

TUTORIAL FOR IRRIPRO



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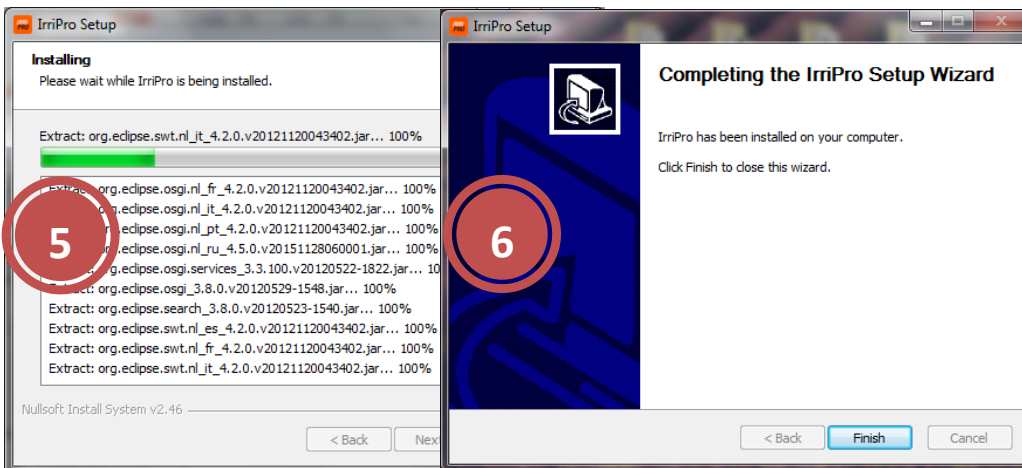
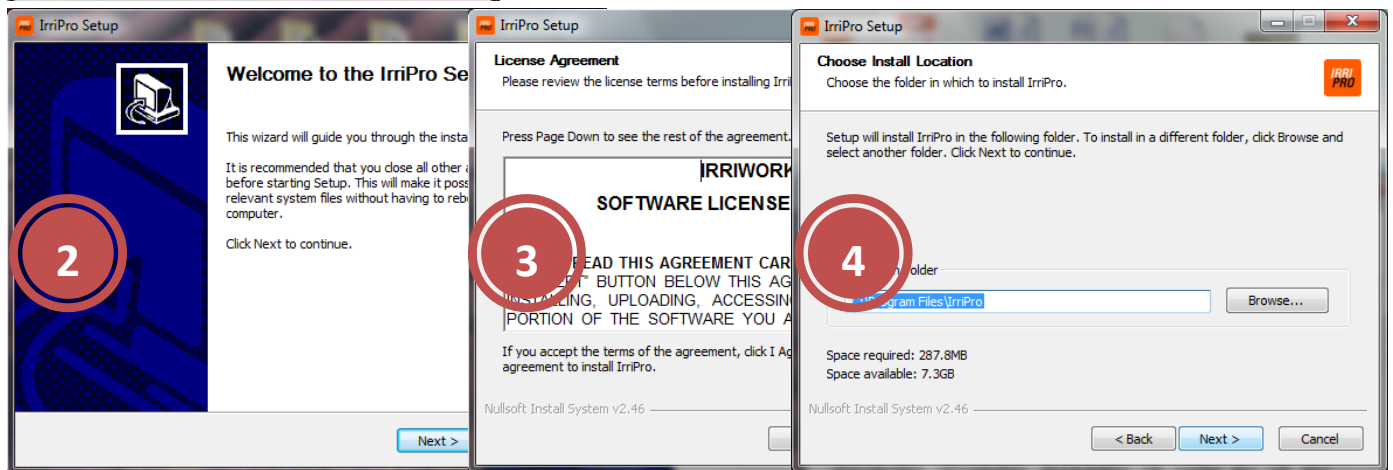
installation

The latest version of the software can be downloaded from www.irriworks.com or directly clicking [HERE](#). IrriPro can be installed on MS Windows systems (both 32 and 64 bit) from the XP version up to the current Windows 10 and MAC systems (MAC OS, MAC OS X and OS X)

Installation on WINDOWS systems



Double-clicking on the downloaded executable file the installation process will start. Select the language, accept the license agreement, indicate the installation folder (it is recommended to leave the pre-set path) and proceed with the next windows to complete the installation. Follow the instructions as shown in the sequence of windows.



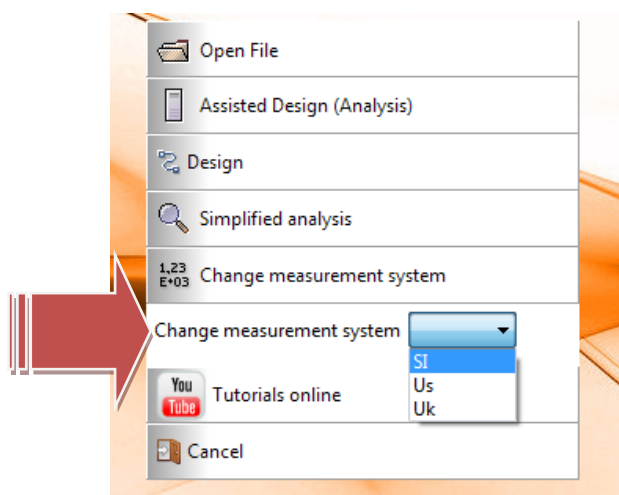
Once the application is installed, an icon appears on the desktop through which to start the program.



language and measurement system

The IrriPro language automatically changes to match the language of the operating system of your PC. Available languages are English, Italian, Spanish, Portuguese, French and Russian. If the operating system does not have one of the above languages, it will be set to English by default.

IrriPro allows the use of 3 different measurement systems that can be chosen in the first window shown at the opening of the program:



- **SI** or International System, the most commonly used.
- **Us** or American Measurement Systems, used mainly in the United States
- **Uk** Imperial system, used mainly in UK and anglosaxon countries.

See the conversion table below for all the units:

	SI		US		UK	
Lenght / distance	<i>m</i>	meter	<i>ft</i>	Feet	<i>ft</i>	Feet (piedi)
Diameter	<i>mm</i>	millimeters	<i>"</i>	Inches	<i>"</i>	Inches
Thickness	<i>mm</i>	millimeters	<i>mil</i>	Mil	<i>mil</i>	Mil
Speed	<i>m/s</i>	meters/second	<i>ft/s</i>	feet /second	<i>ft/s</i>	feet /second
Source pressure	<i>bar</i>	bar	<i>PSI</i>	PSI	<i>PSI</i>	PSI
Pressure / Head	<i>m.c.a</i>	Meters in water column	<i>ft</i>	Feet in water column	<i>ft</i>	Feet in water column
Discharge source	<i>m³/h</i>	Cube meters /hour	<i>gpm (US)</i>	Gallons / minute	<i>gpm (UK)</i>	gallons / minute
Discharge pipe	<i>m³/h</i>	Cube meters /hour	<i>gpm (US)</i>	Gallons / minute	<i>gpm (UK)</i>	gallons / minute
Flow rate emitter	<i>l/h</i>	liters/hour	<i>gph (US)</i>	Gallons per hour	<i>gph (UK)</i>	Gallons per hour
Temperature	<i>°C</i>	Celsius degrees	<i>°F</i>	Fahrenheit dg	<i>°F</i>	Fahrenheit dg
Price	<i>€</i>	Euro	<i>\$</i>	US dollars	<i>\$</i>	US dollar

Once you select the units of measure the program requires the application restart.

The examples that follow and the results shown will be proposed with the international system (SI). The input data (*text in cursive*) will also be converted into Us and UK for being so performed in other measuring systems.

