

Water Sensitive Cities: Integrated Approach To Enhance Urban Flood Resilience in Parma (Northern Italy)

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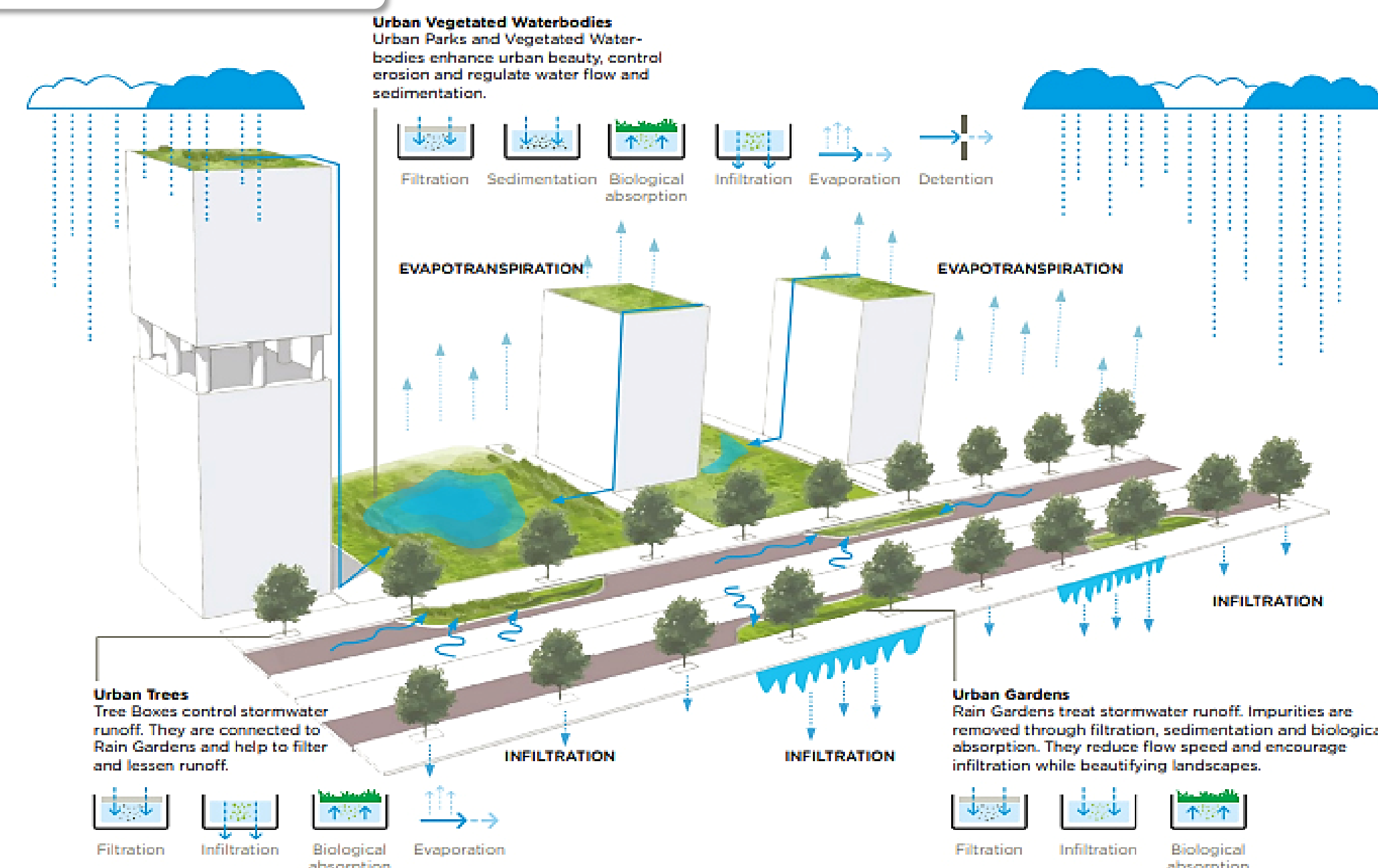
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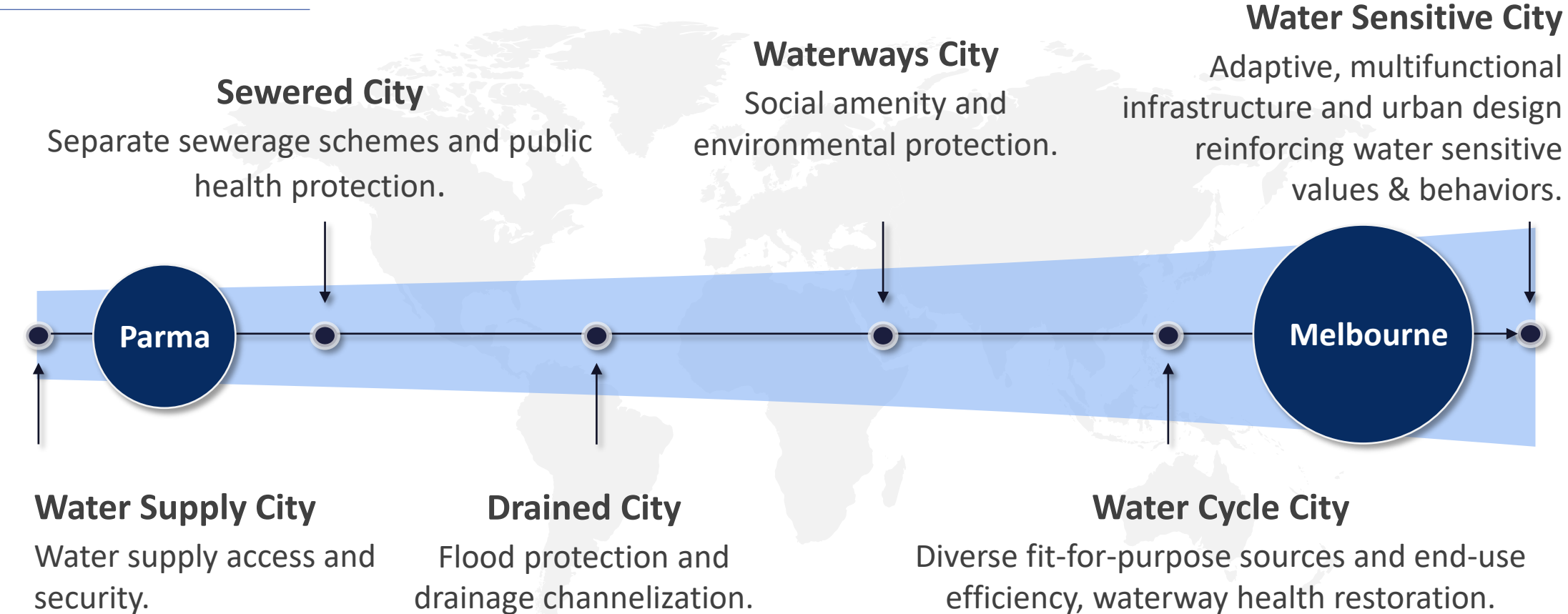
Introduction

