OVERVIEW OF FLUIDIT WATER

Aalto University – 2019-03-18

Content: Session 2

- About Fluidit Water Software and Licenses
- Setting Up & Navigating in Fluidit Water
- Basic Features
- Background Layers & Elevation Model

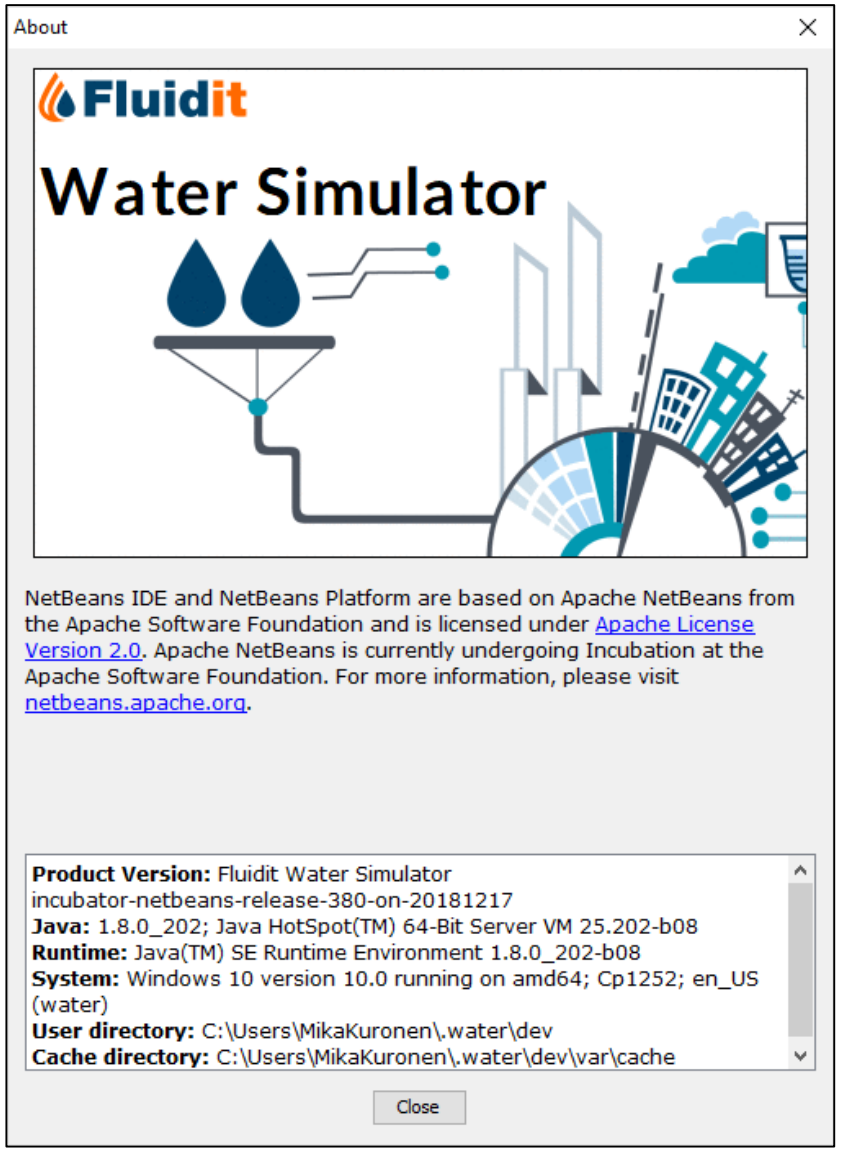
ABOUT FLUIDIT WATER SOFTWARE & LICENSES

FLUIDIT WATER

- Is a hydraulic network modelling and analysis software from Finland
- Core simulator is an improved version of EPANET 2.2
  - → EPANET manual is a good source of basic information

- Fluidit Water model files have postfix ”.fwat”
  - ”Simple independent files” – can be copied, renamed, deleted, etc…
  - All model information (network, results, etc.) is stored in the ”.fwat” –file, there is no external database
  - Some background maps and elevation model are fetched from internet or from external files

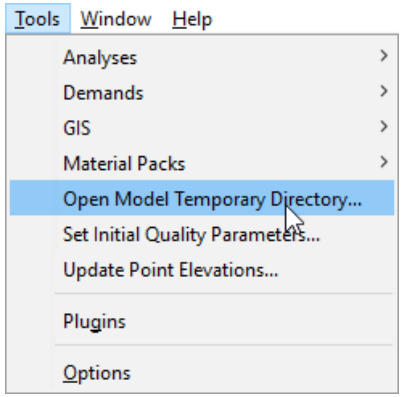
- Technical information:
  - Runs on Netbeans Platform
  - Written in Kotlin (Java-based language)
  - Also uses Python and JavaScript as scripting languages
  - (but you dont need to know these to use the software)



INSTALLATION

- Requires Java JRE 8, 9 or 10 (64-bit)

- Unzip software package, no separate installation
  - Do NOT use folder “Program Files” – might run into user right problems
  - At Fluidit we use “C:\prog\”
- To start the software: \bin\water64.exe
- Fluidit Water uses a temporary folder: **C:\Users*YourUsername*\.water\dev**
  - This can also be accessed via: *Tools → Open Model Temporary Directory (→)*



- Program version 1.0 (and soon 1.1) is available as Windows installers, which make shortcuts to desktop and start menu
- New versions of the software are available frequently
  - Please check support –service regularly

LICENSES

- HueWACO has a test license for now, which is valid until the end of March

SUPPORT

Support web pages: https://support.fluidit.fi

- Wiki / manual
- Latest versions of the software
- HueWACO has one username/password –set

Support: support@fluidit.fi

SETTING UP & NAVIGATING IN FLUIDIT WATER

GENERAL VIEW

Model Properties (calculation properties, CRS, etc…)

Drawing States:
- Control what and how components are shown on Map View
- Drawing Order
- Colors and Sizes (possibly based on results)
- Filters, Numerical Labels, etc…

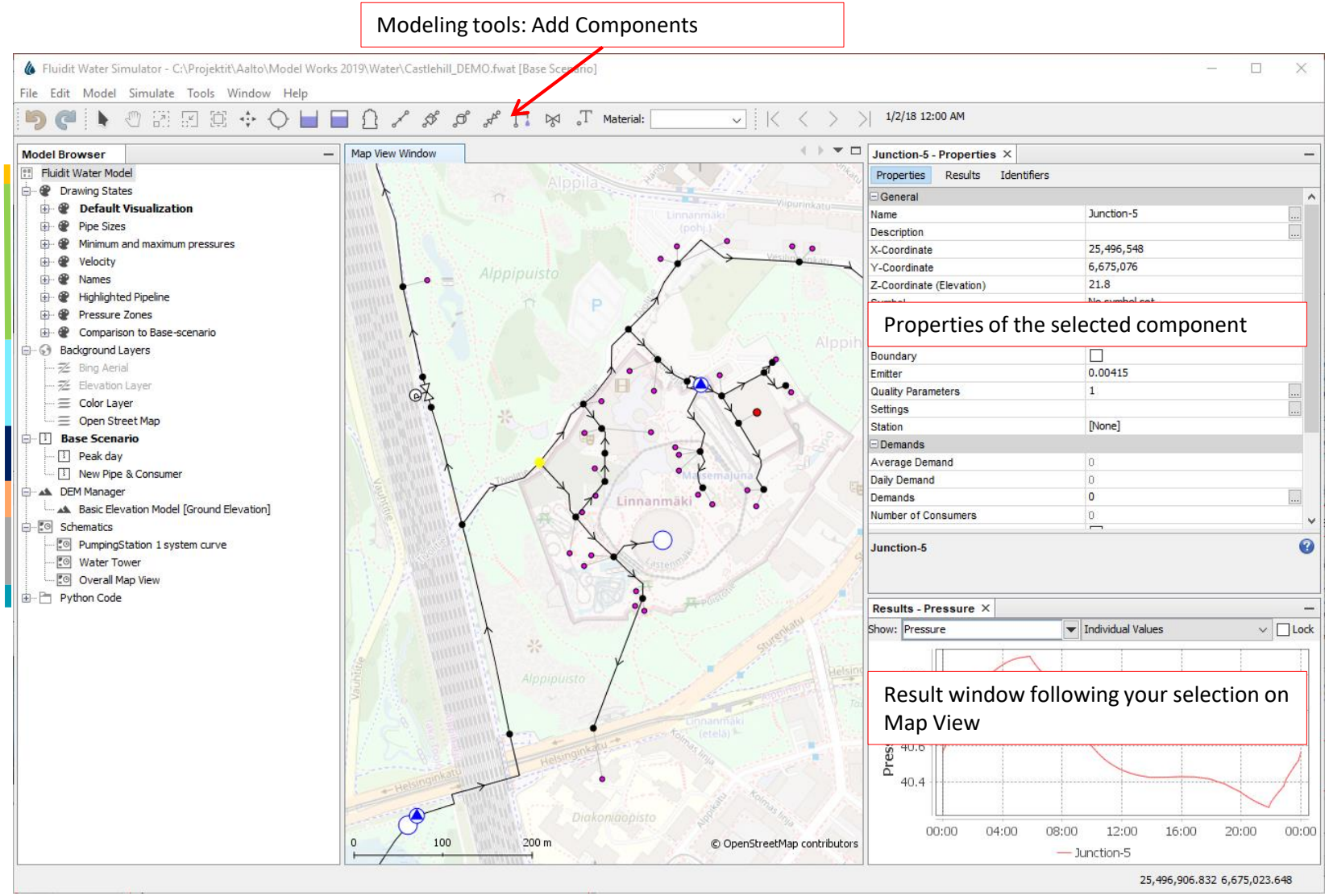
Background Layers:
- Online background maps (street maps, aerial, etc.)
- Add files as background image (for example .dxf or .shp)
- Raster layers calculated from results
- Manage layer order

Scenarios:
- “Treelike” structure of the model

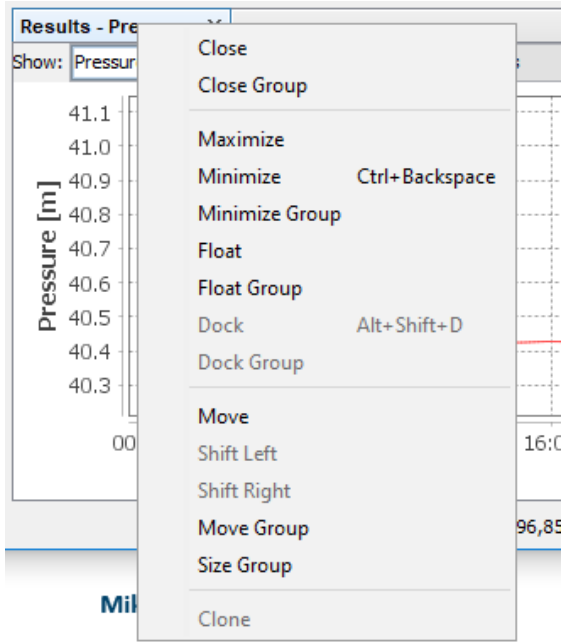
Elevation Model

Schematics – predefined chart, figures and maps to present results

Python Code – optional, enable complex control systems



CUSTOMIZE YOUR VIEW



- Manage windows
  - Move around by dragging from the tab
  - Close and minimize are found as icons
  - Additional options can be accessed with a right-click on the tab (→)
    - *Float* makes a new separate window, which can be taken to a second screen for example

- New windows can be opened via *Windows* –menu. Common ones include:
  - *Properties* – selected component (or scenario, drawing state, etc.) properties
  - *Results* – visualize results from selected components as time series
  - *Statistics on Selected Components*
  - *Profile View*

- Tooltip – what is shown in Map View when cursor is above a component – can be customized
  - *Tools → Options → Map View → Tooltips*

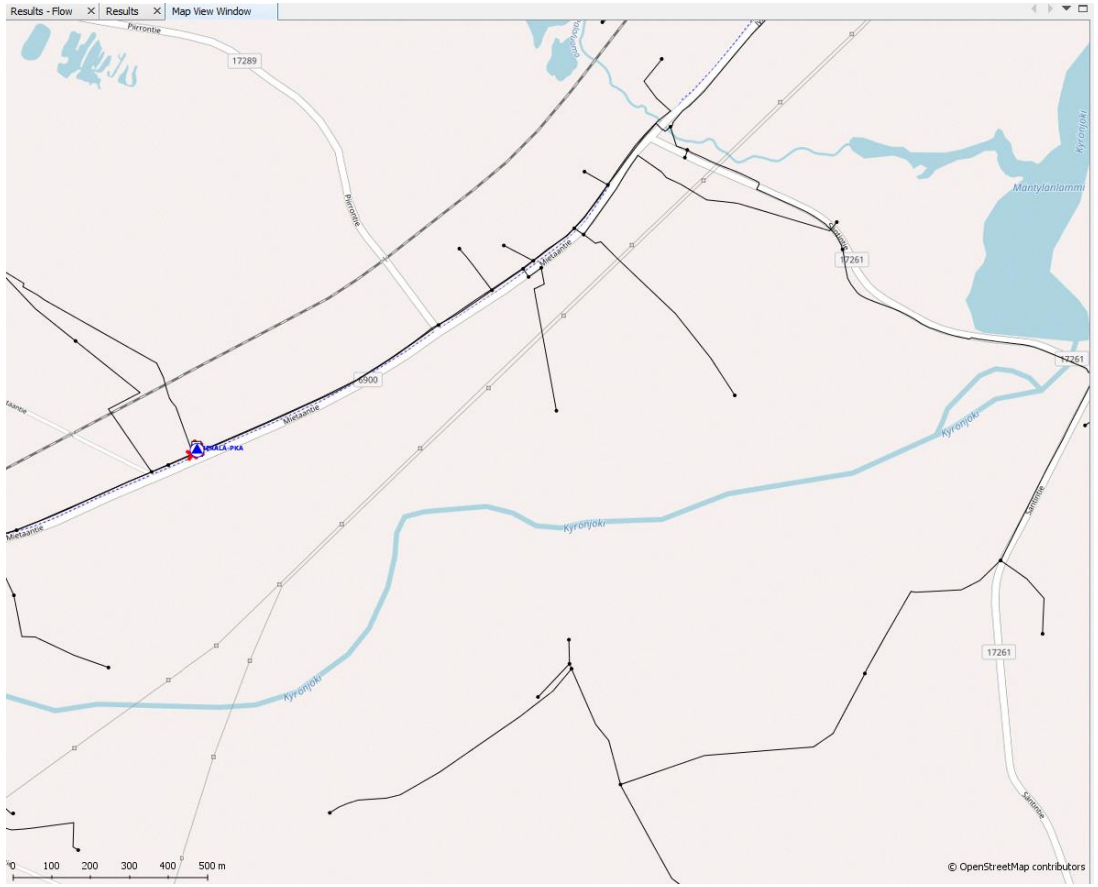
- General Appearance of the software can also be modified
  - *Tools → Options → Appearance → Look and Feel*

NAVIGATING MAP VIEW

- Move around: **middle mouse button** or **arrow keys**
- Zoom: **mouse roll** or **”+” ja ”-” keys**

- **ESC key** activates select tool
- Select components by clicking or dragging over an area
  - **+CTRL** adds to current selection
  - **+SHIFT+CTRL** removes from current selection

- **CTRL** down → shows elevation in lower right corner
- **ALT** down → can be used to measure distances
- **ALT + SHIFT** down → can be used measure area



