Ilembe District Municipality

Review of the Technical Asset Register and Data Quality Standards

Part A: Water

May 2023

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List of Acronyms

AOI	Area of Interest
CV	Closed Valve
D/S	Down Stream
DJ	District Junction
DMA	District Metered Area
FCP	Flow Control Point
IDM	iLembe District Municipality
MC	Meter Chamber
NDM	EDAMS Network Data Management

List of Definitions

Compound Elements	Elements (Assets) that have a configuration such as pump stations, reservoir sites, meter chambers, control valve chambers, etc., where their main components are captured.
D/S Chain	Down Stream Chain defines the direction of water
Element	Element refers to Asset (e.g., a specific pump)
Element Configuration	Element configuration holds the main components of compound element types. For example, a pump station configuration will hold all PS pumps in their respective configuration (e.g., installed in series or parallel).
Element Type	Element Type refers to Asset Type (e.g., pumps)
Library	A set of attributes per asset type grouped together into a library item. The water network data model includes libraries for: water pipes, pumps, valves, control valves, bulk meters, pressure relief devices, hydrants and fittings.
Topological Elements	Topological elements are abstract in the sense that they do not refer to an actual entity in the field. Topology is used to define the relationships and connectivity of the elements in the EDAMS data model
Water Chain	A topological element type that establishes network connectivity for chain elements (pipes, valves, hydrants, etc.)
Water Node	A topological element type that establishes network connectivity for node elements (pump stations, reservoir sites, WTPs, etc.)
Zoning	Zoning refers to one of 1) Hydraulic Zones, 2) Mass Balancing Zones, or 3) Head Zones

1 Introduction & Background

This report evaluates the information in the current Technical Asset Register, identifies changes that must be made and identifies areas that need further investigation with the objective of achieving an accurate representation of all the transmission and distribution networks in *EDAMS Network Data Management (EDAMS-NDM)*.

A brief overview and timeline of the work carried out for the Water Network data conversion exercise is described in the section below:

1. The work started with the pre-processing of the external data provided by the IDM. This involved, fixing connectivity issues, attribute issues, and setting up external shapefiles as per the required EDAMS format. Some of the key findings are shown below:
    a. The IDM provided various datasets for the same network (as builts, master plans, esri generated from VILP/I/041, etc.).
    b. The datasets had multiple duplicates (exact location duplicates with exact attributes).
    c. The datasets had multiple duplicates with minor length changes (e.g., a pipe on top of another pipe with coverage 95%).
    d. Attributes existing in one dataset but not in others.
    e. Multiple asset types existing in a single layer, etc.

    Data pre-processing was performed to consolidate information, attributes, features, etc.
2. The above process was repeated multiple times in order to achieve the best possible result for every asset type. Every pre-processing was followed by EDAMS data conversion, then data evaluation, etc., to receive feedback from the system.
3. Consequently, the consultant proceeded with the final import of the pre-processed layers into the system.

This evaluation report will help the municipality with any problems regarding both, above and below ground assets, attributes, missing network, and zoning information so that the municipality can begin to address them as soon as possible with the objective of completing the Technical Asset Register with meaningful and correct information.

Please note that this report must be read in conjunction with Attachment 1 (Excel file). The attachment provides a detailed list of all relevant issues individually, along with their respective attributes and information. This information will help the Municipality in prioritizing the assets that require fixing and determining the order in which they should be addressed.

2 Asset Register Statistics

No	Element Type	Total no of Network Elements
Water Network - System Elements		
1	Water Nodes	67,077
2	Water Chains	64,362
3	Water Pipes	50,275
4	Water Valves	469
5	Hydrants	273
6	Water Air Valves	118
7	Water Control Valve Chambers	24
8	Water Control Valves	0
9	Water Reservoir Sites	418
10	Water Reservoirs	0
11	Water Pump Stations	140
12	Water Pumps	0
13	Water Treatment Plants	20
14	Water Connections	0
15	Borehole Sites	94
16	Relief Devices	0
17	Meter Chambers	534
18	Bulk meters	0
19	Supply Points	15
Water Network - Custom Elements		
20	Consumer Meters	29,189
21	Jojo Tanks	600
22	Stand Pipes	1,425

There is a total of 5,839 km of water pipes in the existing network. A breakdown of the pipes per a) material type and b) nominal diameter is shown in the tables below:

Material	No of Pipes	Water Pipes length (km)
AC-CID	242	53.29
AC-COD	15	0.95
Default	47,373	5,261.69
FC	2	0.71
GRP	1	0.01
HDPE	568	100.38
MPVC	143	23.68
Steel - B	202	170.60
UPVC	1,729	228.00
Totals	**50,275**	**5,839**

Nominal Diameter	No of Pipes	Pipe Length (km)
0	45,678	5,171.15
25	1,666	52.65
32	1,077	130.45
40	28	13.10
50	621	154.74
63	154	60.02
75	446	102.72
80	33	3.37
90	97	28.85
100	22	1.16
110	260	65.79
125	16	3.26
140	8	0.21
150	38	6.32
160	83	23.74
200	31	19.13
300	10	1.85
315	4	0.11
450	3	0.70
Totals	**50,275**	**5,839**

Furthermore, the pipe's age is calculated based on their commissioning date and grouped as follows:

No	Age	No of Pipes	GIS length (km)
1	0-10 years	-	-
2	11-25 years	-	-
3	26-50 years	-	-
4	51-80 years	-	-
5	Unknown	50,275	5,839

Note: Year 1899 is used to denote unknown dates

3 Element Definition Problems

In this section we describe all different data issues regarding the connectivity of the network, the data attribute problems as well as discuss about vital missing elements.

A summary of the errors is shown below:

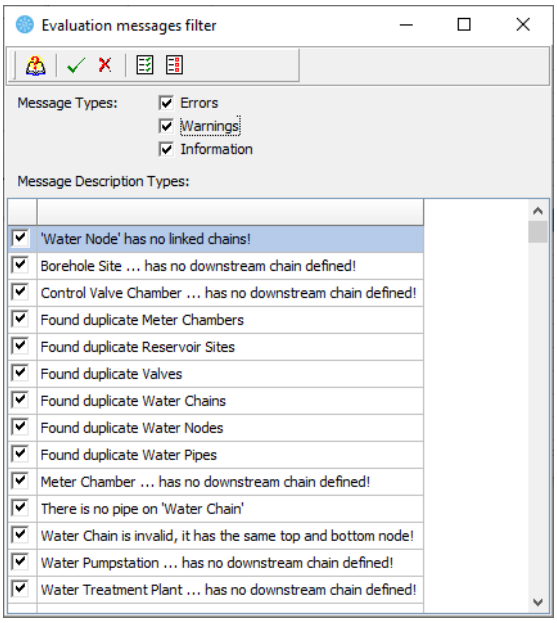
Report Code	Description	No of Problem Records	Comments
Connectivity Errors/Warnings		*4,451*	
ARE.1.1	Standalone Water Nodes	1,208	Standalone nodes with other assets on top must be connected to the network. The rest should either be connected or deleted
ARE.1.2	Duplicate Water Nodes	848	All duplicates must be deleted after investigation
ARE.1.3	Boreholes Sites without D/S chain	94	Must specify D/S chain
ARE.1.4	Control Valve Chamber without D/S chain	24	Must specify D/S chain
ARE.1.5	Meter Chamber without D/S chain	534	Must specify D/S chain
ARE.1.6	Water Pumpstations without D/S chain	140	Must specify D/S chain
ARE.1.7	Water Treatment Plant without D/S chain	20	Must specify D/S chain
ARE.1.8	Duplicate Meter Chambers	10	All duplicates must be deleted after investigation
ARE.1.9	Duplicate Reservoir Sites	2	All duplicates must be deleted after investigation
ARE.1.10	Duplicate Valves	4	All duplicates must be deleted after investigation
ARE.1.11	Duplicate Water Chains	31	All duplicates must be deleted after investigation
ARE.1.12	Duplicate Water Pipes	6	All duplicates must be deleted after investigation
ARE.1.13	Invalid Water Chains	1,530	All duplicates must be deleted after investigation
Element Configurations and Config Errors		*1,215*	
ARE.2.1	Pump Stations and their configurations (pumps)	140	Configurations must be set up within the system
ARE.2.2	Pump stations with only one pipe connected	5	Fix network connectivity.Three PS in total, one is decommissioned
ARE.2.3	Boreholes and their configurations (pumps)	94	Configurations must be set up within the system
ARE.2.4	Meter Chambers and their configurations (Bulk Meters)	534	Insert Configuration & Libraries. Missing all other Bulk Meters
ARE.2.5	Control Valve Chambers and their configurations (Control Valves)	24	Attach to parent element & put attributes OR delete
ARE.2.6	Reservoir Sites and their configurations (Reservoirs)	418	Attach to parent element & put attributes OR delete
Missing Attribute/ Library Errors		*45,698*	
ARE.2.7	Water Pipes without material, class, diameter	45,672	Fix pipe libraries / Attach the correct library to the pipes
ARE.2.8	Pipes without Attached Libraries	6	Attach libraries
ARE.2.9	Treatment Plants with missing attributes	20	Insert necessary attributes
Zoning			
ARE.3.1	Hydraulic Zones	4,467	There are 4,467 discrete networks. Disconnected networks (islands) must be joined to the rest of the network
ARE.3.2	Mass Balancing Zones	3,367	There are 3,367 discrete networks (DMAs). Most of them are disconnected networks and must be joined to the rest of the network
Water Pipe Libraries			
ARE.4.1	List of Water Pipes Libraries Used	69	Check and fix in Network Data Management (especially Default ones)

The image is taken out of Attachment 1, where you can find all detailed lists for each category.

3.1 Data Connectivity Issues

The majority of connectivity errors have been fixed by the consultant during the Water Network pre-processing exercise where more than 80,000 errors were identified and fixed as mentioned in section 1 above. The remaining errors could not be fixed in bulk by the consultant and therefore the client, with assistance from the consultant, must look at them carefully and fix in EDAMS NDM.

The image below shows the different types of the network connectivity issues found right after the data conversion:



The above table provides the different groups of errors and warnings, with all of them having an impact on the systems' results. For example, 1) duplicates affect the number of actual assets that the municipality owns, 2) downstream chains affect zoning which in consequence will affect the water balancing module, 3) chains without pipes affects connectivity, etc.