The climate change of the last half century is globally causing an increasingly of violent meteorological phenomena with severe consequences, especially in urban areas. In order to make our urban water systems more adapt to these challenges new water management strategies must be developed. The complexity of this challenge calls for the integration of knowledge from different disciplines and collaborative approaches. The concept of **Water Sensitive Cities** is the starting point for developing new strategies, policies and tools to ensure greater livability, sustainability and resilience of our cities.

Water Sensitive Cities



Transition towards Water Sensitive City



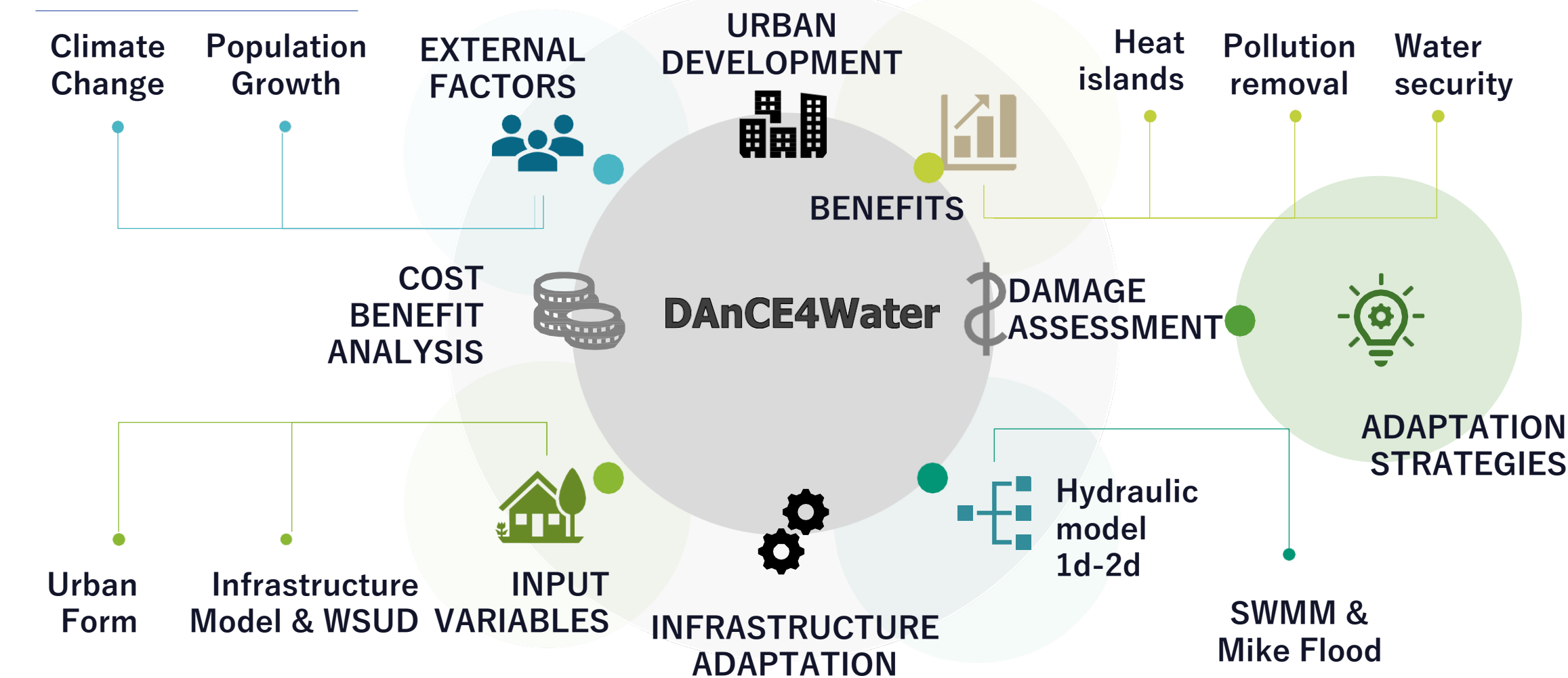
Water Sensitive Urban Design



Methods

The study has been divided into three parts: a first part relating to the collection and management of data about the urban and natural environment of Parma; a second part relating to rainfall surveys and hydrological and hydraulic modeling and a third part relating to the use of the DAnCE4Water model and the application of the WSUD.

DAnCE4Water Model



Case Study: Parma

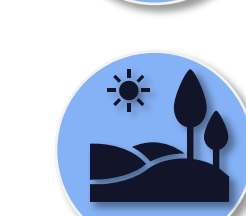
In the last century, the city of Parma has been affected several times by intense flood events, and at the same time it faced a drought emergency in 2017. Moreover, in the last seventy years its resident population has doubled.



Population
197,499 inha (from ISTAT)



