# Network optimization – Gondwana

Impact    ☐ Product Quality    ☑ Sustainability    ☑ CO2 Reduction    ☑ Operational cost

Impact advanced modelling and optimizing in drinking water distribution systems.

## Technology description

Water utilities make large investments in their infrastructure every year to maintain their assets and improve service levels to customers. It is vital that these funds are spent efficiently, maximizing system performance while minimizing costs. To this end KWR has developed Gondwana: a tool which opens up numerical optimisation techniques for the drinking water sector.
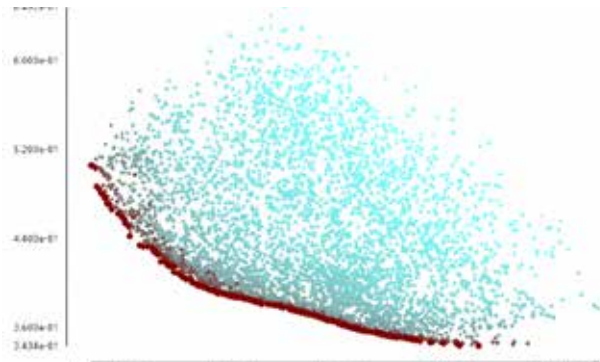


The application of Gondwana requires a hydraulic model that is representative of the situation under consideration. Additional information on the network and its operation and information relevant for the evaluation of objectives and constraints may be required. When these requirements are met, the tool is universally applicable at utilities around the world.

Once all information is in the system, Gondwana gets to work. A better performing network is created by randomly making changes to the decision variables, while structurally detecting and further incorporating the several resulting performance improvements. In a process known as an 'evolutionary algorithm', the calculations progress step by step towards an optimal solution.

https://www.kwrwater.nl/en/tools-producten/gondwana/

## Use case description

District Metered Areas (DMAs) are parts of a water distribution network that are isolated from the rest by flow meters and/or closed valves, and play an essential role in pressure regulation and water loss (leakage) reduction. The Dutch drinking water utility Dunea wanted to create DMAs in the network serving The Hague. Since installing flow meters and/or valves to create DMAs is expensive, it was necessary to the search for efficient DMA designs with as few boundaries as possible. Experts from Dunea and KWR used Gondwana to determine the optimal DMA design for The Hague. This design, depicted in the figure below creates 15 DMAs with 92 boundaries. Different colors indicate different DMAs. The magnification in the inset shows several boundaries between DMAs, marked with a star.



Besides this case, Gondwana has also been successfully applied in questions like:
• Which diameter should each pipe in my system have, to minimize investment costs, while meeting minimum pressure and continuity of supply requirements?
• How many and where should I install pressure sensors in my network for leak detection?
The application of Gondwana has resulted in better designs for network and sensor systems, with material and monetary savings of 10-50%. There is also a better performance with respect to current or original designs or plans.

https://library.kwrwater.nl/publication/56109186/publication/56109186/

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| Name of technology | Gondwana |
| Name of end-user | Dutch Water facilities |
| Main application areas | Drinking water industry |
| Industry 4.0 domain | Value-Based Service |
| Technology provider | KWR |