3.1.1 Duplicate Elements

3.1.1.1 Duplicate Water Nodes (848)

There are 848 duplicate water nodes. If these duplicates water nodes are also standalone, then they can be deleted without any problems. Otherwise, the users need to investigate the connectivity in order to ensure that no other necessary data are deleted. In order to retain the correct connectivity, the users need to remember that by deleting a water node, they are also deleting everything that 'sits' on top of it (e.g., pump stations, reservoir sites, etc.).

3.1.1.2 Duplicate Meter Chambers (10)

There are 10 duplicate meter chambers within the system. The Municipality must investigate and delete if indeed duplicate or move to the correct location.

3.1.1.3 Duplicate Reservoir Sites (2)

There are 2 duplicate reservoir sites in the system. Similarly to the meter chambers, they must be deleted or moved to the correct location.

3.1.1.4 Duplicate Valves (4)

There are 4 duplicate valves in the system. Similarly to the meter chambers, they must be deleted or moved to the correct location.

3.1.1.5 Duplicate Water Chains (31)

There are 31 duplicate water chains in the system. Water chains are 'virtual' asset types (meaning that they don't actually exist in the field) ensuring the network connectivity at all times. Duplicates of this type must be investigated and fixed in the system by deleting the duplicate chain. Since this asset type ensures connectivity, it means that it has other linked assets on top (e.g., pipes, valves, hydrants, etc), therefore, the users must carefully delete the duplicate while ensuring that other assets are not deleted as well.

3.1.1.6 Duplicate Water Pipes (6)

There are 6 duplicate water pipes in the network that must be investigated and fixed within the system. Duplicates of any kind are not allowed within the system as they don't exist in the field and therefore must rectified.

3.1.2 Elements without Downstream (D/S) Chain

Most compound elements/assets (e.g., pump stations, meter chambers, etc.) have a special feature, called D/S chain (downstream chain), and it's captured in order to specify the flow of the water. If left blank, the system is considered incomplete, and the municipality can't utilize the EDAMS systems at their full capacity. For example, if the downstream chains are missing from the compound elements, the municipality will not be able to generate the mass balancing zones which in consequence is preventing the system from running the Water Balancing module since the mass balancing zones are incomplete, and so on.

3.1.2.1 Borehole Sites without D/S Chain (94)

There are 94 borehole sites without D/S chain. Investigate and specify the correct chain. Most, if not all boreholes, have only one water chain connected, so it should be easy to rectify. Please also verify the correctness of existing D/S chains. If Borehole site is correctly set as standalone (i.e., not connected to the network), please mark it as such.

3.1.2.2 Control Valve Chambers without D/S Chain (24)

There are 24 control valve chambers without D/S chain. Please investigate and specify the correct chain. Please also verify the correctness of existing D/S chains.

3.1.2.3 Meter Chambers without D/S Chain (534)

There are 534 meter chambers without D/S chain. Please investigate and specify the correct chain. Please also verify the correctness of existing D/S chains. D/S on meter chambers are extremely important for generating Mass Balancing zones and calculating NRW as they denote the inflow/outflow from zones.

3.1.2.4 Pump Stations without D/S Chain (140)

There are 140 water pump stations without D/S chain. Please investigate and specify the correct chain. Please also verify the correctness of existing D/S chains.

3.1.2.5 Treatment Plants without D/S Chain (20)

There are 20 treatment plants without D/S chain. Investigate and specify the correct chain. This is very important in order to specify the mass balancing zones inlet/outlet meters. Please also verify the correctness of existing D/S chains if any.

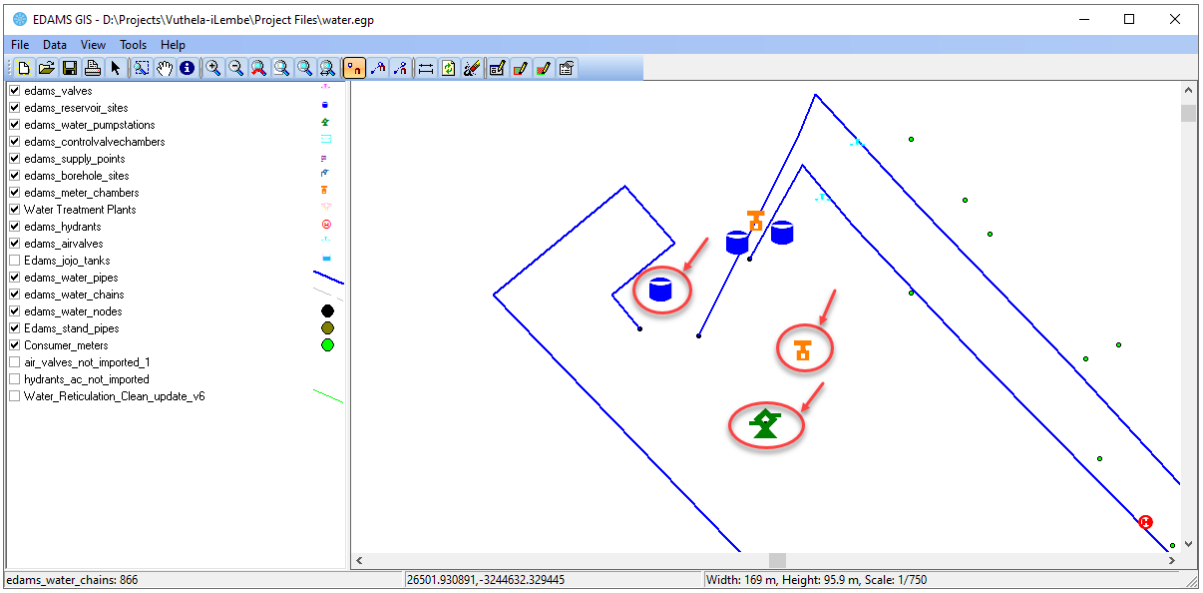
3.1.3 Standalone Elements

Most standalone elements need to be deleted with the exception of a few elements such as supply points (boreholes, treatment plants, etc) that exist but the connection to the rest of the network is yet to be captured.

3.1.3.1 Standalone Water Nodes (1,208)

All 1,208 standalone water nodes need to be deleted if no element 'sits' on top of them. Standalone, means that the water nodes do not have a water chain/pipe connected to them, however, they could have other elements (e.g. boreholes, reservoir sites, treatment plants, etc) located on top of them.

In this case for example, 133 nodes have pump stations on top that are standalone and not connected with any pipes. Example of standalone reservoir sites, meter chambers and pump stations in one specific area:

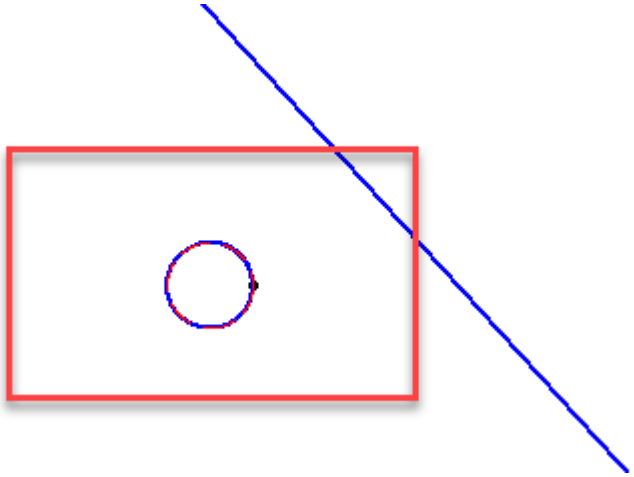


This type of error is important and needs to be investigated and fixed in EDAMS Network Data Management.

3.1.4 Invalid Elements

3.1.4.1 Invalid Water Chains (1,530)

The error “invalid water chains” refers to chains that have the same bottom and top node (i.e., creating a close circuit by itself) which is something that cannot exist in real life. An example is shown below:



All errors of this type must be rectified within the system either by deleting the chain or by breaking the close circuit (e.g., by splitting the chain in two).

4 Element Attribute/Configuration Issues

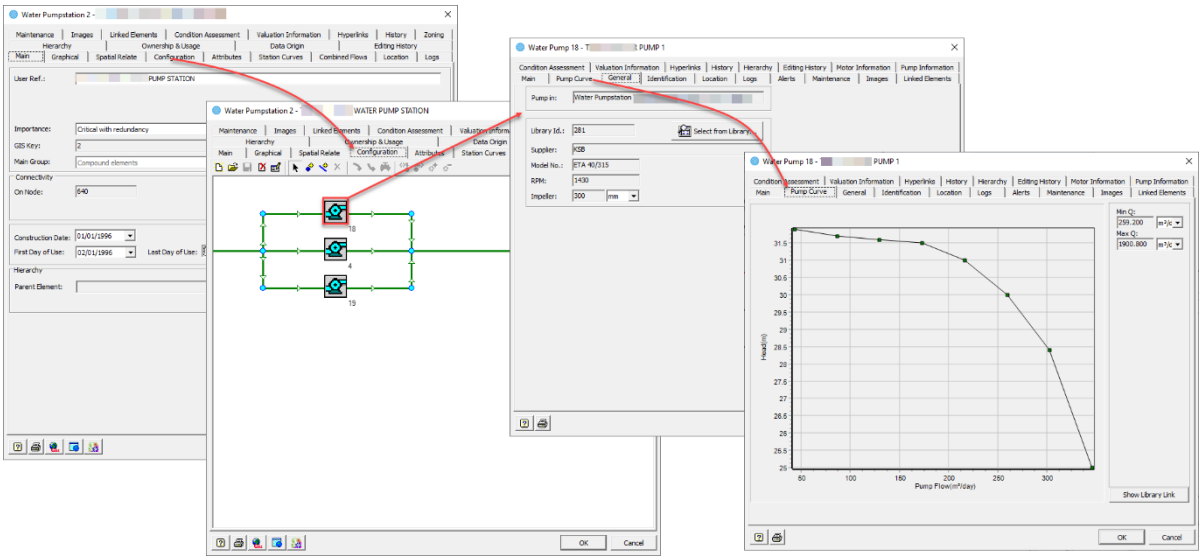
The data attribute and configuration issues refer to errors and warnings concerning the necessary attributes of the network elements. Such attributes can be the pipes libraries, the compound element configurations (such as reservoir levels, pump details, etc) as well as secondary attribute problems such as valves statuses, etc. In this report we will only refer to the important attributes, the ones that are vital for a correct asset registry.

