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Decentralised Wastewater Management

- An Introduction to Environmental-Economic Approaches, Decision Support Methodologies and Capacity Development

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The Training and Demonstration Centre Decentralised Infrastructure - BDZ e. V. ..

..is a non-governmental organization

..is an initiative for the promotion and successful establishment of sustainable wastewater management

..provides a vendor-neutral, independent platform in the decentralised wastewater sector and sets itself the goal to support economical and ecological reasonable wastewater treatment at local, national, and international levels

..aims at securing quality of these technologies sustainably in order to protect water resources

..unites 100 members from economics, science, politics and administration

Main Activities

Demonstration & Information

Capacity Development

Research & Development

Standardization

Demonstration & Information

International Activities of the BDZ

- Research and Development
  - ➢ Analysis of the actual state of waste water management
  - ➢ Development of scenarios for the implementation of decentralised sewage treatment
  - ➢ Development of Decision Support Systems based on GIS
- Capacity Development for different target groups
- Assistance for the Installation of pilot plants and demonstration centers

Modern Wastewater Management

A modern sewage disposal system must be flexible and able to react to the future challenges:

- Demographic changes
- Decreasing specific water demand (through efficient use or even local reuse,..)
- Changing of quality of waste water due to industrial use, pharmaceutica, …
- Necessity of optimisation of the system: costs on the long term, ecological impact (decrease of energy consumption, reuse of nutrients, ...)

A modern sewage system is an integrated one - many dimensions have to be considered

- Short-, mid- and long term characteristics of the system
- All aspects of planning, building, operation
- Ecological, technical, economical and overall acceptability
- Availability of resources (water, nutrients, energy, ...)

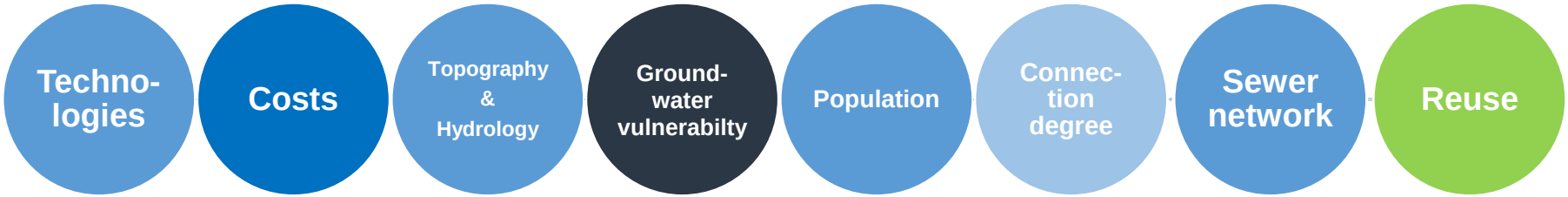
Many approaches are possible, the end of pipe central system is only one of them.

Modern Wastewater Management

Starting basis for the comparison of different types of Waste Water Management Systems are the local and regional boundary conditions / Multi-Criteria-Analysis - MCA:

- Economical aspects (life cycle costs – LCC)
- Ecological / technical effects (cleaning capacity, nutrient recovery)
- Prospective adaptability for future changes (demography)
- Prospective aspects for the society (employment, agriculture)
- Legal framework

A modern WWMS combines the needs of the society and the environment with available technologies on a transparent and coherent way.



Advantages of Decentralised Wastewater Management (DWM)

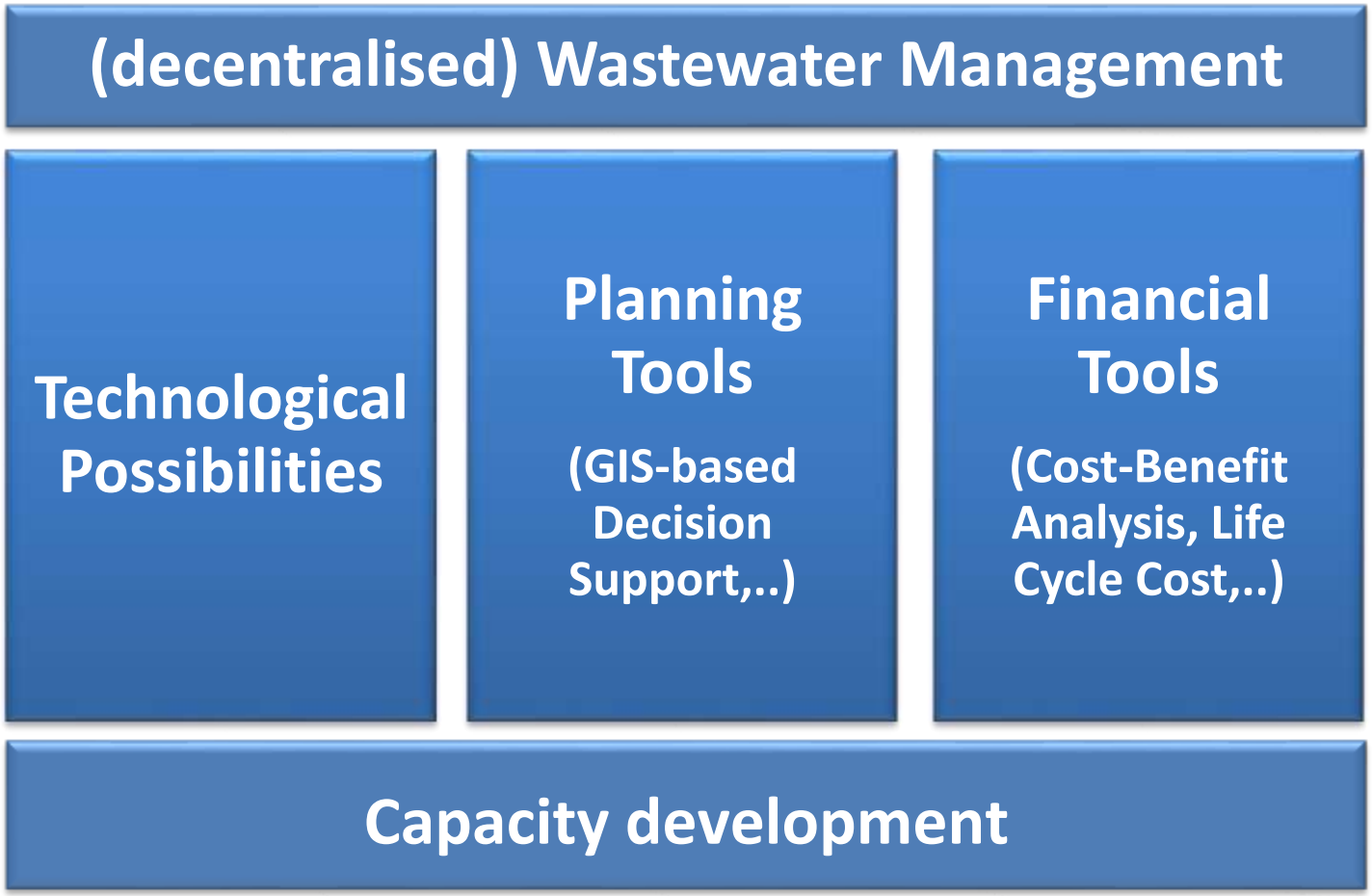
- **Adaptation**: Resilience infrastructure
- **Financial advantages** by less collection costs: Centralized approaches require 60% - 80% only in collection and transportation
- **Simple operation** and less O&M costs
- Appropriate for rural and suburban settlements

