# DIGITAL WATER

Dashboard prototype:

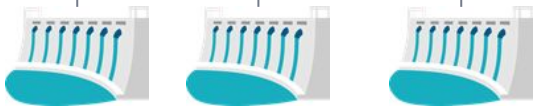
https://digital-water.herokuapp.com/
https://digital-water.herokuapp.com/leaks

Please read PDF document **"Digital Water Understanding Water Demand"** for further explanation

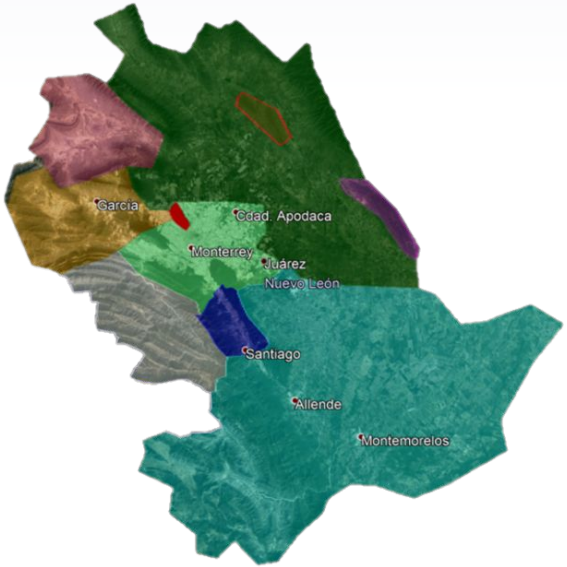
# Monterrey, Nuevo León

Provides its citizens with water from different sources

Surface



**3** Water Dams provide 50% of water




Underground

Qanats

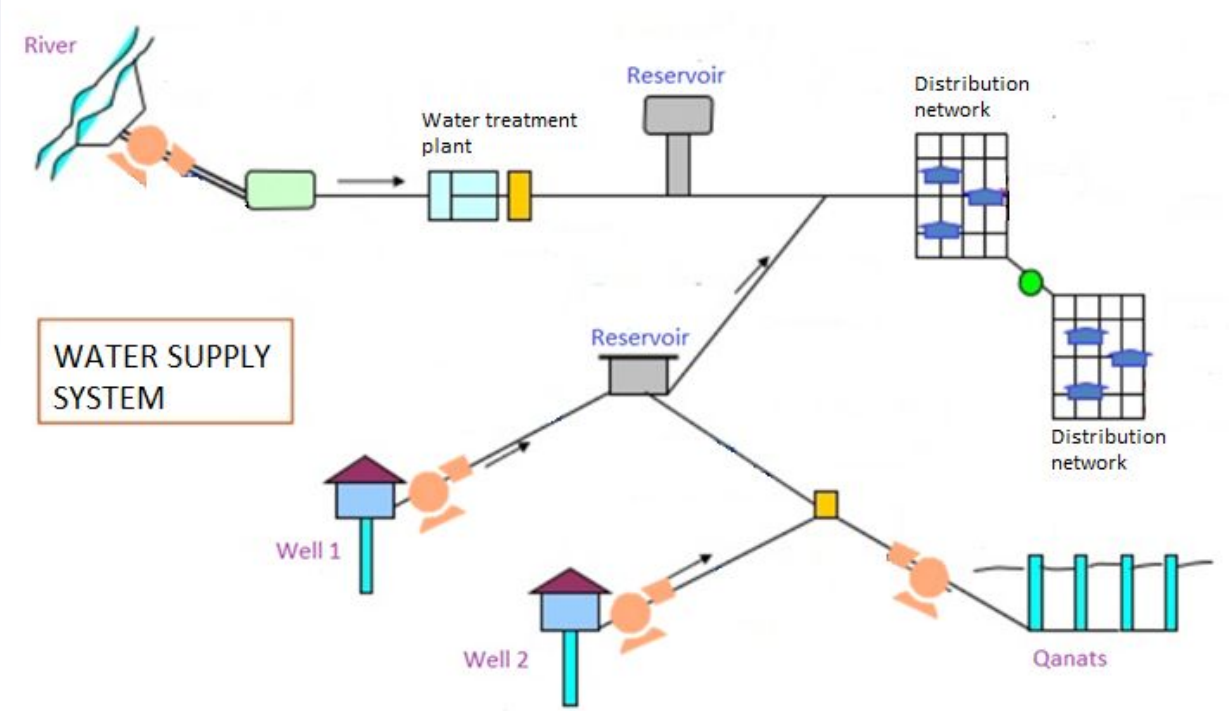
Wells

Natural Springs

These are scattered throughout Monterrey. In total, there are **406** combined

Source

# Water system at each source




*This is a simplified view of the water supply process, adapted from 1 and 2.