Attachment 1 shows the lists of errors we will be describing in detail in the following sections. Please read carefully in conjunction with Attachment 1 and resolve any errors in EDAMS Network Data Management.

4.1 Compound Element Configurations

4.1.1 Pump Stations without Configuration (140)

There are 140 pump stations without configurations inside. This means that we have the location of the pump station, but we do not know what kind of pump(s) it has inside and in which configuration.
The municipality needs to investigate and complete the configurations for each station accordingly. An example of the correct configuration is shown below:

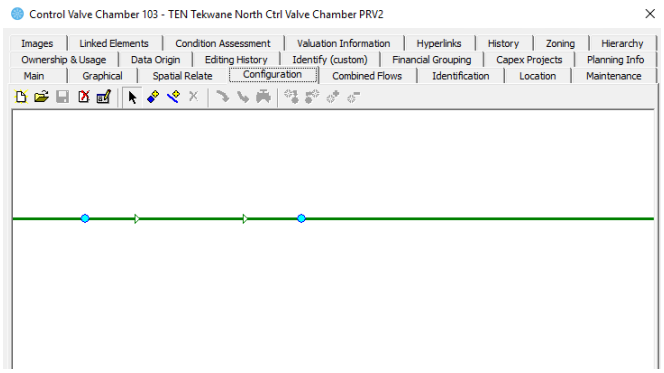


4.1.2 Borehole Sites without Configuration (94)

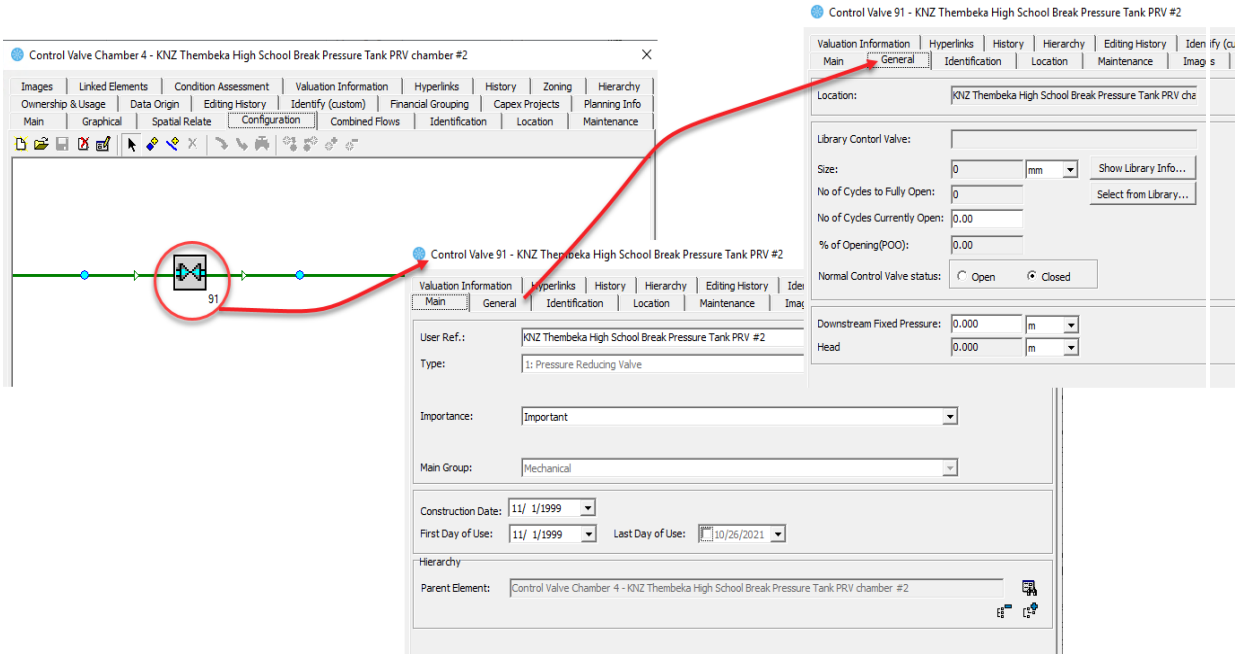
There are 94 borehole sites without configurations inside. This means that we have the location of the borehole, but we do not know what kind of pump(s) it has inside and in which configuration.
The municipality needs to investigate and complete the configurations for each borehole accordingly. Similar example to the pump stations can be used.

4.1.3 Control Valve Chambers without Configuration (24)

There are 12 control valve chambers without configurations inside. This means that we have the location of the chamber, but we do not know what kind of control valve(s) it has inside and in which configuration.
The utility needs to investigate and complete the configurations for each control valve chamber. An example of the current configuration state of the 24 elements is shown in the image below:

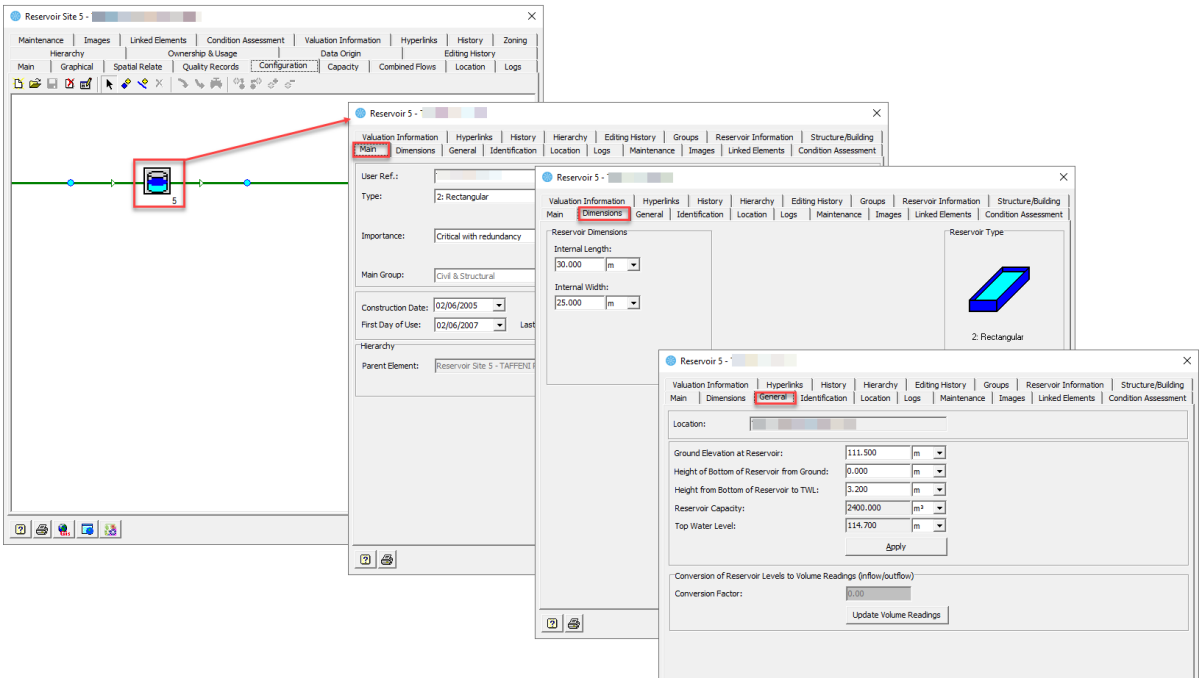


On the other hand, a complete configuration, should be similar to the below:



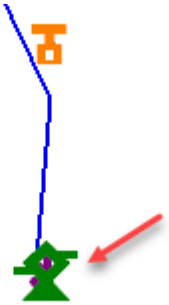
4.1.4 Reservoir Sites without Configuration (418)

There are 418 reservoir sites without configurations inside. This means that we have the location of the site, but we do not know what kind of reservoir (s) it has inside and in which configuration.
The municipality needs to investigate and complete the configurations for each site accordingly. An example of a complete reservoir site configuration can be seen in the image below:



4.1.5 Pump Stations with only one pipe connected (5)

There are 5 pump stations with incorrect connectivity within the network. The status is incorrect because they are located at the beginning or end of a water pipe, which once again is incorrect as shown in the image below:



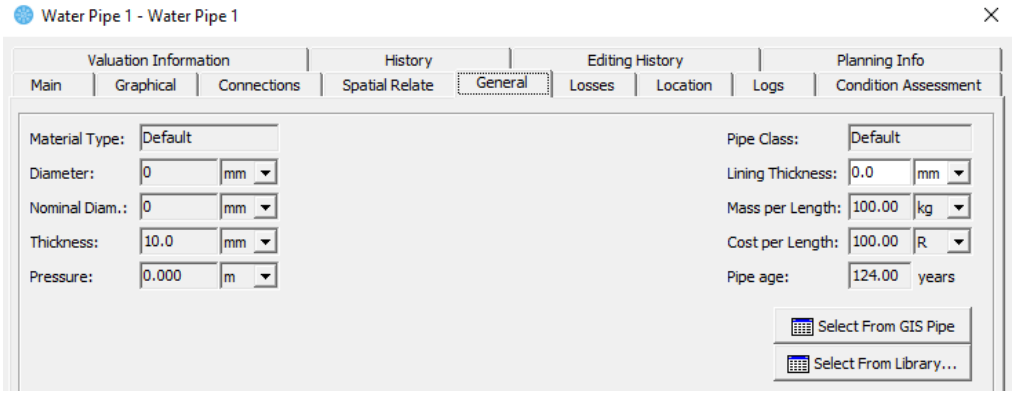
In most cases, these errors can be easily fixed in Network Data Management by editing the network components.

4.2 Element Attributes

Element attribute errors refer to attributes other than the configurations of compound elements such as asset libraries, engineering attributes, etc., that are important for certain modules.