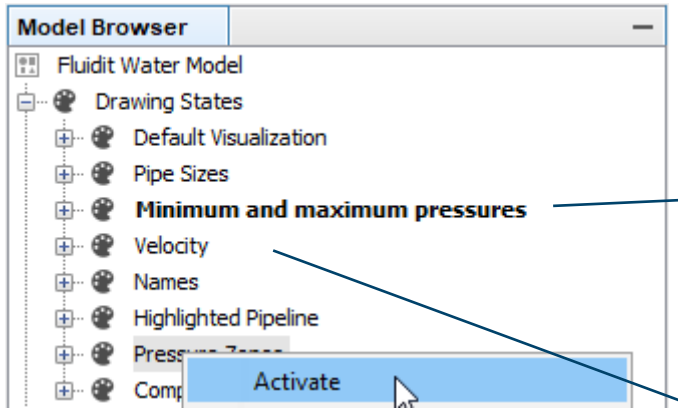
ACTIVATE DRAWING STATE

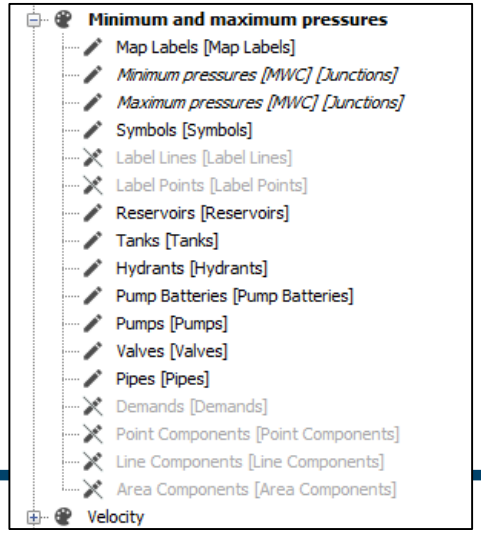
- Activate a *Drawing State*
  - By double click
  - Or right click → *Activate*

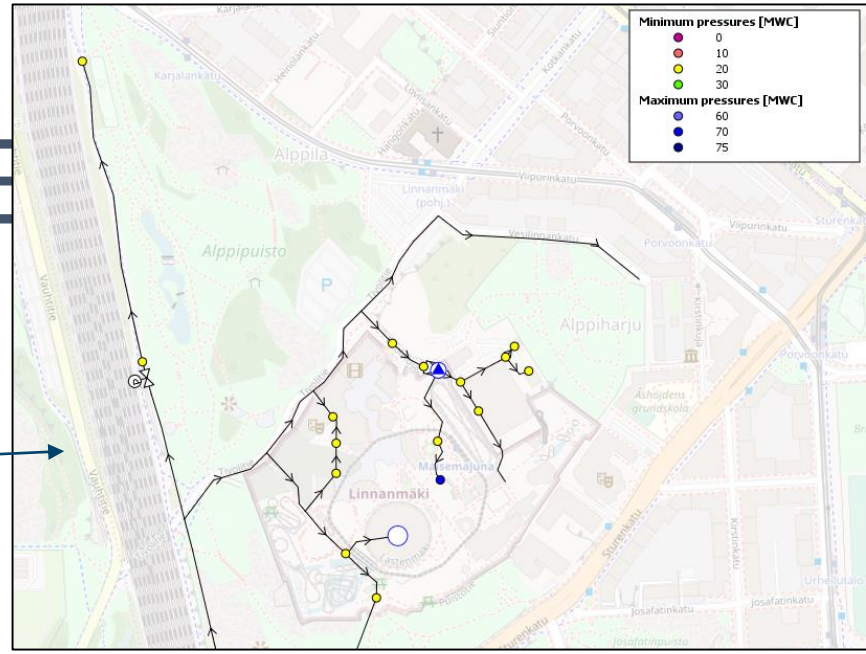
- *A Drawing State* defines what components are shown and in what colors & sizes
- *A Drawing State* also has a specific set of Background Layers visible

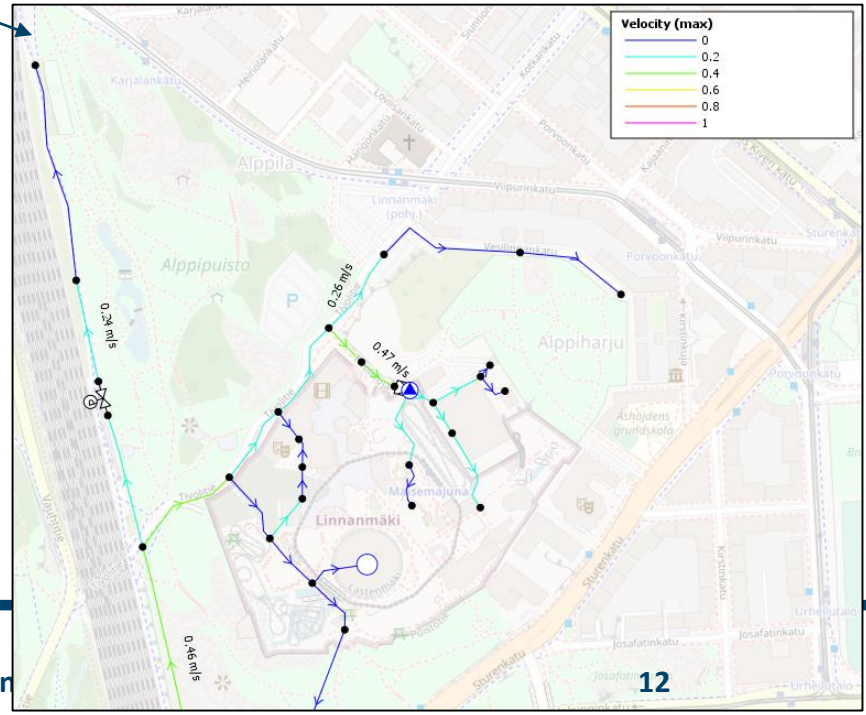
- *Drawing States* are model-specific, but can be imported from other models

- More on *Drawing States* later…

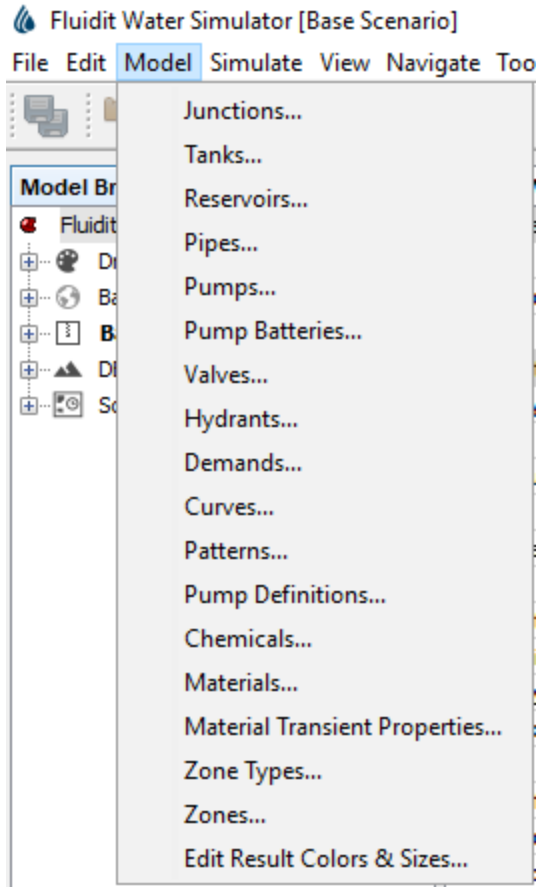








COMPONENT LISTS



Map View Window | Junctions

Nodes	averageDe...	boundary	dailyDemand	demands	description	emitter	ignoreForG...	minimumHead
Junc-3873	0,029	☐	2,501	3		0	☐	
Junc-15466	0,006	☐	0,479	2		0	☐	
Junc-19854	0,008	☐	0,734	4		0	☐	
Junc-21324	0	☐	0	0		0	☐	
Junction-71	0,021	☐	1,786	5		0	☐	
Junc-10875	0,002	☐	0,175	2		0	☐	
Junc-22755	0,017	☐	1,458	6		0	☐	
Junc-5739	0,01	☐	0,894	3		0	☐	
Junction-70	0	☐	0	0		0	☐	
Junc-6828	0	☐	0	0		0	☐	
Junc-20769	0,016	☐	1,422	4		0	☐	
Junc-13403	0,015	☐	1,279	5		0	☐	
Junc-18032	0,032	☐	2,781	2		0	☐	
Junc-19875	0,009	☐	0,781	2		0	☐	
Junc-14934	0	☐	0	0		0	☐	
Junc-20253	0,021	☐	1,855	2		0	☐	
Junc-4294	0,002	☐	0,198	1		0	☐	

All components of the model can be seen as a list from *Model* -menu

Lists can be used for example to:

- Select components
- Arrange components by any property or result
- Edit several components at once
- Copy-Paste (into Excel for example)

BASIC FEATURES: MODEL PROPERTIES & SIMULATION

MODEL PROPERTIES

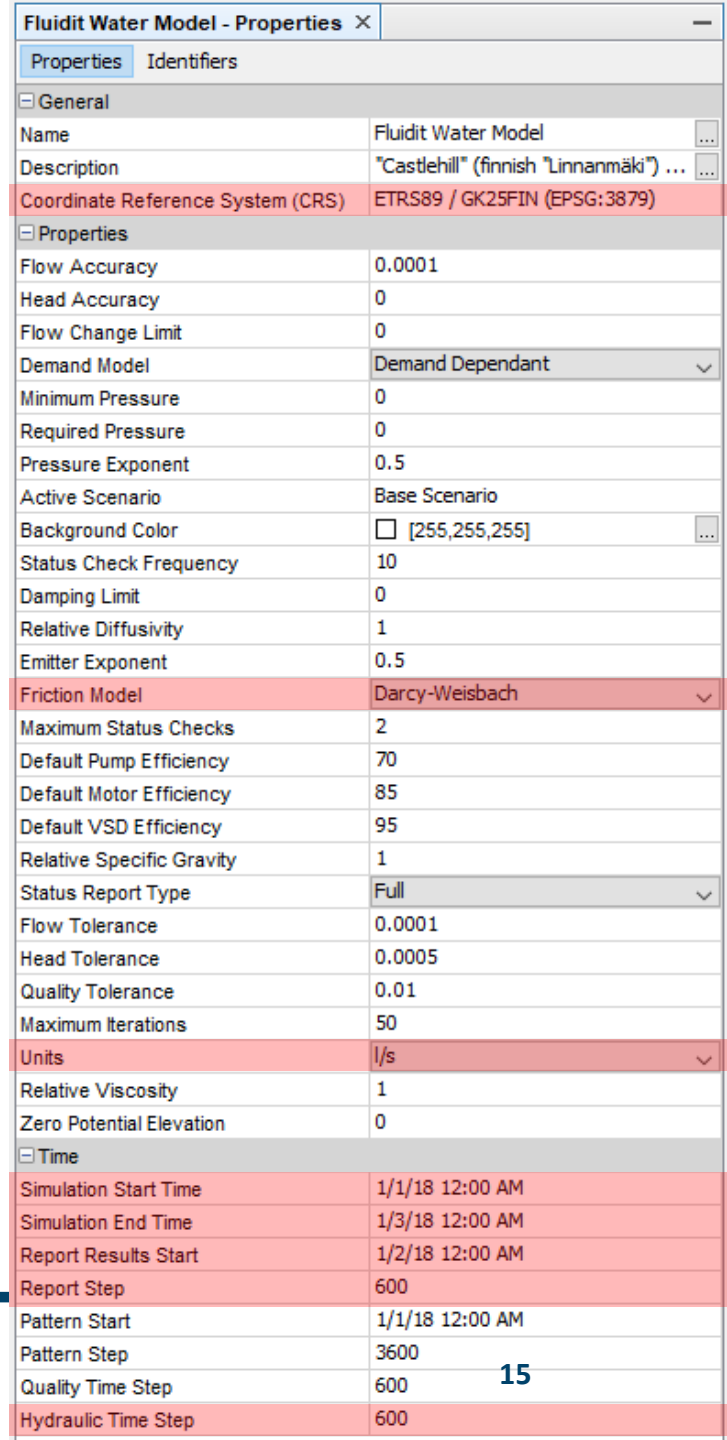
- Coordinate Reference System (CRS)
  - Select from the list, you can type to use search
  - This is the model general CRS. Import material and background layers can be given different CRS and the program will make the transformation.

- Friction Model – we recommend using Darcy-Weisbach
- Units – we strongly recommend using standard l/s

- Simulation Start Time
- Simulation End Time
- Report Results Start

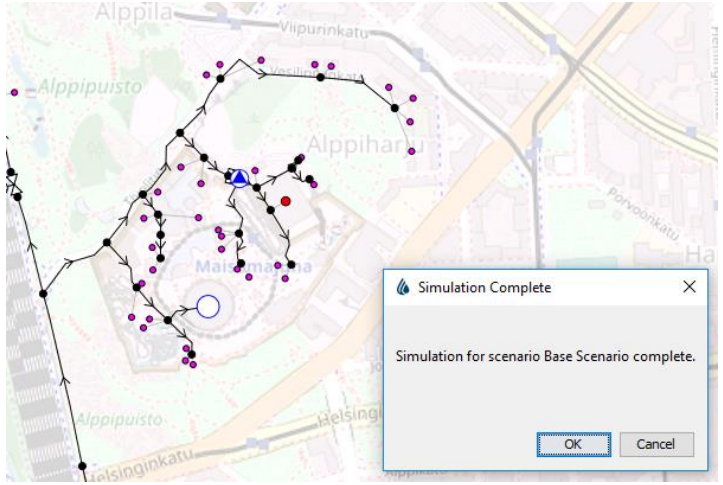
- Report Step
- Hydraulic Time Step

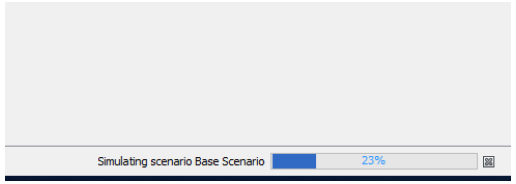
- More about simulation settings can be found in the EPANET manual
- …and we can also talk more about advanced setting later in this training



SIMULATION

- From menu “*Simulate*” → “*Simulate*” or shortcut **F5 key**
- Simulator writes a report on the progress of the simulation during calculation. This report can be found “*Simulate*” → “*Simulation Report*” or shortcut **F6 key**
  - If simulation fails, this is the main way to find out why





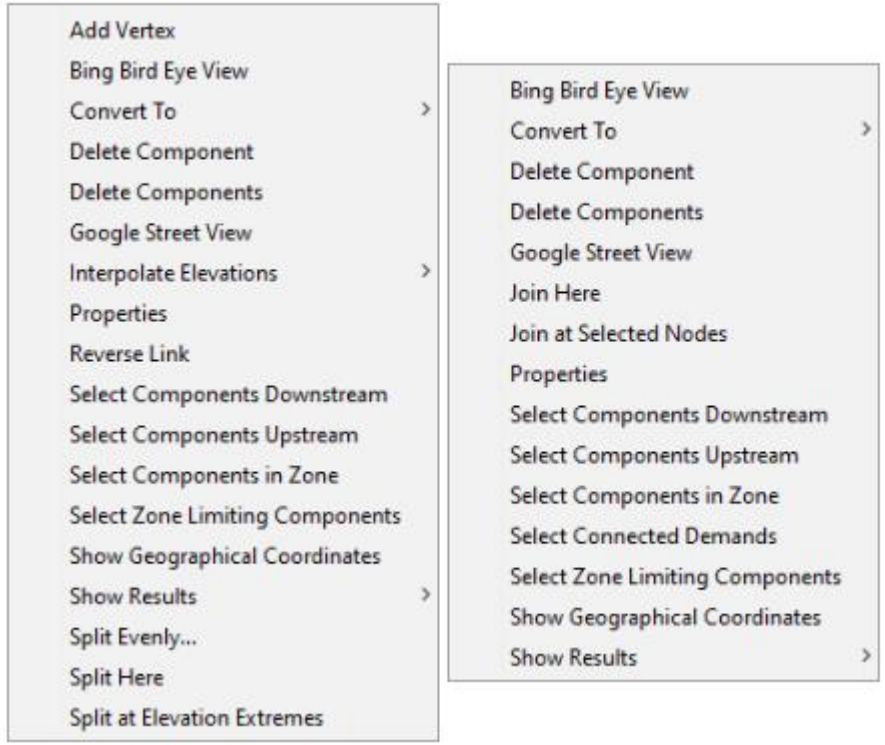
MORE BASIC FEATURES: TOOLS & WINDOWS

MAP VIEW: RIGHT MOUSE BUTTON

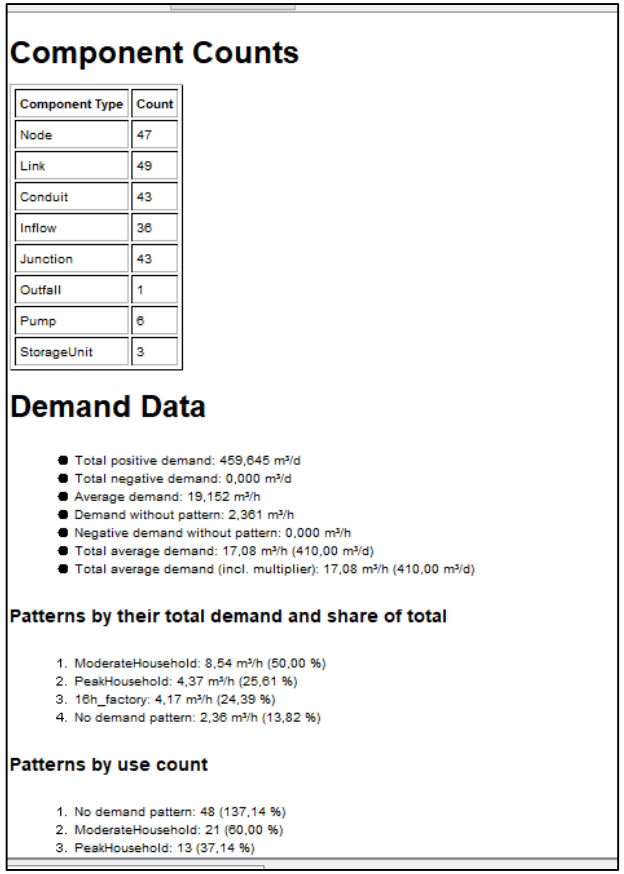
- Right mouse click anywhere opens up a menu, which is dependent on the location and selection