Legal Framework

Council Directive 91/271/EEC

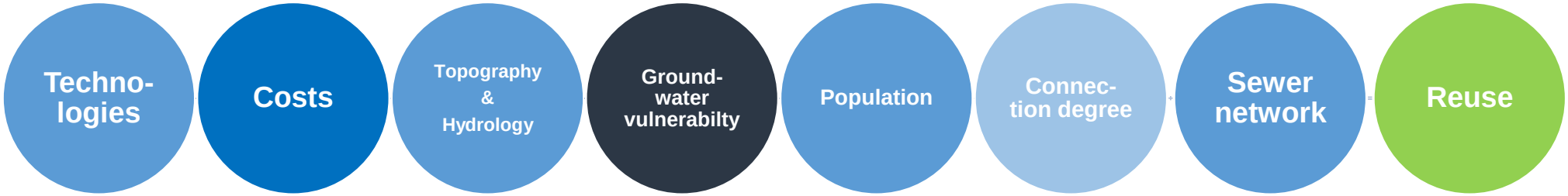
- „Where the establishment of a collecting system is not justified either because it would produce no environmental benefit or because it would involve excessive costs, individual systems or other appropriate systems which achieve the same level of environmental protection shall be used.“

Decision making supported by…



GIS-based Decision Support

Aim: Development of scenarios for Decentralised Wastewater Management



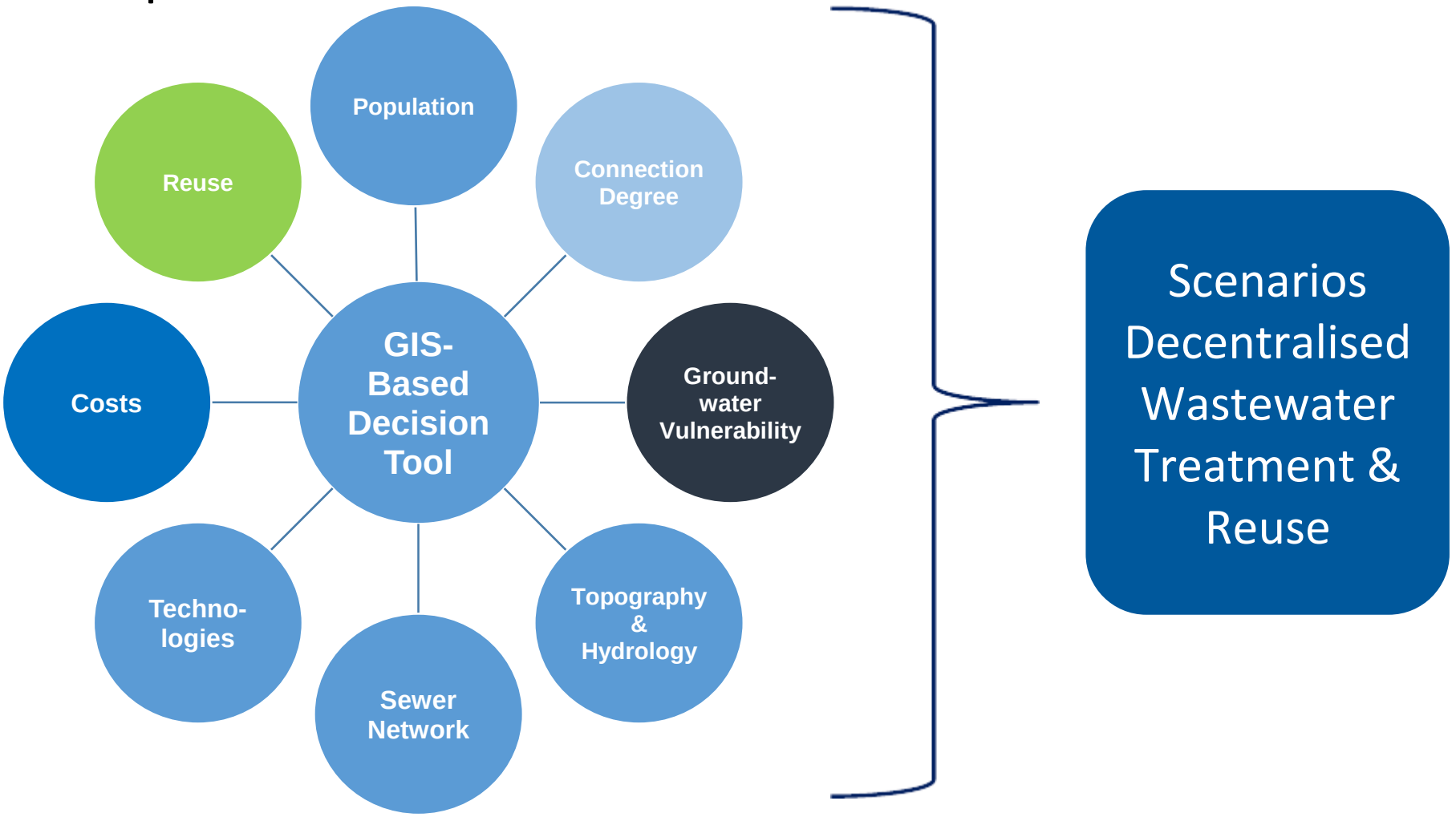
Advantages:

- Integration of multiple criteria
- Geographical data integration with multiple sources of information (statistical data, digital elevation models, etc.)
- Visualization of results presenting Maps
- Processing spatial data for better site selection avoiding pumping stations
- Preliminary costs assessment of sewer lines using satellite imagery
- Identification of potential clusters for construct and operate DWWT&R solutions

GIS-based methodology – expected outcomes

- **Geo-database:** including geographical, socioeconomic and statistical data of the area of interest information about population, connection degree, groundwater vulnerability, topography and hydrology conditions, required collection sewer networks, as well as technologies and reuse potentialities.
- **Required treatment capacities:** From the population statistics and parcel index for future building construction, the future required treatment capacity (m^3/d) for DWWT&R solutions can be estimated.
- **Catchment areas definition:** Based on satellite imaging and digital elevations models, catchment areas for sites with highest potential for the future implementation of DWWT&R system without pumping stations are identified.
- **Gravity flow sewer networks delineation**: for the selected catchment areas are defined to favour the natural drainage of the area.
- **Cost estimations**: for construction, operation and maintenance as well as required reinvestments for DWWT&R
- **Optimized portfolios for operation** of DWWT&R based on annualized investments in terms of Total Project Value (TPV) and Annualized Costs AC in JOD/m^3.
- **Reuse potentialities** based on Satellite imagery identifying the potential reuse areas nearby the selected sites for DWWT&R systems.

Concept

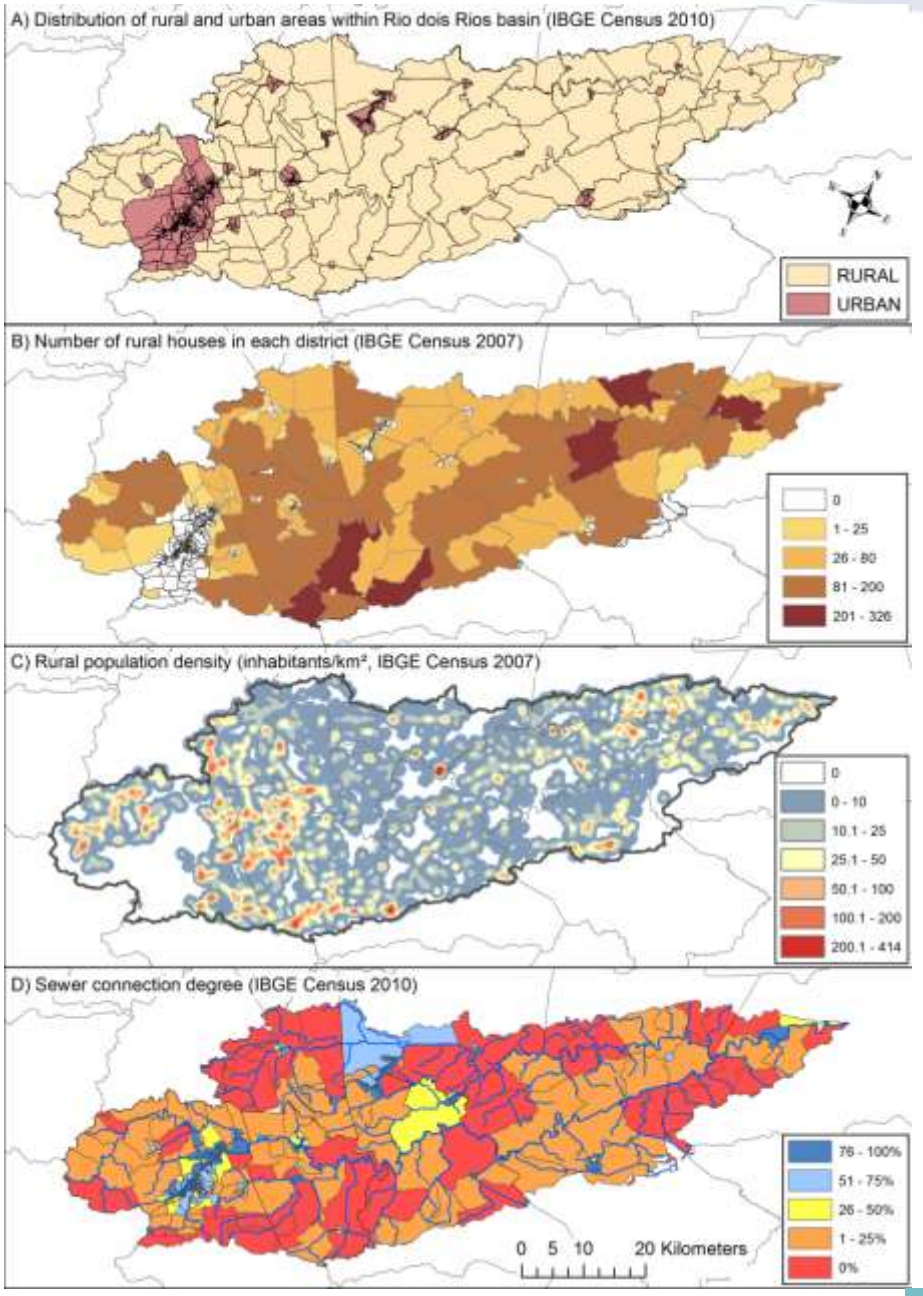

Population
Reuse
Connection Degree
Costs
GIS-Based Decision Tool
Ground-water Vulnerability
Techno-logies
Sewer Network
Topography & Hydrology
Scenarios Decentralised Wastewater Treatment & Reuse