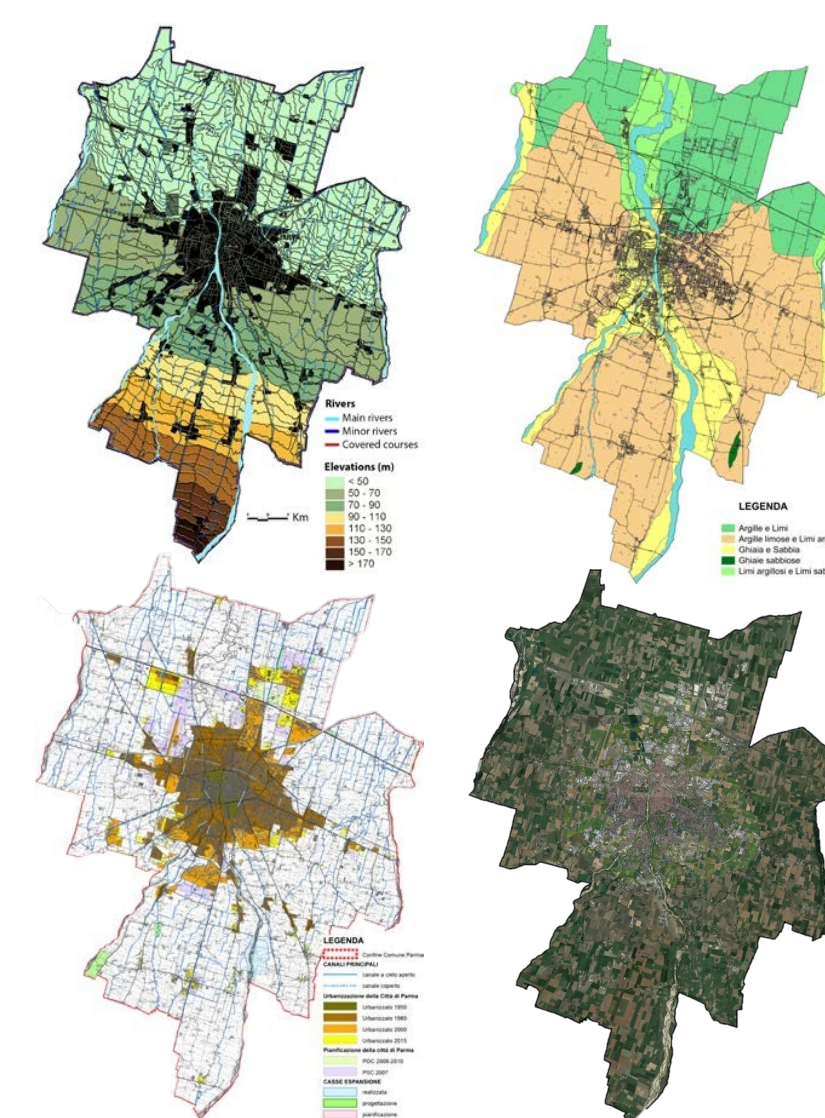
Location
44° 48'12"96 N - 10° 19'48"00 E
260,77 km²



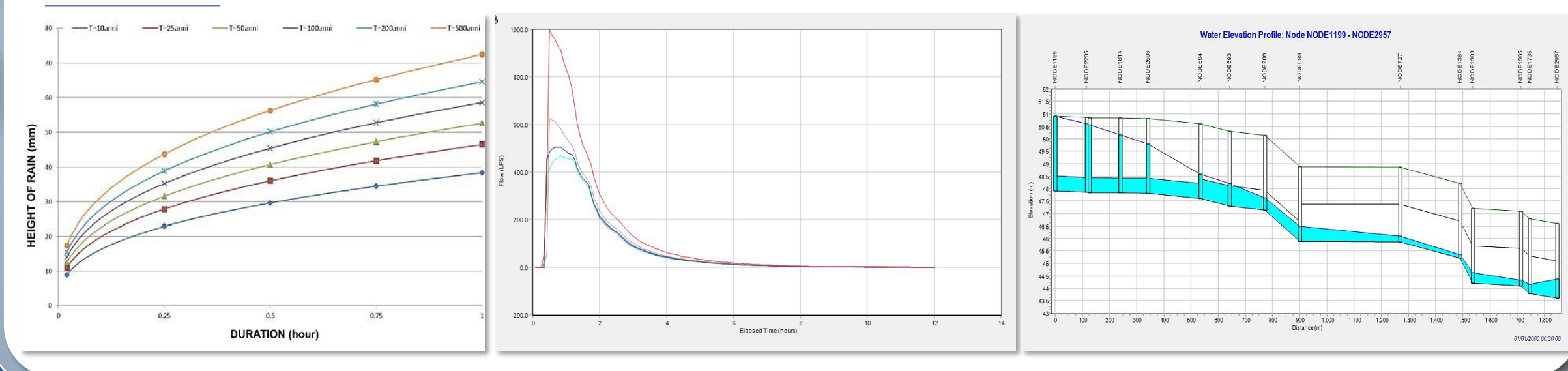
Geomorphology
Flat area, with an average slope of 0.5 - 1% and altitudes from 183 to 28 m a.s.l.



Sewerage
Mostly combined, separated only in areas of recent urbanization.