- Common uses:
  - Google Street View
  - Split Link / Join Here
  - Select components in Zone/Downstream/Upstream
  - Connect Selected Link/Demand here
  - +++

For example, right click on links and on nodes open the following options in Fluidit Water:



STATISTICS ON SELECTED COMPONENTS



Component Counts

Component Type	Count
Node	47
Link	49
Conduit	43
Inflow	36
Junction	43
Outfall	1
Pump	6
StorageUnit	3

Demand Data

- Total positive demand: 459,645 m³/d
- Total negative demand: 0,000 m³/d
- Average demand: 19,152 m³/h
- Demand without pattern: 2,361 m³/h
- Negative demand without pattern: 0,000 m³/h
- Total average demand: 17,08 m³/h (410,00 m³/d)
- Total average demand (incl. multiplier): 17,08 m³/h (410,00 m³/d)

Patterns by their total demand and share of total

1. ModerateHousehold: 8,54 m³/h (50,00 %)
2. PeakHousehold: 4,37 m³/h (25,61 %)
3. 16h_factory: 4,17 m³/h (24,39 %)
4. No demand pattern: 2,36 m³/h (13,82 %)

Patterns by use count

1. No demand pattern: 48 (137,14 %)
2. ModerateHousehold: 21 (60,00 %)
3. PeakHousehold: 13 (37,14 %)

This window shows statistical information about components selected in Map View.

Common uses are for example:

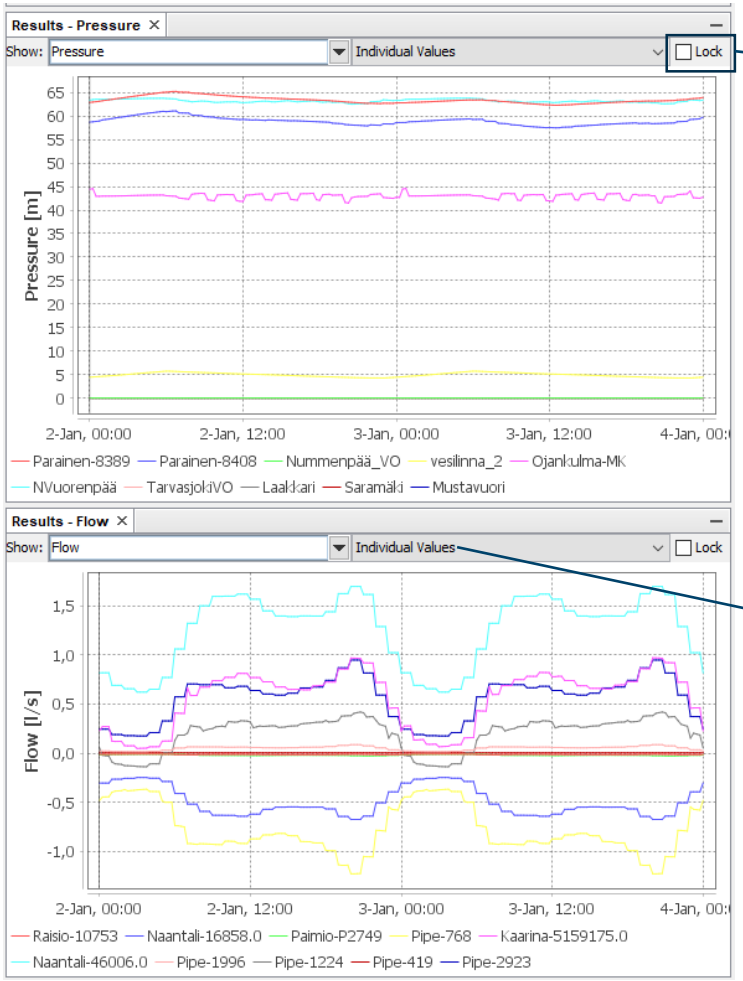
- Number of components selected
- Total length of selected links
- Highest and lowest pressures or unit head losses
- +++

Alt + mouse click on top of the results from individual components (for example highest maximum flow) selects the component

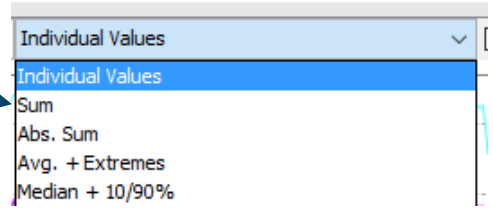
Pipe Results

Result	Sum	Average	Min (time)	Max (time)	Smallest sum (time)	Largest sum (time)
Abs. Flow [l/s]	5666591,12	2,12	0,00 (2.1.2017 0:00)	689,64 (2.1.2017 21:00)	1,63 (3.1.2017 6:45)	2,74 (3.1.2017 20:30)
Abs. Flow (avg) [l/s]	29360,58	2,12	0,00	494,17		
Abs. Flow (max) [l/s]	43142,54	3,11	0,00	689,64		
Abs. Flow (min) [l/s]	14574,34	1,05	0,00	358,14		

RESULT WINDOWS



Can be used to lock to current selection – window does not update with Map View selection anymore



Instead of individual component results, result - window can be set to show statistical values

Some example uses:

- ”Sum” of the result ”Demand” – total water taken out of the network from selected nodes
- ”Avg. + Extremes” of the result ”Pressure” – lowest and highest pressure in the selected nodes

FIND TOOL – CTRL + F

Expression	Result
`Pipe-3`	Search for a component named "Pipe-3"
`!open`	Search for closed pipes (non-open)
`["Junc-1531", "J-4", "J-3"].indexOf(name) != -1`	Search the model for components with names Junc-1531, J-4 and J-3
`tags.contains("tag name")`	Search for components with a tag "tag name"
`tags.isEmpty()`	Search for components with no tags
`result("MIN_PRESSURE") < 25 || result("MIN_PRESSURE") > 70`	Search for junctions, which have minimum pressure below 25 mwc OR maximum pressure above 70 mwc
`hasZone("PressureZone", "Center")`	Search for all the components, which have "PressureZone" set to "Center"
`abs(result("MAX_PRESSURE") - model.base.findComponent(uuid).result("MAX_PRESSURE"))`	Change in maximum pressure compared to base-scenario, absolute value
`connections.size()==0`	Search the model for junctions with no connected links
`connectionsList.size() == 1 && connectionsList[0].length<30`	Search for node components, which have only one connection AND the connection is less than 30 meter of lenght
`connectionsList.size() == 2 && connectionsList[0].material == connectionsList[1].material`	Search for nodes, which have two connecting links AND those links have the same material

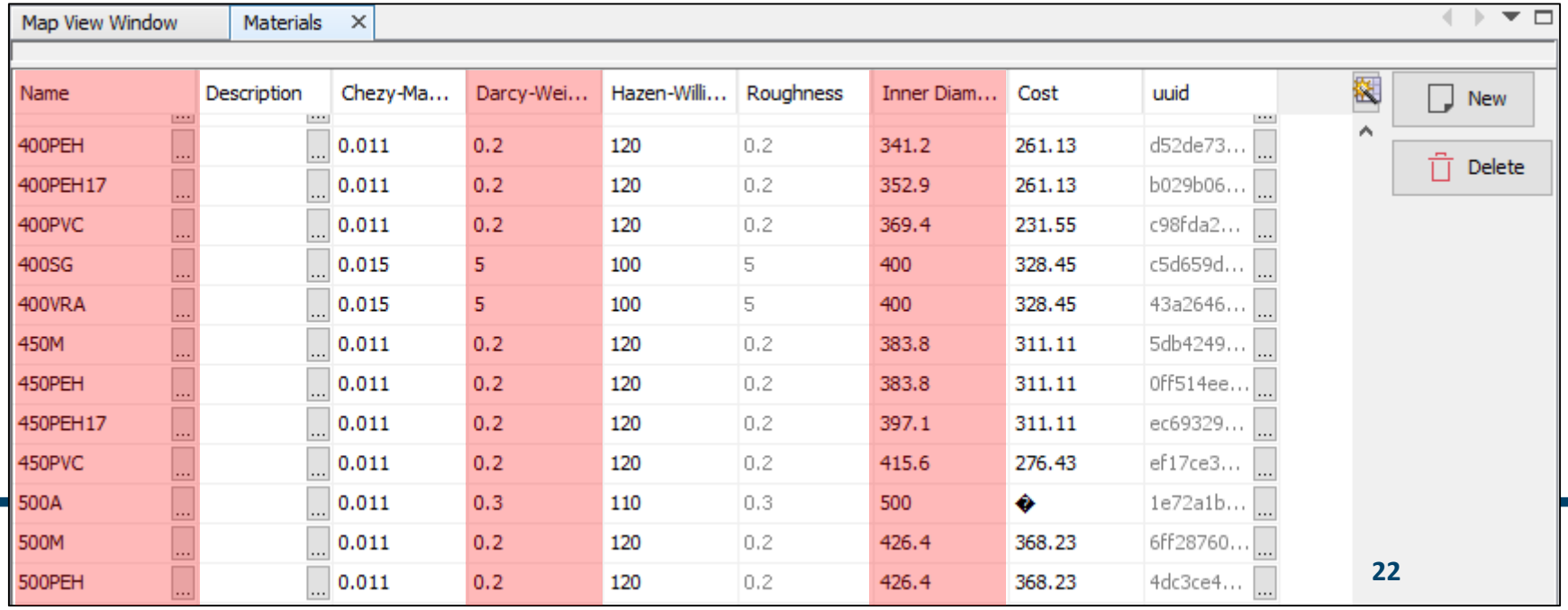
- Can be used to find components with expressions from simple to very complex
- For example:
  - *Junction-1*
  - *z > 20*
  - *connectionsList.size() == 2 && connectionsList[0].material = connectionsList[1].material*
- Tool uses JavaScript
- Example expressions can be found in Wiki

MATERIAL LIBRARY

- *Model → Materials*
  - Add new materials
  - Modify or delete old materials
- Materials can be imported from another model (*File → Import Features to Model)*

- *Tools → Material Packs*
  - There is no full ”Vietnamese Material Pack” ready
  - We have started to make one, we should finish it together

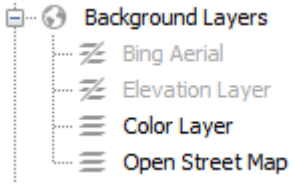
- Important material features:
  - Name
  - Darcy-Weisbach roughness
    - (or Hazen-Williams)
  - Inner Diameter (mm)

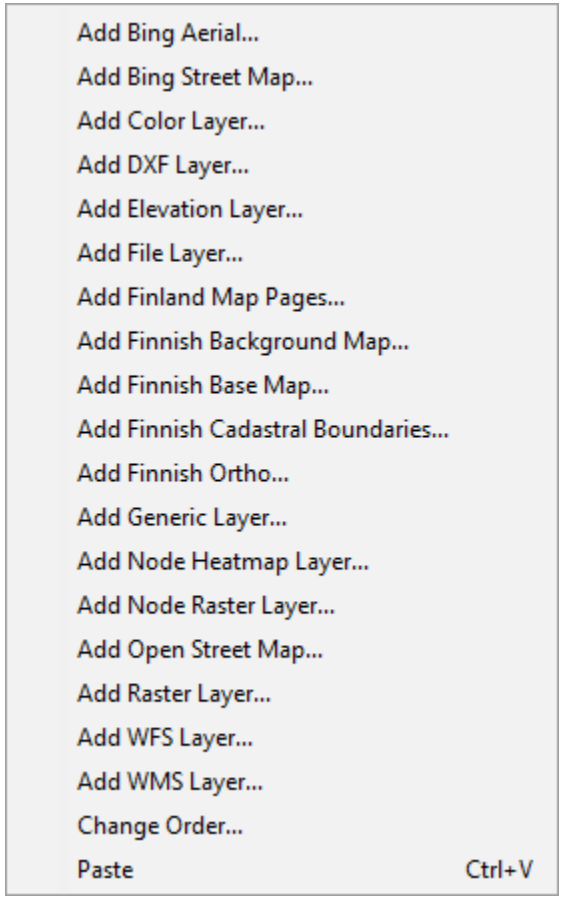


Name	Description	Chezy-Ma...	Darcy-Wei...	Hazen-Willi...	Roughness	Inner Diam...	Cost	uuid
400PEH		0.011	0.2	120	0.2	341.2	261.13	d52de73...
400PEH17		0.011	0.2	120	0.2	352.9	261.13	b029b06...
400PVC		0.011	0.2	120	0.2	369.4	231.55	c98fda2...
400SG		0.015	5	100	5	400	328.45	c5d659d...
400VRA		0.015	5	100	5	400	328.45	43a2646...
450M		0.011	0.2	120	0.2	383.8	311.11	5db4249...
450PEH		0.011	0.2	120	0.2	383.8	311.11	0ff514ee...
450PEH17		0.011	0.2	120	0.2	397.1	311.11	ec69329...
450PVC		0.011	0.2	120	0.2	415.6	276.43	ef17ce3...
500A		0.011	0.3	110	0.3	500	□	1e72a1b...
500M		0.011	0.2	120	0.2	426.4	368.23	6ff28760...
500PEH		0.011	0.2	120	0.2	426.4	368.23	4dc3ce4...