Identification of the rural areas

Population

Population density

Connection degree to sewer network



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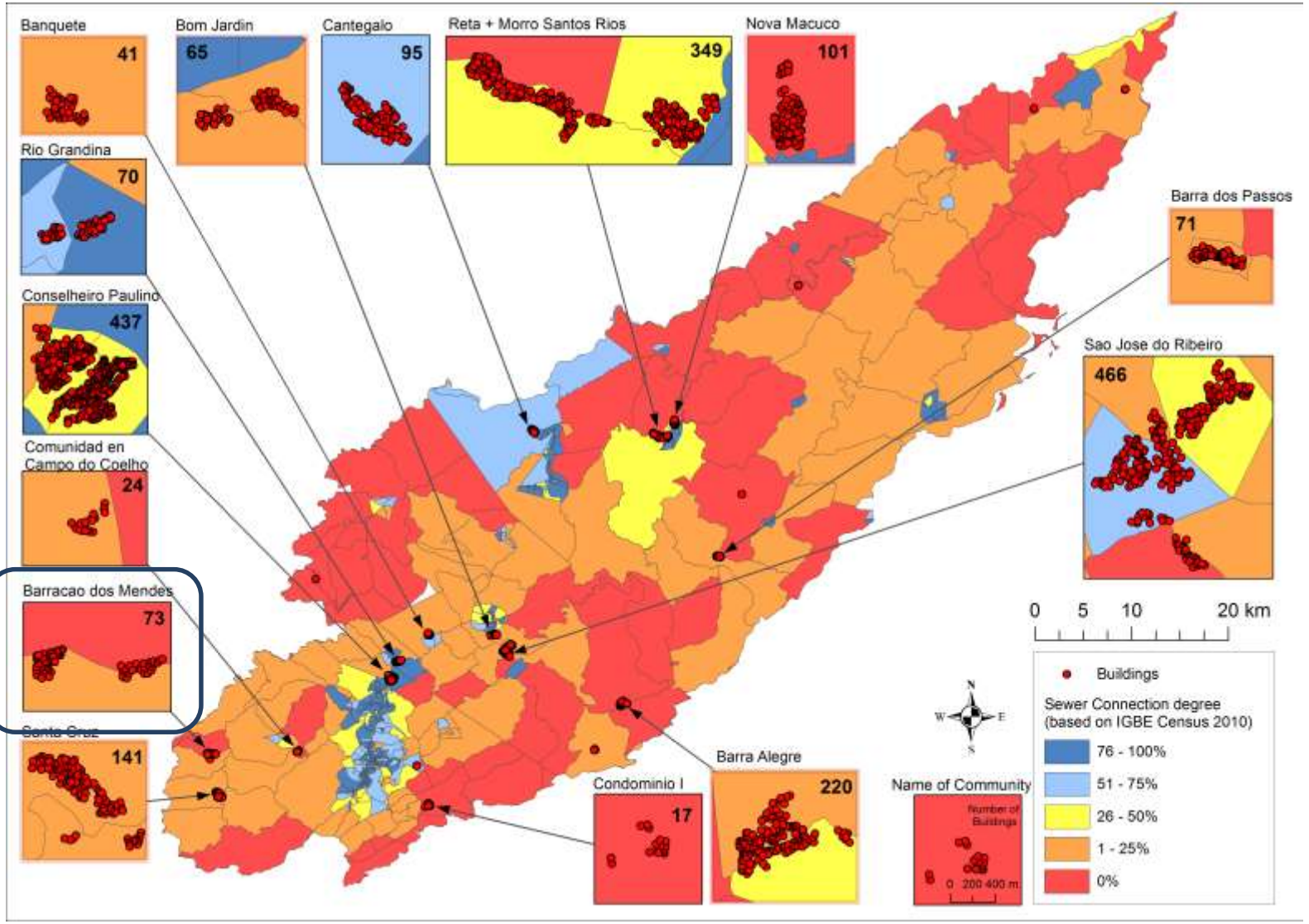
Identification of relevant settlements