- Before taking water from the sources, demand has to be defined or known.
- To fulfill total demand, there is an array of water sources (labelled in **purple**).
- Due to the capacity of each source on a certain day, the water agency might decide that 50% of the water to meet demand is to be extracted from the river, 35% from Well 1, 15% from Well 2 and 0% from qanats.
- Thus, the independent water pump system (marked in **orange**) at each source extracts the water needed from that source.
- Each water source contributes in different extents to the day-to-day fulfillment of demand.

Our water demand model forecasts the amount of water **needed to extract** from each individual water source to fulfill the total demand

We built two types of water demand models

## Daily Frequency

Focused on day-to-day operations.

Short term.

## Monthly Frequency

Focused on strategic planning and counter-active actions such as limit extraction

Medium & Long term

# Why it is important to understand demand and apply a fine model

## Day-to-day operations

The water network of the city is huge, 409 total water sources. Day-to-day it's important to know how much water you need to extract from **each** of the 409 sources to **fulfill** demand

## Strategic use of water

Although technically you could extract **more** water and store it, unlike electricity, storage has a limit and a cost. In contrast, if **less** water is extracted than what is needed, sudden changes in the pump systems are highly stressful and expensive (pumps work more efficiently with fixed volumetric flow rate)

## Sustainability

Water sources ARE **limited**.

There is a reason behind the amount of water extracted from each source. It is not possible to fulfill 100% of the demand with a single or a couple of water sources. Doing this would cause an imbalance in the long term avoiding **over-exploiting**.

# Collaboration of AI Models

Please note that the following example will contain just 3 water sources for example purposes. In reality this network is made up 409 sources as previously stated. Also values are not real and only for example purposes

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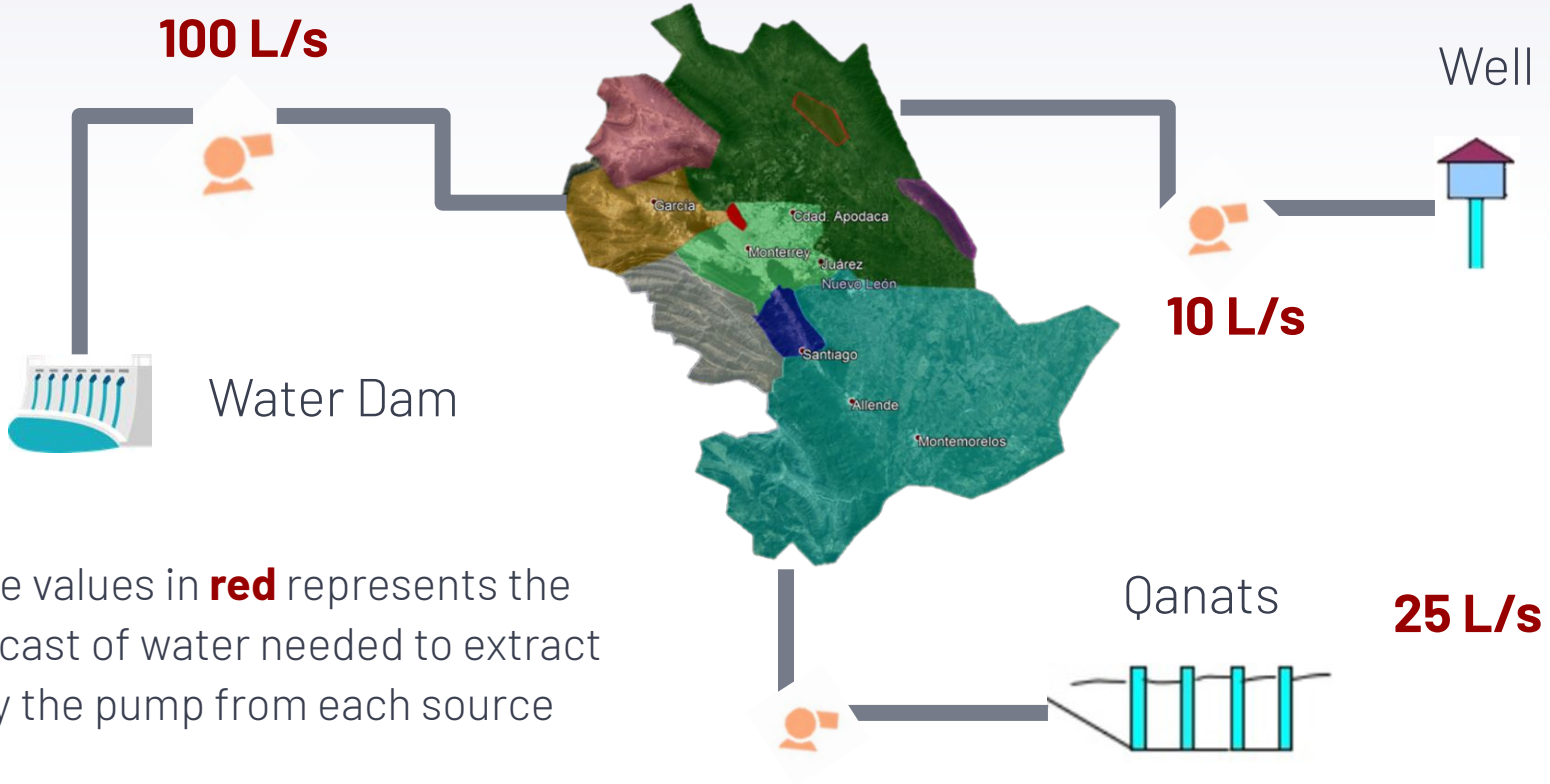
# Example of collaboration of models