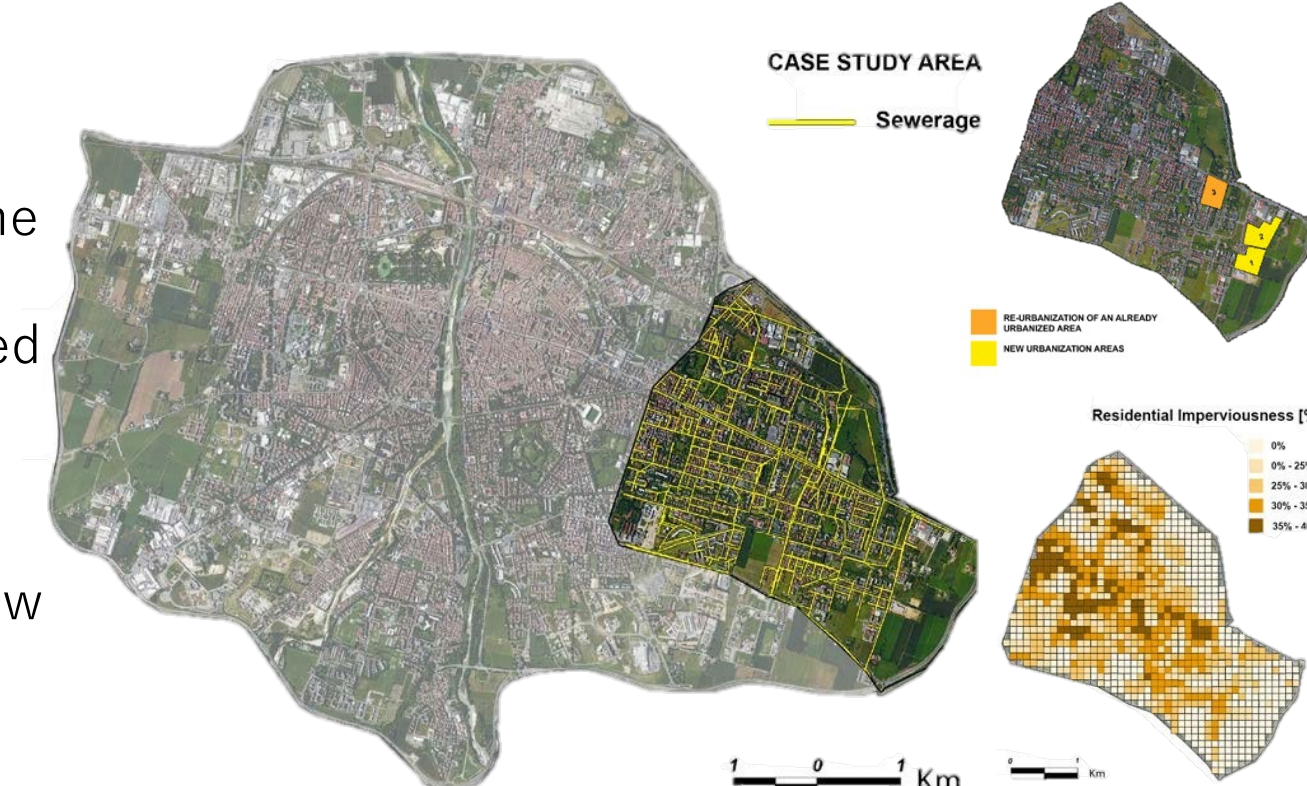


Hydrological Analysis



FrameWork

To apply the integrated approach, I focused my attention on the area to the east of the city, an area that showed different hydraulics criticalities. I tested the sewerage system in four different scenarios. In the last one, assuming that Parma will enjoy a continuous demographic growth, I added three new urbanized areas, selected from the municipal structural plan of the city.



Results

BUSINESS AS USUAL	Scenario that represents the state of art.
POROUS PAVEMENT	25% of the impervious surface is considered as porous.
GREEN ROOF	25% of the existing roofs are considered as porous.
NEW URBANIZATION	Increase in population and impervious surfaces.

	Total Precipitation [mm]	Infiltration Loss [mm]	Surface Runoff [mm]	Finale Storage [mm]
BAU	24,0	1,7	19,4	2,9
POROUS PAVEMENT	24,0	5,3	15,0	3,7
GREEN ROOF	24,0	5,9	14,9	3,2
NEW URBANIZATION	24,0	1,5	19,5	3,0

The new urbanization areas have been modeled using the DAnCE4Water model which offers the possibility not only to evaluate possible adaptation strategies, but also to evaluate different urbanization solutions, self-generated by the model based on the inputs entered.



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