

# SUSTAINABLE WATER MANAGEMENT IN A *Changing Climate*

13<sup>th</sup> BALKANS JOINT CONFERENCE  
AND EXHIBITION

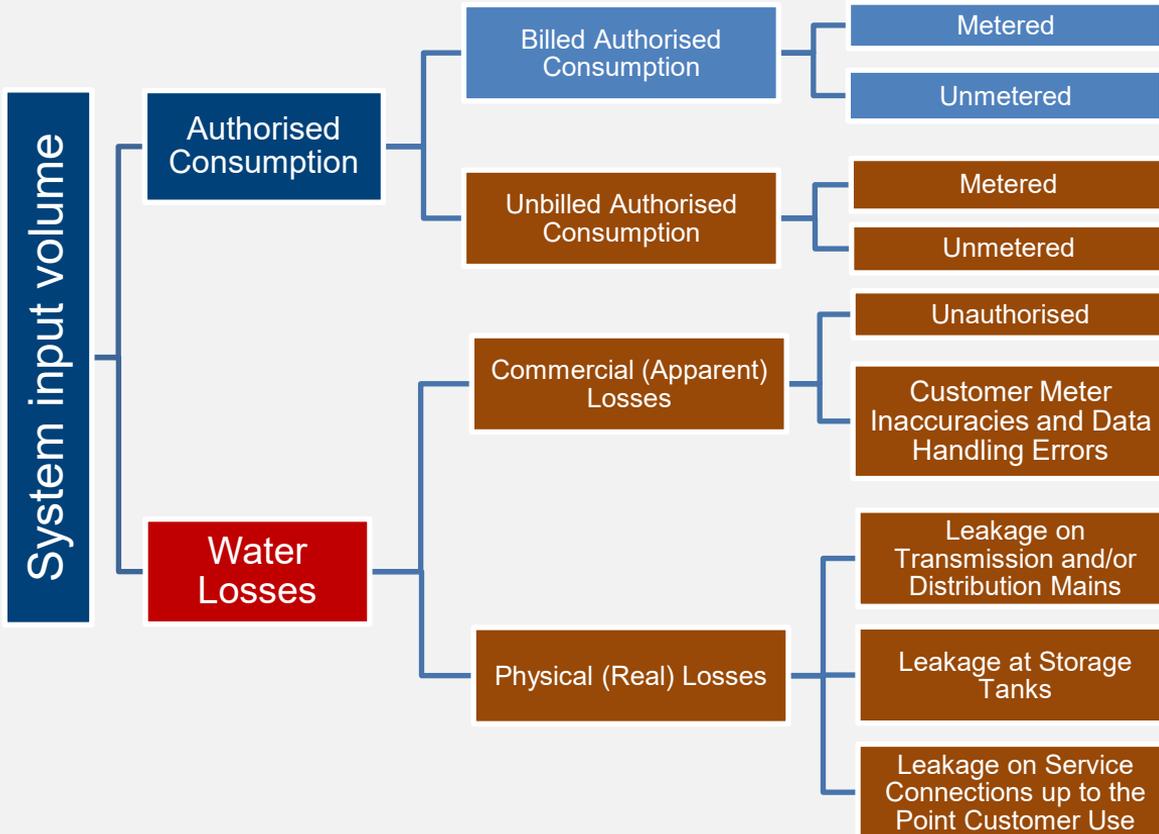


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DURRËS, ALBANIA

## Concept of Designing a DMA System Supported by Hydraulic Modelling

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Budapest Waterworks

# Water loss



# District Metered Area (DMA) design

## Area

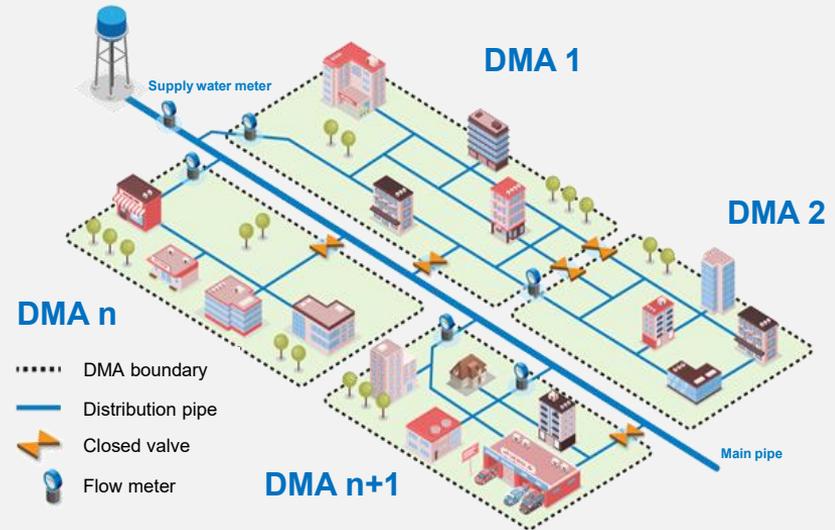
- ✓ Water loss
- ✓ Cost of water
- ✓ Area size

## Boundary

- ✓ Minimization of measurement points
- ✓ Utilization of existing suitable structures

## Measurement point and device

- ✓ Appropriate measuring device and measurement conditions



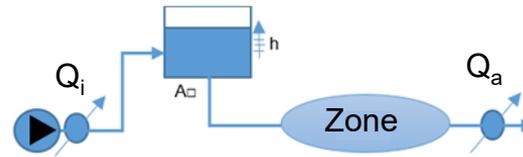
# DMA consumption monitoring

## Defining DMA boundaries

1. Each zone should have at least 2 supply points
2. Minimize the number of measurement points
3. Minimize the size of meters
4. Do not close transport pipelines
5. Pipelines that are up to 3 sizes smaller than the largest can be closed
6. Large consumers must be integrated

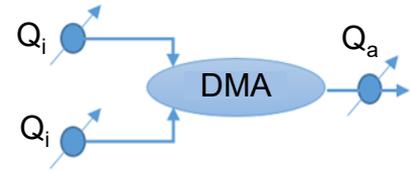
### Zone

$$Q_{\text{cons}} = Q_i - \Delta h \cdot A - Q_a$$



### DMA

$$Q_{\text{cons}} = \sum Q_i - \sum Q_a$$



## Monitoring

1. Analytical interface and reports
2. Processes and evaluation criteria

## Diagnostics

1. Failure reports
2. Regular and event-driven reports

Daily water consumption of a residential zone (Budapest)