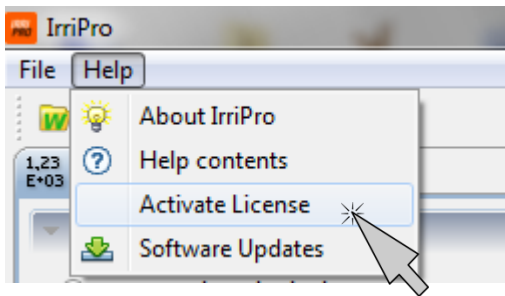


license activation

The IrriPro software without being activated can be used in Freeware version (freely and without time limit). In this condition, IrriPro has several limitations as better specified in the [comparative table](#). You can activate the freeware version at any time through a license that is a serial code received via e-mail once made the purchase on [this page](#). The licenses are divided into three categories, depending on the system size:

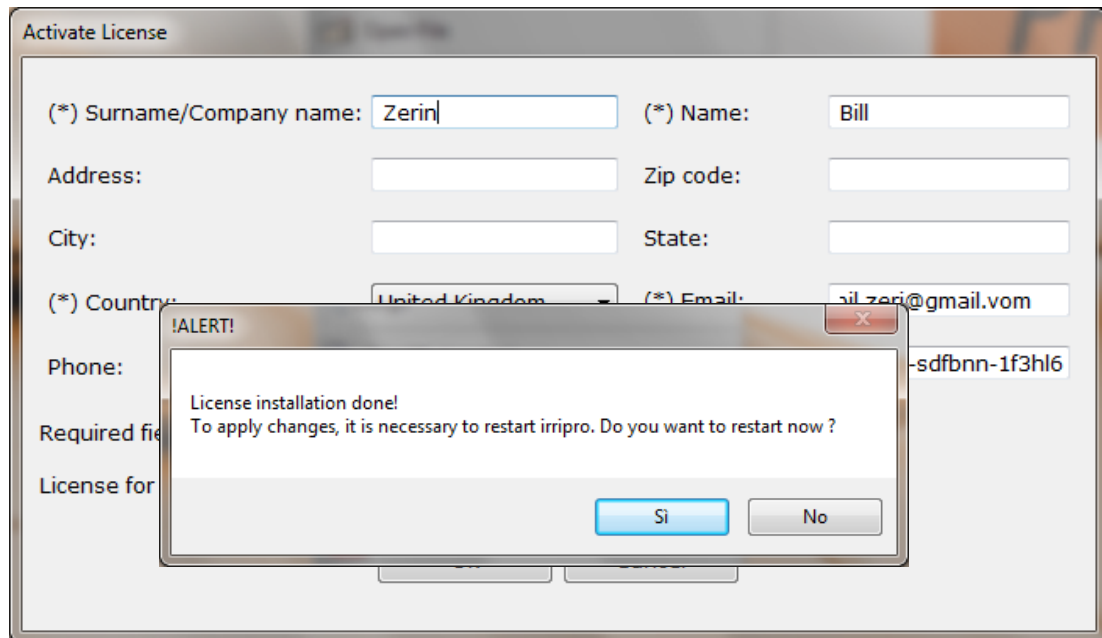
- SMALL (up to 5 Ha)
- MEDIUM (up to 30 Ha)
- BIGFARM (plants of any size)

Depending on your needs, you can purchase a time-limited license (On-Demand) or Lifetime: this last license is updated for one year, but additional updates can be purchased.



To activate click on "Activate License" listed in the first box, or by going to the "Help" menu voice and then "Activate License".

After filling in the various fields (at least the required fields marked with an asterisk (*)), entered the 33-character serial number received via e-mail and clicked OK, you will see the correct message confirming installation of the license.



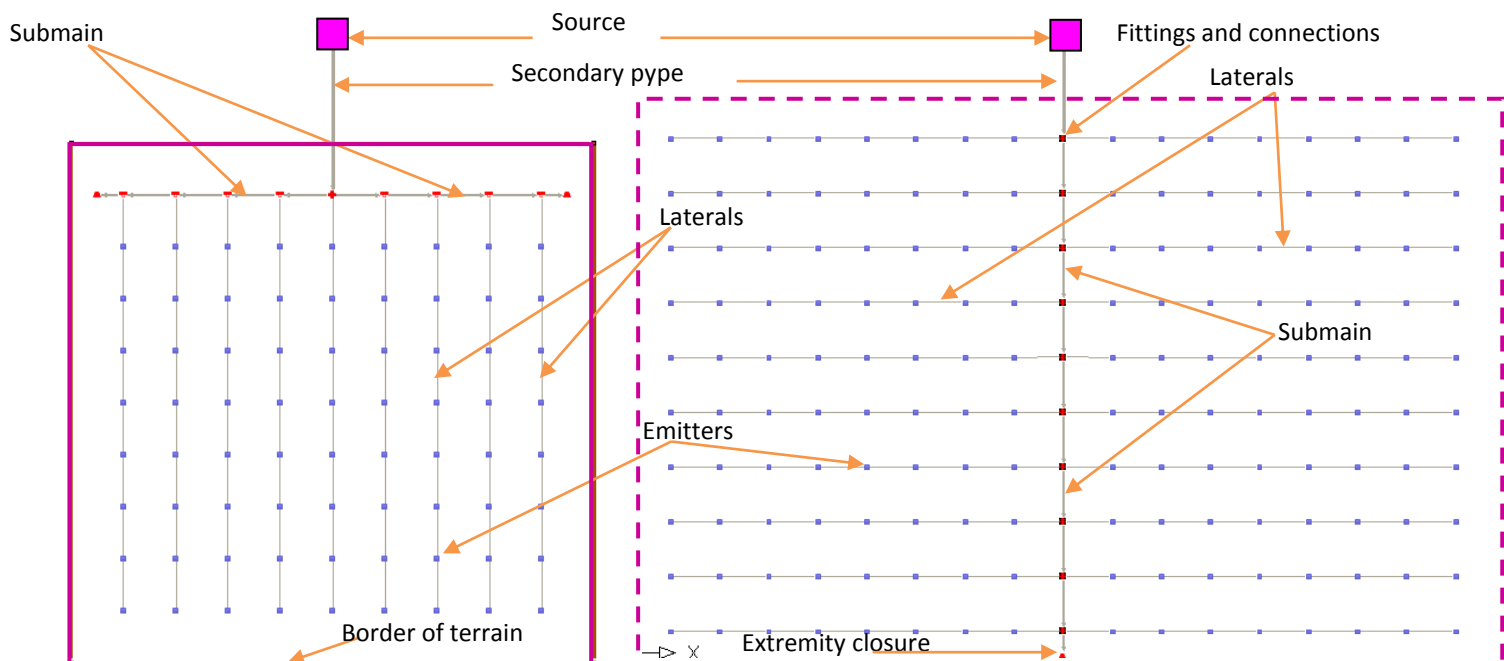
Be careful not to copy the serial code with special characters or typing spaces. Once activated, the program will ask to restart the application to complete the process and acquire the license.

The program activated by the same license can be used on one workstation at a time although it can be installed on multiple workstations / PCs.