4.2.1 Water Pipes without Material, Class, Diameter (45,672)

During our investigation, we found that there are a lot of water pipes attached to wrongly defined libraries (i.e., Default library item = no material, class, or diameter) because the initial dataset did not have any information regarding the material, class and diameter of the pipe. The pipe libraries should be correctly defined with all relevant information captured, especially the essential data such as material and nominal diameter. An example of the water pipes library issues can be seen below:

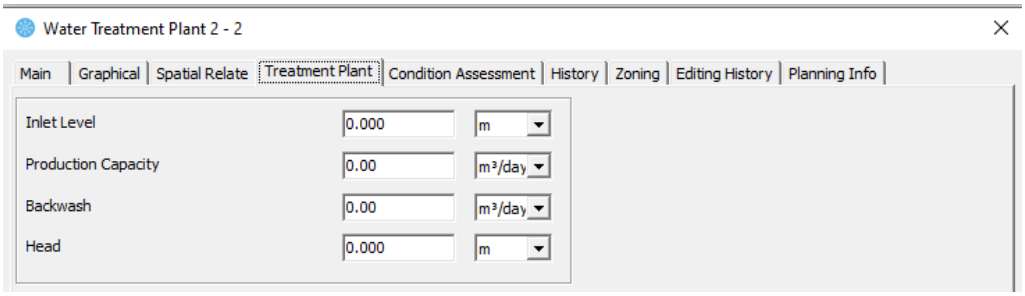


In cases such as the above, the municipality will need to either capture the correct library item for each pipe or import this information in bulk to update all pipes together.

If the libraries are captured correctly, the municipality needs to ensure that the water pipes associated with the libraries will also be correct.

4.2.2 Treatment Plants with missing attributes (20)

There are 20 existing treatment plants in the database and all of them are missing some vital attributes such as the attributes shown in the image below:

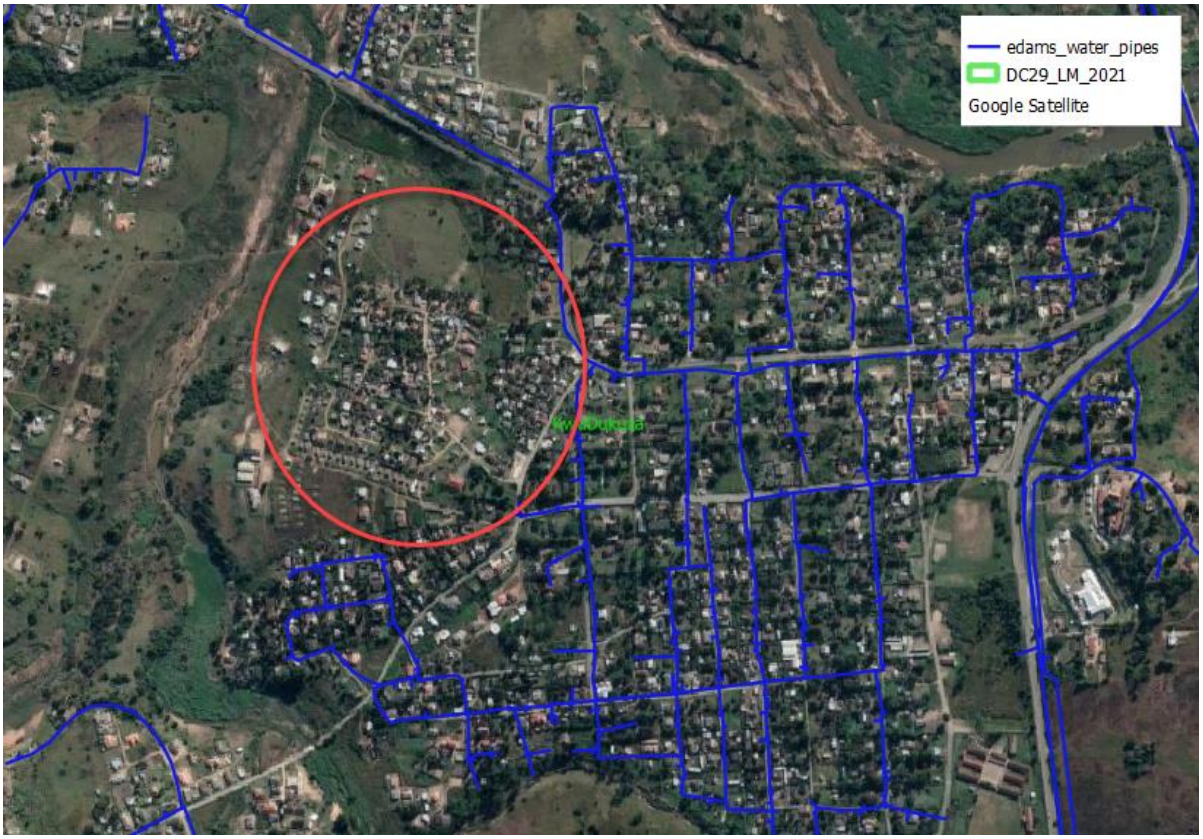


5 Network and Zoning Problems

5.1 Possible Missing Network

During the asset register evaluation, we noticed that there are areas within the municipality's AOI without network coverage. In our investigation we used satellite images in conjunction with a) the local municipality layer and b) the water pipes layer. See images below showing areas with missing network.