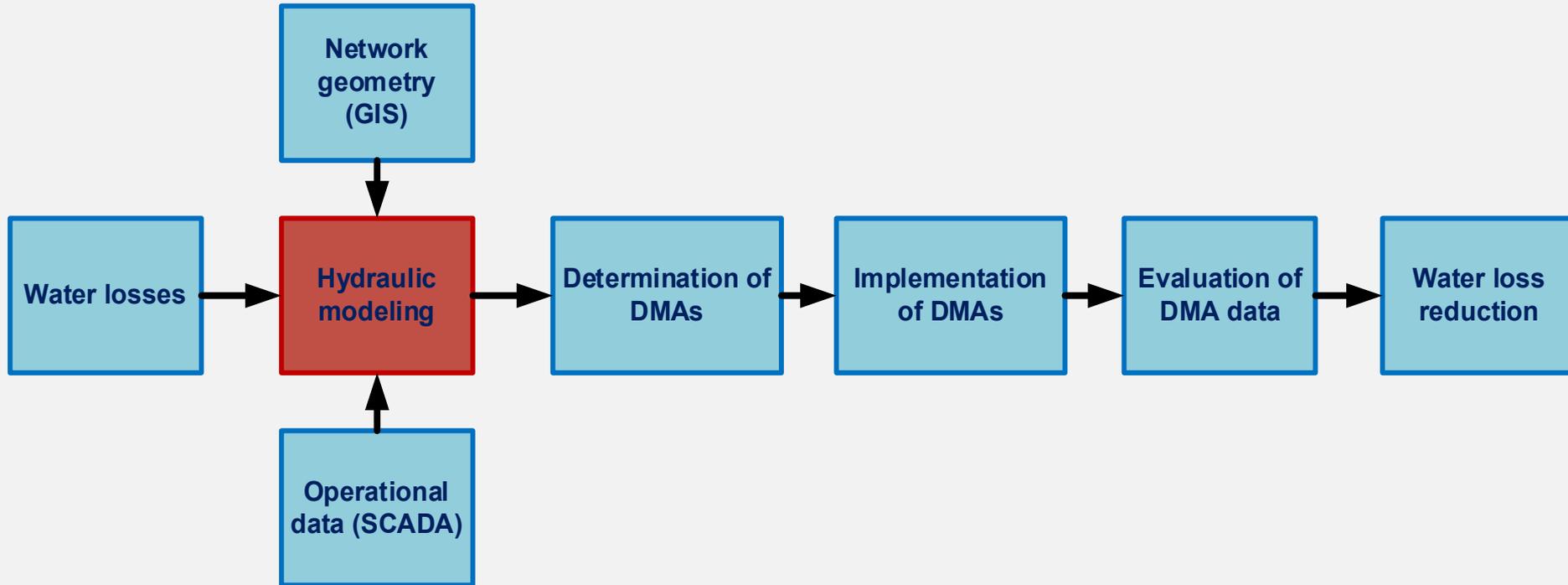
# Benefits of DMA implementation

- ✓ The establishment of **DMAs** can make the **detection** and repair of pipeline failures faster, more targeted, and therefore **more efficient**.
- ✓ The **volume of water** produced, treated, and then supplied into the network — often transported over long distances — **can be reduced**, resulting in significant **savings**.