## (1) Water Demand Model **forecasts**:




The values in **red** represents the forecast of water needed to extract by the pump from each source

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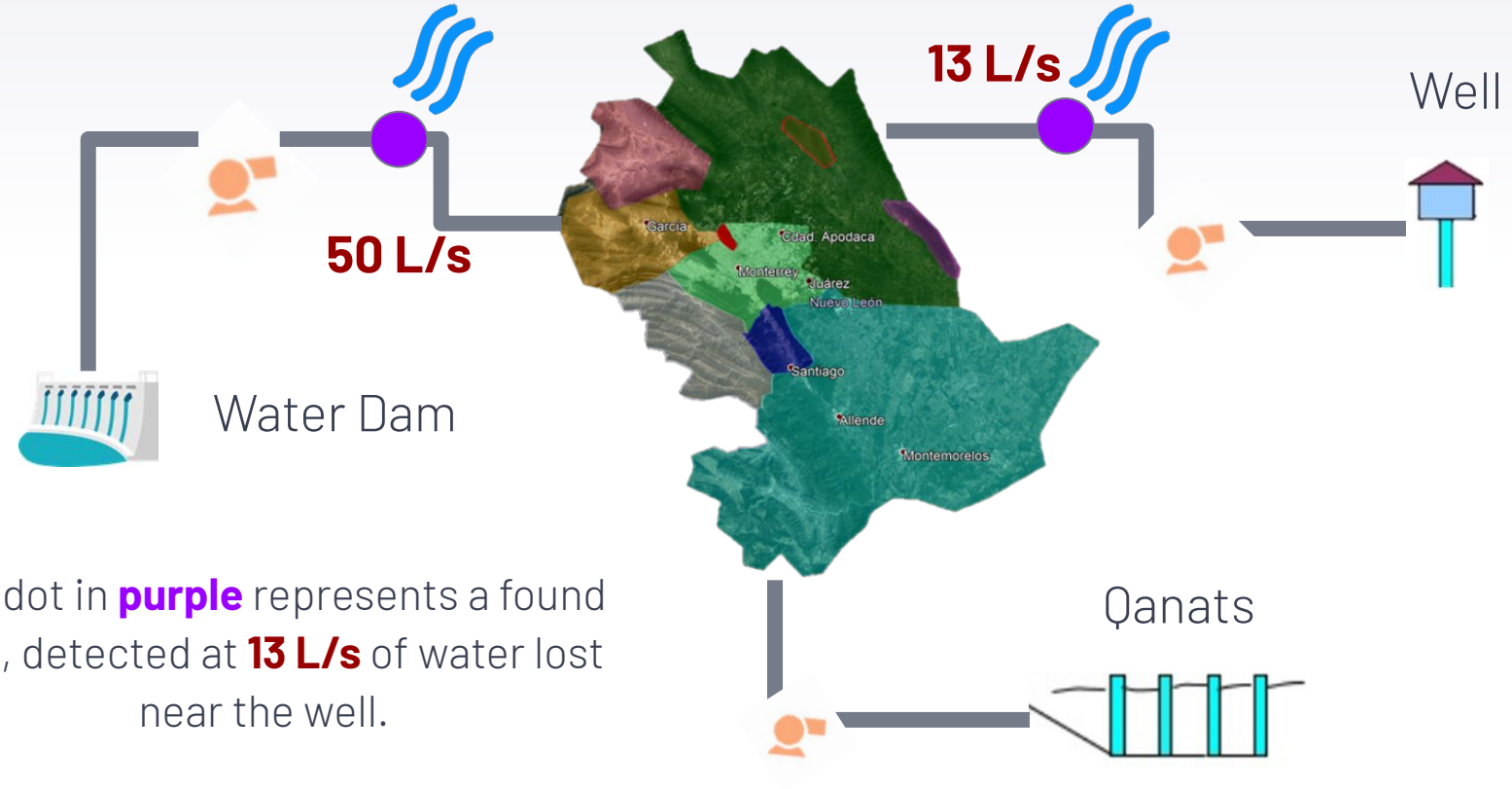
# Example of collaboration of models