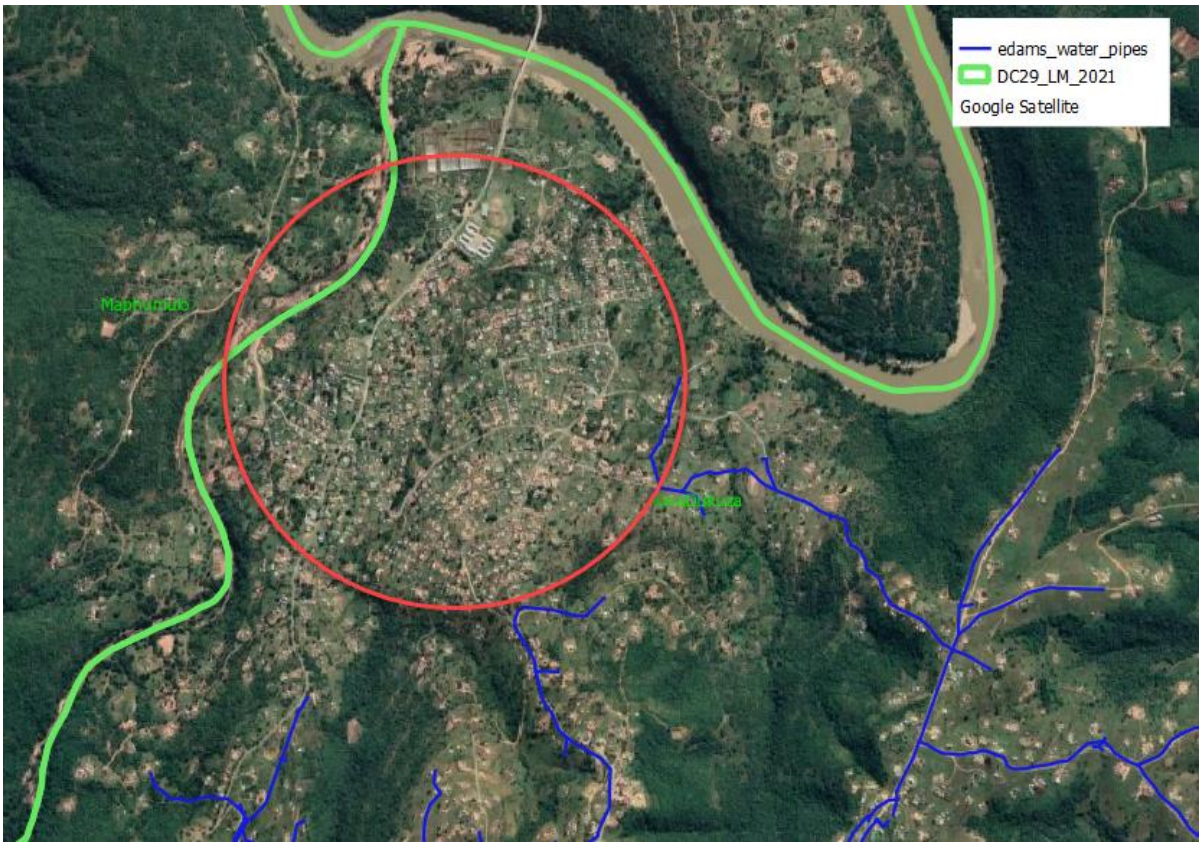
5.1.1 KwaDukuza Local Municipality



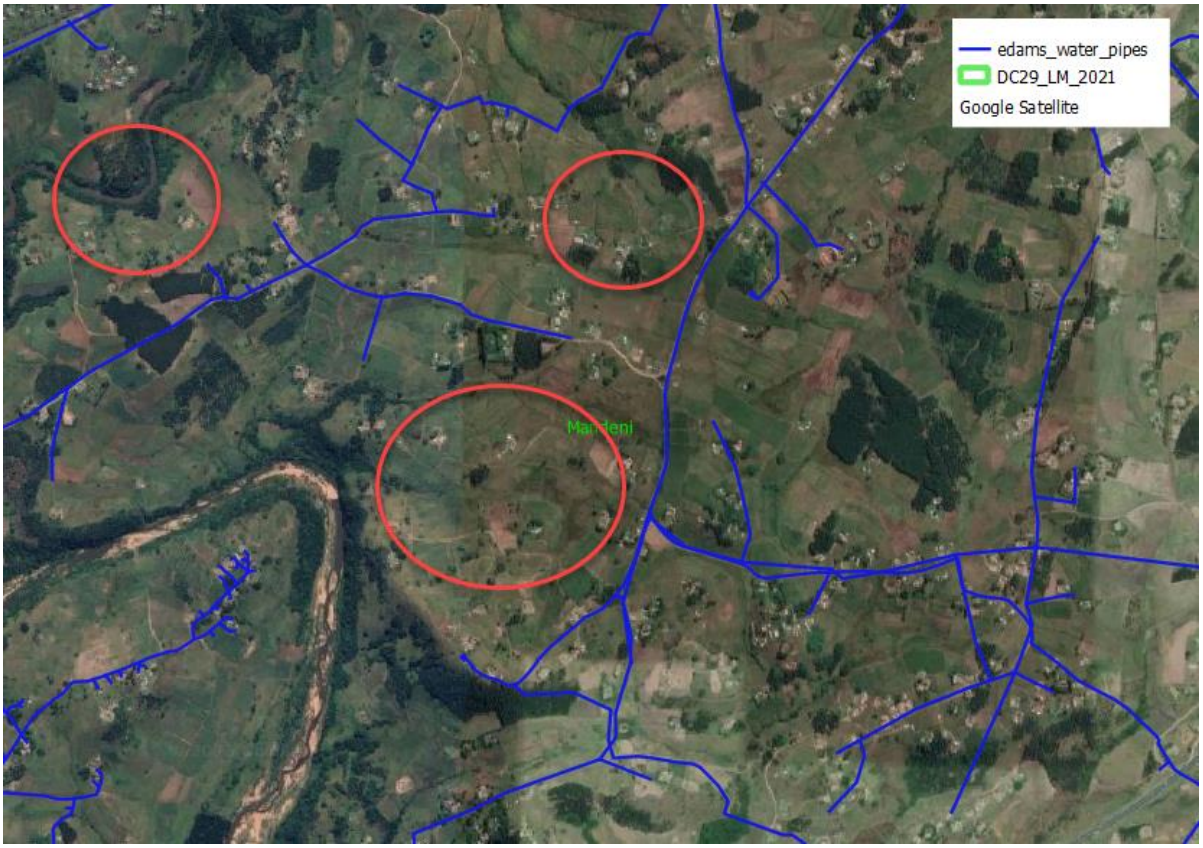

edams_water_pipes
DC29_LM_2021
Google Satellite

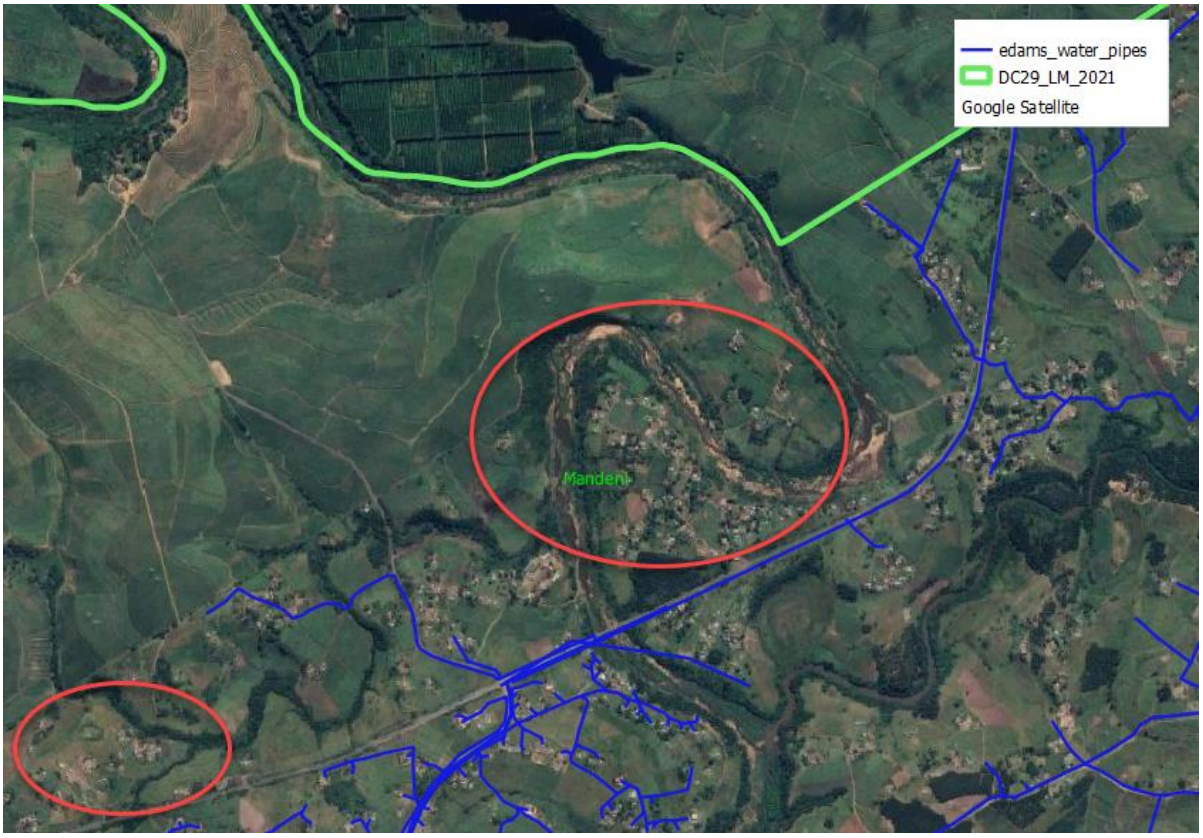

edams_water_pipes
DC29_LM_2021
Google Satellite

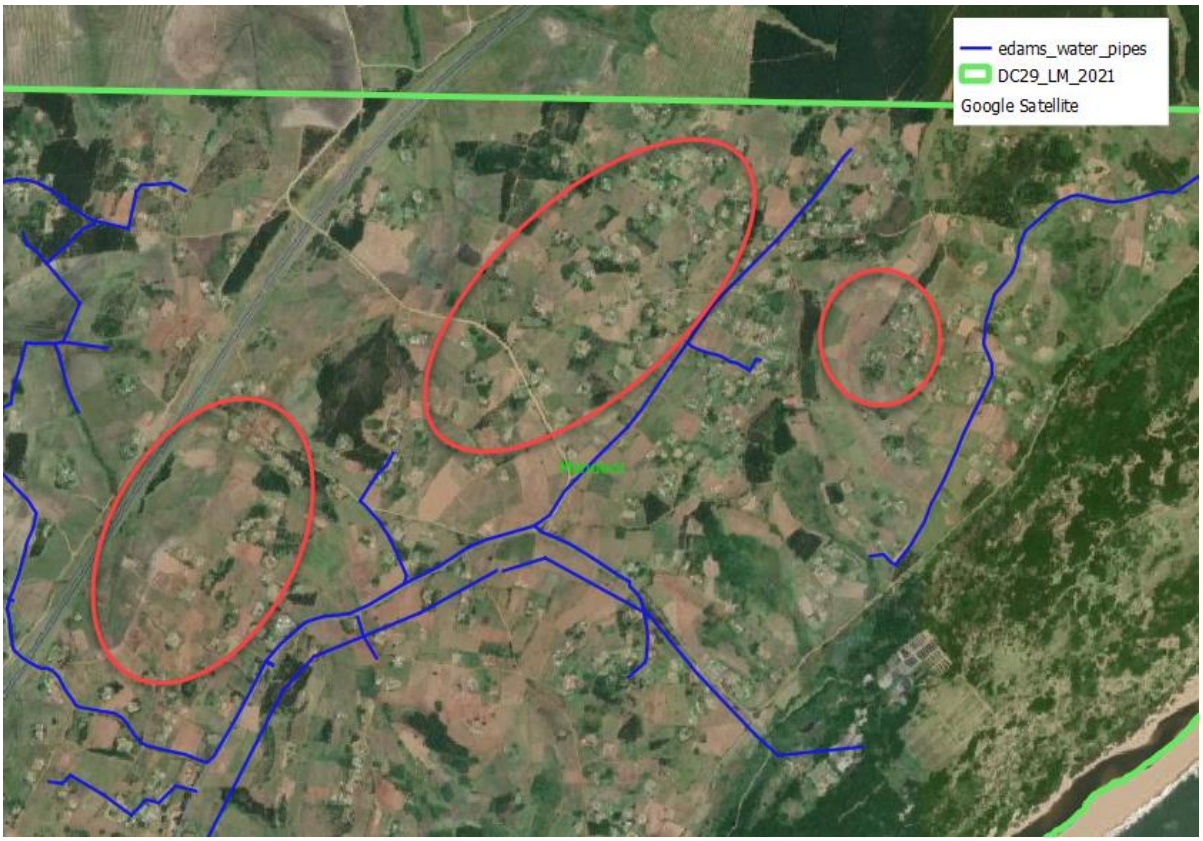

edams_water_pipes
DC29_LM_2021
Google Satellite


edams_water_pipes
DC29_LM_2021
Google Satellite

5.1.2 Mandeni Local Municipality