- ✓ The earlier pipeline failures are repaired, the **lower** their repair **costs** will be.
- ✓ **Damage** caused by hidden leaks (e.g. road undermining, basement flooding) can be **minimized** through prompt repair.
- ✓ Online measurements provide **additional operational data** (flow, pressure), which can be extremely **useful** for various modelling and planning tasks.

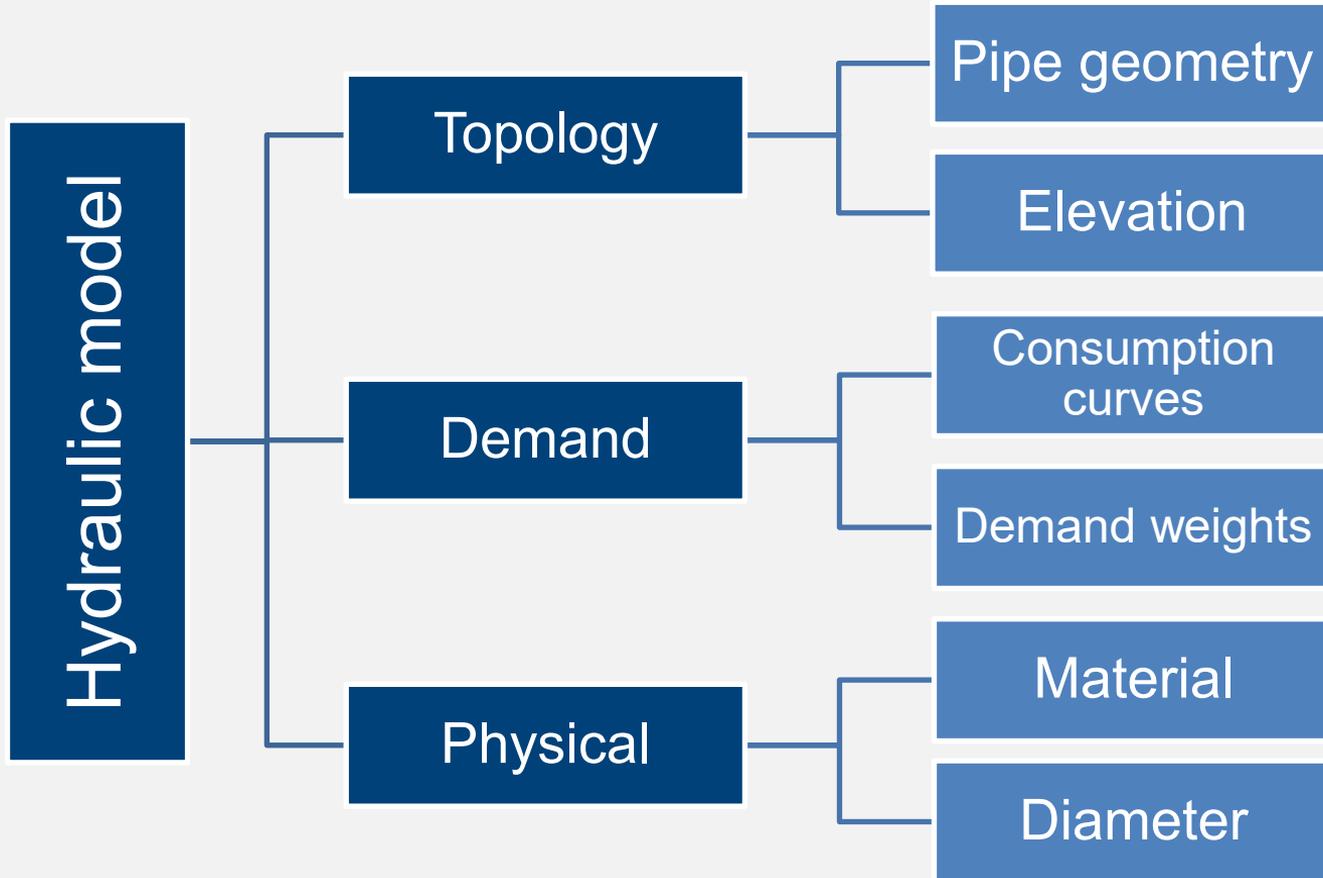
# Difficulties determining the correct DMA