## (2) Pipe Leakages Model **detection**:




The dot in **purple** represents a found leak, detected at **13 L/s** of water lost near the well.

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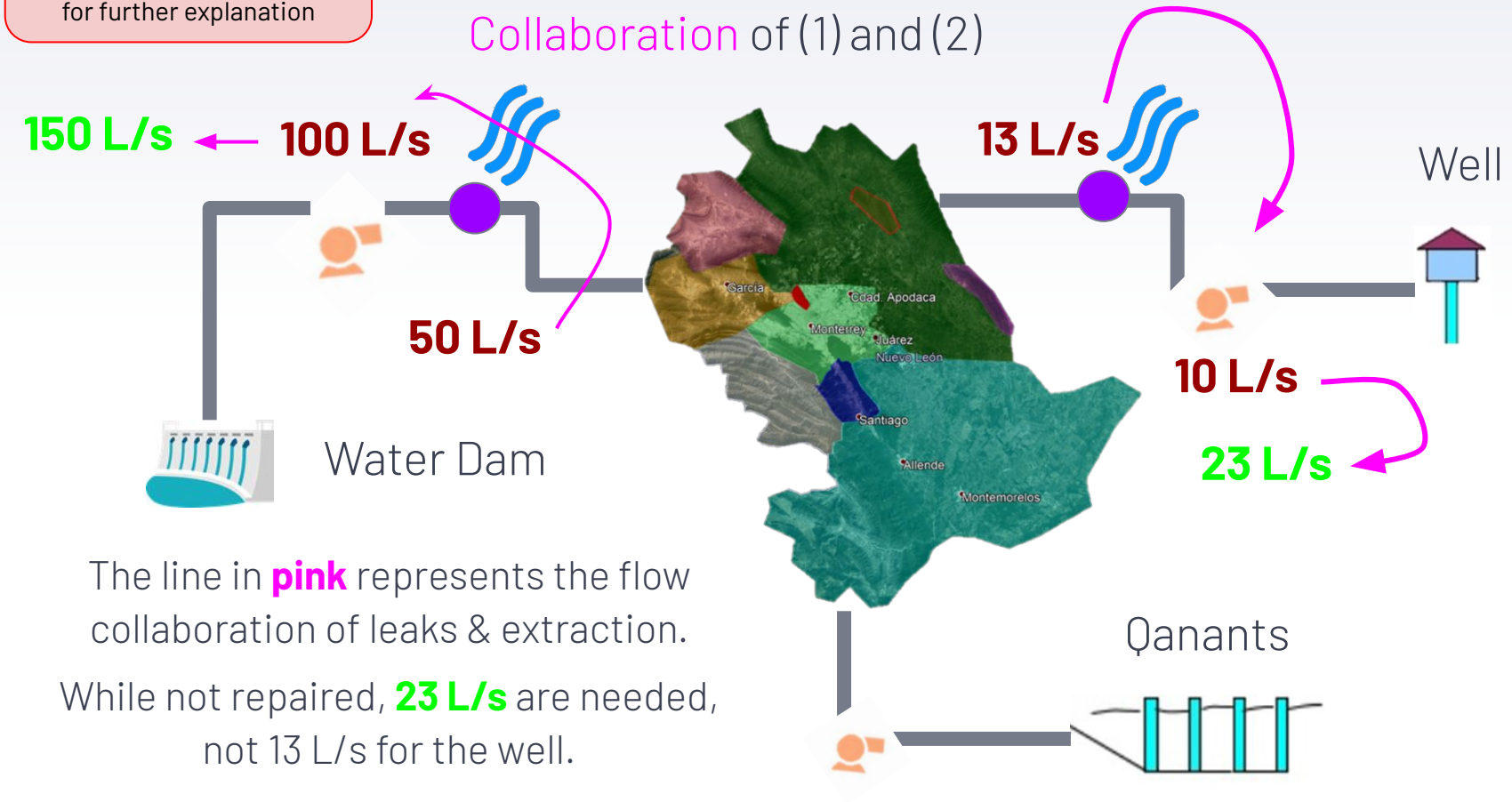
# Example of collaboration of models




