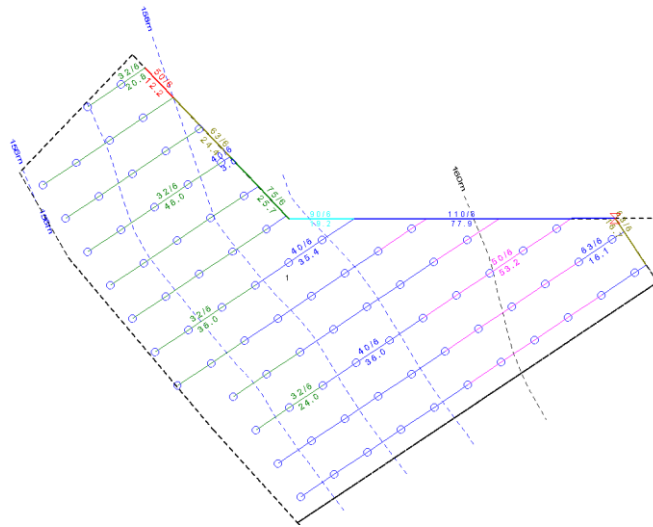


IrrMaker – Step by step

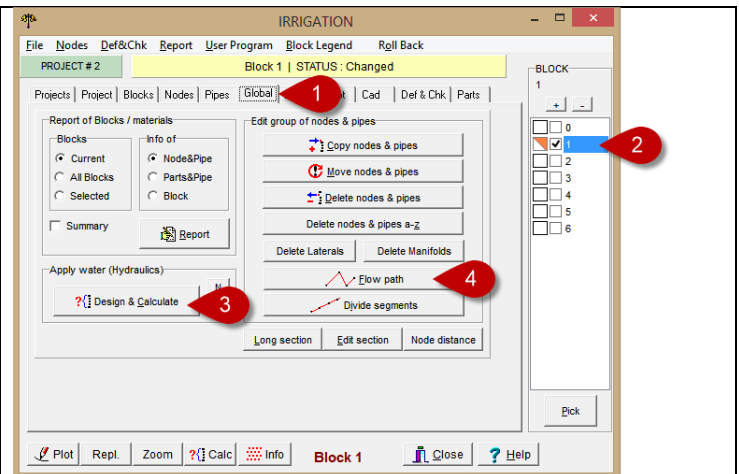
Part 5 – Pipe Sizing with IrrMaker



This article build on the foundation laid in my previous article where I explained some theory that need to be remembered when using IrrMaker, as well as the typical IrrMaker approach to hydraulic pipe sizing. In this feature I will go over the practical steps to size the lateral- and manifold pipes inside a sprinkler block using IrrMaker.

Step 1: On the Global (1) page, make sure you have the correct block active (2) then click on "Design & Calculate" (3).

Tip: If the "Design & Calculate" button is inactive it might be that some node or pipe is disconnected from to the rest of the pipes. If this is the case, press the Flow path (4) button to see where you have disconnected nodes/pipes. Loops are also not allowed inside blocks. Correct where necessary and try the "Design & Calculate" button again.



Step 2: On the next page click the “Size Pipes” (5) button. Set your lateral (6) and Manifold (7) parameters. If both the Laterals and Manifold must be sized with one click, make sure that the Laterals tick box (8) is selected, then press the Manifold (9) button to perform the pipe sizing. Notice the report (10) that is given, this is where you will see if pipes were sized or not.