- Determining the size of the DMA
- Listing all the closure and measurement points
- The required closures' effect is unknown
- The velocity characteristics of the measurement point is not known
- Selection of correct measurement method is uncertain
- It is difficult to determine the DMA construction priority

# Novel design concept for DMA



# Model building for DMA



# DMA design based on hydraulic modeling

## Building of the hydraulic model of the entire water supply network

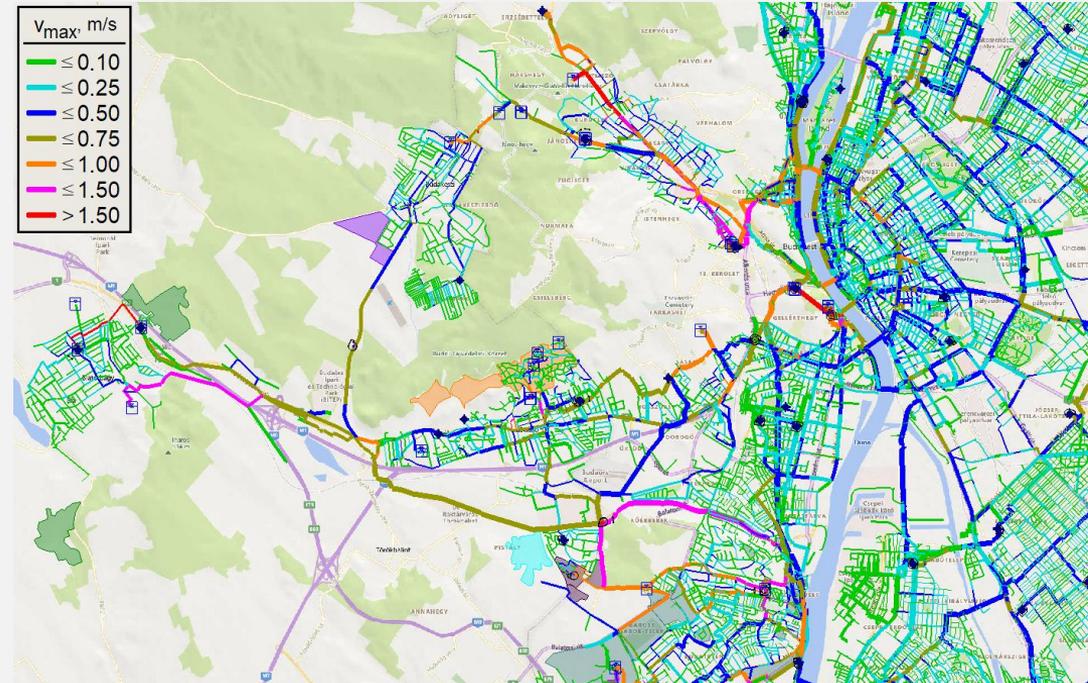
- Understanding how the system operates
- Analyzing key infrastructure elements like pump houses, reservoirs
- Determining non-trivial zone connections
- Analyzing local GIS system
- Analyzing locally available operational data
- Analysis of water consumption data



