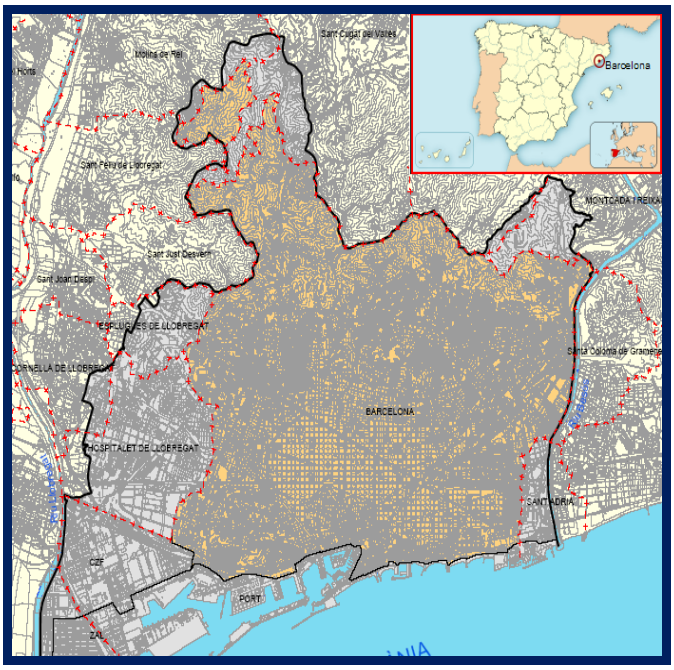

Figure 1.1:Map of Barcelona

The morphology of Barcelona presents areas close to the Collserola Mountain with high gradients (with an average of 4%) and other flat areas near to the Mediterranean Sea with lower slopes (with an average of 1%). This morphology produces flash floods in the lower city in case of heavy storm events.

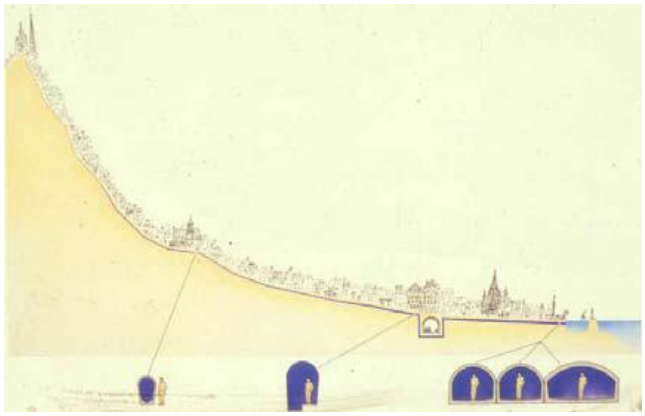

Figure 1.2: Typical slopes and morphology in Barcelona

Due to the presence of mountains in the upper part of the catchments and the described gradients, sediments enter the sewer network. They are eroded and transported through the sewers with high gradients and sediment in the low part of the city with low sewer slopes, causing several problems such as a reduction of hydraulic capacity and odours in this part of the city. Other major sediment inputs result from parks located inside the city, and construction works. It is expected that these issues could increase in the future due to climate change as more intense events and prolonged dry periods will lead to increase rural catchments erosions so more sediments can get into the sewers.

To reduce these problems and also to reduce pollution problems linked to sediments, the municipality spends a high annual budget for monitoring and cleansing of sewer sediments, so any improvement, understanding the sediment behaviour would contribute to great savings and a better and most efficient use of the municipality resources.

Within the PREPARED project a methodology for sediment monitoring and modelling is being developed within WP 3.2 by CETAQUA and INSA. The transfer of this methodology into practice will be conducted in a demonstration phase, commencing in February 2012. The objective of this report is to document the basic information necessary for the demonstration and to clearly identify tasks and responsibilities beforehand so there is a mutual understanding amongst the involved partners on what is to be done, where, by whom and when.

2 Demonstration participants and responsibilities

2.1 CETAQUA

2.1.1 General description

Cetaqua is a non-profit private foundation. The center is an agent and an integrator organisation of the research, the technology development and the innovation in the field of water - especially in the urban cycle - with national and international activities.
The founding members are: AGBAR - Societat General d'Aigües de Barcelona (private water cycle company in Spain with more than a hundred years of experience); UPC - Technical University of Catalonia (public University of recognized prestige specialized in the engineering, sciences and architecture areas); and CSIC - Spanish National Research Council (the major public research organisation in Spain, embraces all the fields of the knowledge, since the basic research to the most advanced technological developments).

2.1.2 Previous relevant experience

The activity of Cetaqua can be summarized in: development of R&D projects in the field of the integral water cycle, and appliance of the R&D results (results transferring and scientific diffusion).
The R&D project areas of the center are: new water resources, impact of global change in water resources, asset management, water quality, energy related to water, and water demand.