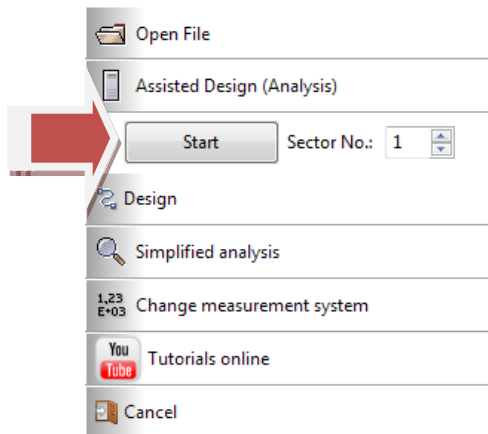


single sector case study

Layout of a system and definitions for a single classic sector (on the left) and symmetrical (on the right):



Considering the above definitions we proceed now with the project of a single sector. Starting from the first window to open the program, you can choose among:

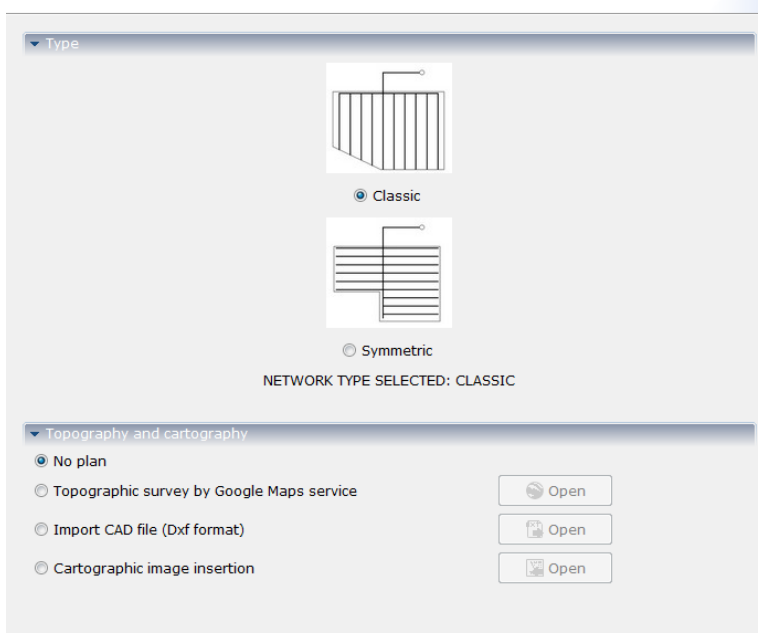


- **Open file** to open a previously saved file
- **Assisted Design (Analysis)** of a plant made of one or more sectors (this is the most commonly used option)
- **Design** option used if you want to go directly in the work area without being accompanied by the wizard (guided windows path for data entry). Recommended for unusual plant geometries and gardening.
- **Simplified analysis** o quickly verify a single rectangular sector knowing lengths, diameters and number of laterals

In this example case choose “Assisted Design (Analysis)”, 1 as number of sectors and click on Start.

Network Type

Select irrigation network type



A window will open where you can choose between the classic geometric arrangement (with laterals only on one side of the head pipe) and symmetric (with laterals from side to side). In the second pane, you can choose among:

- **Topographic survey by Google Maps service**, to obtain a 3D model of the terrain directly from Google service and without being on site or needing an existing survey
- **Import CAD file**, to enter a DXF file to import the layout of the plant and elaborate the contour lines (if quoted)
- **Cartographic image insertion**, to enter a raster image or a scanned cartography to be scaled

Choose “Classic” typology and “No plan”

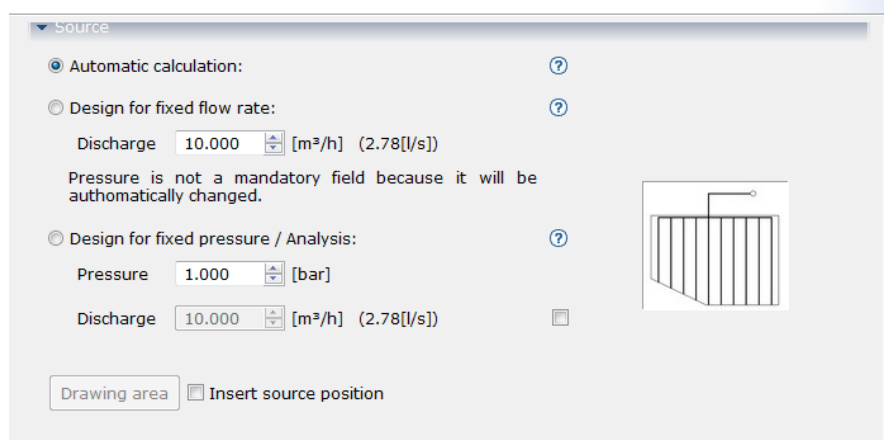
Clicking on "Next", a new window for the feeding supply system (source) and the arrangement of delivery points will open.

In the first pane choose **Automatic calculation** if you don't know pressure and flow rate at the source. The software will calculate these quantities automatically according to plant needs (balancing the performance of the pressures according to the nominal pressure of the emitters). This is the most used option. The other options are

preferable in case a **fixed flow rate** is available to you (for example by a delivery nozzle) or a **fixed pressure** (for example a pump head). In the latter case, you can specify a maximum flow rate to be verified.

Source and crop arrangement

Insert source, temperature and crop arrangement data



Emitters/delivery points and plants' rows arrangement

☒ Emitters spacing (a) and plants' row spacing (b)

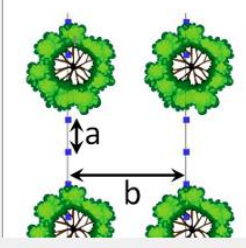
a: 1.0000 [m] b: 1.0000 [m]

☒ Single lateral

☐ Double lateral

☐ Triple lateral

☐ Quadruple lateral



In the last box indicate the spacing (a) between two consecutive emitters, and the distance (b) between one row and the next. With single, double, triple and quadruple lateral you specify the amount of laterals for each row of plants.

In this sample case choose "Automatic Calculation", spacing (a) equal to 1m (3,28 ft),

plants' row spacing (b) equal to 1,5m (4,92 ft) with single lateral. Clicking on "Next" the following window will open:

In the first tab choose the **shape** and the **dimensions of the terrain** of the sector containing the plant. Within this

Terrain features

Insert sector shape and slope

Shape

☒ Sector shape

Rectangle

a: 70,000 [m] s: 1,000 [m] ?

b: 50,000 [m]

c: 5,000 [m]

e: 1,000 [m]

Laterals Angle 90,0000 [°]

☒ Source-Sector Distance 2,000 [m]

☐ Insert source and terrain position Drawing area

☐ Generic sector shape

s 1,000 [m]

Laterals Angle 90,0000 [°]

Drawing area

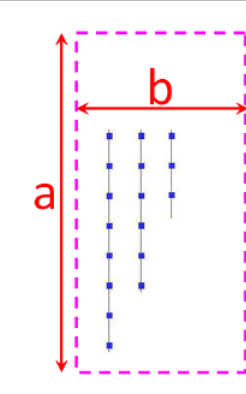
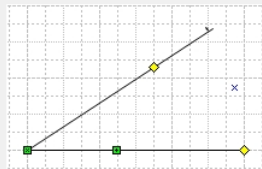
Pipes slope

Secondary pipe Set

Laterals slope

☒ Constant slope 1.50 [%] 0.9[°]

☐ Variable slope Set

board it will be automatically designed the network with the best possible coverage. The form of the sector can be **known** (square, rectangular, trapezoidal, triangular, etc.) And for drawing it is necessary to know the size, or can be **generic**: in this case the form must be drawn directly on the work area having already imported a cartographic image or a survey as a reference.

The dimension s is the minimum distance between the edge of the terrain and the network included in it (for example, properties limit or road). "Laterals angle" means the value of the angle with respect to the North of the design (for example 90 [°] are vertical wings and 0 [°] horizontal) max 360 °.