BACKGROUND LAYERS & ELEVATION MODEL

BACKGROUND LAYERS





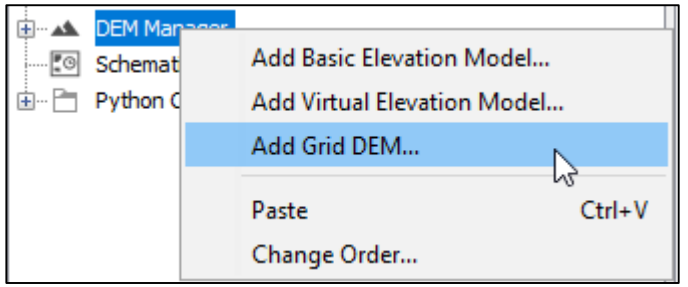
- In model tree on the left
  - Mouse right button on “Background Layers” adds layers
  - Double mouse click: on/off
  - Top Layer is shown on top
    - Right mouse button “move up/down” or by drag
- Selection of street maps, aerial imagery, etc.
- Files / network maps / own maps:
  - Add DXF Layer
  - Add Raster Layer → Raster layers: for example georeferenced images
  - Add File Layer → Vector Layers: for example .shp
  - Add WMS Layer → Map servers: URL and username/password, select layers
- Calculated Layers from model properties/results:
  - Add Elevation Layer
  - (Add Node Raster Layer → general node result visualization raster → more later, if we have time)

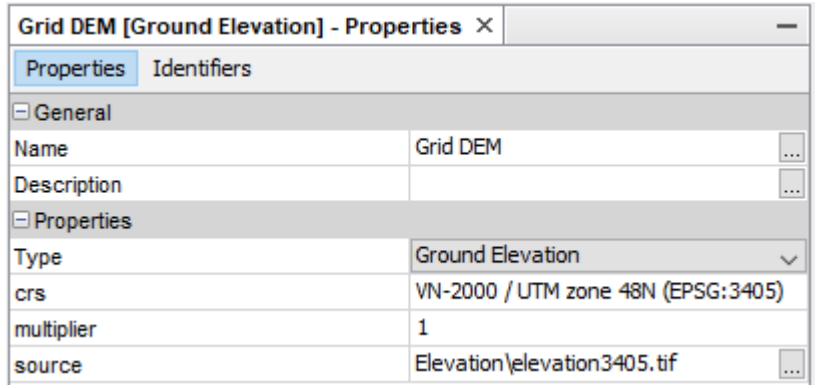
ELEVATION MODEL (FROM FILE)

- *"Basic Elevation Model"* from Google DEM
  - (quality of the elevation data varies around the world, some fixes to handle the material better is currently under work at Fluidit)
- *"Grid DEM"* from File: ".tif" raster files

- Possible to have several elevation models
  - Fluidit Water first tries the one on top
  - → if no data, then tries the next, etc.

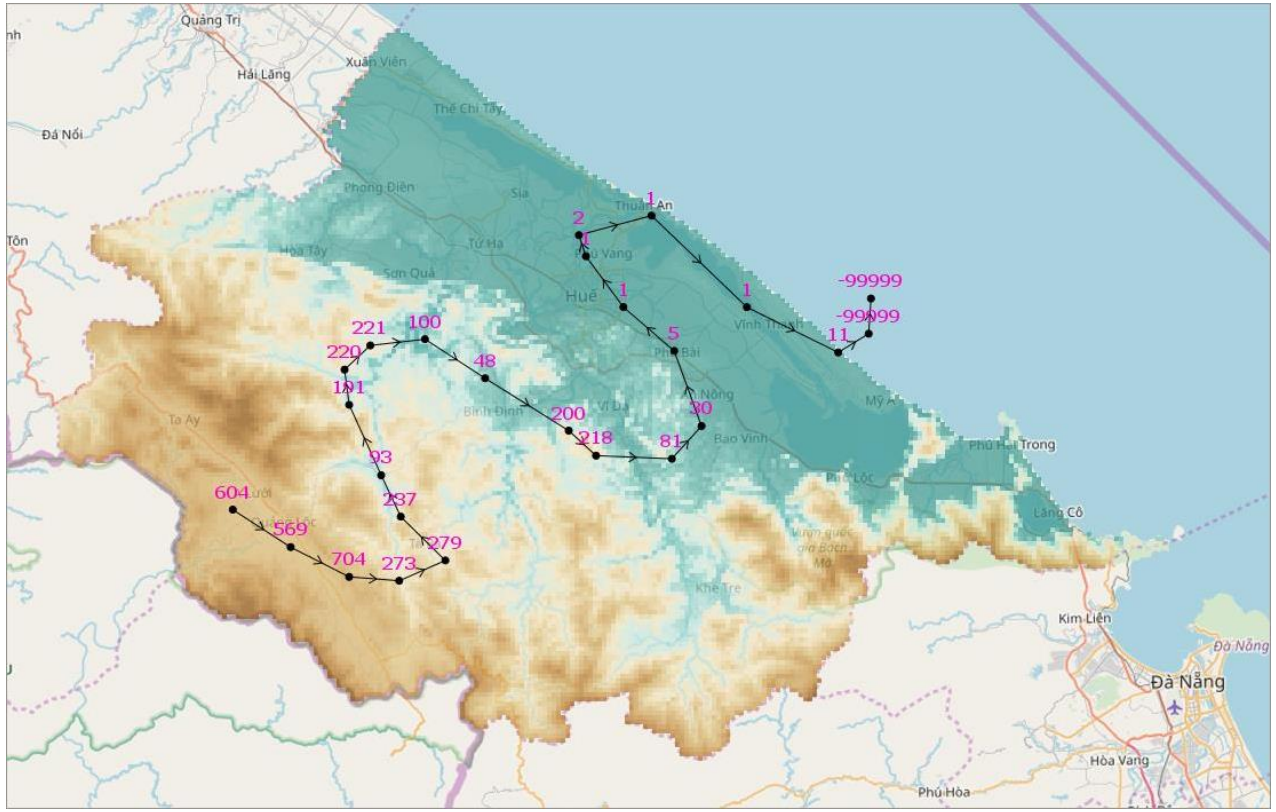
- Fluidit Water also supports *Virtual Elevation Models* – elevation layers calculated from other elevation models
  - For example constant "– 1 meter from *Basic Elevation Model*"
  - Rarely used in Water Distribution (more in Sewer)…





ELEVATION MODEL IN HUEWACO MODEL

- Fluidit made a conversion to .tif (in QGIS)
- Grid DEM in HueWACO model refers to a file ”Elevation\elevation3405.tif” → keep the folder with the file in the same directory as the model
  - Or update the path to the elevation file



Grid DEM [Ground Elevation] - Properties

Properties | Identifiers

General	
Name	Grid DEM
Description	
Properties	
Type	Ground Elevation
crs	VN-2000 / UTM zone 48N (EPSG:3405)
multiplier	1
source	Elevation\elevation3405.tif

HueWACO test1.fwat	✓	14.2.2019 18:32	FWAT File	2 891 KB
Elevation	✓	15.2.2019 10:30	File folder	

SOME GENERAL TIPS

GENERAL TIPS

- Save often
- Every now and then make a new copy (Save As…)
- Fluidit Water automatically makes a back-up save of the old model file (“.fwat.bak”) to the same directory when you save replacing the old version

- Many problems can be solved by simply closing the software and re-opening

- Fluidit Water writes an internal log
  - *Windows → IDE Log*
  - If you have some problems, this can help to find out why
  - Can be copy-pasted and sent to Fluidit Support

PHYSICAL COMPONENTS

PHYSICAL COMPONENTS

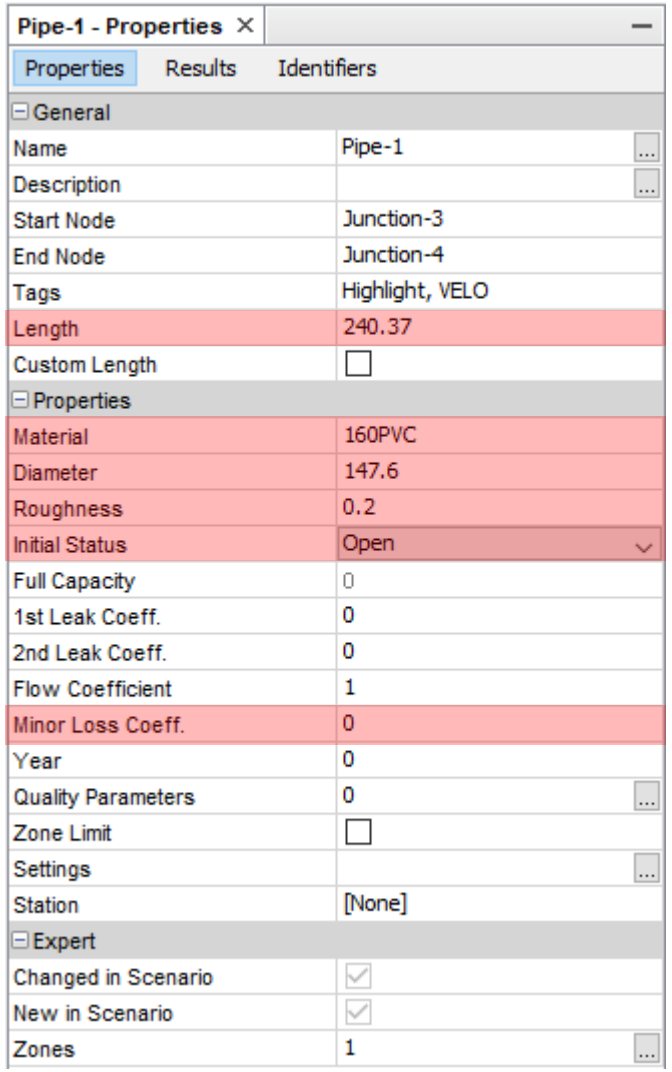
- Links
  - Pipes
  - Valves
  - Pumps
  - Pump Batteries
- Nodes
  - Junction
  - Reservoir
  - Tank
  - Demand
    - Technically not a “node” as it is not part of the network

LINKS

PIPE

- Basic hydraulic parameters:
  - **Length** [m] (automatically calculated)
  - **Material or**
  - **Diameter** [mm] and **Roughness** [mm]
  - (Minor Loss Coefficient)

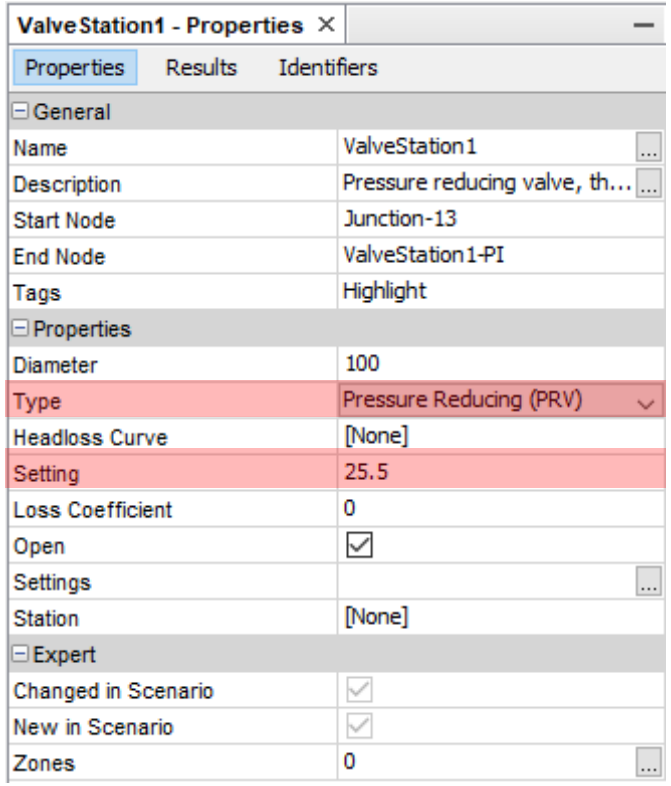
- **Initial Status**
  - Open – free flow
  - Closed – no flow
  - Check Valve – one-way flow (from Start Node to End Node)



VALVE

- Used to model **control** valves, gate valves (fully open/closed) can be modeled with closed pipes

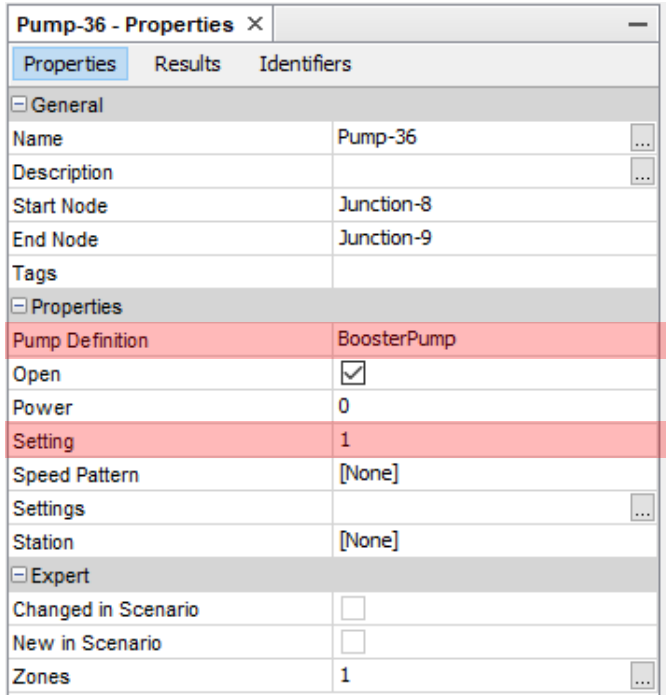
- **Type**
  - Flow Control – reduces flow to given setting
  - Pressure Reducing – reduces pressure to given setting
  - + 4 others…
- **Setting**
  - Depends on the type
  - Flow Control = l/s
  - Pressure Control = mwc
  - etc…



PUMPS

- Used to model pumps running at known speed (rpm)
  - Speed (setting) can be changed during simulation

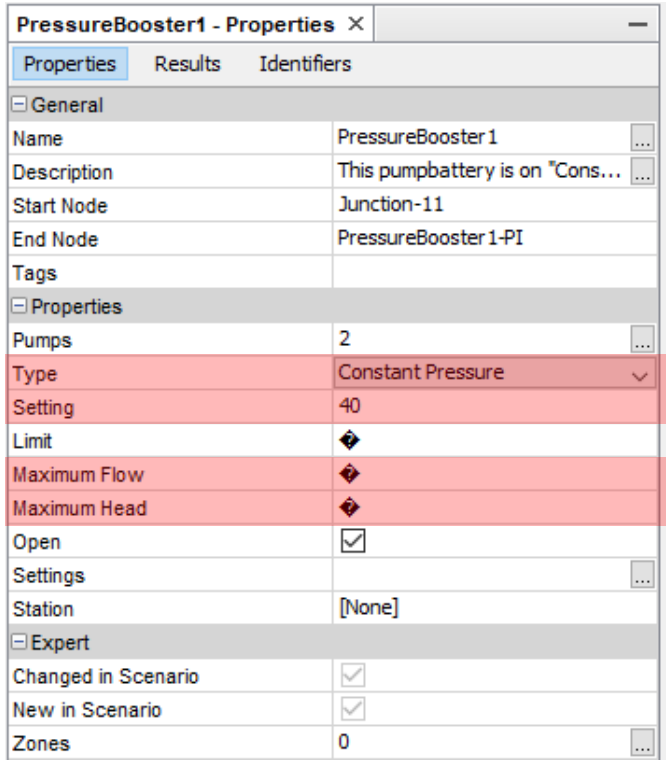
- **Pump Definiton**
  - **Q-H –curve**
  - Efficiency Curve (+ electric motor information)
- **Setting**
  - 1 = pump running at full speed
  - 0.5 = pump running at half speed
  - etc…



PUMP BATTERIES

- Used to model pumping stations with controls – for example constant pressure

- **Type**
  - Constant Pressure – keeps the given pressure setting at end node
  - Constant Flow – pumps a constant flow through the pump
  - Constant Generated Head – adds a constant amount of pressure
- **Setting**
  - Depends on the type
  - Constant Pressure = mwc
  - Constant Flow = l/s
  - Constant Generated Head = mwc