2.1.3 Short profile key staff in the demonstration

- *Anna Massagué*, industrial engineer and MSc Environmental Diagnostics, with 4 years of experience in the field of climate change mitigation of urban water systems.
- *Xavier Aldea*, industrial engineer and MBA, with 2 years of experience in the field of climate change mitigation of urban water systems.

2.1.4 Main responsibilities in the demonstration

According to CETAQUA experience and involvement in other work areas of the Prepared project, their main responsibilities will be:

- General knowledge transmission between task 3.2 – Improved measurement and modelling of sediments in sewer systems, where the general conclusions of the reasearch work will be applied in this demonstration.
- General planning and coordination work
- Result analysis
- Writing the deliverable

For a more detailed list of tasks and responsibilities see table in chapter 4.4

2.2 CLABSA

2.2.1 General description

CLABSA is a mixed company owned by Barcelona Municipality and Metropolitan Environmental Entity, as public bodies, and AGBAR as main private shareholder.

2.2.2 Previous relevant experience

The company is responsible for Barcelona sewer system management which includes planning, projecting, construction of the planned and projected sewer works, remote control management, and maintenance of the sewer network.
Due to this main activity, CLABSA can provide expertise on:

- Integrated Master Drainage plans, based on a GIS and a modeling system for the sewer network, the WWTP and the receiving waters (quality and quality)
- Remote control system, operating 11 detention tanks, with a global storage capacity of 500.000m3, 21 pumping stations and 36 gates, receiving information from next to 2000 sensors.
- Emergency operation in wet weather: controlled with a centralized operation system, that decides the warning level and starts a coordinated procedure, in order to protect citizens, minimize flooding and reduce environmental impacts

Also CLABSA has participated in several R+D projects, always with a double role: researcher and end-user.

2.2.3 Short profile key staff in the demonstration

- *David Suñer*, civil eng., Project Manager, 10 years of experience focused on hydraulics modelling and R&D projects development.
- *Montse Martínez*, Ph D. Environmental Sciences, Project Manager, over 6 years of experience in the water cycle and water quality.

2.2.4 Main responsibilities in the demonstration

According to CLABSA experience and involvement in other work areas of the Prepared project, their main responsibilities will be:

- Sediment monitoring campaign.
- Create the sediment modelling for the pilot catchment.
- Modelling the different scenarios.
- Results analysis.

For a more detailed list of tasks and responsibilities see table in chapter 4.4

3 Description of the deliverable being demonstrated

The deliverable being demonstrated is being developed in task 3.2.. It focuses on developing a methodology for sediment monitoring and modelling.

This methodology will be more clearly described in deliverable D3.2.4, but a short summary of the main ideas can already be presented below:

- Definition of sediment monitoring campaign.
  In task 3.2.1 several sediment sensors and manual methodologies were analyzed, each having its main applications depending of the monitoring campaigns goals. Although there are chances to test again the sonar sensor developed in INSA (task 3.2.2), most of the campaign will be done manually using the protocol and the sedimentation form developed.
- Creation of the sediment model and definition of the modelling scenarios and methods.
  In task 3.2.3 different sediment modelling software is being tested and compared, so one of these will be chosen to create a model for the pilot catchment and the different scenarios. The methods will be defined depending on the demonstration goal. The process for creating the sediment model must start by creating a good validated model for the hydraulics in dry weather flow and in wet weather flow, and once this is done, the sediment model can be added on top.
- Results analysis and conclusions
  Results of the different model runs and scenarios will be evaluated, focusing on identifying those critical sedimentation points where sediment would constantly increase and those where sedimentation and erosion will reach an equilibrium so there is no need to clean them. The monitoring campaign data will be used for validating the model results.

4 Demonstration Experimental Design

4.1 Performance Objectives

Two main objectives are foreseen in this demonstration:

- Test the methodology developed in task 3.2 for sediment monitoring and sediment modelling.
- Understand the sedimentation and erosion processes affecting the demonstration site to identify the critical sedimentation points, those ones that should be cleansed with more frequency and those ones that they don't need to be cleansed.

4.2 Demonstration Site Description

The general location of the demonstration site inside Barcelona is shown in the figures below. It is called Bac de Roda catchment (178.3 ha) which is quite independent of the rest of the sewer system of the city.