In this sample case choose *rectangular shape with measures of 70 m (229,66ft), b 50m (164ft) and s 1m (3,28ft).*

In the second and third pane indicate the **slope** of the various types of pipelines. The slope value is positive when the conduct

1.5 rises in the direction of the water flow (counterslope). And negative when the heights of the pipeline decrease.

For laterals, you can use a tabular entry of the slopes in which specify the slope for each percentage in length (compared to the overall length of the lateral). On your right the window that appears after selecting "Variable Slope" and then the "Set" button.

In this sample case select "constant slope" and change the value to 1.5%. In general, it is preferable in a system to have negative slopes to get a variation in height to compensate for the pressure loss.

Laterals slopes

Insert Delete Modify

SECTION	FROM [%]	TO [%]	SLOPE [%]
1	0	20	2.0
2	20	65	-3.0
3	65	100	4.0

Ok Cancel

Then click "Next" to go to the next wizard window.

Emitters and laterals data

Insert emitters and laterals data

Emitters Type

☐ Sprinkler ☐ In-Line drip ☒ On-Line drip ☐ Spray/Minisprinkler

Emitters features

Choose a mode of insertion of the emitter

☐ Insert from database

☒ Manual insert

☐ Pressure compensated emitter

Nominal pressure: 1,000 [bar]

Nominal flow rate: 1,000 [l/h]

pmin: 1,000 [bar] pmax: 4,000 [bar]

Range 1,000 [m]

Advanced

Number of emitters per delivery point: 1

Indicate the type of emitter by selecting the entry of rain/sprinkler, in-line drip (integrated with the conduct), on-line drip (offtake inserted with the conduct that is to say plug) and spray/minisprinkler.

Each emitter is defined through a **characteristic curve** which indicates the trend of the flow in function of the pressure (graph in the figure). The emitter features can be entered manually or introduced by choosing the item from the database. To manually enter a standard emitter just enter the pressure values and the nominal pressure (typically PN = 1 [bar] that is to say 14.5 [PSI]). For pressure-compensated emitters put the value of

the nominal flow rate and specify the maximum pressure (pmax) and minimum (pmin) related to the compensation range. In the case of rain emitters also indicate the range that is to say the radius of the wet circle (item "Range").

Through the "Advanced" button you will access an optional window where introduce the characteristic parameters K and x or the local losses. In this sample case choose the

Search criteria

Emitters Type

☐ Sprinkler ☒ On-Line drip ☐ Spray/Minisprinkler

Brand: Plast Project

Code: Model:

Nominal flow rate: From 3,00 To 5,00 [l/h] ☐ Single searching

Nominal pressure: From 0,00 To 0,00 [bar] ☐ Single searching

Max pressure: From 0,00 To 0,00 [bar] ☐ Single searching

Pressure compensated: ☐

Range: From 0,00 To 0,00 [m] ☐ Single searching

PRICE: From 0,00 To 0,00 [€]

Search results

Brand	Code	Model	Nominal flow rate	Max pressure	Nominal pressure	Press.from	Press.to	Range
Plast Project	1010.0040	Lem	4		1	1	1	
Plast Project	1015.0040	Lem	4		1	1	1	
Plast Project	1110.0040	Nike 1	4		1	1	1	
Plast Project	1112.0040	Nike 1 Eco	4		1	1	1	
Plast Project	1130.0040	Sirio 1	4		1	1	1	

Number of items found: 5

Ok Cancel

type "On-Line drip", select "Insert from database" and then on "search". This will open a window through which to search, with queries for the brand, model, flow rate and nominal pressure, range, price, etc. (also as range) the element.

Properties

Property	Value
Brand	Plast Project
Code	1110.0040
Model	Nike 1
Pressure compensated	No
Nominal flow rate	4
Max pressure	-
Nominal pressure	1
Press.from	1
Press.to	1
Closing emitter pressure	-
Opening emitter pressure	-
Hole diameter	3.6
Kind of coupling	I
Mesh	-
Micron	-
Orifice diameter	3.9
CV	-
K	1.5
X	0.54
Range	-

Description

"Nike 1" inspectable dripper 4 Lt/h

Comment

DESCRIPTION:

Button dripper, composed of a labyrinth created on the two sides of a cylindrical insert, placed in an easy-to-disassemble shell for facilitating any necessary cleaning. During disassembly, the insert remains in its seat and light lateral pressure is sufficient to remove it, therefore minimising the risk of accidentally losing it, even when disassembling during the irrigation cycle. It is particularly easy to take apart thanks to the different kinds of materials used to manufacture it.

ADVICE:

Use flexible small pipe (art. 9130 Ø 3.5x6) / Recommended hole for assembling: Ø 3.6

Ok

Choose the standard emitter Nike 1 of the brand Plast Project, the nominal flow rate of 4 [liter/hour] (1.06 [US gph], 0.880 [UK gph]). Selecting it and clicking on properties, the characteristics of the element will be shown.

Pipes data

Insert main, secondary and submain pipes data

Pipes

☒ Diameters automatic calculation procedure

Suggest Diameters

Diameters

Secondary pipe 48.00 [mm]

Submain 44.00 [mm]

Lateral 12.00 [mm]

Database **Database** **Database**

☐ Diameters manual insert

Secondary pipe

Diameter 200,000 [mm]

Submain

Diameter 100,000 [mm]

Lateral

Diameter 20,000 [mm]

range of diameters (internal) to be searched. Once assigned the item, it will appear a green check next to the "Database" button to indicate that the selection was successful. Repeat this for the 3 types of pipelines choosing: secondary pipe Plast Project PEAD PN4 DN50, submain Camillini Idrolene Resine PEBD PN4 DN40, and laterals Netafim PEBD PN4 DN16. The information given on the wizard window will be updated to actual internal diameters of selected commercial products.

Once you click on "Next" will appear the last wizard window with a summary of all the data entered so far. You can go back and edit, or click "Finish" to confirm.

Summary

Summary of input data

Sector No. 1 Export as rtf

1 - NETWORK TYPE:
Network type= Classic

2 - SOURCES AND PIPES DATA
SOURCE
User source pressure= 1 [bar]
User source discharge= 10 [m³/h]
MAIN PIPE
Secondary pipe diameter= 44 [mm]
Secondary pipe length= 2 [m]
SUBMAIN
Submain pipe diameter= 44 [mm]
Submain pipe length= 48 [m]
Submain nodes total number= 33

3 - EMITTER AND LATERALS DATA
EMITTERS
Emitter type= Online
K= 1.5 [l/(h·m^{0.5})]
x= 0.54
Emitters spacing= 1 [m]
Total number of emitters= 2244
LATERALS
Laterals distribution= Distribute laterals equally
Number of rows= 33
Number of laterals per row= 1
Plants' row spacing= 1.5 [m]
Lateral diameter= 12 [mm]
Length: 68 [m] From Nr. Lateral: 1 To Nr. Lateral: 1
Length: 68 [m] From Nr. Lateral: 2 To Nr. Lateral: 2
Length: 68 [m] From Nr. Lateral: 3 To Nr. Lateral: 3
Length: 68 [m] From Nr. Lateral: 4 To Nr. Lateral: 4
Length: 68 [m] From Nr. Lateral: 5 To Nr. Lateral: 5
Length: 68 [m] From Nr. Lateral: 6 To Nr. Lateral: 6
Length: 68 [m] From Nr. Lateral: 7 To Nr. Lateral: 7
Length: 68 [m] From Nr. Lateral: 8 To Nr. Lateral: 8
Length: 68 [m] From Nr. Lateral: 9 To Nr. Lateral: 9
Length: 68 [m] From Nr. Lateral: 10 To Nr. Lateral: 10
Length: 68 [m] From Nr. Lateral: 11 To Nr. Lateral: 11
Length: 68 [m] From Nr. Lateral: 12 To Nr. Lateral: 12
Length: 68 [m] From Nr. Lateral: 13 To Nr. Lateral: 13
Length: 68 [m] From Nr. Lateral: 14 To Nr. Lateral: 14
Length: 68 [m] From Nr. Lateral: 15 To Nr. Lateral: 15