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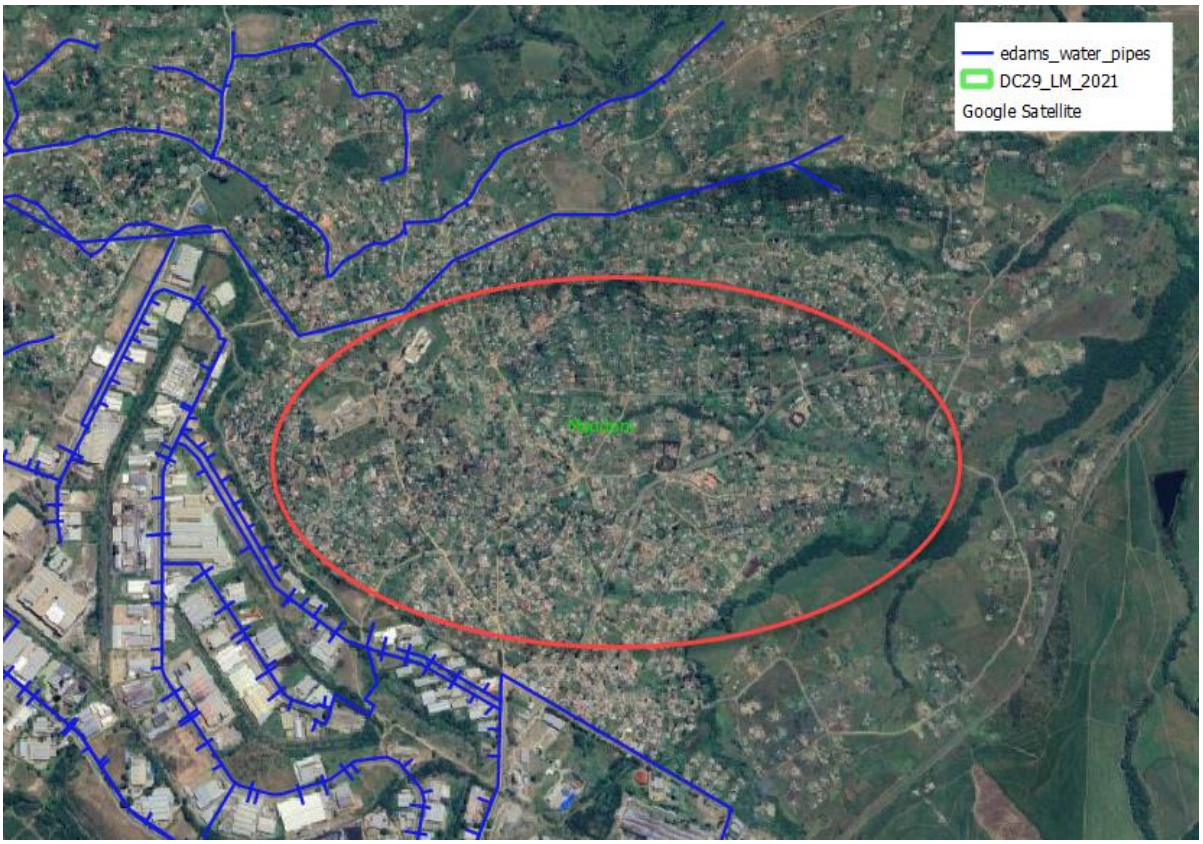
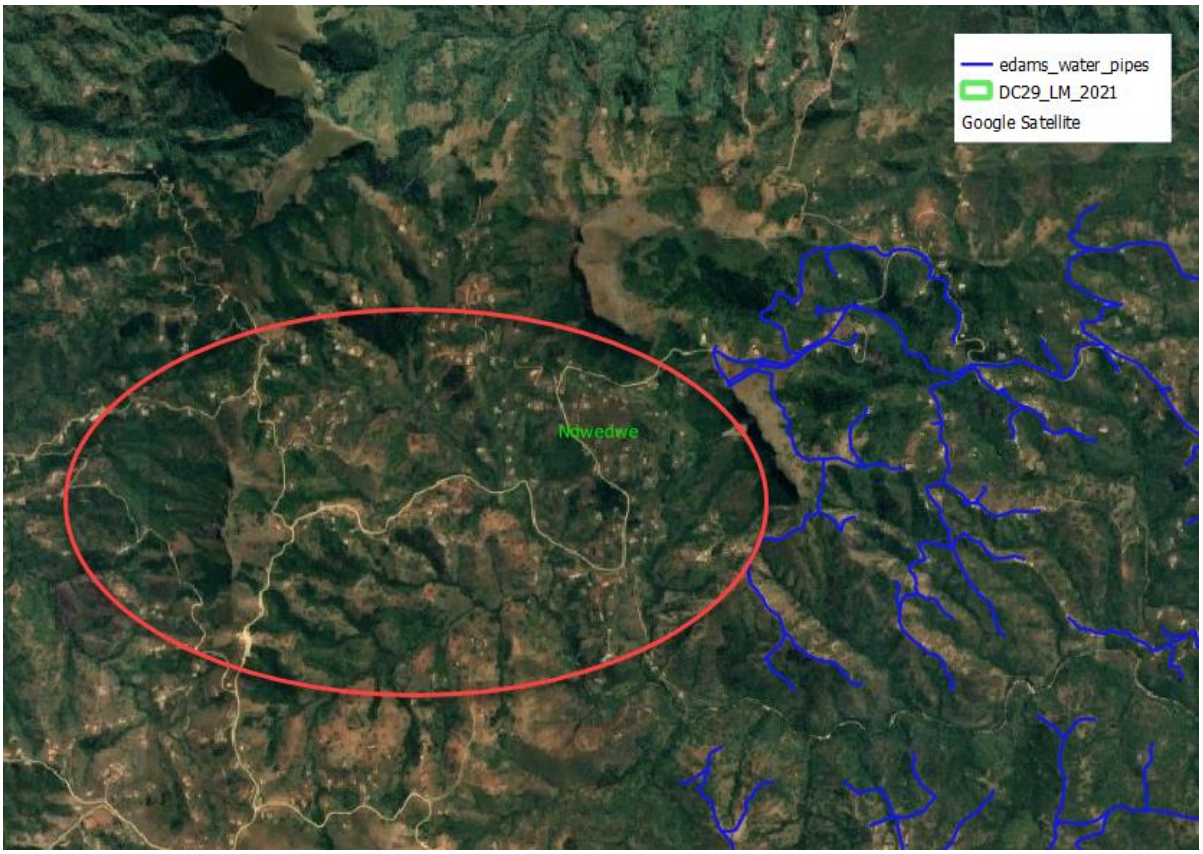
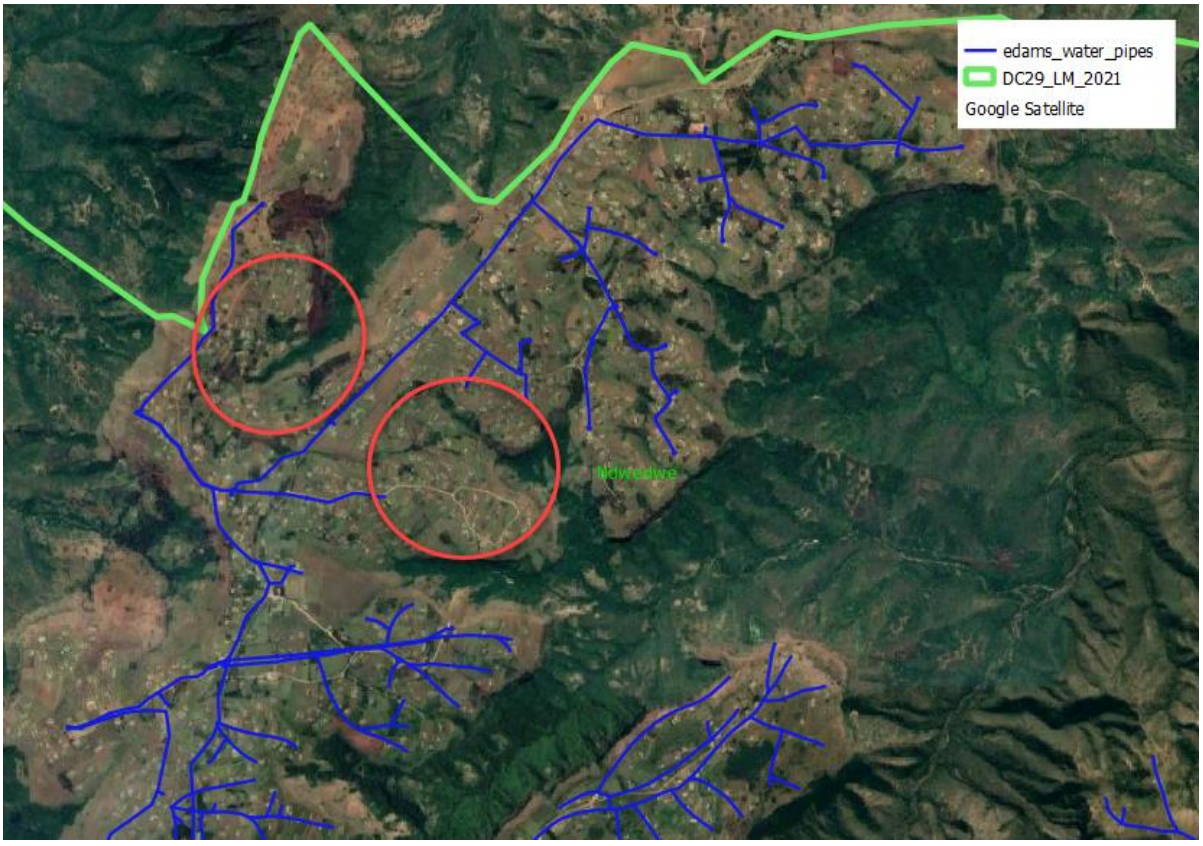
DC29_LM_2021
Google Satellite


edams_water_pipes
DC29_LM_2021
Google Satellite



5.1.3 Ndwedwe Local Municipality


edams_water_pipes
DC29_LM_2021
Google Satellite
Ndwedwe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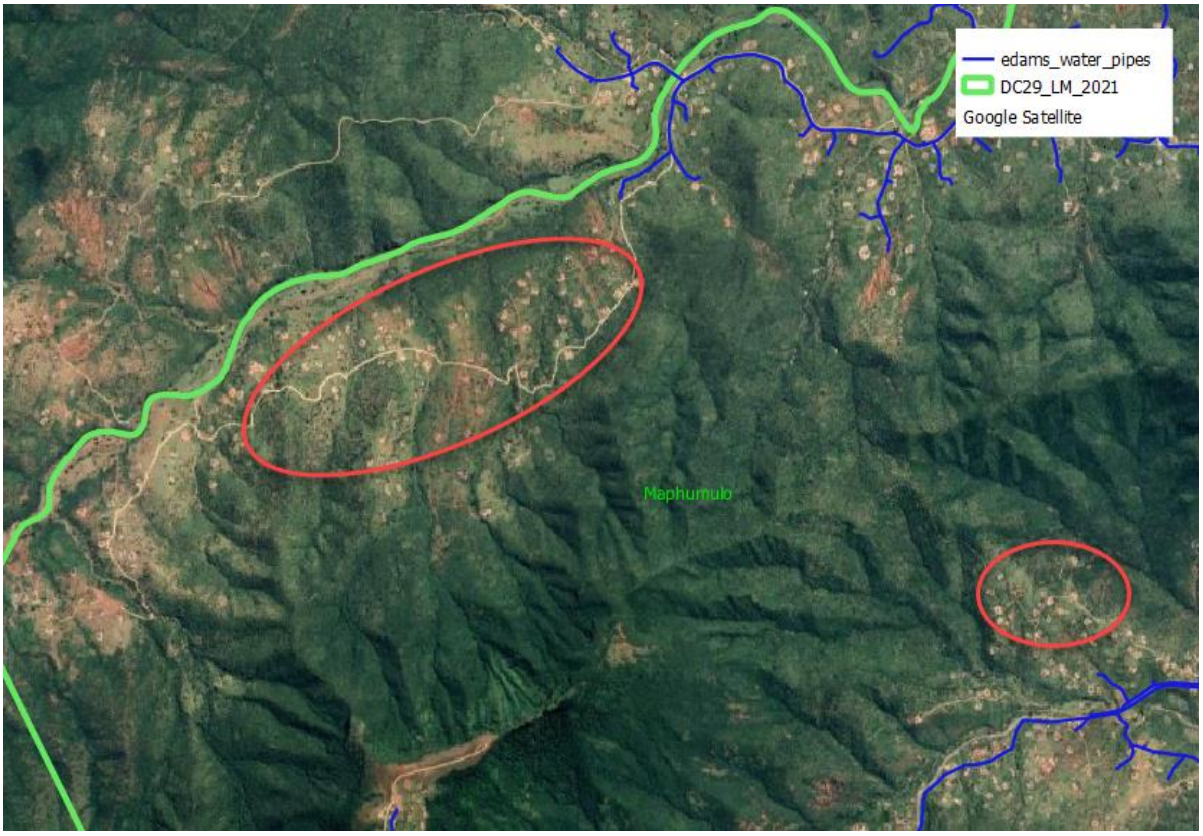
DC29_LM_2021
Google Satellite
Ndwedwe