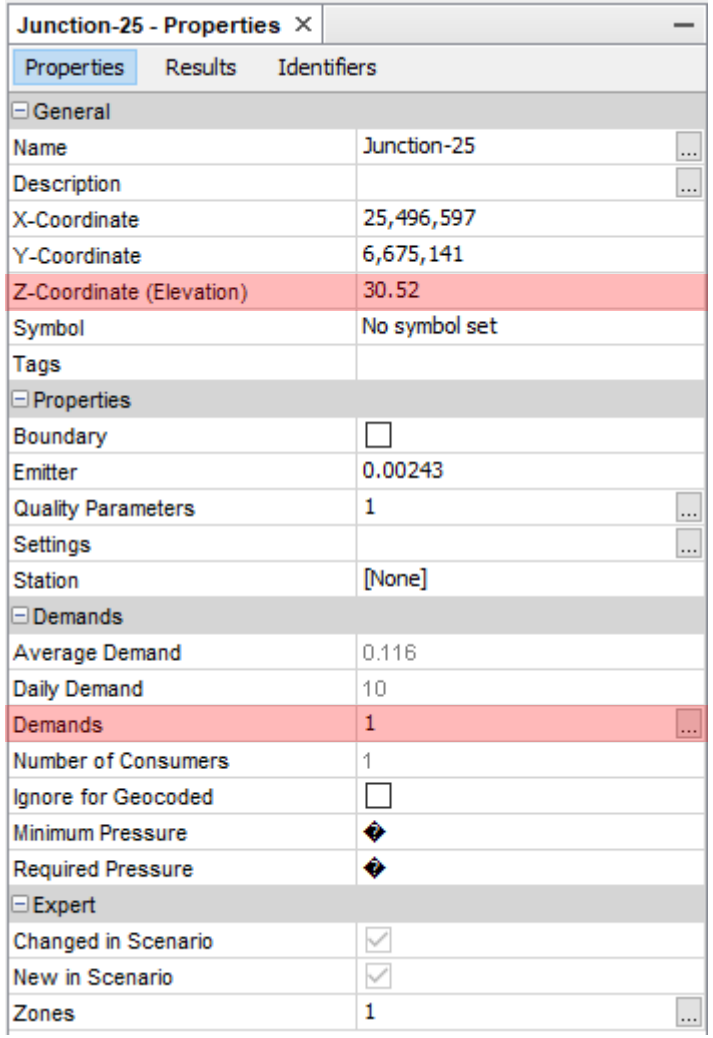

NODES

JUNCTIONS

- Used to model pipe intersections, material changes and points for consumers to take water from network

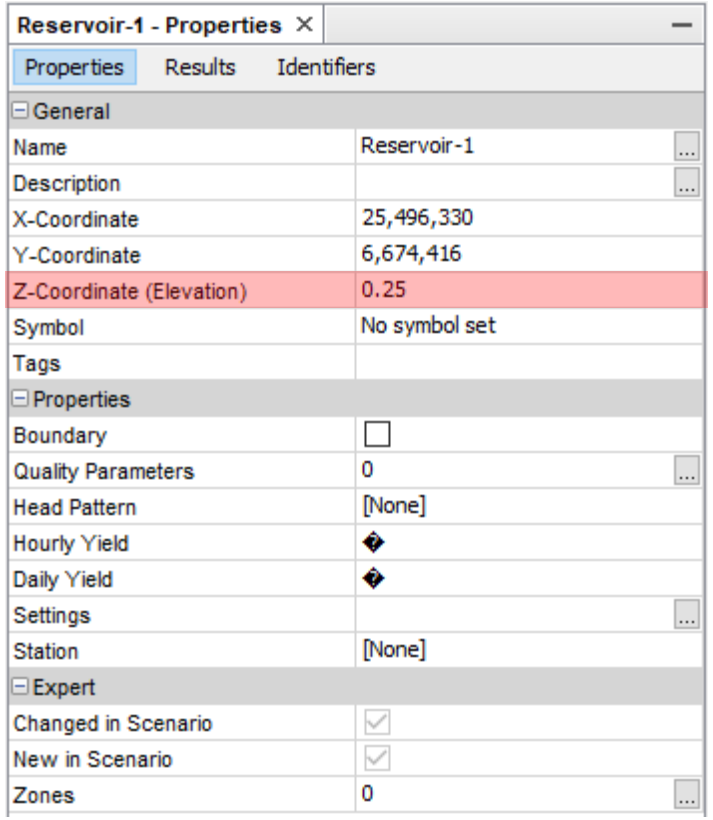
- **Elevation**
  - Usually taken automatically from Elevation Model
- **Flow out of Junction**
  - Consumers are usually modeled with geocoded demands, which attach to junctions
  - Leakage can be modeled steady direct demand in junctions
  - Or with Emitters – a coefficient taking water out of the junction depending on pressure

- Demand
  - Can be set directly in the Junction, although usually Geocoded Demands are used
  - Demand can also be negative (water into network)



RESERVOIRS

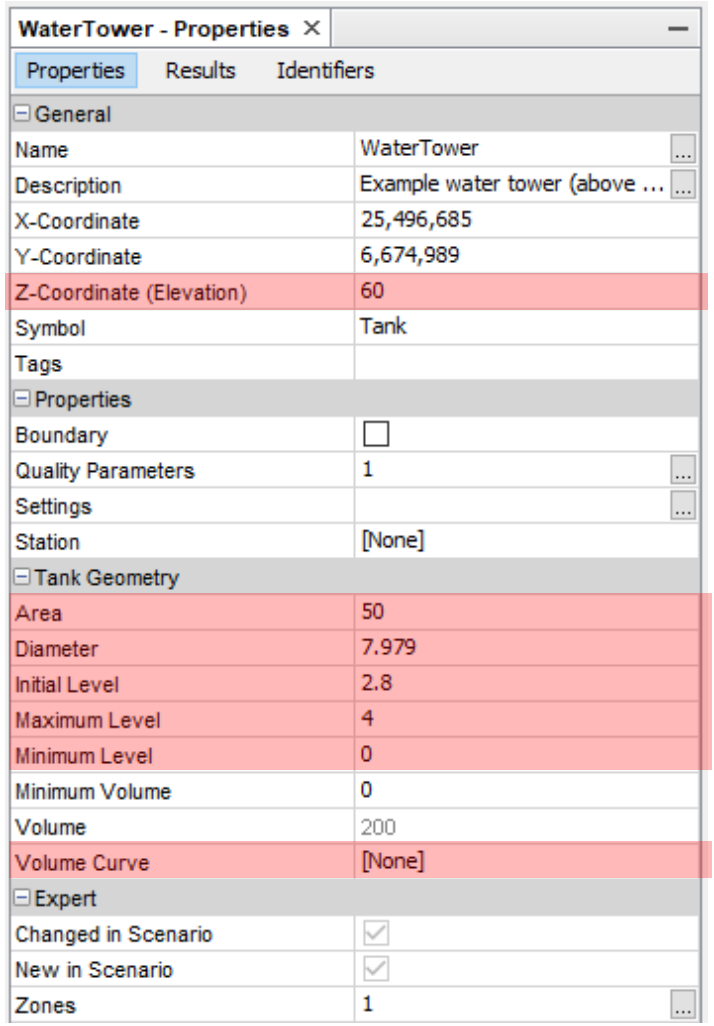
- Used to model water sources
  - Water enter network from Reservoirs: “new water is created”
- Always keeps a desired (usually constant) *Head* – by pushing water into network or taking water from network
  - Reservoir ALWAYS has a Head equal to its Elevation
  - → Pressure = 0 (free water surface)
    - (Pressure = Head - Elevation)
- **Elevation**
  - Possible also to give a Head Pattern (elevation changes over time)



TANKS

- Used to model any water tanks
  - (usually water towers or underground tanks)
  - Water can flow in and out, but no new water is created

- **Elevation**
  - Tank bottom elevation – when the tank is empty
- **Levels**
  - Minimum Level – almost always 0
  - Maximum Level – at what water level the tank is full
  - Initial Level – water level at the start of the simulation
- **Area / Diameter / Volume Curve**
  - Only one of these is given
  - Defines the relation between water volume and level in the tank
    - For example if 100 m^3 of water flow into tank, how much water level rises

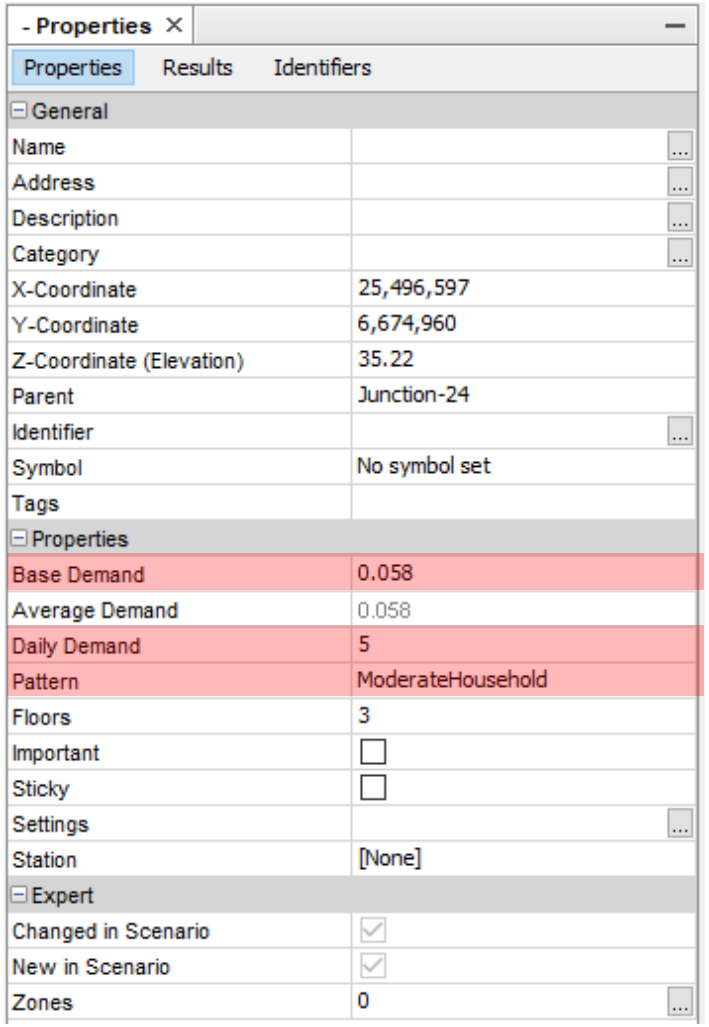


DEMANDS

- Used to model water consumers
  - Always connect to a Junctions
  - → Water leaves the network from Junctions

- **Base Demand (l/s) or Daily Demand (m^3/d)**
  - Water taken out of the network by this demand
- **Pattern**
  - How water intake varies during the day
  - If Pattern = [None] → steady flow

- Demands are usually imported from CIS / NIS / GIS



NON-PHYSICAL COMPONENTS

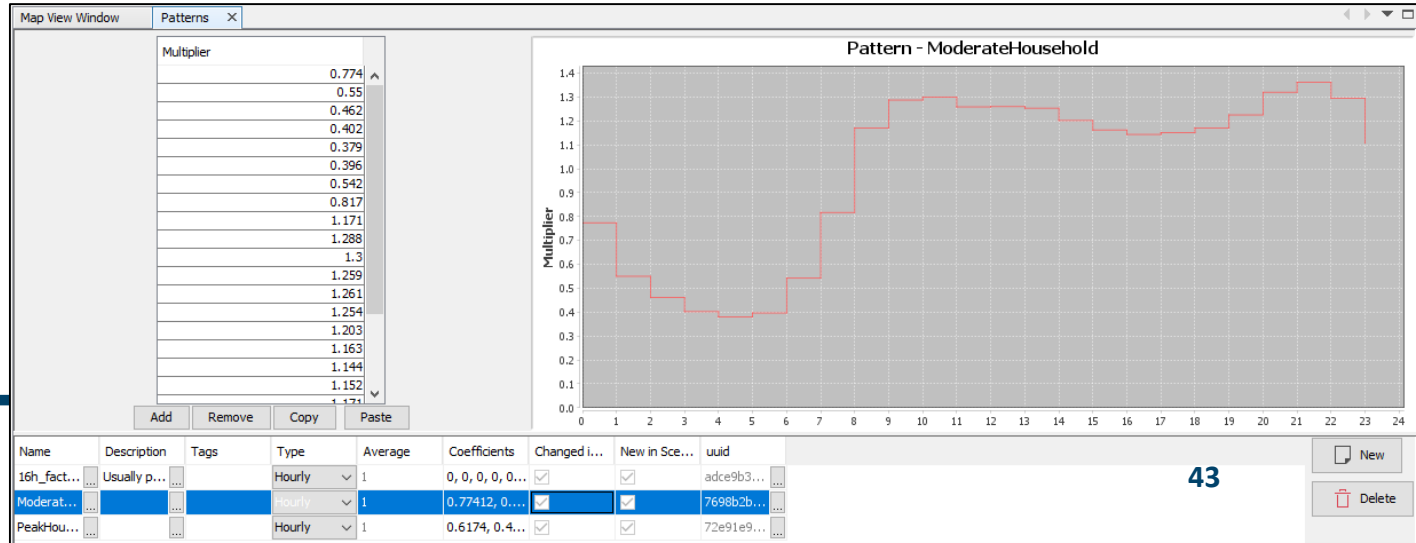
NON-PHYSICAL COMPONENTS

- Patterns
  - Describe repetitive changes in a value, usually relative to the average value
- Curves
  - Describe relation of two variables
  - Different types
- Pump Definition
  - Combine QH-curves, efficiency curves and motor information into a pump
- Chemicals
  - Parameters for water quality simulations

Values can be pasted from clipboard (from Excel, for example) into Fluidit Water and the other way around

PATTERNS

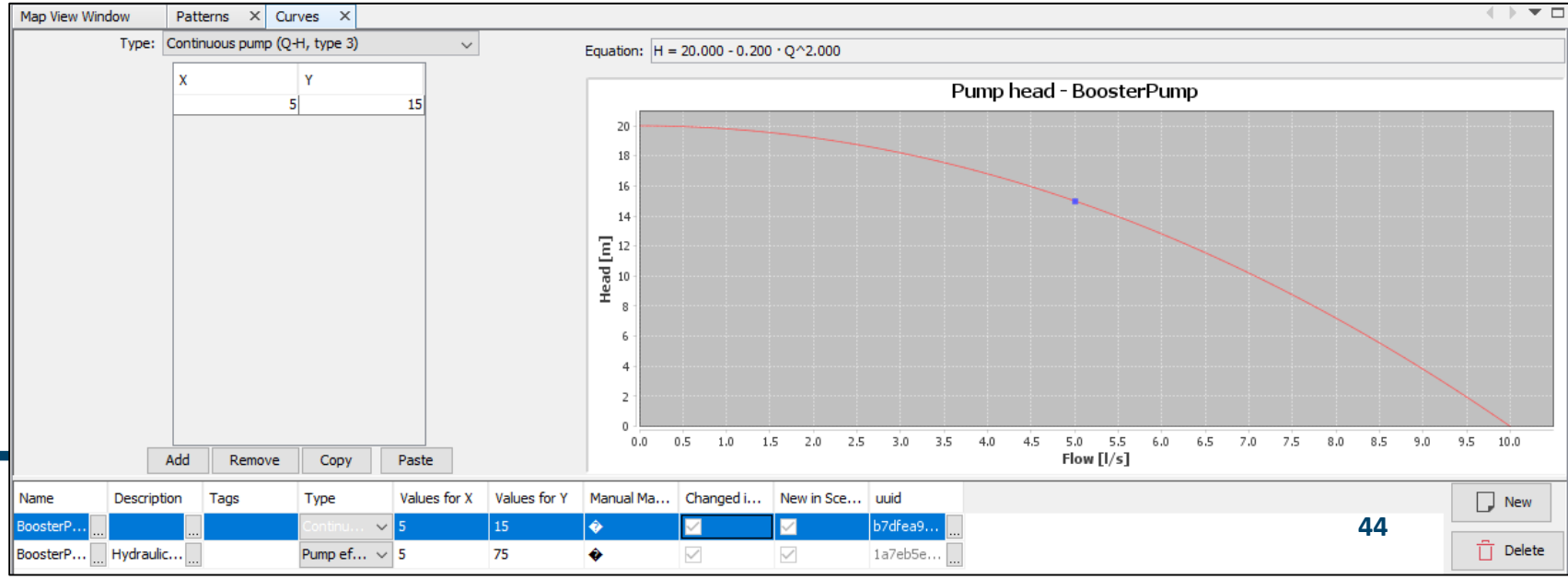
- Most commonly used to hourly change water taken from the network by demands
  - Water taken out from the network = Base Demand (l/s) * Pattern multiplier for every hour
- Can also be used to change:
  - Reservoir Head
  - Pump Setting
- Pattern Time Step can be changed in Model Properties
  - Time Step = How many seconds every step lasts
  - Usually and by default Time Step = 3600 = 1 hour → 24 values to represent one day
- Usually made so, that pattern average equals 1 → pattern does not change total consumption (m^3/d)
  - Others can also be used, for example to multiply water demands or for setting/head patterns