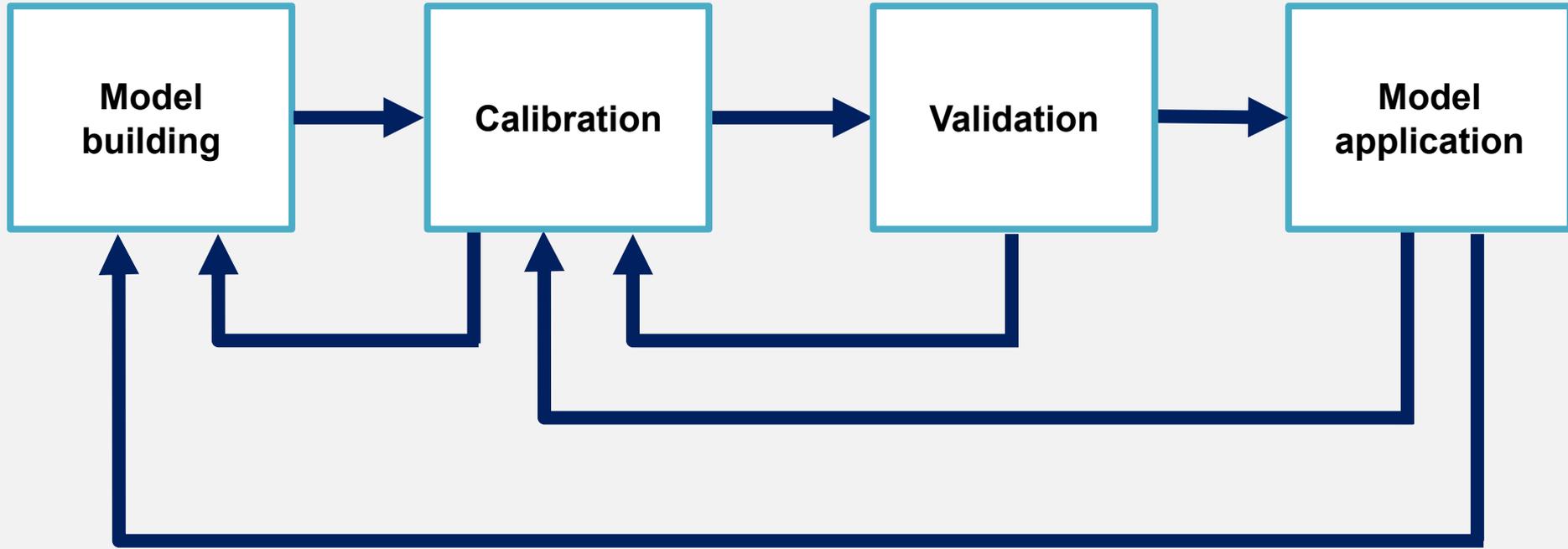
# DMA design based on hydraulic modelling

## Building the hydraulic model of the entire water supply network

- Integrated, controlled model
- Average/maximum consumption day
- Determining DMAs
- Impact of closures on network operation
- Refinement of zone boundaries
- Determination of measurement locations and meter types



# Model building



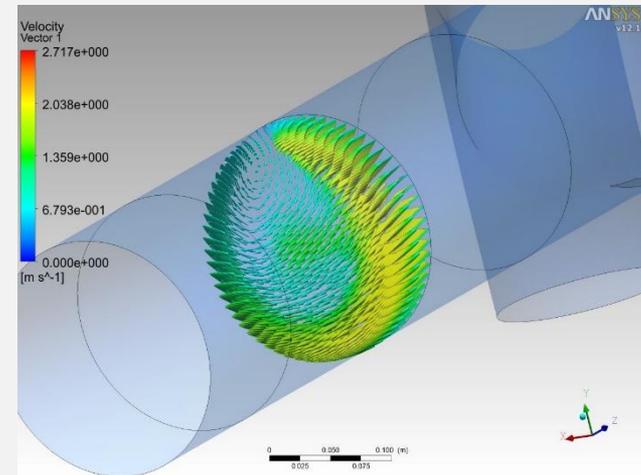
# Measurement point selection

## Types of measurement devices:

- Intrusion and built in flow measurement,
- Induction and ultrasonic flow metres