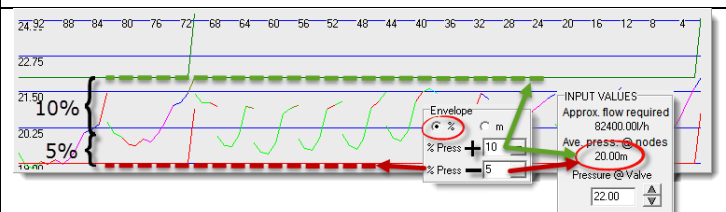
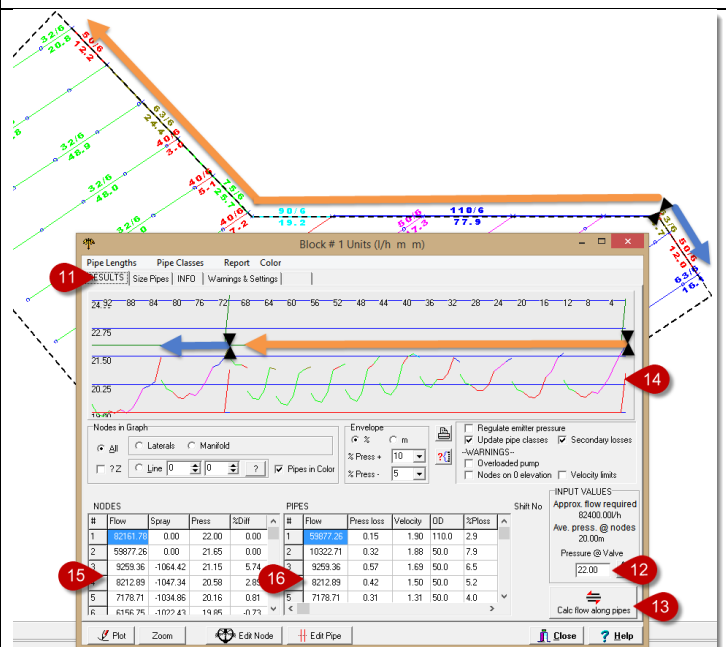
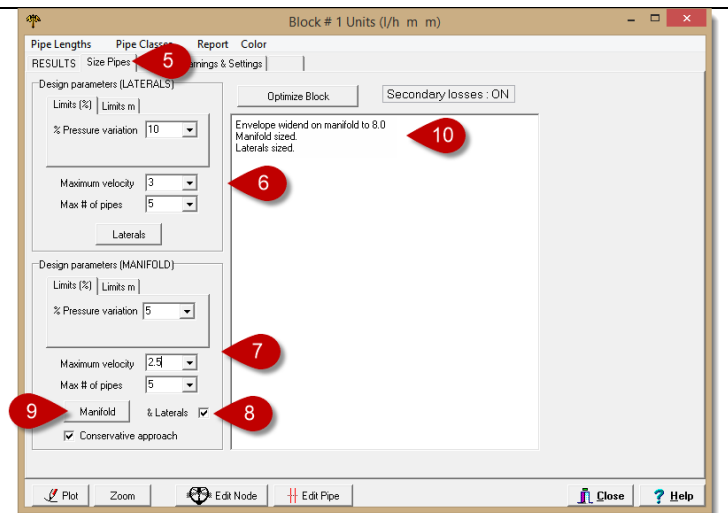
Important: Do not use random values on this page as these values influence the quality of your design. It is at this stage I would like to remind you that you are the designer and IrrMaker is the tool. If you feed the program garbage, expect a garbage answer.

Tip: Refer to my previous article if you want to understand the internal calculation process.

Step 3: Click on the Results button (11) at the top of the dialog to analyze the design. Enter the valve pressure (12) then Calc flow (13) to fill the system with pressure. Hydraulic gradients will be shown for all the pipes in the block. Below the hydraulic gradient graph are two grids with data in them. The data grid on the left (15) will display the actual design values at each node. The data grid on the right (16) will display the actual design values of each pipe segment.

Notice the orange and blue arrows on the hydraulic gradient graph and how they relate to the plan view behind the dialog. You should clearly notice that the manifold is split into two sections running in opposite directions from the valve, but on the graph they are drawn in succession where the start of each arrow signify the valve position and therefore also the start pressure of each manifold. As this is the same valve, the start pressure for both segments of the manifold is therefore the same (12).