CURVES

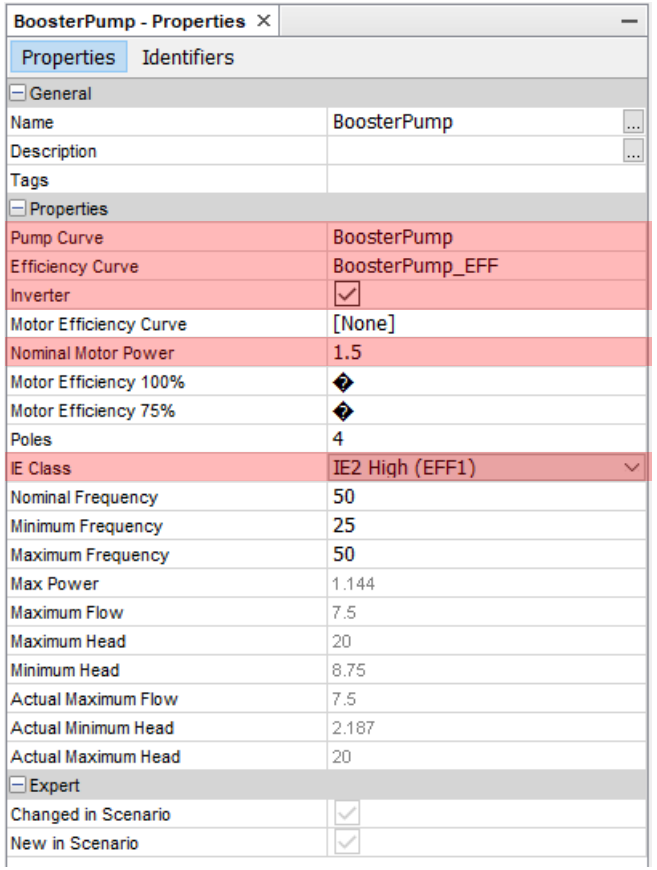
Most common uses include:

- Continuous pump (Q-H, type 3)
  - Can be given in
    - A) One operating point (nominal duty point)
    - B) Three operating points (a curve is fitted through these three points)
    - C) In tabular form (many Q, H –pairs)
- Pump Efficiency
- Volume
  - Used for tanks to define volume – water level relations, if tank area is not constant



PUMP DEFINITIONS

- Pump Definitions are used to combine different curves and other information into pumps
  - Q-H –curve, usually “continuous pump, type 3”
  - Efficiency curve to represent pumps hydraulic efficiency (optional)
  - Electric motor information (usually nominal power and efficiency class)
  - Selection if the pump is driven by an inverter (it’s losses are taken into account)
    - Inverter is also known as frequency converter or variable speed drive (VSD)



ZONES, TAGS

- Zones can be used to classify components into different zones
- Common zone types are pressure zone and metering zone

- Zone types are created via *Model → Zone Types*
- Zones are created via *Model → Zones*

- Zones can be used for example
  - To set leakage
  - Search components
  - Filter components

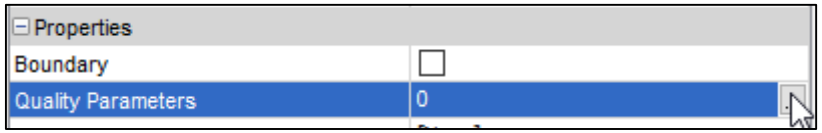
- Tags can be given all components
  - Component can have several tags, separated by a comma
  - Their uses are similar to zone: search, filter, etc…

Name	Description	Zones	uuid
PressureZone		(No Prope...	be912a...

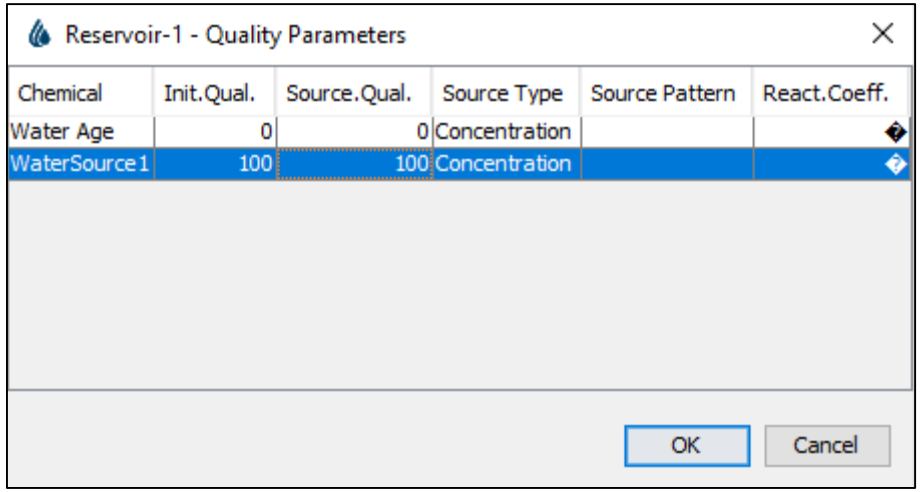
Name	Description	Type	Color	hasGeom...	uuid
LowerZone		PressureZone	null		bef1f33...
MainZone		PressureZone	null		f00ca5...
UpperZone		PressureZone	null		ab231b...

https://support.fluidit.fi/projects/simulators/wiki/Quality_Simulations

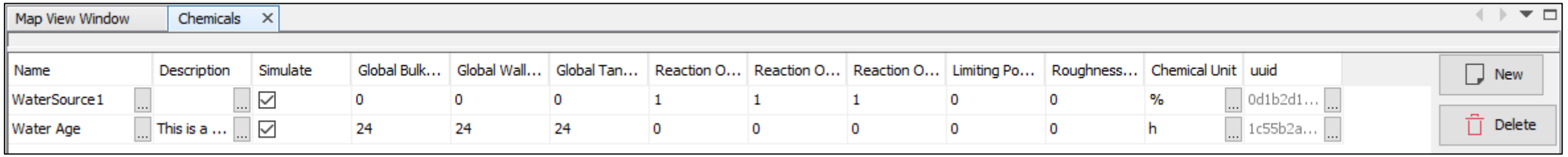
CHEMICALS



- Common uses:
  - Water Age
  - Water Source (tracing reservoirs)
  - Pollution (contamination) spreading
  - Chloride



- Below are chemical properties for:
  - Water source modeling
  - Water Age modeling



TOOLS

TOOLS

- Fluidit Water has a separate tool to assign Demands to their nearest junctions
  - *Tools → Demands → Update Demand Junctions*
  - Demands can also be set by hand (select demand → right click on junction → *Connect Selected Demand…*)
  - Demands with “Sticky” = true are not affected by the tool
  - Junctions set to “Ignore fo Geocoded” = true are affected by the tool

- Fluidit Water has a tool to update selected point elevations from Elevation Model (DEM)
  - *Tools → Update Point Elevations*
  - Updates selected components or if nothing is selected, all components
  - Usually elevations come automatically when nodes are created

https://support.fluidit.fi/projects/simulators/wiki/Assign_leaks

LEAKAGE TOOL

- Fluidit Water has a separate tool for setting leakage
  - *Tools → Demands → Assign Leaks*
  - Leakage can be divided to a specific area (selected area, whole system or by zones)
  - Leakage is se to junctions of the selected area depending on
    - Pressure
    - Lengths and diameters of the pipes joining the node
  - Can be to set a steady leakage (direct demand) or pressure dependant (emitters)

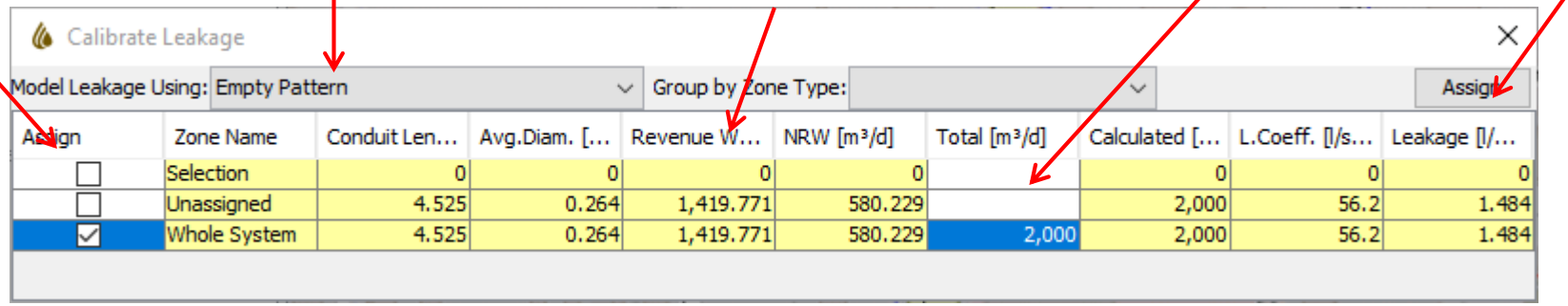
Select area: selections, zone, etc.

Select a pattern for leakage or to use emitter

Displays the billed demand of the area

Input field for TOTAL WATER CONSUMPTION (billed + leakage)

Press *"Assign"*



- There is also a tool to set given demand to selected nodes evenly *(Tools → Demands → Assign Demands)*

SCENARIOS

SCENARIOS

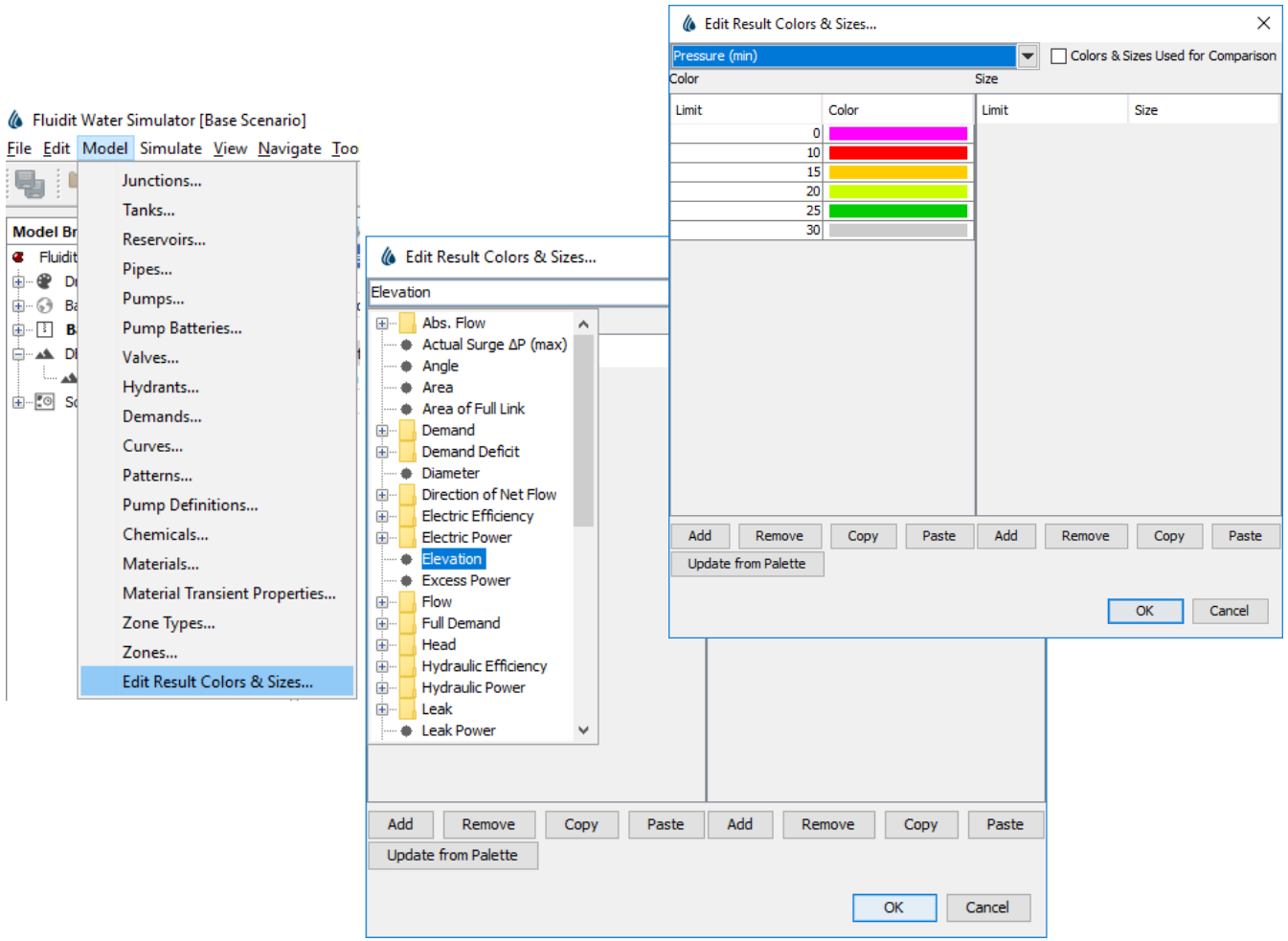
- Fluidit Water has a support for scenarios – different versions of the model in the same file

- Scenarios are hierarchical: changes made to parent scenario is inherited to it's child scenarios, but not the other way around
  - Components changed in a scenario are marked with "Changed in Scenario" = true, and changes made to this specific component in it's parent scenario are no longer inherited
  - New components (no corresponding component in parent scenario) are marked with "New in Scenario" = true
  - NOTE: these changes are always compared to it's direct parent scenario (one above) – not Base Scenario
  - NOTE: this information is only updated when scenario is loaded. Active another scenario and return.
  - Tip: sorting component tables by these properties (Changed / New in Scenario) is an easy way to locate components modified in active scenario

- Simulated results can also be compared between scenarios: visualize with "Compare to"


RESULT
COLORS &
SIZES
DRAWING
STATES

EDITING COLORS & SIZES

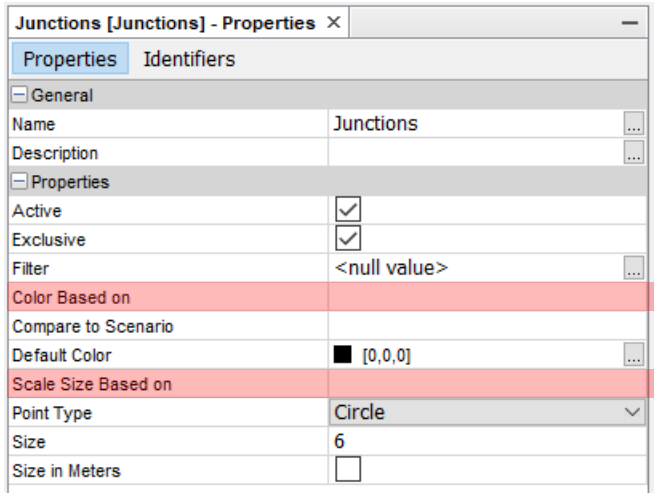


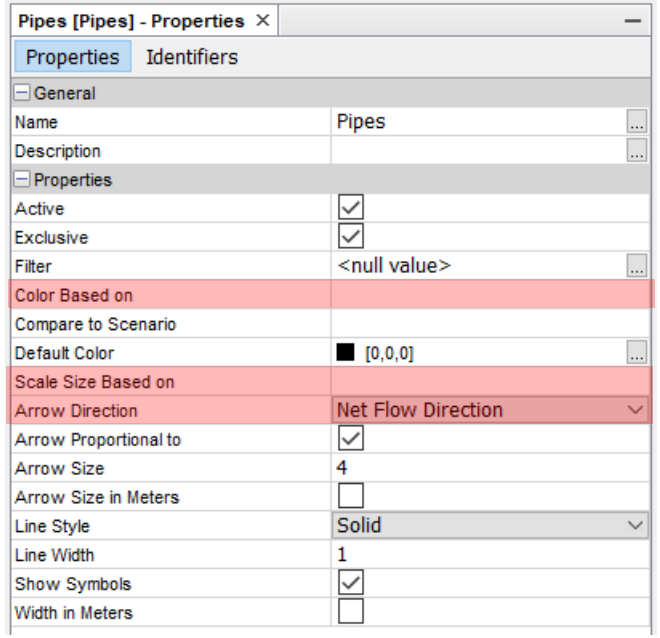
- *Model → Edit Result Colors & Sizes*
- Color and size definitions can be copied and pasted to/from clipboard (for example Excel)
- Color and size definitions can also be imported from another model file
  - *File → Import Features to Model*