5.1.4 Maphumulo Local Municipality



In red circles you'll see areas that are probably missing their water network. The municipality has to investigate the following:

1. The possibility of having the missing network in an external GIS format (i.e. shapefile, CAD, etc)
2. Missing the network in its entirety
3. Networks not in the municipality's jurisdiction (e.g trusts, etc)

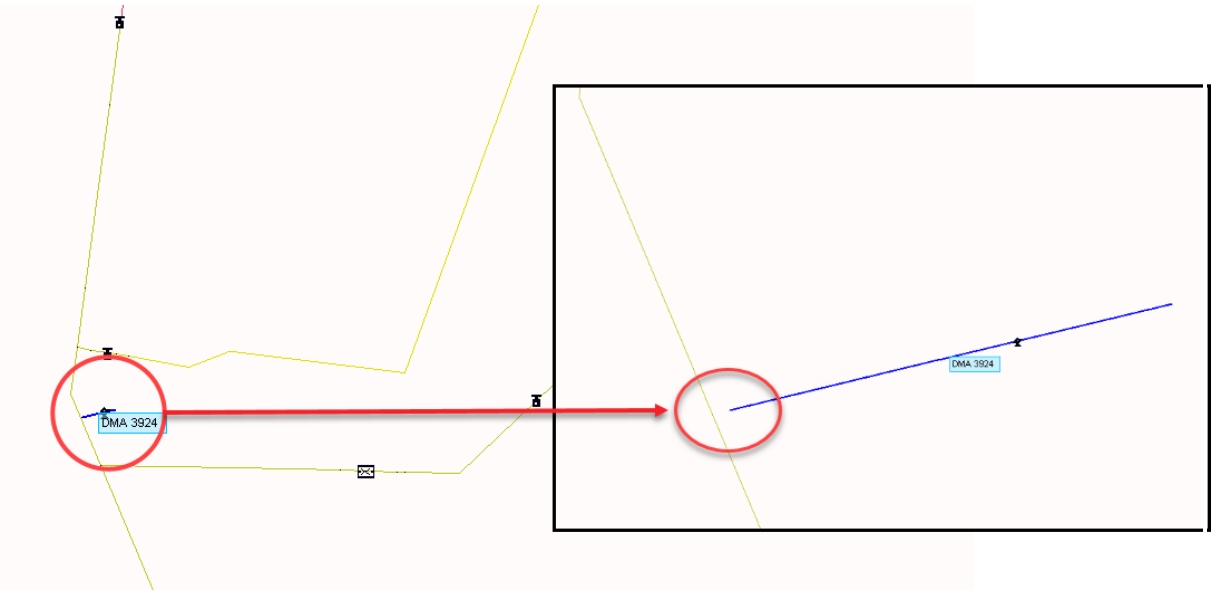
If there is available network in an external format, the consultant can assist in converting the data in EDAMS NDM. If, on the other hand, the municipality doesn't have any data regarding these areas (and others not shown in this report), they need to put down procedures and schedules in order to capture them as soon as possible.

5.2 Disconnected Network

Disconnected Network is an important factor contributing to an incomplete technical asset register. Disconnected zones are usually difficult to identify with just looking at the network as they seem connected to the naked eye and especially from a zoom-out position. One would have to zoom in to a lower scale and inspect the whole network to manually identify these issues. EDAMS Zoning Manager is an excellent tool identifying these discrepancies due to its ability to identify and generate discrete zones.

It's crucial for the municipality to go through all discrete networks and inspect if they should be connected to each other or not and make the necessary changes within the system.

A very common example is shown in the image below:

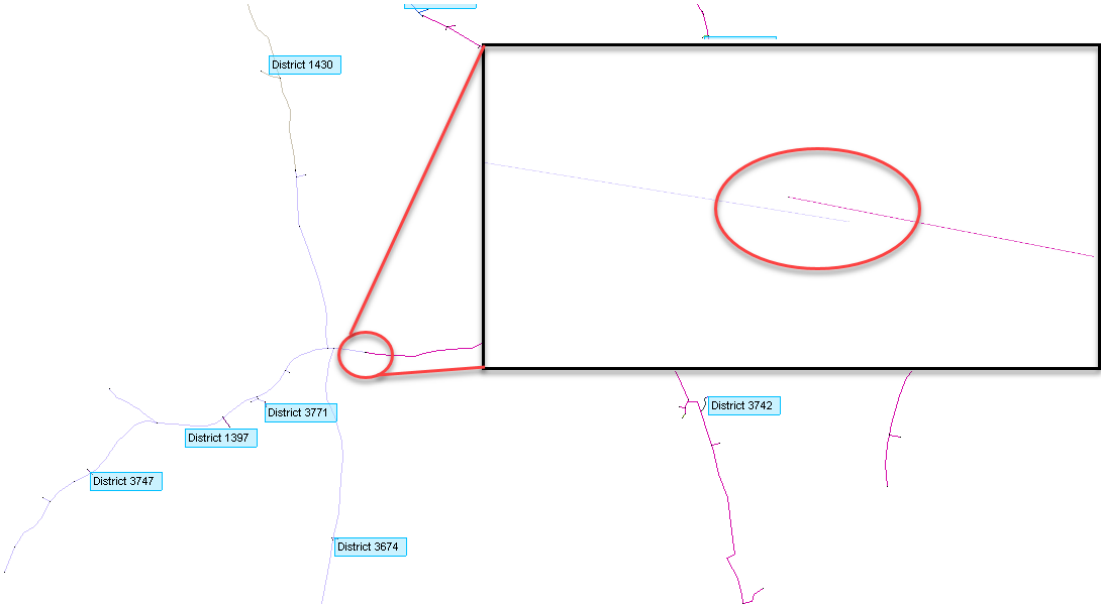


The above example shows a pipe that the system identifies as a discrete zone whereas to the naked eye the pipe looks connected to the rest of the network.

Various examples of such disconnected networks taken from the municipality's database (EDAMS NDM) can be seen in the sections below:

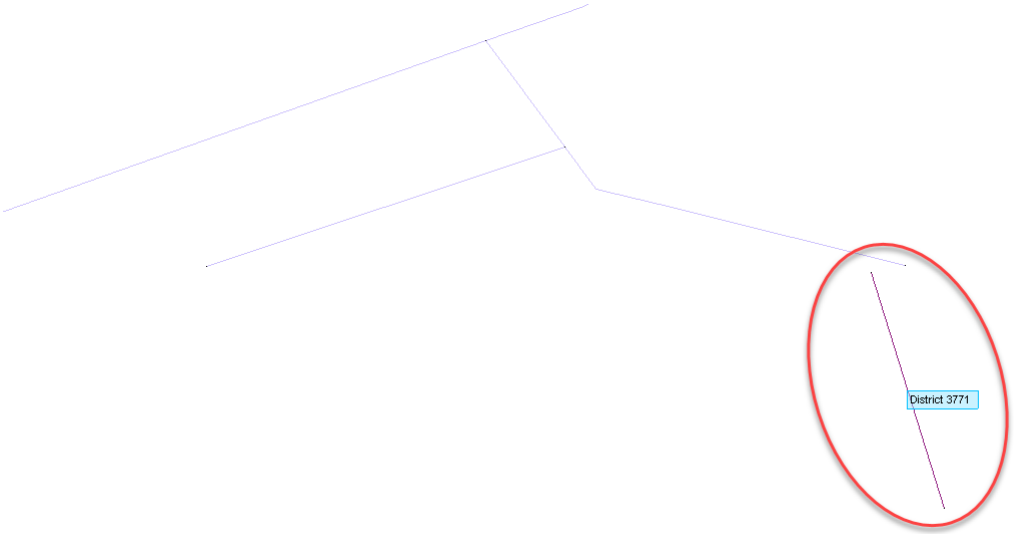
5.2.1 Example 1: Visually connected networks

From afar the pipes look connected but when zoomed in, you can clearly see that there is no connection and thus the system is able to show the two networks as discrete.



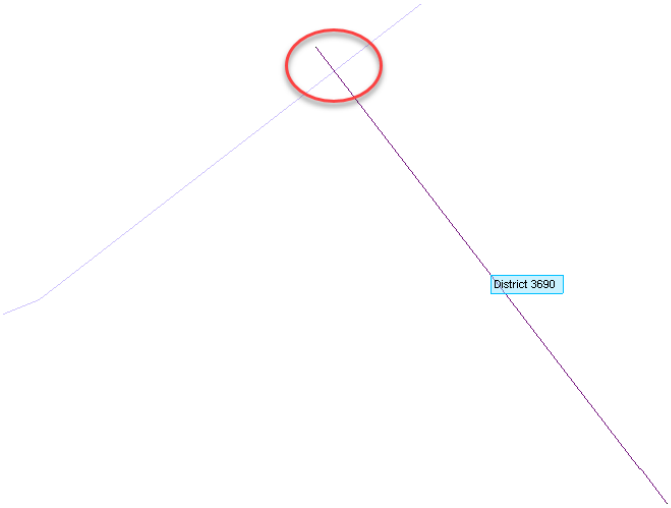
5.2.2 Example 2: Clearly disconnected pipe

Clear standalone pipe.