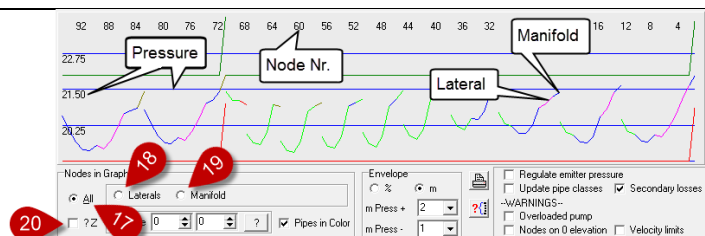
Another important feature on this page is to make sure your targeted design pressures at the emitters are achieved. At the bottom right of the dialog you are reminded of the target design pressure – in this case 20.0m. In the middle of the dialog you have an Envelope setting where you can define the size of your target or allowable pressure deviation. The “Pressure + (plus)” or “Pressure – (minus)” is used to define the top and bottom limit of the targeted pressure envelope. The top line will be drawn in green



and the bottom line in red. This will effectively create a pressure envelope which is used to visualize how the designed pressures for the whole system relate to the pressure envelope. It is important to note that the envelope setting is just a tool to set the size of the "window" through which you look at the actual design to see how much of the design falls within the "window field of view" and will not affect you design. In other words, it is an analysis tool.

When looking at the hydraulics graph you will notice that each lateral is plotted on this graph starting with the leading segment of manifold just before each lateral. The numbers in the top of the graph represent the node numbers as allocated to each node starting from the valve (node nr 1) onward throughout the block. The horizontal blue lines represent actual pressure with the pressure value written on the far left hand side of the graph. The default view setting is to view the full system (17) on this graph and how it represent pressure deviation for each pipe segment and all nodes on the pipes. The graph will scale dynamically to show the full pressure extents of each block being examined. Options are provided to view each lateral (18) or manifold (19) individually and you can also view the ground profile by activating the Z (20) value.

Tip: If you Double Click any pipe in the graph, that pipe will be displayed on its own.



Tip: Click on any pipe segment on the graph and the corresponding node and pipe segment will be selected in the data grids (15 & 16).

The pipes data grid have a unique function that allow the upsize or downsize of any pipe segment in real time. First select the segment with a left click, then right click the data grid and choose if you would like to upsize or downsize a pipe. IrrMaker will find the next pipe diameter in the current pipe database group (if it is available) and immediately update the graph to illustrate the effect of the new diameter on the system.

PIPES

#	Flow	Press loss	Velocity	OD
82				63.0
83				63.0
84				63.0
85	9.14	0.55	1.67	50.0
86	8.11	0.40	1.48	50.0

Right Click

Upsize Pipe 82

Downsize Pipe

By double clicking any node or pipe segment in the data grids will display that node/segment's properties. This is where you can see exactly what was used (21) and where you can manually change a node or pipe segment to any other node or pipe type (22). You may also (usually after an update) apply this setting to any other node / or pipe segment in the main graphic display (23). Remember to run the **Calc Flow** button (13) again to see what effects your changed node or pipe has on the system.

There are 6 tick box settings available on this dialog:

- Regulate emitter pressure**
 This option will assume all emitters are pressure regulated and will deliver the design flow irrespective of the pressure at that point. It is **not recommended** that this option be selected while designing a block, but in some cases it can be a useful tool to find problematic areas within the block, especially if IrriMaker will not show a hydraulic graph but rather the annoying (but much needed) pink error message due to the fact that the design flow differs by more than 20% across the block. This can typically happen in steep areas where a manifold run downhill and its smallest diameter is already in use, but the pressure increases still. The solution could be to put a pressure regulator on that manifold to lower the downstream pressures, but the program does not know that, all it sees is that the downstream emitters flow variation is more than 20% when compared to other emitters in the same block.
- Update pipe classes**
 IrriMaker sizes pipes based on the inside diameter values as supplied in the pipes database. When this option is selected the program will automatically update the pipe class while the "Calc Flow" button is pressed. This will ensure that appropriate pipe classes are selected that correspond with the actual pressure reached in each pipe segment. Pipe sizes will only update if

ERROR : Model unable to converge to acceptable limits due to :
The actual and design flow differs by more than 20%. Please check.