The line in **pink** represents the flow collaboration of leaks & extraction.

While not repaired, **23 L/s** are needed, not 13 L/s for the well.

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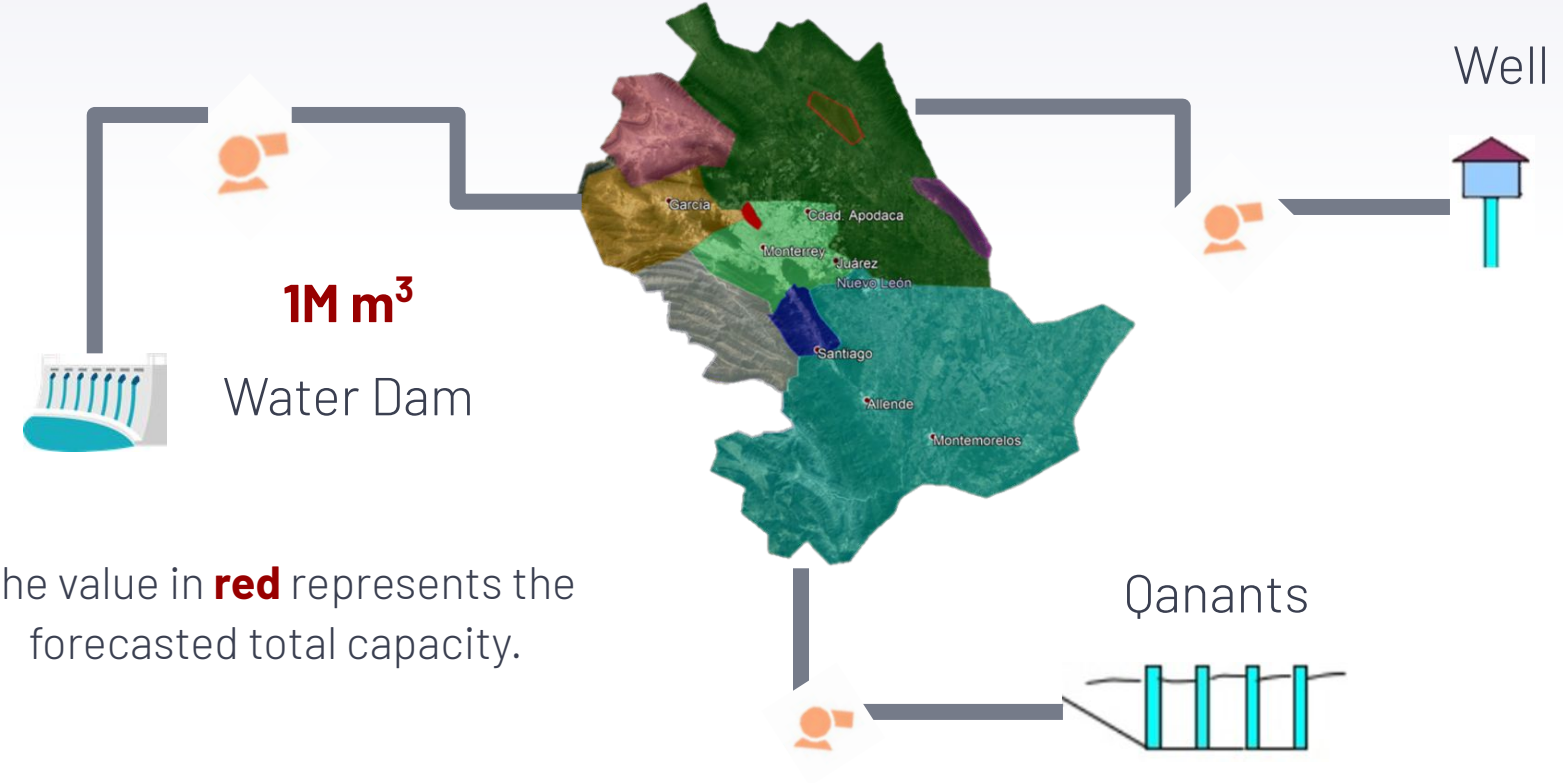
# Example of collaboration of models