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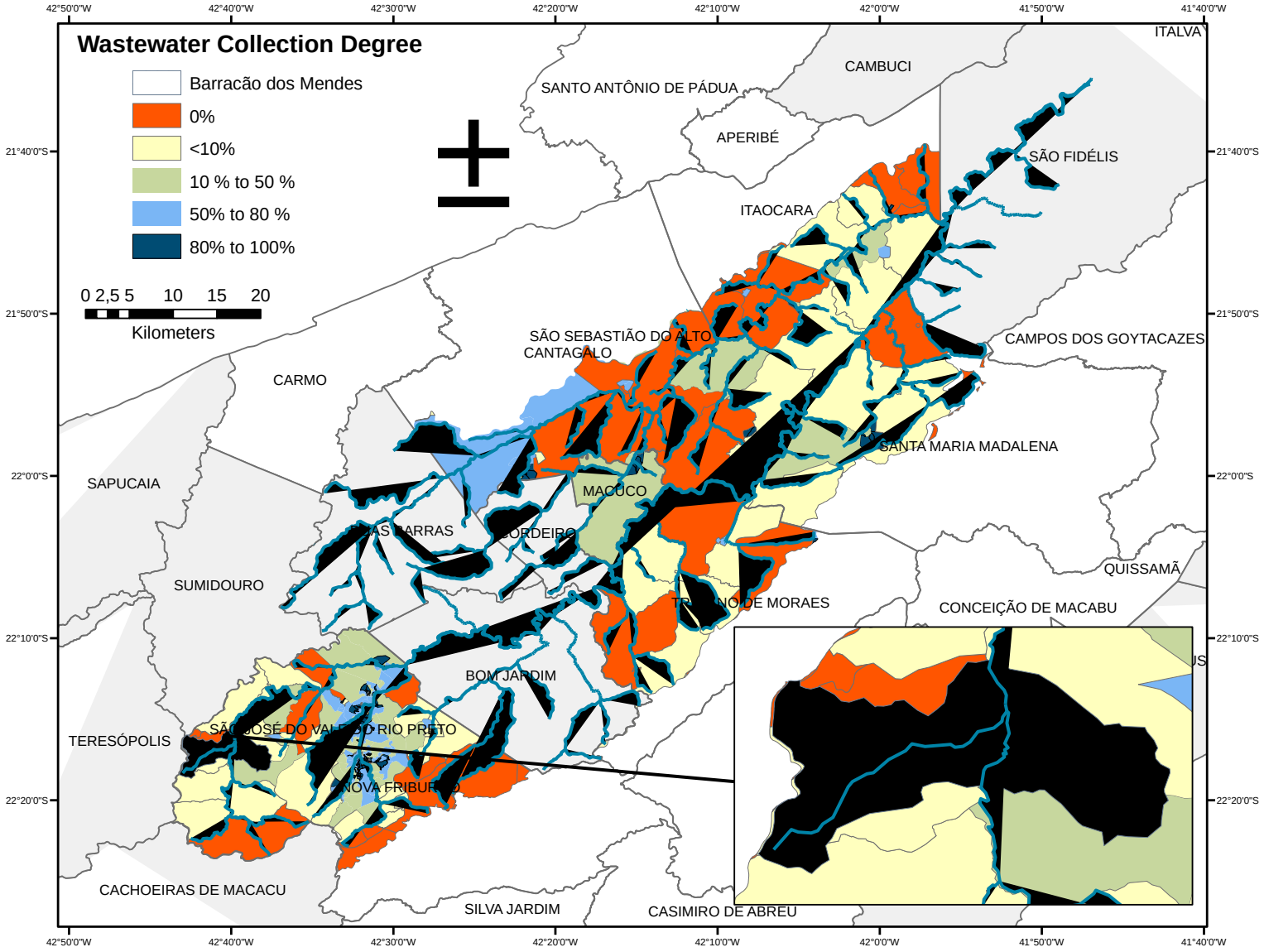
Connection Degree



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Topography & Hydrology

Contour
Available Area
Natural Drainges

Barracão dos Mendez

0 50 100 200
Meters

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Decentralised Sewage Treatment

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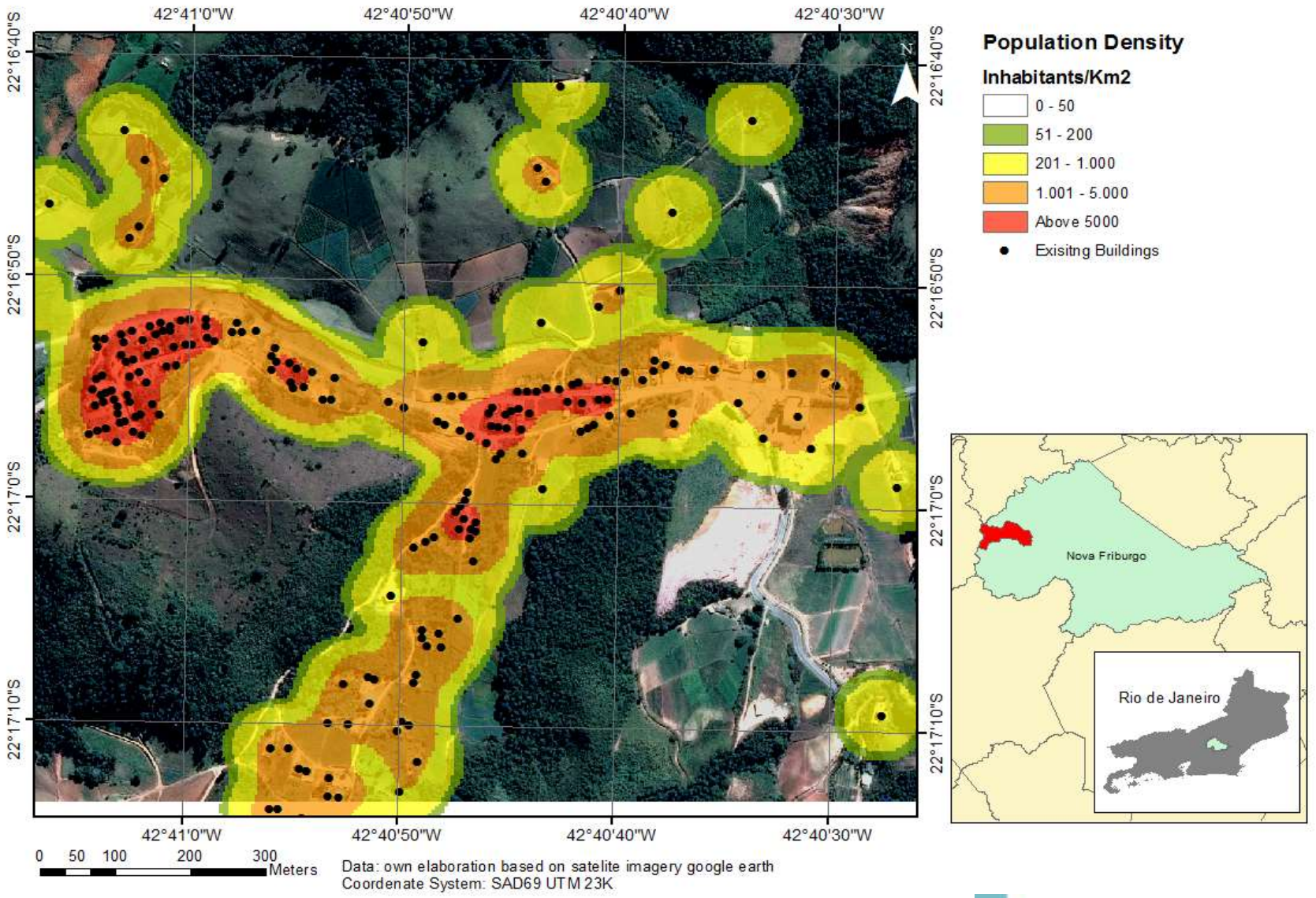
Population