DRAWING STATES

- Drawing States
  - Each *Drawing State* has definitions how components are displayed in the map view (if at all)
  - Usually component colors (*Color Based on*) or sizes (*Scale Size Based on*) are changed depending on some simulation result
  - …or text / numerical value is added next to components
  - Pipe arrows *(arrowDirection),* several options (for example net flow or maximum velocity)
  - Visualizations can be *filtered* to show only some of the components (for example visualize only junctions with very low or high pressure)
  - Active *(Background Layers)* are also saved in every *Drawing State*
  - One component type (for example pipes) can have several visualizators in the same drawing state

- Visualization as background layers → *Node Raster Layer*
  - First define colors (*Model → Edit Results Color & Sizes)*
  - Select which results is used *(field)*
  - Common settings: transparency *(alpha)* ja interpolation on/off *(interpolation)*





SCHEMATICS

https://support.fluidit.fi/projects/simulators/wiki/Schematics

SCHEMATICS

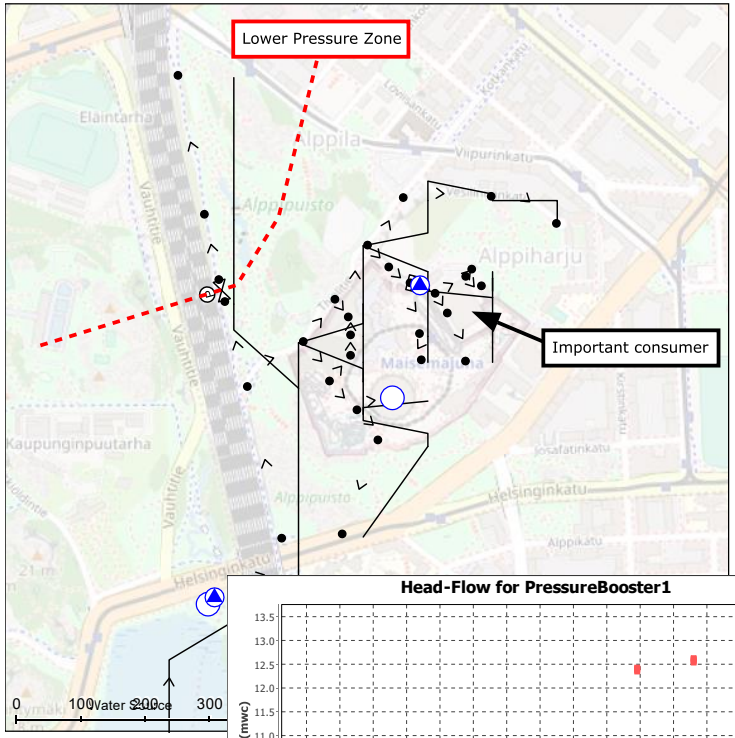
- Are used to make views of common and essential results
  - Schematic figures are defined which component and which result to show
  - → updates automatically if scenario is changed or simulation made
- → Makes it possible to see the essential results fast and easy after simulation

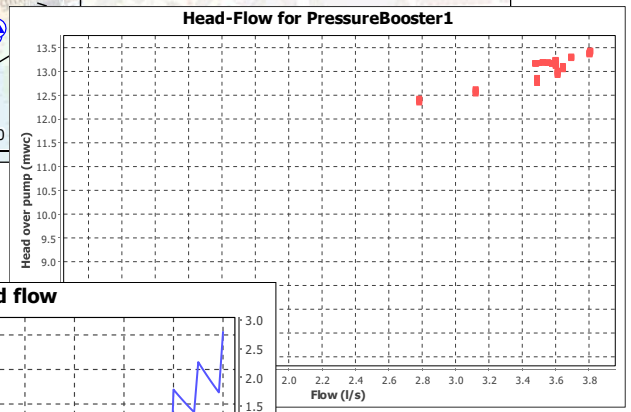
- Common schematic tools:
  - Map Views
  - Figures
  - Value View
  - Making notes and drawing on top of these: lines, arrows, text…

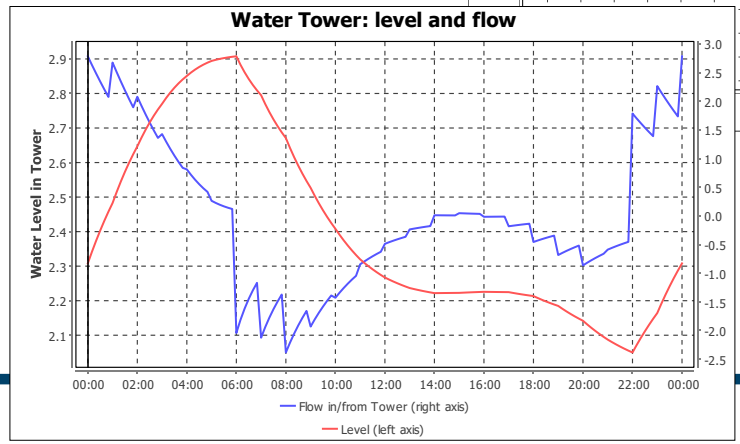
- Examples of schematics can be found in wiki and in the demo model

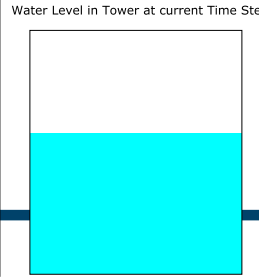
- Can be copied to clipboard
  - By default as ".svg" –vector images

- Most dynamic things are done via calculation context
  - Introduce variables: a result from a component
  - Create an expression using the values

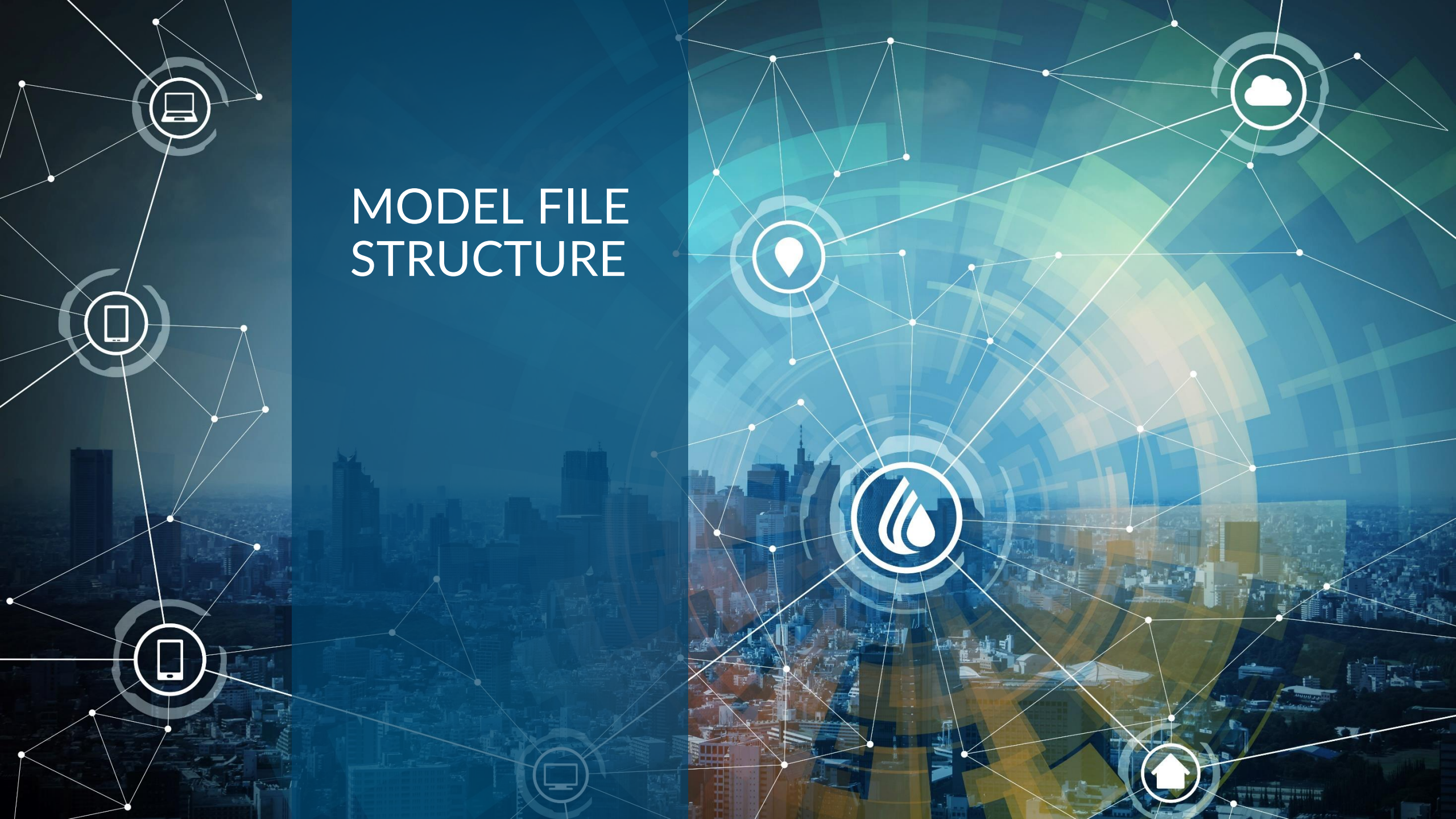




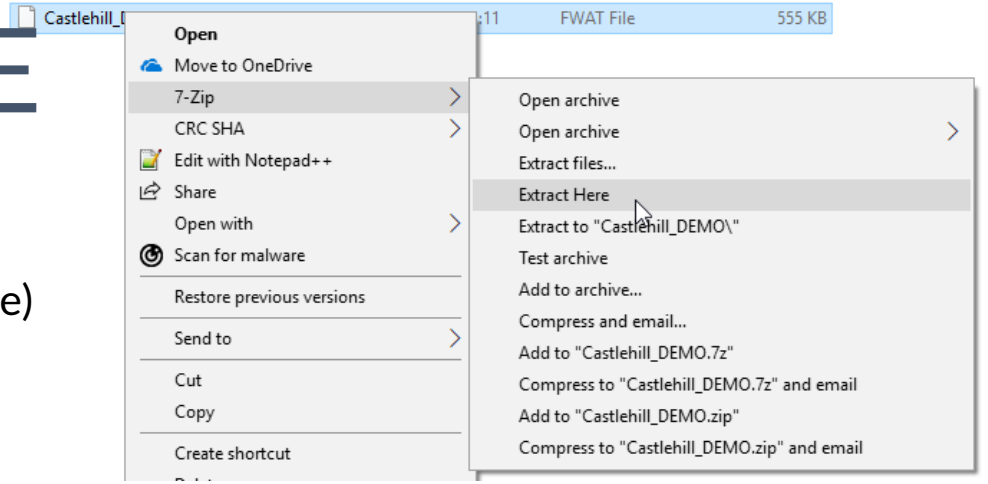




MODEL FILE STRUCTURE



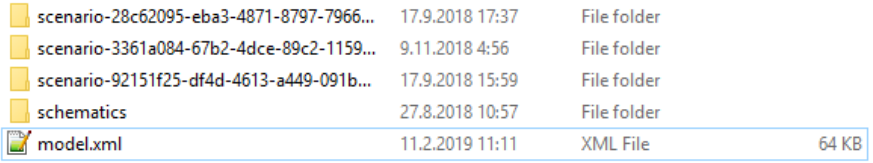
MODEL FILE STRUCTURE



- Fluidit Water –files (.fwat) are zipped archives (.zip)
- Can be unzipped with all common compression software (7zip for example)

- Files are human-readable .xml

- Model can be modified in these .xml –files directly
  - Unzip → make changes → zip → change suffix from .zip to .fwat
  - Be careful, it is easy to "brake" a model (for example delete a junction that a pipes refers to)



- Example of a single junction named "Junction-4" in the .xml –data:

```
- <junction z="9.770380733507675" y="6675006.460059326" x="2.5496461079022586E7" uuid="45e5bec2-81f9-405e-818a-050832413500" name="Junction-4" id="16" emitter="0.0064716954">
  - <zones>
      <zone uuid="f00ca5ab-2128-481e-a447-85721e066a25"/>
    </zones>
  - <quality-parameters>
      <parameter initial-quality="1.4622804" chemical="1c55b2a4-8775-4673-a877-57f14d8ee6db"/>
    </quality-parameters>
</junction>
```

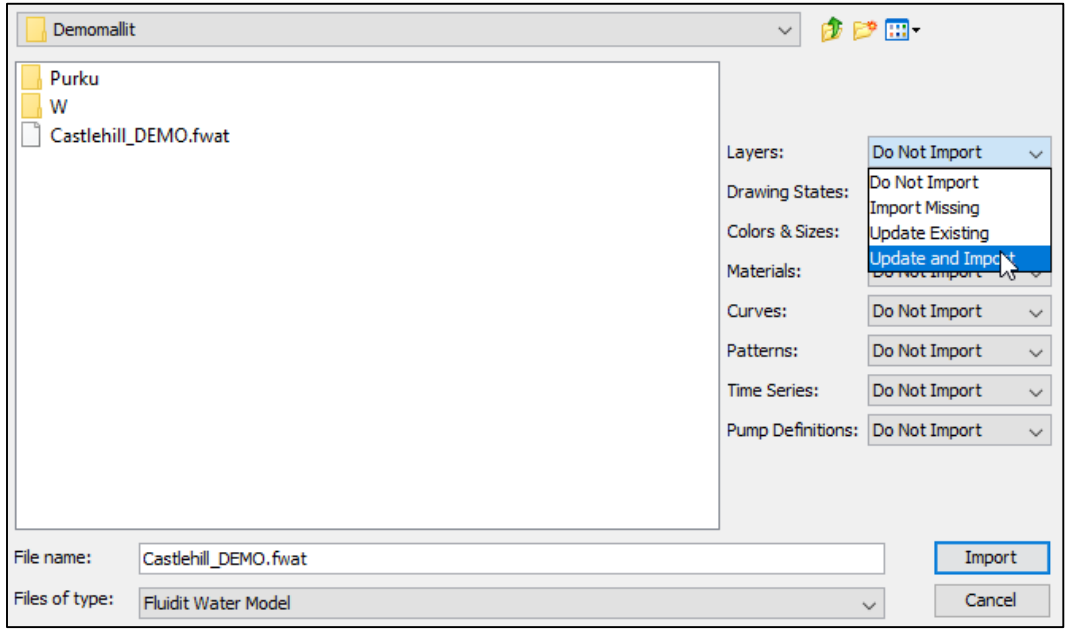
IMPORT & EXPORT

IMPORT FEATURES

Can be found in *"File"* → *"Import Features to Model"*

Select:

- Do Not Import
- Import Missing – imports the feature if there is no similar feature already set in the model
- Update Existing – import attributes only to already existing features
- Update and Import – both of the above