Do not show next time

Click on this panel to remove the message

multiple sizes and classes are available in the pipe database group that was selected when choosing the pipes.

- **Secondary losses**

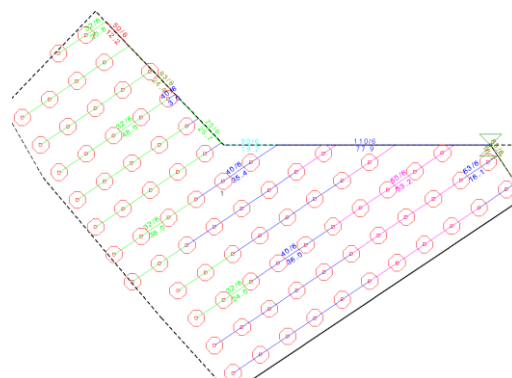
This option will apply a secondary loss at each emitter position, but only if such a secondary loss factor (or KD value) is available in the pipes database. Each pipe in the database can have a different KD value. These KD values are usually supplied by the manufacturers of the pipe and emitters. The thinner the pipe, the higher the KD value and therefore the higher the pressure loss inside a pipe. The effect of secondary losses cannot be ignored. In my opinion, this checkbox should always be used!

Information: For those who do not know, the KD value represent the friction caused due to the emitter being present inside the pipe and the emitter literally obstruct water passing the emitter.

Step 4: On the Info (24) page you will find the a summary of the emitter discharge (25) and pressures (26) for the whole block. You will also have the opportunity to enter the number of emitters per plant as well as the manufacturers coefficient (Cv) as supplied by the manufacturers of the emitters. This will enable you to determine the Emitter Uniformity (EU%) (27) for the designed block. If the EU% is not adequate, the design need to be changed until the EU% is within acceptable limits.

IrriMaker provide a very useful tool to view the emitters that fall within preset criteria on the plan graphics. In this example the setting is set to view the Nodes (a) Discharge (b) that fall within (c) 15% (d) of a predefined value (e). Now when the Display (29) button is pressed, all nodes that fall within 15% of the discharge value of 1030 l/h will be displayed red and those that are outside this criteria will be shown in green. In this example it can be clearly seen that all emitters discharge are within the 15% variation.

The screenshot shows the 'Info' tab in the IrriMaker software. The title bar indicates 'Block # 1 Units (l/h m m)'. The 'RESULTS' section shows 'Block No. 1 Approximate time to fill : Velocity 3 minutes | Volume 1.75 minutes'. The 'DESIGN CHECK' section has radio buttons for 'Nodes' (a), 'Pipes', 'Classes', 'Friction', and 'W-hammer'. The 'Check' section has radio buttons for 'Discharge' (b), 'Pressure', 'Radius', and 'Criteria'. The 'Selection' section has a 'Standard l/h' value of 1030 (c) and a 'Design (20.00m)' value. The 'DTM POINTS' section has a 'Copy selection as DTM points to' dropdown set to '1' (d) and a 'Clear project first' checkbox. The 'EDIT MANIFOLD NODES' section has radio buttons for 'All Nodes', 'Fitting Nodes', and 'Regulator Nodes'. The 'With pressure' section has radio buttons for 'Above this value' and 'Below this value'. The 'Report' section has radio buttons for 'All', 'Selected', and 'In sorted format'. The 'EMITTER DISCHARGE' table shows: Maximum 70, Minimum 60, Average 1031.339, Percentage discharge variation 7.646. The 'EMITTER PRESSURE' table shows: Maximum 70, Minimum 60, Average 20.146, Percentage pressure variation 10.616. The 'EU%' is 96, 'DU%' is 96, and 'EU%' is 90. The 'Report' button is highlighted with a red circle (27).



The first part of the process is to get to know the tool, in this case IrriMaker, the second part is to apply your knowledge and some common sense. There is a lot still to say on this topic. I suggest you

start to practice. If you get stuck, please contact me and I will do my best to help. You can contact me at corne@mmsdesign.co.za or phone my mobile +27832333784.