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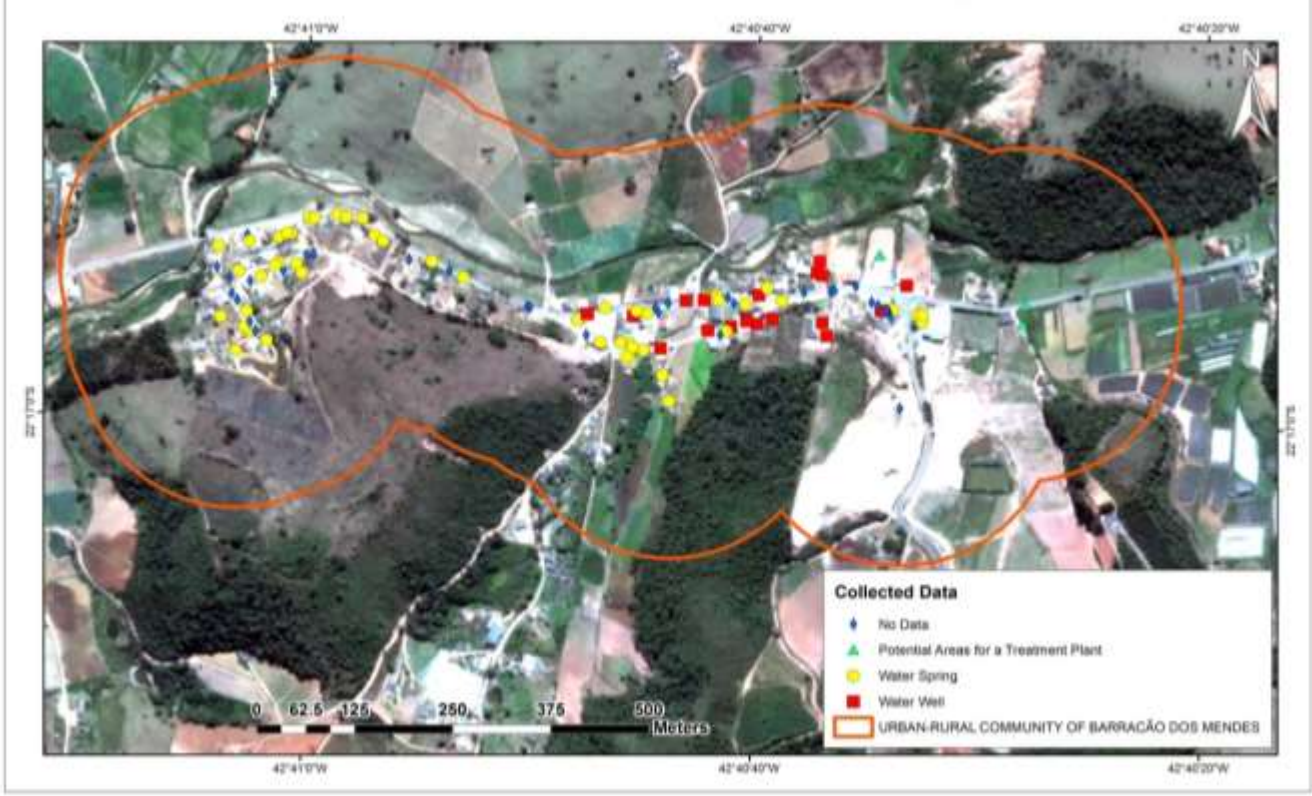
Results of local data acquisition – Sanitation & Socioeconomic Survey

Groundwater Vulnerability

- Water Supply sources
- Wastewater treatment infrastructure
- Potential site for wastewater treatment plant
- Population / Current and Future expected
- Willingness to accept wastewater treatment projects
- Waterborne diseases incidences (Diarrhea), based on statistical records



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Sewer Network

Vorplanung des Entwässerungssystems (Quelle: Google Earth)

