GISwater

PROTOCOL DOCUMENT

Mapzones basic concepts

E-13.1

GOALS

Detail the concept of *mapzones* and establish a framework for their configuration and start up.

DESCRIPTION

The elements of a drinking water network establish elements of hierarchy and work between them, from which an organization can be deduced that from a functional and system analysis point of view can have many opportunities.

• Storage tanks. It modifies the residence time of the water in the system.
• Supply and storage tanks. It establishes a pressure or primary supply level for one or more customer sectors and modifies its residence time of the water in the system.
• Queue tanks. It establishes a secondary supply level for a sector of customers and modifies the residence time of the network water.
• Supply and queue tanks. Queue tanks, establish a primary and secondary supply level at the same time for two or more customer sectors and modifies the residence time of water in the network.
• Flow meters and network meters. Determine the differential flow in the first and integral in the second case, by a specific synchrony.
• Pressure reducing valve. It modifies the pressure and supply level downwards. It is generally associated with customer sectors but not exclusively.
• Pressure group. It modifies upwards the pressure and supply level to a sector of clients. It has a small storage (pilot whale) that usually should not be considered, since the storage time is usually less than the measurement frequency of the flow meters.
• Impulse. Water transfer between two storage points with elevation increase.
• Unique clients. Customers with a very high or unique consumption in their behavior. They should be treated as specific nodes.

To this end, a network can be sectorized from the point of view of:

SUPPLY SECTOR (SECTOR)
Related subgraphs, sectioned at the exit and entrance of any type of tank. It does not account for water storage.

Goal:
- Minimum unit for hydraulic calculation since it contains the water supply.

Outline condition:

- Entry / exit tanks.
- Closed sectioning valves.
- Impulse.

Necessary conditions:
- That one or more nodes of the subgraph contain customer consumption.

Generic conditions:
- Flow meters or network meters are not considered.
- Pressure reducing valves and pressure groups are not considered.
- The actual volume of the tanks and the actual configuration of the inputs / outputs are not considered.

MINIMUM SECTOR (MINSECTOR)
Related subgraphs of the LOW SECTOR graph, sectioned in the shut-off valves.

Goal:
- Minimum network affected in case of breakdown.
- Minimum number of clients affected by the supply cut due to the breakdown.
- Breakdown probability calculation.
- Effects on the hydraulic behavior of the network (LOW SECTOR) if the MINIMUM SECTOR is removed from the graph as a result of a breakdown.

Outline condition:

- Shut-off valves as disconnection points of the LOW SECTOR graph.

MEASUREMENT SECTOR (DMA)
Typology according to the frequency (greater or equal) of the flow data. Related subgraphs of the LOW SECTOR graph, sectioned in the flow meters, network meters and tanks understood as a measurement unit.

Goal:
- Minimum flow balance unit, between the input / output flow of the DMA sector and the consumption of customers.
- Calculation of losses.

Outline condition:

- Flow meters and network meters as disconnection points of the LOW SECTOR graph.
- That one or more nodes of the subgraph contain customer consumption.

PRESSURE SECTOR (PRESSZONE)
Related subgraphs of the LOW SECTOR graph, sectioned in the pressure modification mechanisms.

Goal:
- Calculation of the maximum and minimum static pressure supplied to the clients, a function of the maximum and minimum pressure of the regulating equipment (tank, reducing valve and pressure group) and the level of the connection.
- They take the cadastral data of building heights, calculation of the real maximum and minimum static pressure.
- Calculation of the minimum admissible losses.

Outline condition:
- Pressure reducing valves and pressure groups of the network as disconnection points of the LOW SECTOR graph.

QUALITY SECTOR
By type of quality sensor. Related subgraphs, sectioned in the analyzed quality sensors. Accounts the storage.

Goal:
- Counts the residence time and the evolution of the quality parameters in sectors with consumption.
- Calculation of the k of decrease of chlorine.
- Time of permanence of the water.

Boundary conditions:
- Graph between sensors of the quality parameters analyzed.
- Shut-off valves.

Necessary conditions:
- Real volume of the tanks and real configuration of the inputs / outputs.

Generic conditions:
- Flow meters or network meters are not considered.
- Pressure reducing valves and pressure groups are not considered.
- Impulses are not considered.

HIGH SECTOR (SECTOR)
By type of quality sensor. Related subgraphs, sectioned in the analyzed quality sensors. Accounts the storage.

Goal:
- Flow movement of the global system, function of flow meters, consumption and losses of the downstream sectors, and the level of the tank.

Boundary conditions:

Necessary conditions:
- Real volume of the tanks and real configuration of the inputs / outputs.
- LOW SECTOR are transformed into a single node where the consumption and losses of the sectors are added.

Generic conditions:
- Impulses are not considered.

This network sectorization can be performed dynamically if the elements are properly configured and using the function gw_fct_graphanalytics_mapzones

In this sense, the configuration and start up phases are:

PHASE 1: SYSTEM CONFIGURATION
Populate the node type table with the graph_delimiter field.
Graph delimiter means delimiter of the *graph* and can be of two types (border element or dual element). In this sense:

They are minimum sector boundary element: shut-off valves

They are dual elements (header and border) for the following zoning:

- Sector (high or low): flow input elements (wtp, *source*, wells, tanks)
- Measurement area: measurement elements (*flowmeter*)
- Pressure zone: pressure control elements (VRP, load break chambers)
- Quality zone: quality control elements (chlorinators)

DETAIL:
Certain types of deposits such as QUEUE TANK or STORAGE TANK in sectors in HIGH above all are not main elements for the sectorization. In this sense, it would be interesting to have the TANKS separated into two *features*, the header and those that are not, e.g.: queue or transport/storage
Activate the system variable so that the class graph can be realized

Note: For more details see protocol document E.13.2

PHASE 2: MAPZONES CONFIGURATION

Configure the graphconfig field of the different *mapzones* (sector, dma, dqa, presszone). The syntax is a bit special but allows every possible cardinality (multiple nodeParent with multiple toArc for a single *mapzone*).
In case that the nodes whose node_type is a *graphdelimiter* and has not been named as the head of any *mapzone*, the system will allow the calculation but will give a *warning*. Since this is a possible option (transport tanks or queue tanks without a specifically defined node_type) it is advisable to use the "ignore" *key* of the graphconfig field so that at least the system does not give warnings of elements that we have clear and checked.

Note: For more details see protocol document E.13.2

PHASE 3: START UP

Operative and start-up. The algorithm is quite fast but in the face of topological inconsistencies it can get 'hung'. Therefore, it is advisable to go step by step starting with the smallest *mapzones*...
Note: For more details see protocol document E.13.2

REVIEWS

Action	User	Date
Created	Xavier Torret	30/10/2019
Modified	Xavier Torret	01/08/2020