Once you passed to the next wizard page you can indicate the diameters of the pipes in automatic or manual mode. In case of automatic procedure, click on "Suggest Diameters" so the software will suggest the diameters to be adopted for all pipes: (in the example 48 [mm] that is to say 1" 1/2 for secondary pipe, 36 [mm] that is to say 1" 1/8 for submain and 12 [mm] that is to say 3/8" for laterals): the values are given related to the **internal diameters**, and the pipes will remain generic if not specified as commercial products selected from the database. Clicking the "Database" button next to the various pipelines, you can specify the model in the windows of the query where it is already pre-set a

Search item

Search criteria

Brand Plast Project

Typology

Code Model

Nom.Diam. From 0,00 To 0,00 [mm] ☐ Single searching

Int.Diam. From 40,80 To 55,20 [mm] ☐ Single searching

Max pressure From 0,00 To 0,00 [bar] ☐ Single searching

Nominal pressure From 0,00 To 0,00 [bar] ☐ Single searching

Price From 0,00 To 0,00 [€]

Search

Search results

Brand	Code	Model	Typology	Nom.Diam.	Int.Diam.	Nominal pressure	Max pressure	Price
Plast Project	TRIPL050042	PEAD PN4 DN50	PEAD	50	44	4	6	1.51
Plast Project	TRIPL063042	PEAD PN4 DN63	PEAD	63	55.4	4	6	2.37
Plast Project	PELAB05004100	PEAD PN4 DN50	PEAD	50	44	4	6	1.5
Plast Project	PELAB06304100	PEAD PN4 DN63	PEAD	63	55.4	4	6	2.35
Plast Project	PELAB06306100	PEAD PN6 DN50	PEAD	50	41.6	6	8	2.08
Plast Project	PELAB06306100	PEAD PN6 DN63	PEAD	63	52.6	6	8	3.29
Plast Project	PELAB07310100	PEAD PN10 DN63	PEAD	63	46.4	10	12.5	4.9
Plast Project	PELAB07310100	PEAD PN10 DN75	PEAD	75	55	10	12.5	7.1
Plast Project	PM-S1	LAYFLAT PM-S1	PEAD		52	6	19	1.8
Plast Project	PM-N1	LAYFLAT PM-N1	PEAD		52	8	24	2.3

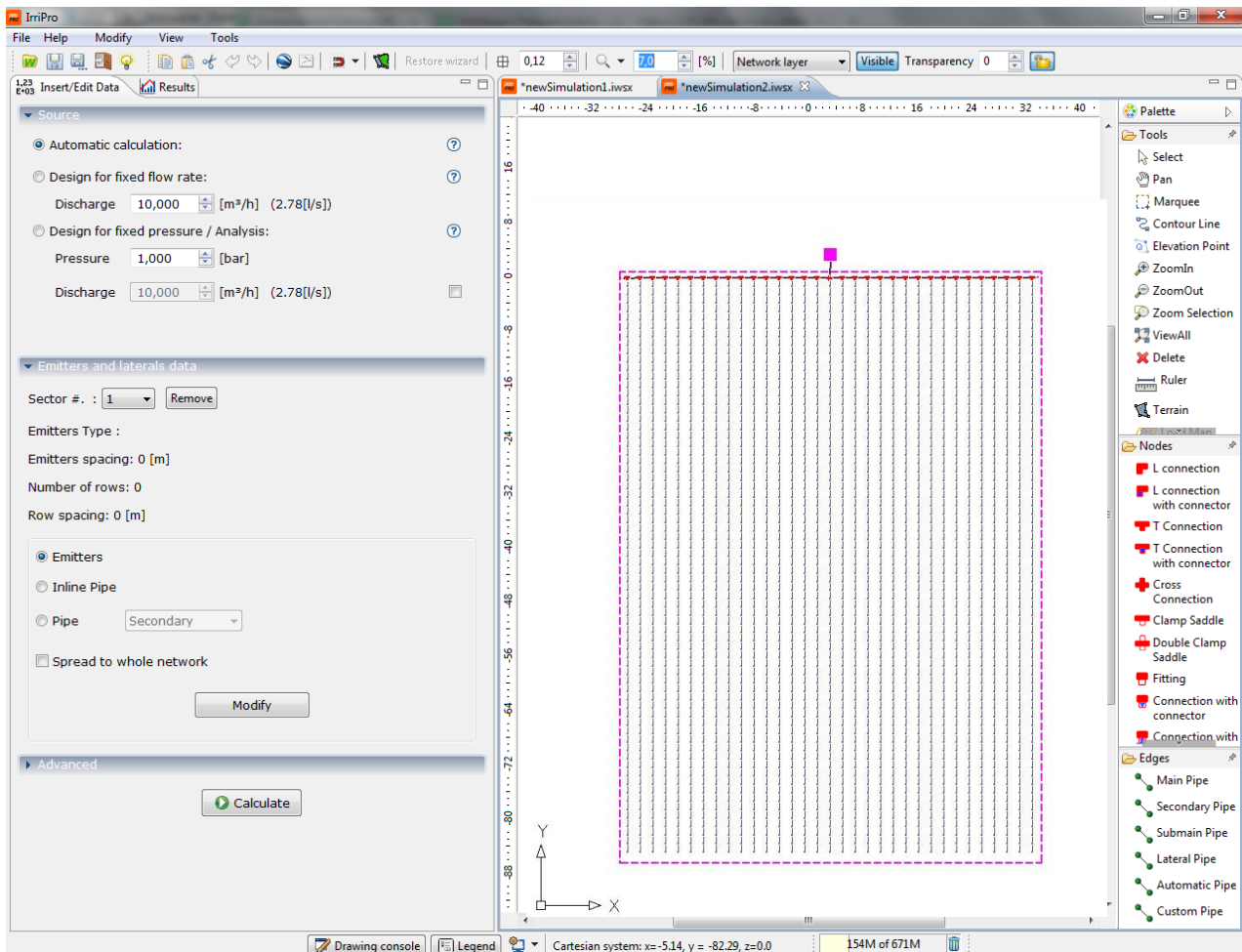
Number of items found: 10

Ok Cancel property

Completing the wizard using the "Finish" button, it will no longer be possible to go back and change it. Then a window will appear to show the degree of completion of the drawing that, at the end of the process, will appear in the work area.