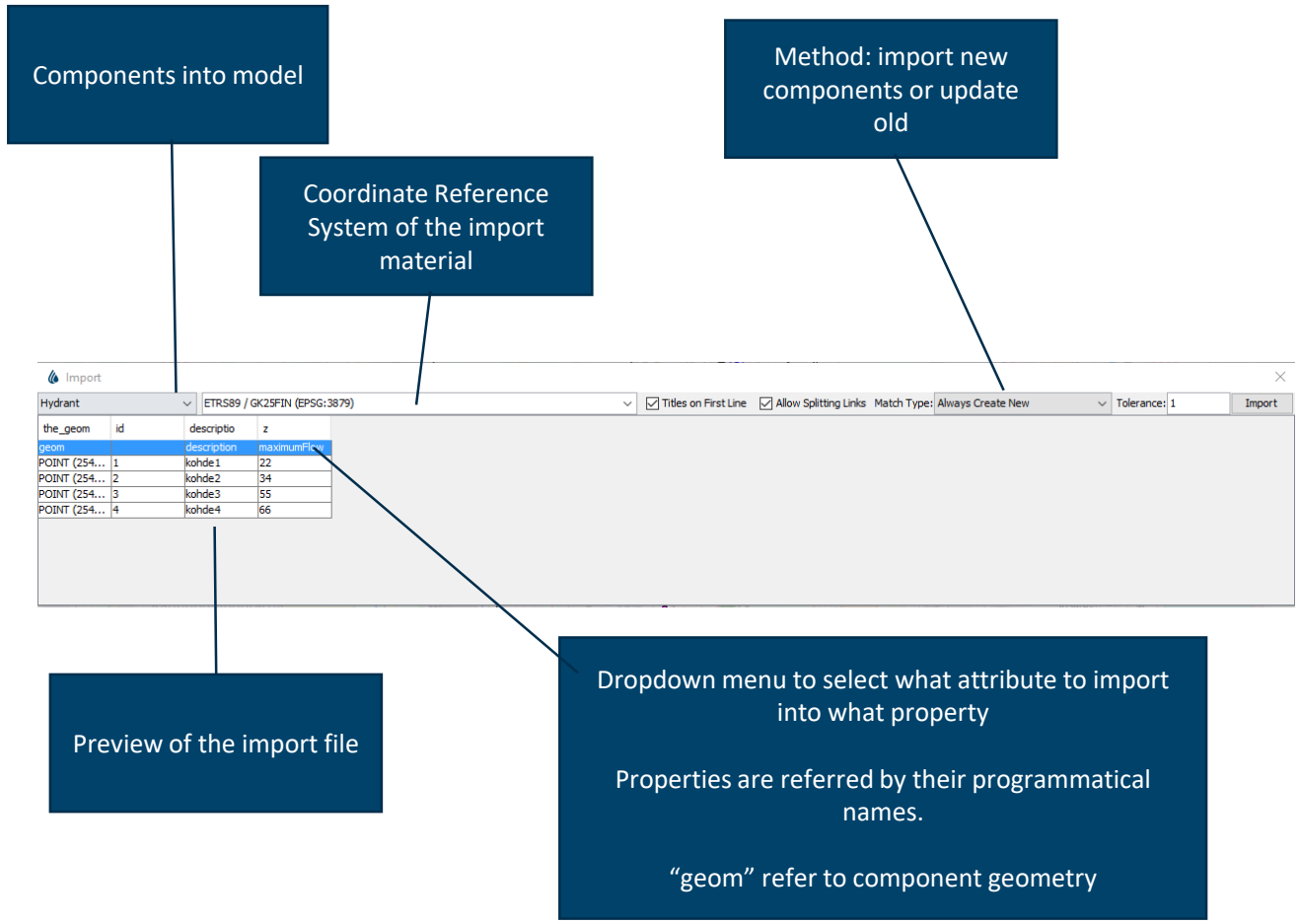
IMPORT COMPONENTS

Can be found in *"File"* → *"Import Components to Model"*

Import tools is a generic tools – all supported data types can be imported into all model components

Supported file types currently:

- .shp
- GeoJSON
- Excel
- CSV / TSV
- GML
- DXF (no support for importing attributes, only geometry)



EXPORT

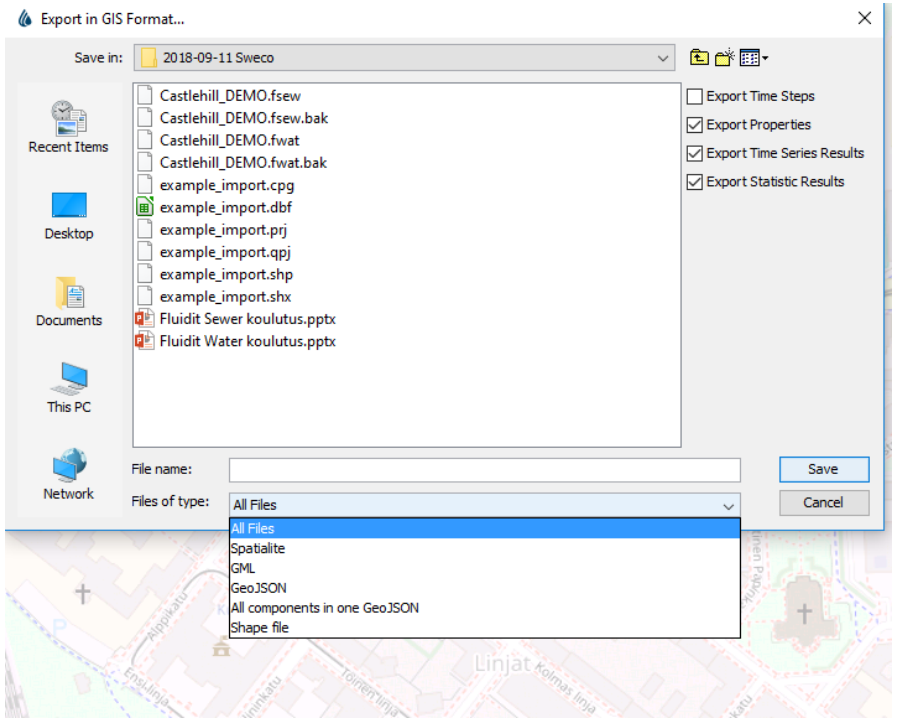
Can be found in "*File*" → "*Export in GIS format*"
(or "*Export in EPANET format*", but EPANET does not support all Fluidit Water components)

Supported file types currently:

- GeoJSON
- .shp
- Spatialite
- GML

These common GIS-formats can be directly opened in most GIS-software, for example Qgis or ArcGIS

If you have a selection in Map View tool will export only those selected components. If nothing is selected the whole model is exported.



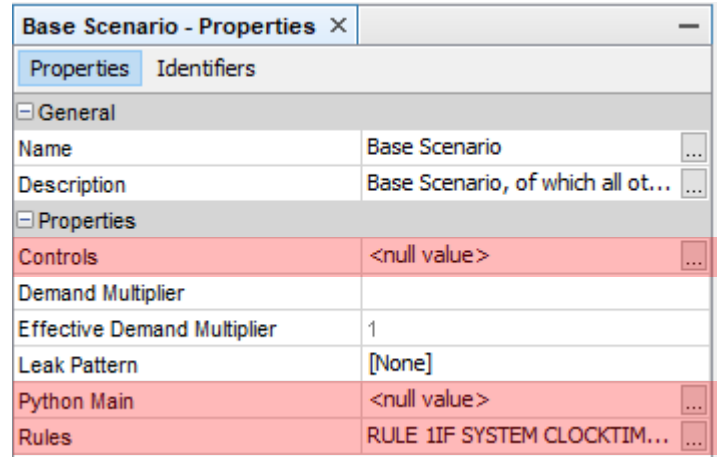
Export functionalities:

- With GeoJSON you can select whether to make one GeoJSON with all components or different components into separate files
- Select if you want to export properties, results, etc.

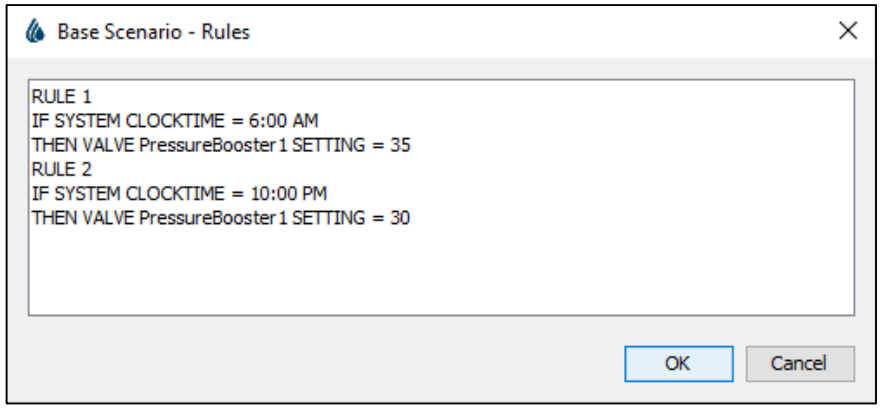
CONTROLS

CONTROLS

- Fluidit Water has several ways to control components
  - Common steady parameters directly in components (Setting for Pump Battery, etc)
  - Support for EPANET Rules and Controls
    - Are enough for most networks
    - Easy to use and well documented in EPANET manual
  - Python –programming language can be used to write scripts
    - For complex control systems
    - Not part of this basic training, but if needed Fluidit can provide additional material / training



- More about rules and controls can be found in EPANET manual:
  - Controls page 143
  - Rules page 164
- Example from demo model (→)
- Note: Pump Batteries are controlled as “Valves” in EPANET commands



COMMON MISTAKES

- Not enough water or too much water is pumped in to a pressure zone
  - Happens with flow control – pressure control adjusts to water use
  - Can lead to very (unrealistic) high or low pressures – results are not to be trusted

- EPANET is by default a demand dependent calculation engine – all demand will always be fulfilled
  - No matter how high or low pressures are required
  - Simulation engine will even open closed pipes to fulfill demand

- Changes made to wrong scenario or wrong drawing state

COMMON PROBLEMS WITH SOFTWARE

- Self-updating windows (Properties, Results, Statistics on Selected Components, etc) are very useful, but can be slow when handling large number on components
  - To make things go faster, before making any huge selections, close all or some of these windows

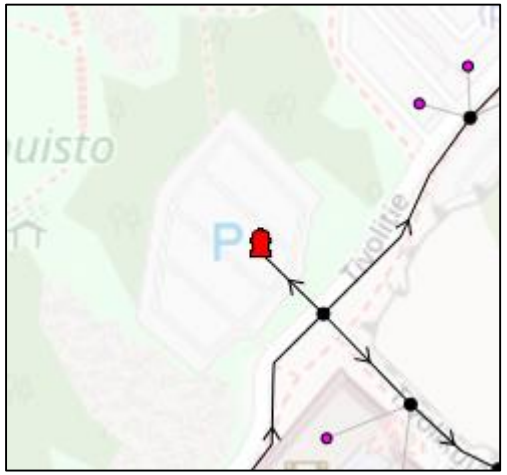
- Drawing States with lots of components visible and complex filters etc. can be slow
  - To make things go faster, use drawing states with less visible components and no filters etc.

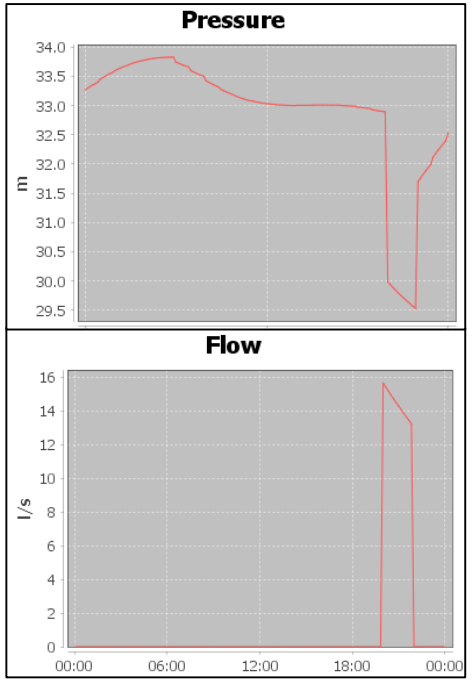
- Some software problems can be solved with a “clean install”
  - Delete the content of your Temporary Directory: **C:\Users*YourUsername*\.water\dev**
  - Install the software (unzip from package) again

HYDRANT ANALYSIS

HYDRANTS

- Usually used to model hydrants or sprinklers
  - But can be used to model any water taken from the network
- Important parameters:
  - Opening and Closing Time
    - As seconds from the start of the simulation
  - Maximum Flow
  - Minimum Pressure
- Short instructions also available in Wiki



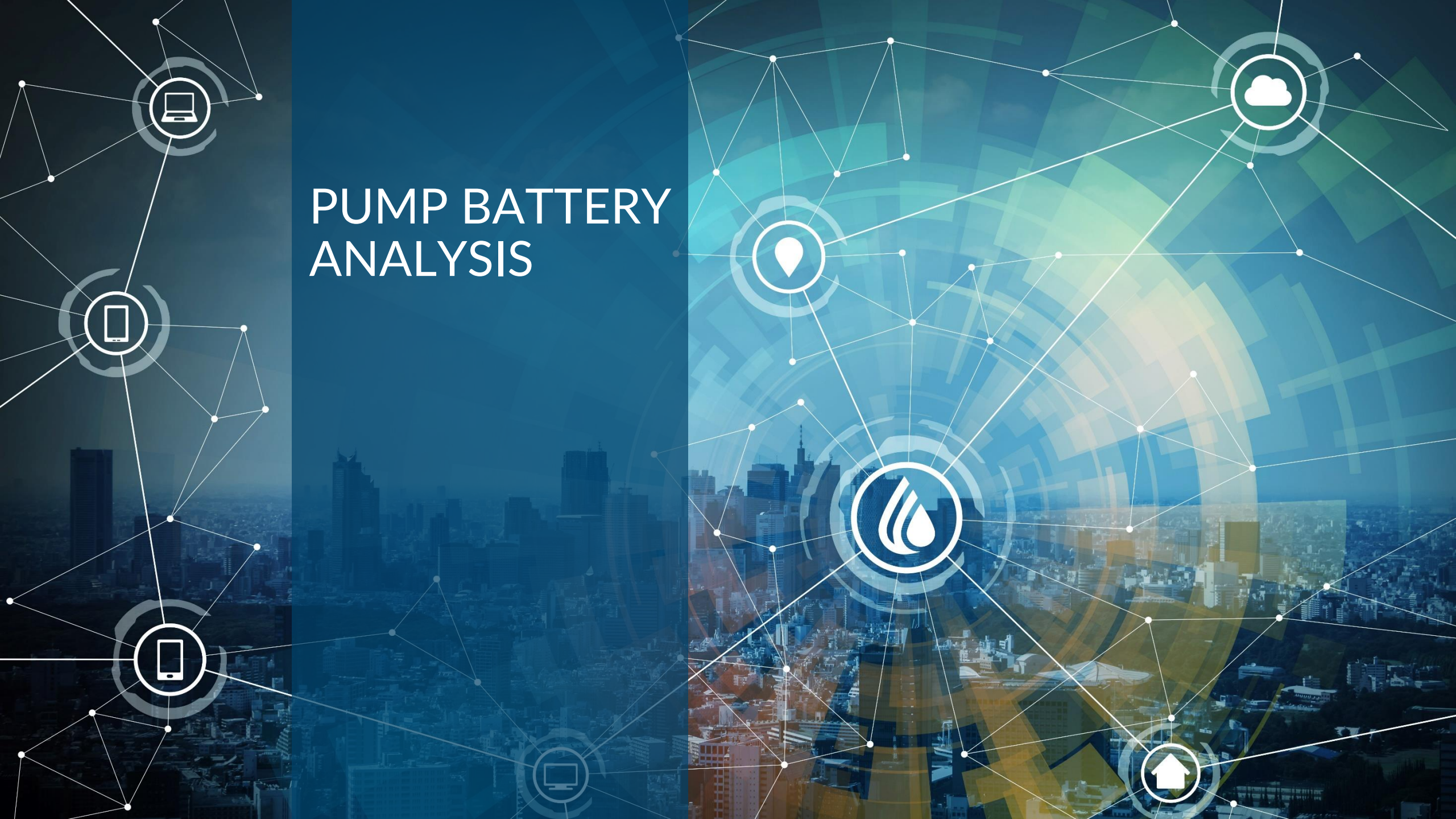


Hydrant-36 - Properties

Properties | Results | Identifiers

General	
Name	Hydrant-36
Description	
X-Coordinate	25,496,624
Y-Coordinate	6,675,248
Z-Coordinate (Elevation)	27.43
Symbol	No symbol set
Tags	
Properties	
Diameter	150
Opening Time	158400
Closing Time	165600
Boundary	☐
Maximum Flow	
Minimum Pressure	30
Pattern	[None]
Quality Parameters	0
Settings	
Station	[None]
Expert	
Changed in Scenario	☑
New in Scenario	☑
Zones	0

PUMP BATTERY ANALYSIS



PUMP BATTERY ANALYSIS