## Criteria for flow measurement:

- Higher velocity will have greater accuracy, but will induce larger pressure loss
- Low velocity ( below 0,1 m/s) will result in measurement error
- Sufficient installation condition (required straight pipe length is present)



# Measurement point selection

- Measurement points are determined by hydraulic model
- The whole velocity data can be acquired from the model
- In case of low velocity the correct diameter flow meter can be selected
- Hydraulic modelling can determine the flow direction on the given point, ensuring correct water balance calculation
- Measurement errors can be avoided
- Correct measurement method can be selected

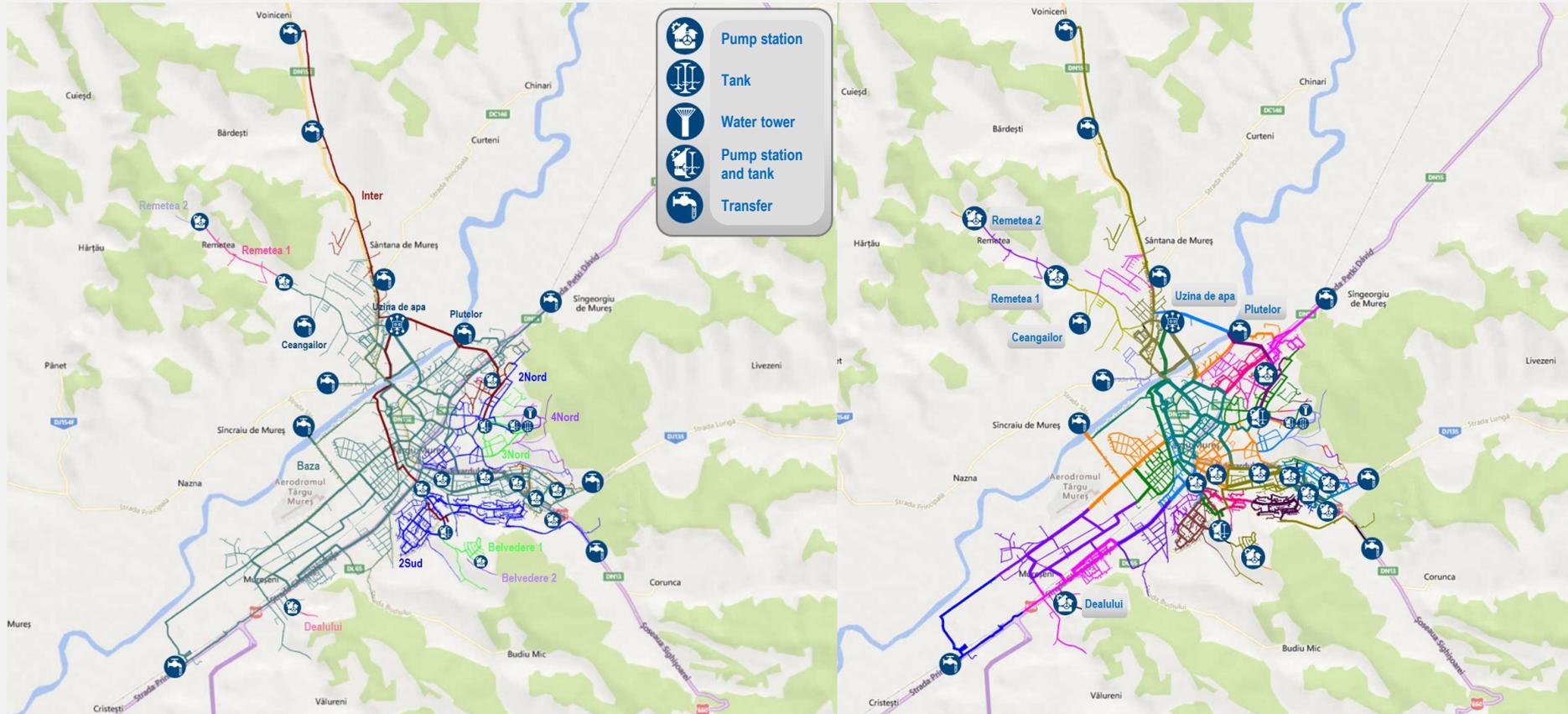


# Practical example

- Determining DMA for Târgu Mureș
- Area: 49.3 km<sup>2</sup>
- Population: 115,493
- Number of zones: 18
- Number of suggested DMAs: 35
- Length of the project: 1 year
- The project was conducted with the help of the colleagues of Aquaserv