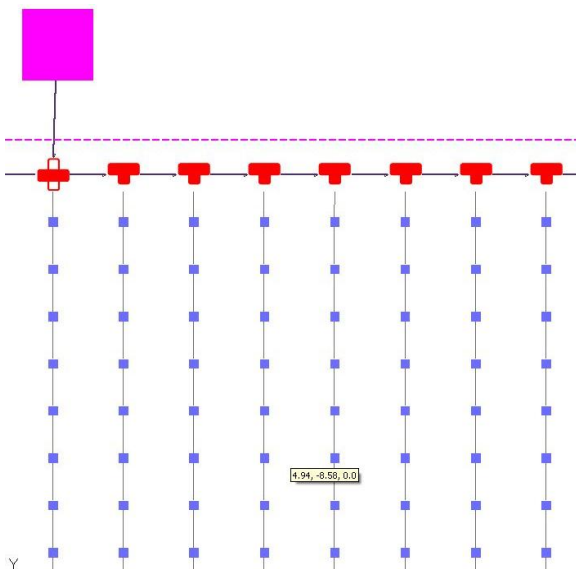
26/05/2015 19:46:14 - START CREATING SECTOR No: 1
26/05/2015 19:46:14 - Secondary pipe created
26/05/2015 19:46:14 - Left submain created
26/05/2015 19:46:15 - Right submain created
26/05/2015 19:46:15 - Start creating left laterals

Building network...

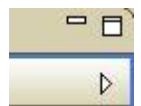


In addition to the plant already designed within the work area you will find:

- On the left, the view **"insert/edit data"** through which you change the type of calculation, pipelines and emitters by selecting the tipology and the sector
- On the right the **Palette** that is a list of commands available for zooming, measuring, moving and rotating, inserting nodes and connections, adding pipelines for each type
- Below the **legend** (for color of the pipeline, and icon of the valves) and the **"Drawing console"** for drawing and moving operations on Cartesian or polar coordinates
- At the top, in addition to the pull-down menu, you find the functions open wizard (a new project), save, copy, cut, paste, redo, snap, grid, zoom, layer management, etc.

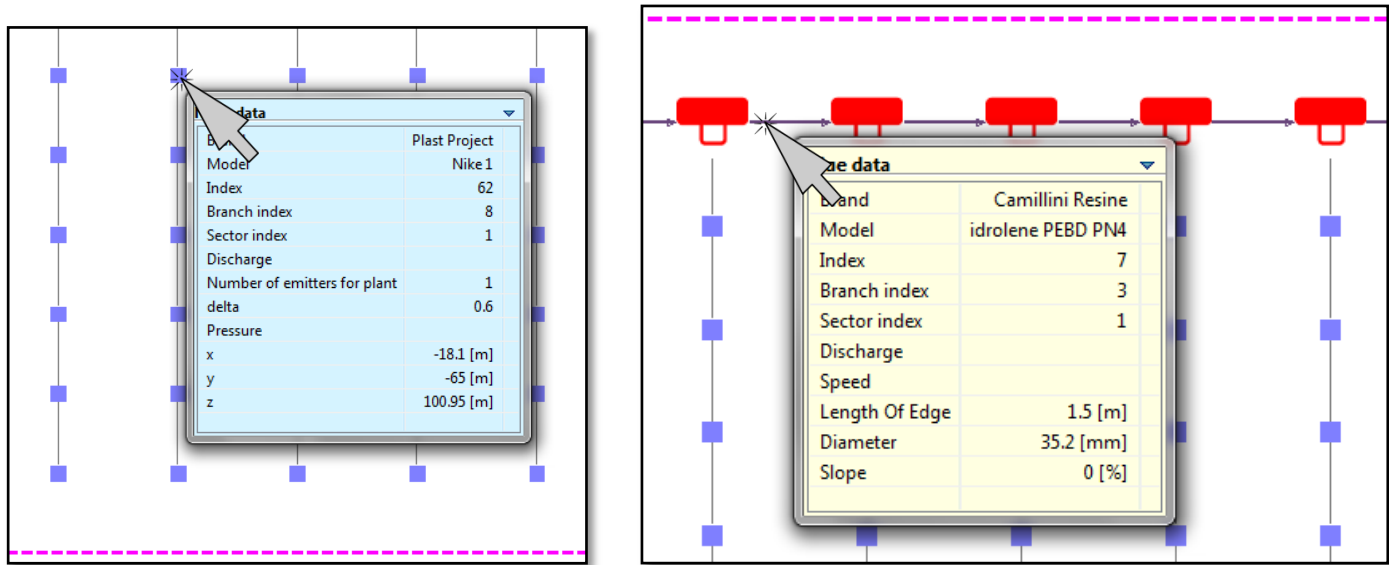


Each command will remain active until the use of a new command or pressing the ESC key from the keyboard. Each portion of the work area can be expanded or minimized with the controls at the top right.



Perform the following operations in succession: **zoom to 10%**, **move the view with the button PAN** and **perform a zoom** **Zoom Selezione** selection upon an area at the right of the submain. The items (like fittings, regulators, pipelines) that have been automatically inserted in the system (as in the illustration) will be shown. Moving the mouse close to a node (eg, an emitter) or to one side (for example a pipe section of submain), it will be shown the relative Tooltip.

This function allows you to evaluate the data entered and the values of the hydraulics for each network element. In addition to reporting the brand, model and index of the element, in the tooltip are reported pressures, flow rate and speed (when already made the calculation).



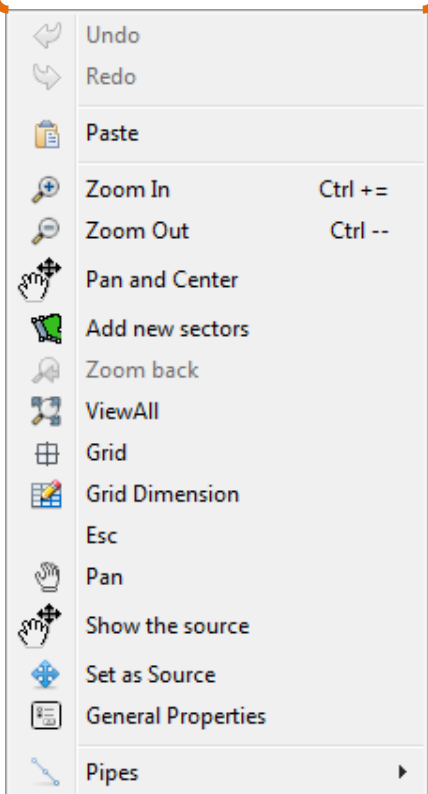
All elements (except the source) after being selected can be deleted (with the keyboard Delete key). All elements can be moved (by dragging the mouse in any part of the screen) or added (by selecting from Palette the node type of pipe to be added).

Remember the rule that in the draw or add one or more types of pipelines, respect the following order: main pipe → secondary pipe → submain → lateral. It is not possible to connect 2 elements or 2 groups of lower order elements into a higher order: in other words the upstream node must be of equal or higher order than that of valley otherwise the connection side will not be drawn and will appear a error message.

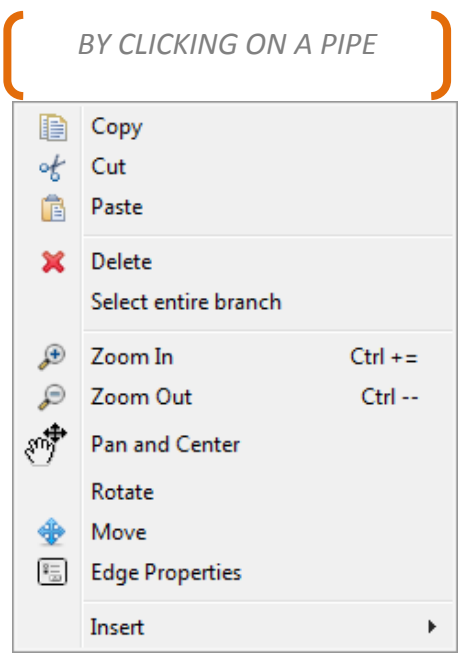
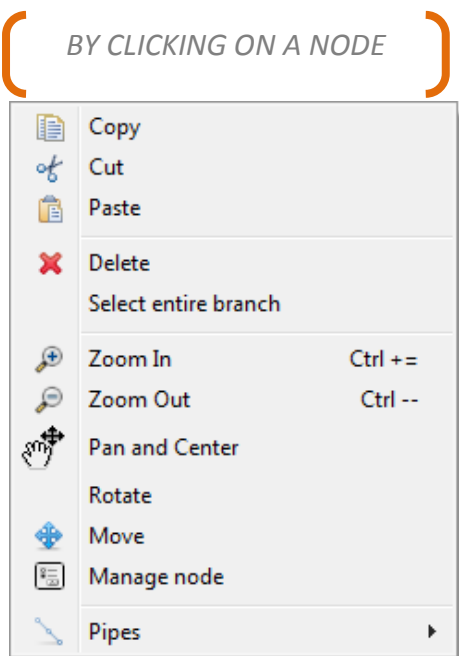
The elements not connected to the source (called floats) are not powered and therefore are excluded from the hydraulic calculation. These elements have the index value of the branch and sector equal to -1 in the tooltip.