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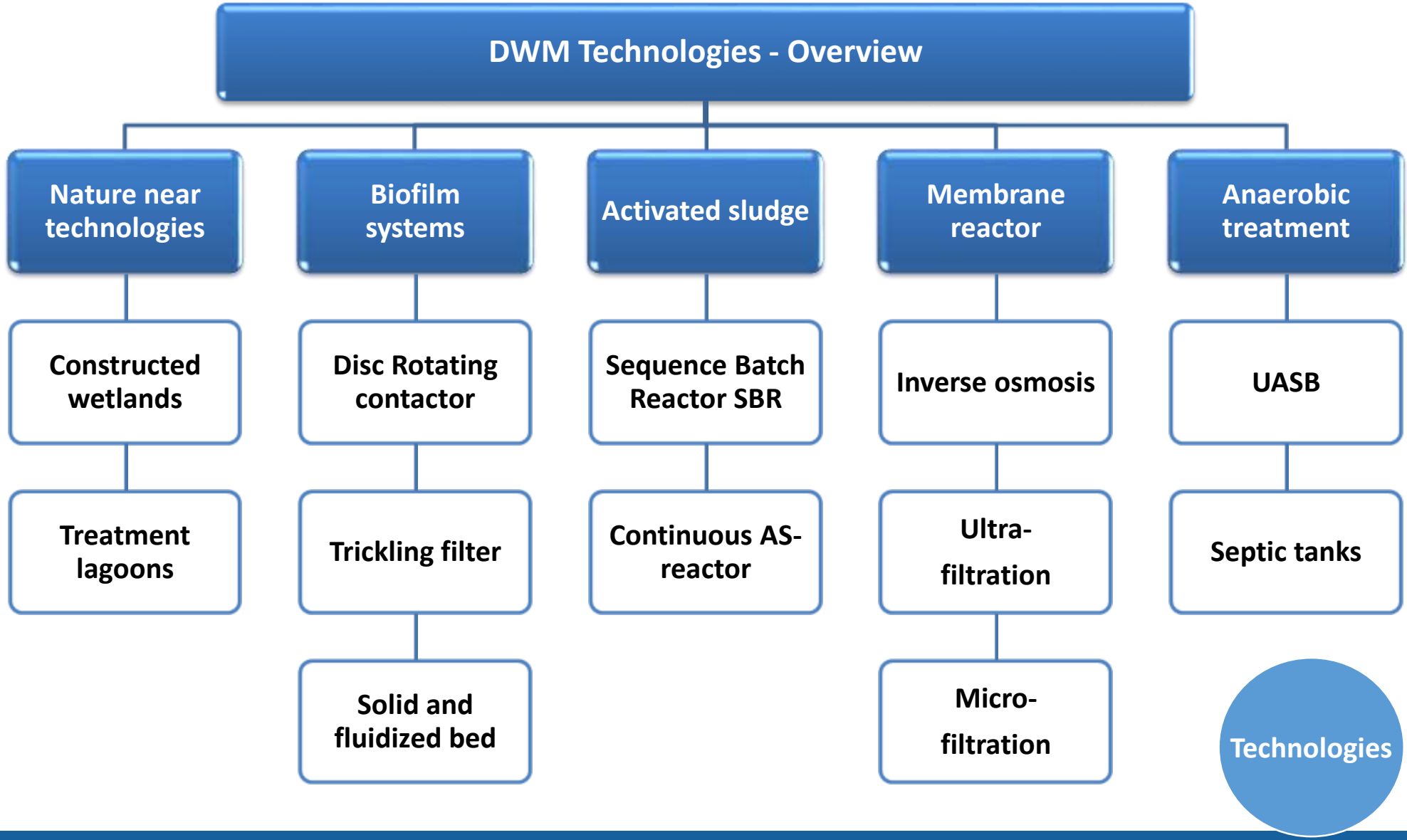
Selection of adequate Technologies – **Wastewater Treatment scenarios**



Costs Reuse

Financial Tools

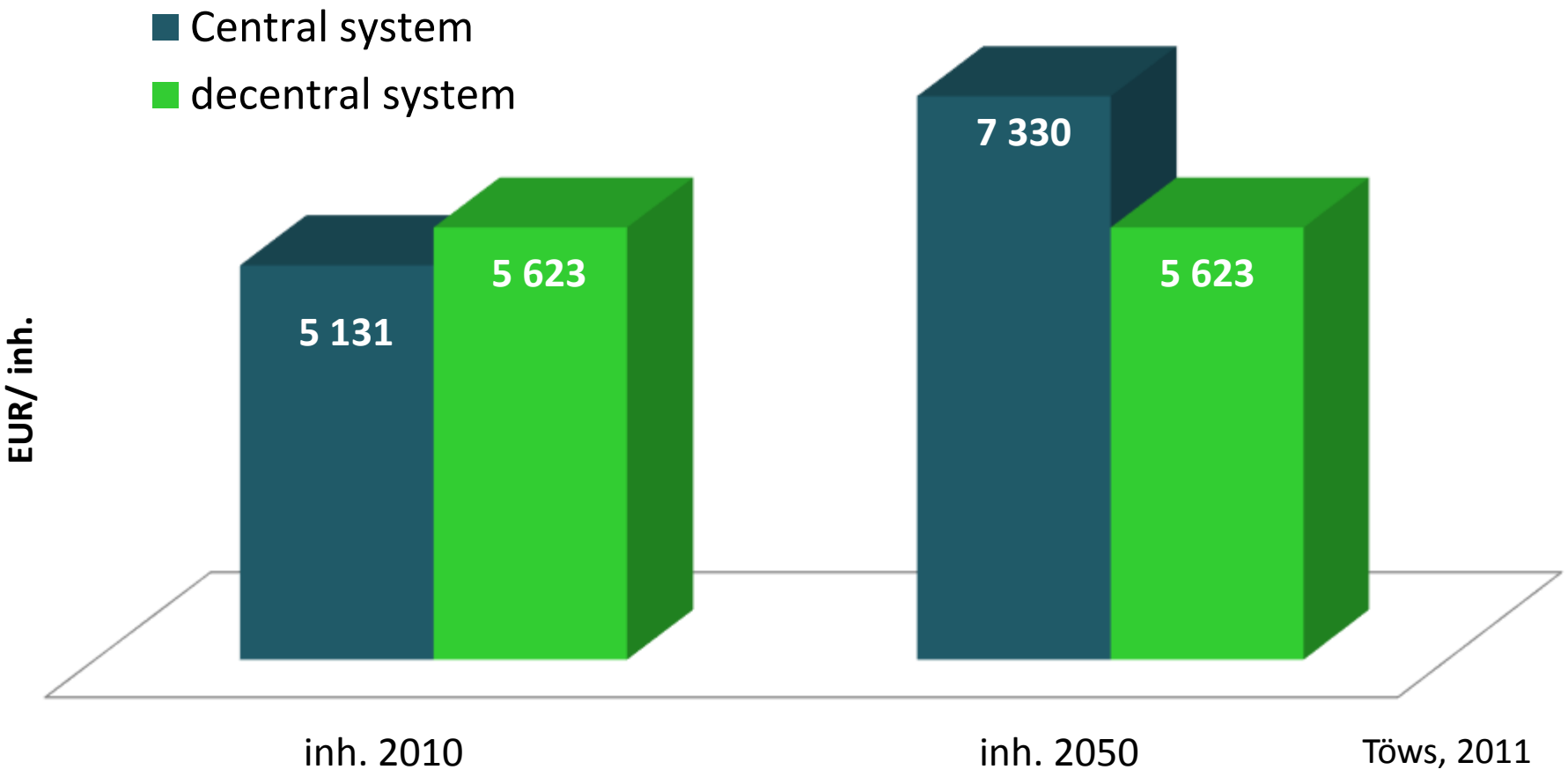
- **Capital expenditure** or **capital expense - CAPEX**
  - the money a company spends to buy, maintain, or improve its fixed assets