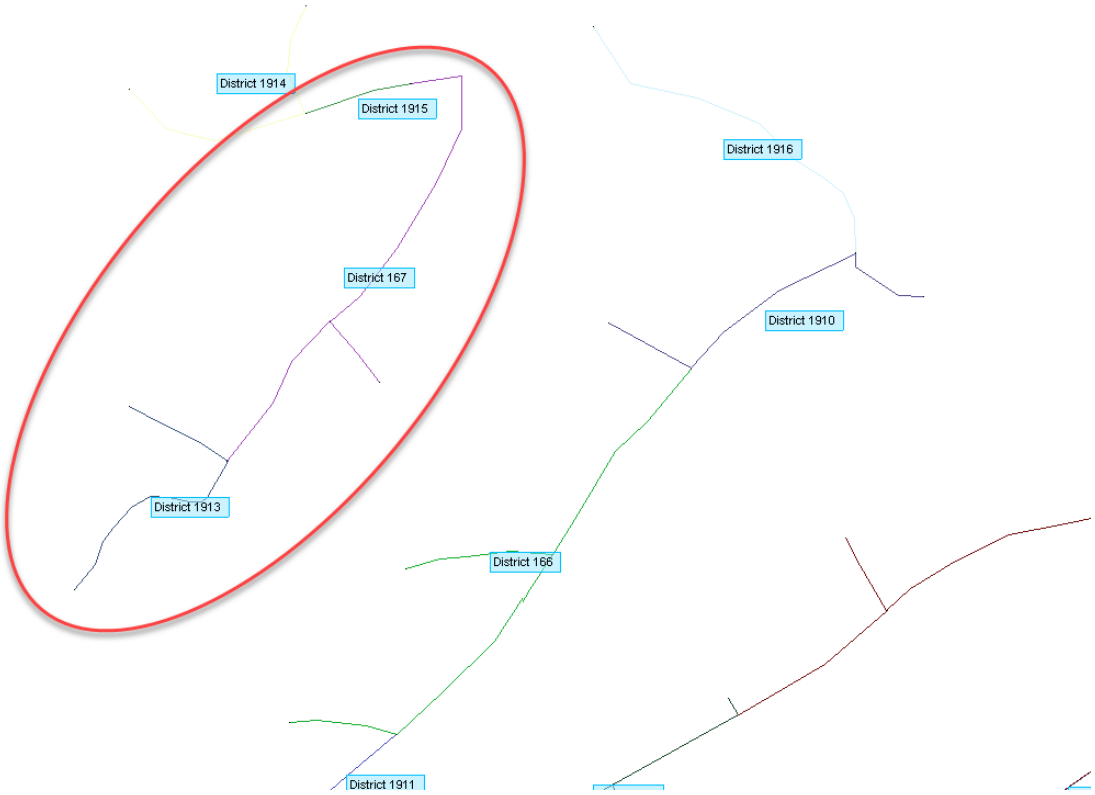
5.2.3 Example 3: Pass-over pipe

Another example that would be difficult to identify through visual inspection. Pipe exists and looks connected to the cross section but clearly the pipe goes over it instead of connecting to it.



5.2.4 Example 4: Network islands

Network island with various disconnected pipes. This clearly needs to be connected to the rest of the network.



The above image can be seen as a sample of the whole water network as there are multiple disconnected pipes, small network islands, pipe pass-overs, etc.

Only self-sustainable, discrete zones are allowed in the system, otherwise zones must be examined and verified in the field. However, most of the discrete zones in the database can be easily fixed via desktop editing within EDAMS Network Data Management (NDM) as most of them are clear data capture errors.

5.3 Rules for Zone definition (naming of zones)

5.3.1 Rules for Zone definition (Hydraulic Zones)

The current zone names are the ones generated by the system plus a few captured by the consultant. Generated zones begin with District followed by a generated number.

Zones that are raw water must start with “RAW-.....”. Zones that are main transmission must start with “BLK-.....”. The rest must have the name of the area.

5.3.2 Rules for Zone definition (Mass Balancing Zones)

All mass balancing zones are auto generated by the system, i.e. they begin with the word DMA followed by a number. The mass balancing zone names must be meaningful to the users. A proposal is to use the following:

Make sure you name all the Zones generated by the system. Zones that are raw water must start with “RAW-.....”. Zones that are main transmission must start with “BLK-.....”, etc. The rest must have the name of the area with the word “DIST” or “DMA” in the beginning to separate them from the rest. If the utility also has some check zones (ie in order to check a certain water pipe’s losses) you can also use the word “CHK” in the beginning to separate them from the rest and especially separate them from the bulk supply zones.

Notes:

RAW = Raw Water

BLK = Bulk Supply

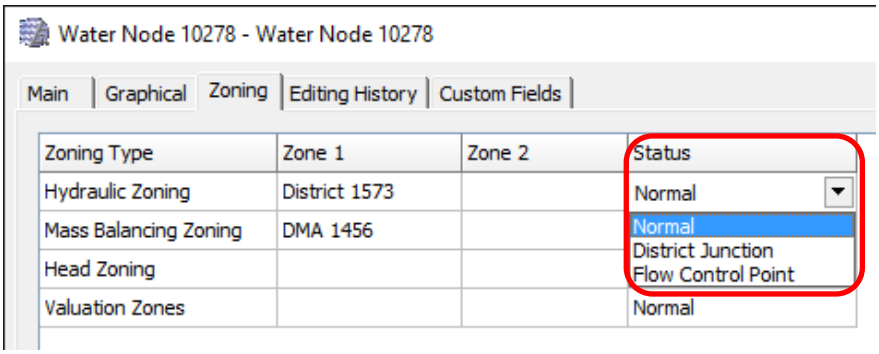
CHK = Check Zone

5.4 Hydraulic Zones

Currently there are 4,467 hydraulic zones (discrete networks) in the system. A complete list of the hydraulic zones can be found in Attachment 1 along with the pipe length and elements per zone. Another major factor in separating hydraulic and mass balancing zones is the correct setup of the isolation valves. Currently there are no closed valves in the system, and this of course can't be the case.

5.4.1 Closed Valves (CV), District Junctions (DJ) & Flow Control Points (FCP)

The three element types can alter how the system re-zones the network. Valves must resemble their normal status in the field, either open or closed, whereas district junctions (DJ) and flow control points (FCP) are node statuses and are used solely to separate the hydraulic zones.



District junctions are used to separate the Bulk Supply from the districts, whereas flow control points are used to separate the different districts between them as well as isolate different bulk supply zones.

Hydraulic zones are primarily used for Hydraulic Analysis as they separate bulk supply from distribution. During the Zoning Manager training, users will have the opportunity to work with and understand this type of zones.

At the moment, the network has no district junctions, flow control points or closed valves, therefore all listed zones are discrete (i.e., separate from each other) and the municipality will have to investigate and rectify where necessary.

5.5 Mass Balancing Zones

Currently there are 3,367 mass balancing zones in the system and none of them is defined correctly.
In general, in order to generate mass balancing zones, the following issues must be resolved:

- Define the D/S chain in all compound elements. This is important since mass balancing takes into account all compound elements that can have a bulk meter installed. If the direction is unknown, then the system can't produce reliable zoning information thus giving errors in the process.
- Define the active meter chambers. This is again important because active meter chambers are taken into consideration during the zone generation process. The inactive chambers are left out.
- Define all closed valves in the system. This step is similar for both, hydraulic and mass balancing zones.

DMAs generated from the system do not cover the whole network as there are a lot of standalone bulk meters. Bulk meters are crucial for forming mass balancing zones and their location must be rectified before re-generating zones.

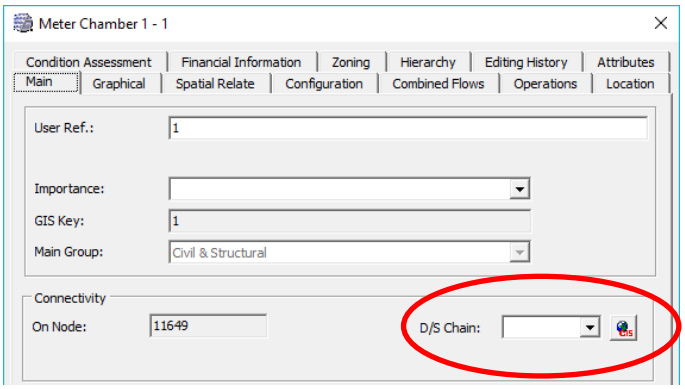
The rules specified in section 5.3.2 apply for the zone names once the process is completed. A full list of the generated DMAs can be seen in Attachment 1.

5.5.1 Closed Valves (CV), Meter Chambers (MC) & D/S Chains (D/S)

The three factors that can alter the mass balancing zones as mentioned above are the closed valves, the bulk meters and the downstream chains defined in all compound elements. If bulk meters and downstream chains are missing, the system won't be able to generate the mass balancing zones, since it doesn't know the flow direction. If though, these are captured correctly and the network is missing the closed valves, the system will automatically generate the mass balancing zones, but they will surely be incorrect.

5.5.1.1 D/S Chain Definition

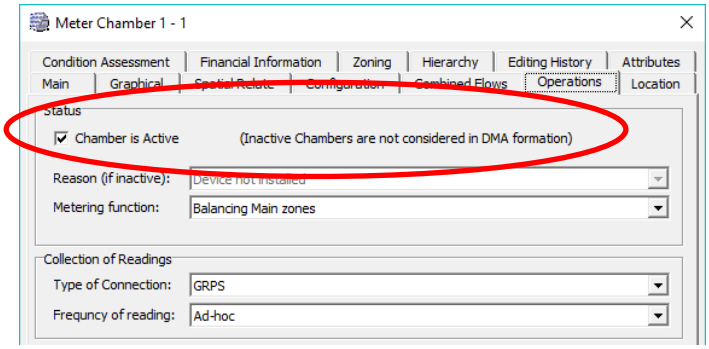
The users need to go through all compound elements and select the correct D/S chain in order to define the flow direction where this information is not captured.



5.5.1.2 Bulk Meter Active in DMA Formation

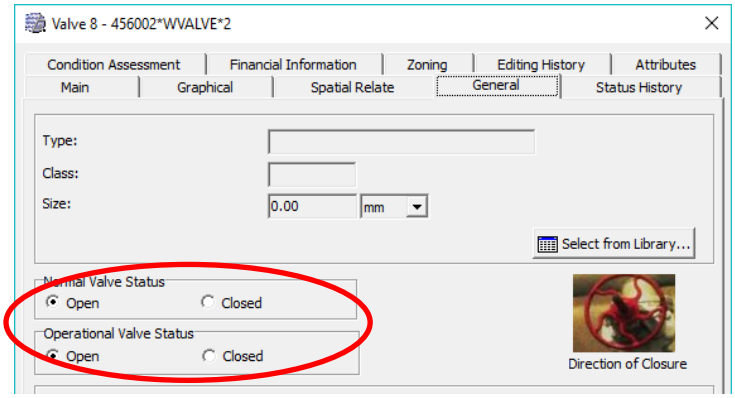
The users need to go through all meter chambers and select if the chamber is active or not. Active chambers will take part in the generation of mass balancing zones, whereas inactive chambers will be left out of the process.

Note: By default, all meter chambers are active.



5.5.1.3 Closed Valves

The users need to go through all valves and enter their normal and operational status. In essence, the utility needs to define the zone valves (i.e. closed valves that separate hydraulic zones). By default, all valve statuses are defined as open.



6 Attachment 1: Asset Register Final Evaluation Tables for Water Supply