It is possible to *go back to the overall view through the command Palette view*

BY CLICKING ON EMPTY AREA all ViewAll



The commands can also be called from contextual menus (depending on the selected item) and are shown by right-clicking with the mouse.



Among the available commands, the insertion of pipelines for the nodes, or of nodes for the pipelines and opening the element properties that can be modified.

Node Properties

Type: Lateral Pipe
 Brand: Plast Project
 Model: Nike 1
 More details ...

X: 11.90000 [m]
 Y: -5.00000 [m]
 Z: 100.05 [m]

Spread to: Current selection

Node type: Emitter
 Pressure: [bar]
 Discharge: [l/h]
 Angle of coverage: 0,1 [°]

Ok Cancel

Clicking on an emitter

You can see the features with "more details", or change brand and model of the emitter by searching from the database with "Search." Finally change the element type using the dropdown menu.

Edge Properties

Type: submain pipe
 Brand: Camillini Resine
 Model: idrolene PEBD P
 Edit Properties

Slope: 0.00 [%]
 Length: 1.5000 [m]
 Diameter: 35.200 [mm]

Ok Cancel

Clicking on a pipe

The characteristics of the pipeline will be displayed, and it will be possible to change them: by clicking on "Edit Properties" you can choose a new product in the database.

Even the slope and length can be changed: in the case of generic product (not chosen by database) also the diameter can be changed.

Clicking on an item other than an emitter (connections, fittings, screens, etc.) it will open a window where you can:

Node Properties

Type: Submain Pipe
 Brand: Plast Project
 Model: Generic
 More details ...

X: 13.40000 [m]
 Y: -2.00000 [m]
 Z: 100.00 [m]

Node type: Clamp Saddle
 Pressure: [bar]
 Discharge: [l/h]

Connection not available
 Diameter not available

Junction 1 Junction 2 Junction 3 Junction 4

Compression PN4
 Diameter: 40 [mm]

Spread to: Current selection

Ok Cancel

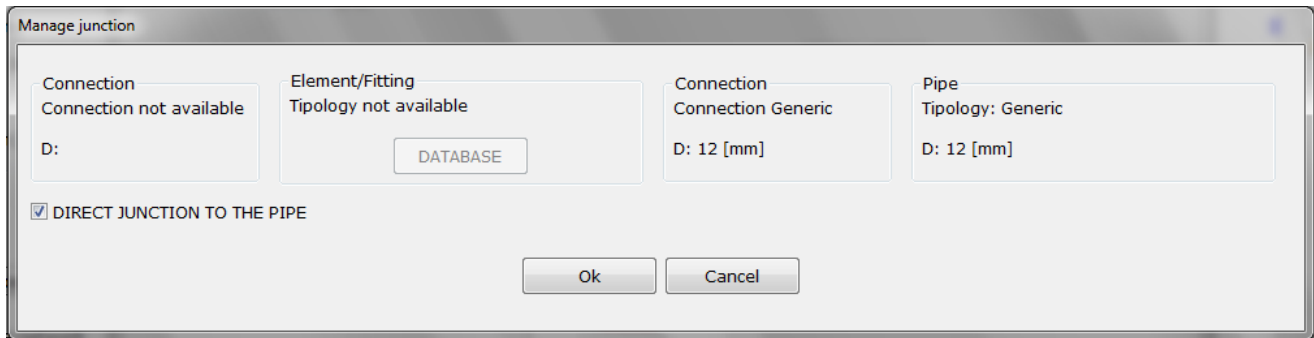
- See the properties of the element

- Change the type, brand and model

- Manage connections between the fitting and the pipes

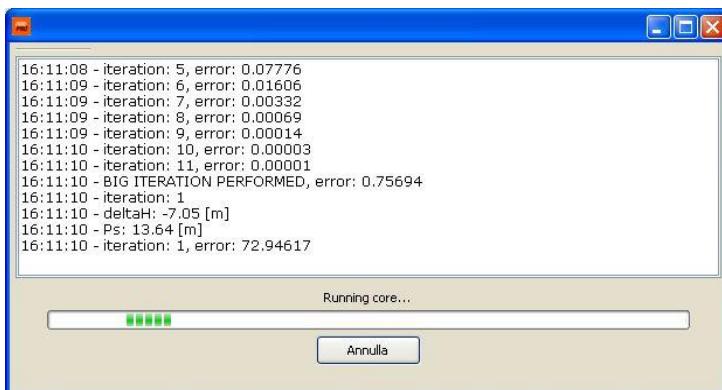
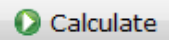
- Choose a new product from the database

Clicking on one of the connection-related buttons, it will be possible to intervene on the junction between the central element (in the case of example a T-fitting) and the pipe for such ticket. The window on which to make these operations is as follows:



If you do not enter any element/coupling, the central element is considered directly linked to the pipe