(3) Water Dam Capacity Model **forecasts**:




The value in **red** represents the forecasted total capacity.

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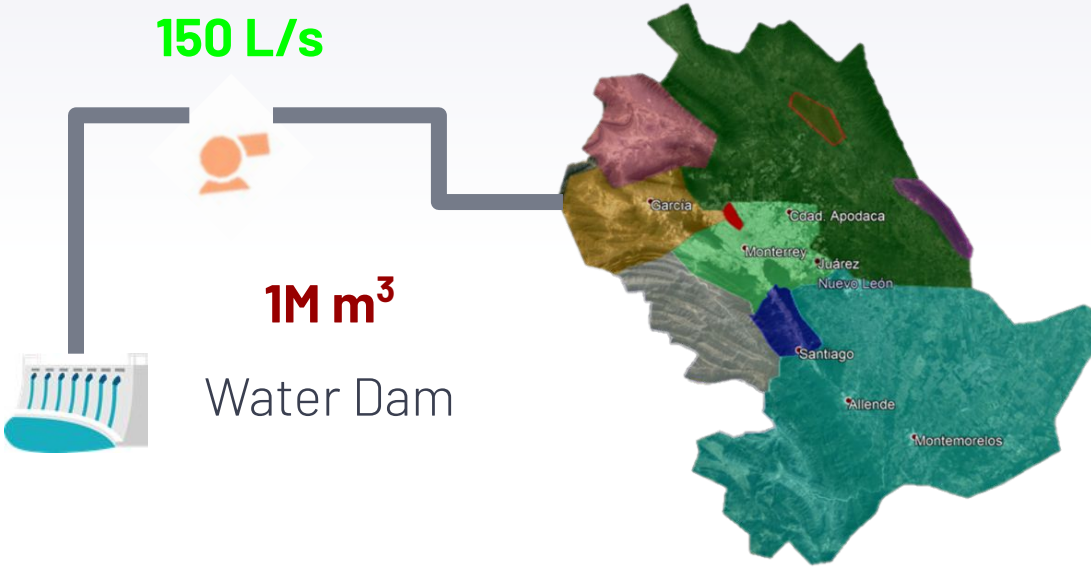
# Example of collaboration of models

## Collaboration of (1), (2) and (3) Models

Given forecasted extraction rate and capacity.

We want to avoid over-exploiting or reaching under-capacity (40%)

Under-capacity = 0.4 * 1M $m^3$ = 400 M L




Days available before reaching under-capacity:

400 M L / 150 L/s = **30.86 days!**

# Final Thoughts

To summarize, we had established that one of the underlying problems with water supply in Monterrey was the reactive approach to its management, which was unsustainable. Digital Water is our approach to better management, based on predictive knowledge.

To achieve it, we rely on our model collaboration. On one hand, a water agency can observe how much water will be needed, based on predicted demand (water demand model) and loss (leakage detection model). On the other hand, the agency can gauge at what capacity the main sources will be (water dam capacity model), to determine beforehand what new policies or actions to take, if needed.

You need both: to know how much you will have versus how much you will need to put things in perspective and understand how your situation will progress in the future. Through such visionary knowledge, water agencies can better decide the next steps and thus ensure a more sustainable water supply, without waiting for the city to be in danger of Day Zero.