- **Life Cycle Costs – LCC**
  - Assessment of all economical aspects associated with all stages of the product's life (e.g. manufacture, use, maintenance, etc.)

- **Cost-Benefit Analysis – CBA**
  - systematic approach to estimating the strengths and weaknesses of alternatives
  - determine options which provide the best approach to achieving benefits while preserving savings

- **etc.**

Specific Life Cycle Costs - LCC caused by demographic changes
e. g. city < 50,000 inh. (less 0,5 % population yearly for 40a)



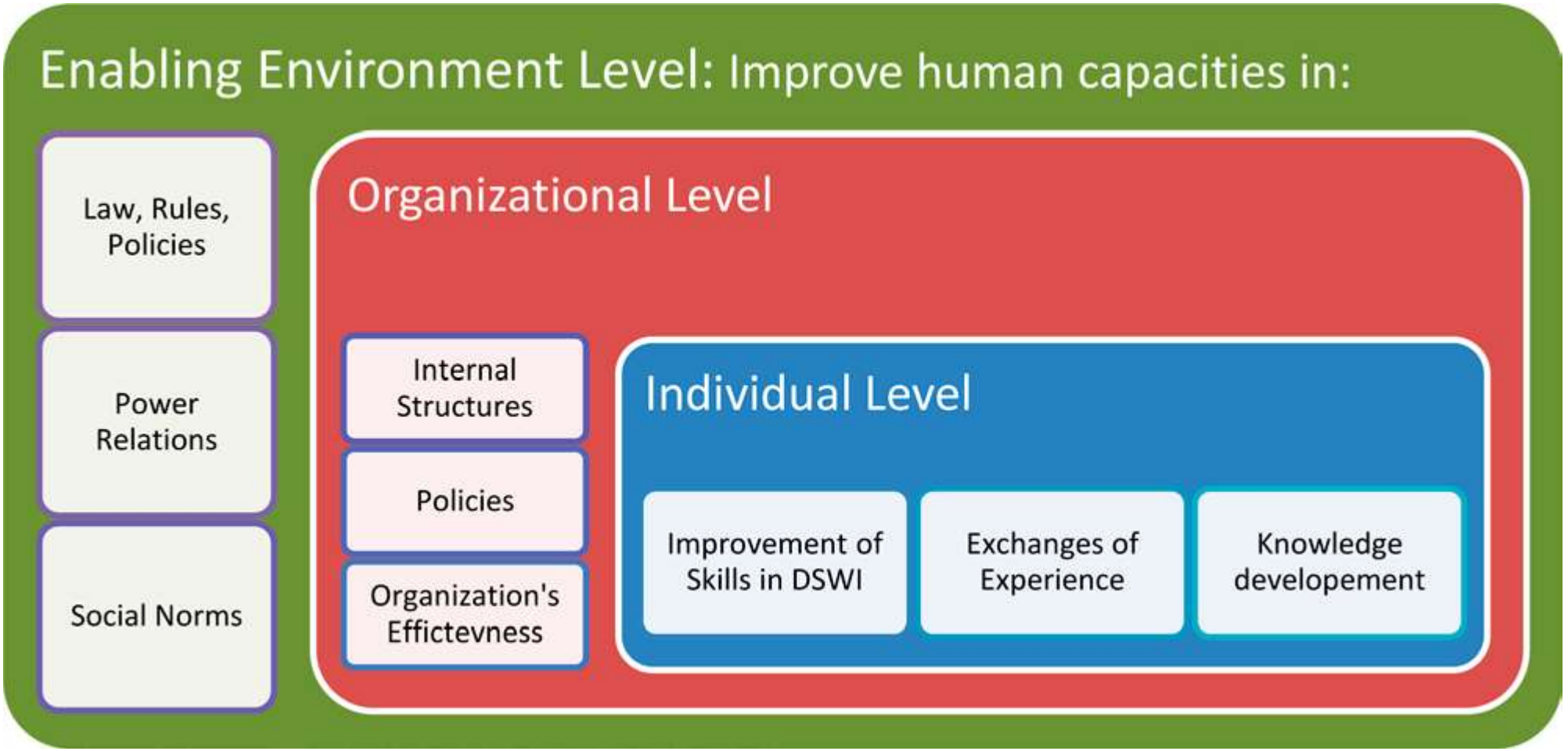
Today both systems are equivalent. But due to demographic changes the cost impact can be different.

Requirements and challenges of cost benefit analysis in the area of decentralised wastewater management

- It is complicated to quantify benefits in terms of monetary values e.g. improvement of groundwater quality, health
- Plants should be planned flexible considering future demographic or structural developments of the community
- A variety of Scenarios with different technologies should be elaborated
- Local market prices and costs for services should be taken into account
- Local technological developments considering the operation of the plants by local personnel

→ Close cooperation with local stakeholders

Capacity Development measures



Onsite Technical Training

- Presentation of DWWT Technologies
- Hands on experience
- Operation & maintenance

Training Activities with Decision Makers

- Concepts for the Implementation DWWT
- Financing
- Sustainability
- Network building

Water Fun Program

- Primary Schools
- Training for trainers
- Development of handbooks and booklets


Thank you!
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