# Practical example



## Impact of DMA on Network Operation

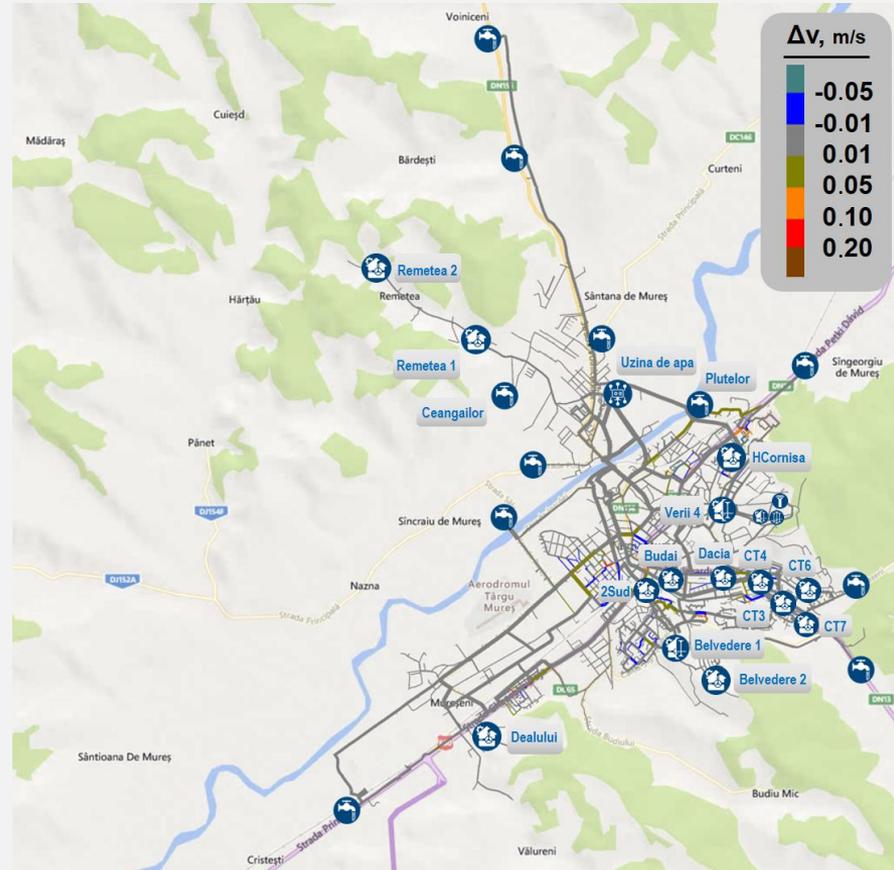
- Velocity and pressure changes caused by closures

## Refinement of zone boundaries

- Mitigation of closure impacts
- Optimization of operational conditions

## Determination of measurement locations and meter types

- Velocity patterns in the monitored pipelines



# Conclusion

To ensure correct data for DMA system, appropriate size and type of meters and installation conditions are required. This can be ensured by thorough engineering design

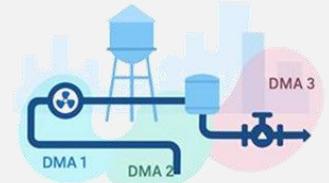
The establishment and continuous monitoring of DMAs enable the effective reduction of both physical and commercial water losses.

The novel design concept for DMA ensures the selection of correct diameters for flow measurement and ensures that the network closures will have minimal effect on the system.

With the help of the hydraulic model, DMA areas can be optimized.

Hydraulic modelling improves the efficiency of DMA boundary design, it ensure that only the minimum number of flow meters is needed.

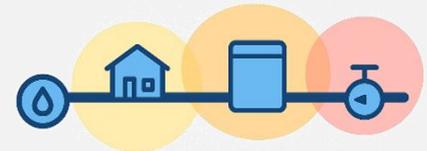
# What we offer



Hydraulic modeling aided  
DMA design



Water age analysis



Chlorine decay

# Thank you for your attention

## Q & A

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