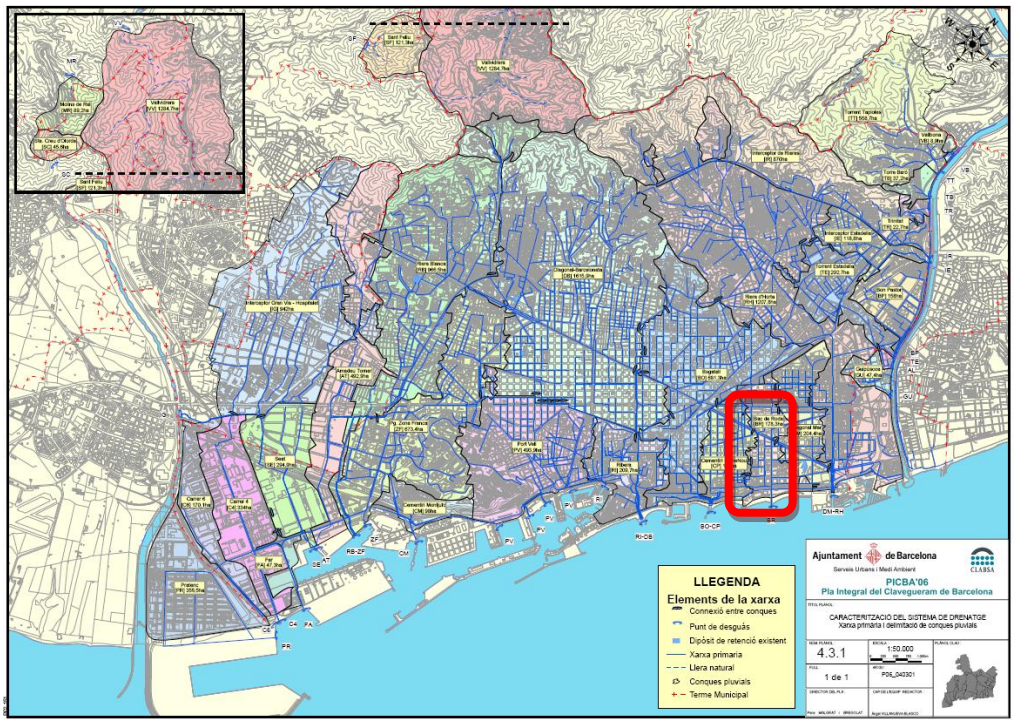

Figure 4.1: Location of the Demonstration site in Barcelona

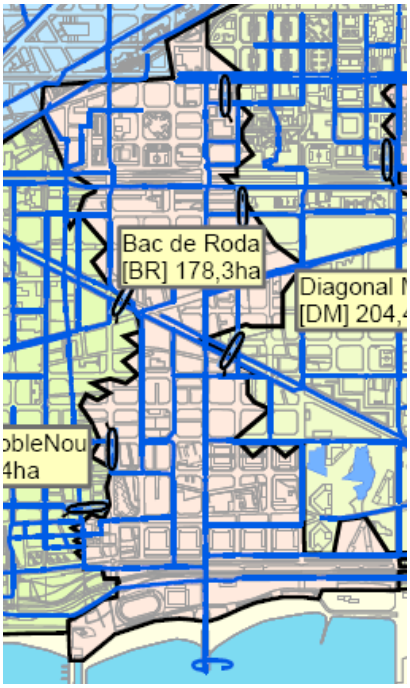

Figure 4.2: Demonstration site catchment and area.

The catchment has several urban parks that get eroded during rain events, and cause sedimentation problems especially in the main sewer trunks. These sediments don't affect the maximum hydraulic capacity of the sewer, so they don't cause flooding problems, but because the sewers in this area have a very low slope they cause retention of dry weather flows and important odour problems for the citizens.

4.3 Physical Setup and Operation

So the physical setup and the operation tasks of the demonstration will consist of:

1. Defining and carrying out a sediment monitoring campaign to provide data for the sediment model.
2. Update and adapt the current sewer model to be able to model sediments.
3. Modelling the different scenarios and strategies
4. Results analysis
5. Writing the deliverable

4.4 Schedule

A first general planned schedule is presented below:

Task	Description	Start	End	Responsible
1	Sediment monitoring campaigns	M25	M40	CLABSA
2	Update and adapt the sewer model for sediment modelling	M29	M37	CLABSA
3	Modelling the different scenarios and strategies	M37	M42	CLABSA
4	Result analysis	M42	M45	CETAQUA
5	Writing the deliverable	M42	M48	CETAQUA

4.5 Performance Assessment and reporting

The work will be conducted by the staff described in chapter 2 by the two companies (CETAQUA and CLABSA) which, although the tasks and responsibilities have been clearly defined for each one, will work in close cooperation, doing at least one coordination meeting once each two months to keep track of the developed work, and identify any problem or delay in the schedule so the required measures can be taken to avoid final delays at the end of the project.

Also the demonstration leader (David Suñer) as a part of the working team will know perfectly the state of the work and will inform as often as required to the WP1.2 and WA1 leaders.

Only one deliverable will be produced at the end of the demonstration, but minutes of all the working meetings between CETAQUA and CLABSA will be done and sent to the PREPARED leaders in case it is required.