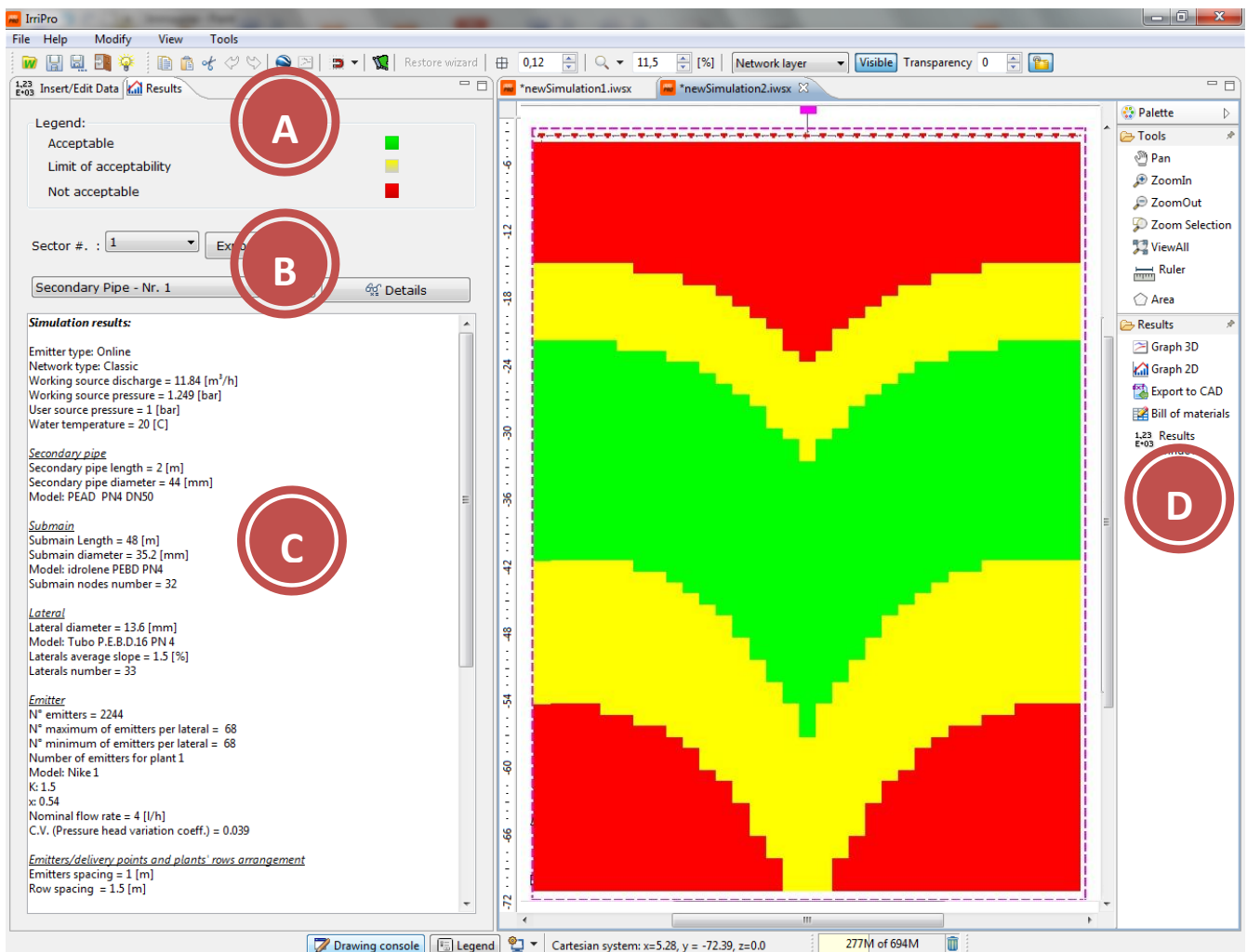
Once you finish possible changes to the elements of the system *you make the hydraulic analysis using the command "Calculate"* placed at the bottom left of the workspace.



Once the calculation is started, this window appears to indicate the processing work. A special algorithm will calculate, with maximum precision, the hydraulic quantities in each point of the system. There is currently no software tool that can perform such a rigorous calculation determining the pressure, flow rate, speed, etc. to which each element is subjected, and consequently the plant behavior. In this calculation it is considered the hydraulic and geometric characteristics of each element,

arrangement and slope, continuous and local losses of load, speed.

Finishing the calculation *the view will change from "Insert/edit data" to "Results"*.



In the work area there is the thematic map with different colors represented by the legend (A) for a qualitative assessment: red indicates a condition of non-acceptability which must be corrected if too extended on the system. It indicates an excessively high or low value of the pressures (over a range of variation of 20%) and then the flow (over a range of 10% of variation) with respect to a mean value or nominal.

Nr.	H _{pn} [m]	Q _n [l/h]
(0, 11, 1)	10.952	5.46
(1, 11, 1)	10.889	5.45
(2, 11, 1)	10.827	5.43
(3, 11, 1)	10.767	5.41
(4, 11, 1)	10.709	5.40
(5, 11, 1)	10.653	5.38
(6, 11, 1)	10.598	5.37
(7, 11, 1)	10.545	5.35
(8, 11, 1)	10.494	5.34
(9, 11, 1)	10.444	5.32
(10, 11, 1)	10.396	5.31
(11, 11, 1)	10.349	5.30
(12, 11, 1)	10.304	5.29
(13, 11, 1)	10.260	5.27
(14, 11, 1)	10.218	5.26

The goal of a project is to get a plant with the highest emission uniformity. Indicating on the drop down menu (B) the pipe to evaluate and clicking on "Details" a numerical table with all the pressure and flow rate values will be displayed. Except IrriPro no software now allows to know with such precision these values. To go back on the work are click on "Thematic Map".

In the area (C) the report referred to the sector indicated in the drop-down menu at the top. In this

document exportable ("Export button as RTF") are indicated:

- the values of pressure and flow to the source calculated or set by the user
- The characteristics, quantities, lengths and slopes of pipelines
- The characteristics and quantities of the emitters
- results of the hydraulic analysis: coefficients of uniformity, efficiency, maximum/minimum/average flow rate, maximum/minimum/average pressure, speed, surface area, distribution intensity and total pressure loss.

Nel caso in esame (report risultati):

RESULTS

Uniformity coefficient (WU)= 95.53 [%]
Efficiency= 79.88 [%]
Volume wasted in an hour= 2.44 [m³]
Uniformity coefficient (Keller e Karmeli)= 85.7 [%]

Emitter

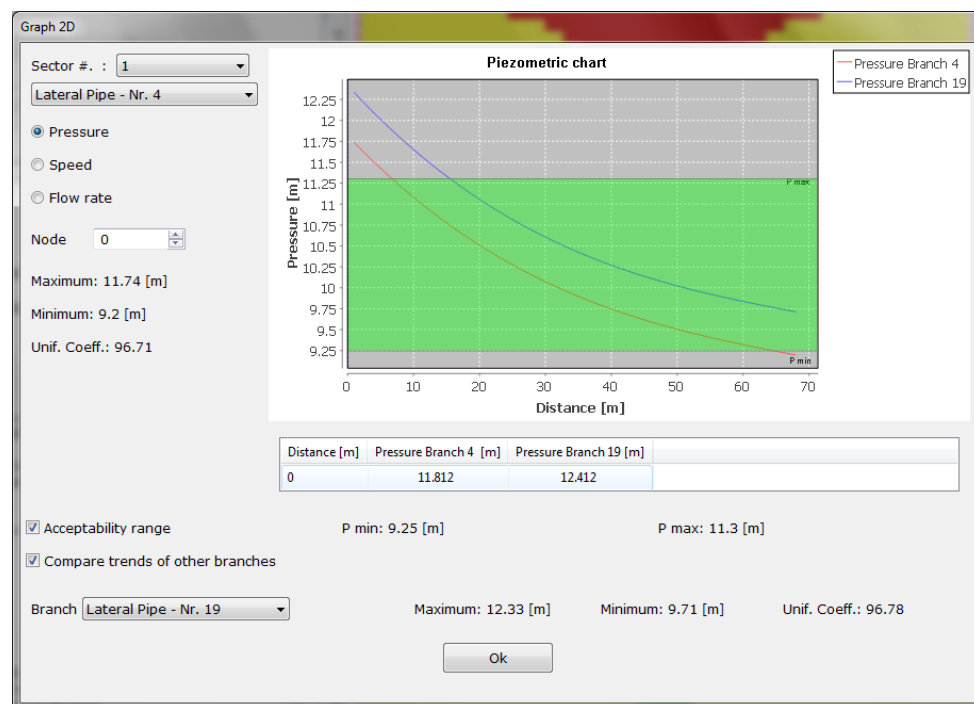
Maximum flow rate = 6.13 [l/h]
Minimum flow rate = 4.97 [l/h]
Average flow rate = 5.41 [l/h]

Maximum speed = 0.721 [m/s]
Minimum speed = 0.01 [m/s]
Average speed = 0.347 [m/s]

Maximum pressure head = 13.538 [m] (1.326 [bar])
Minimum pressure head = 9.196 [m] (0.901 [bar])
Average pressure head = 10.796 [m] (1.058 [bar])

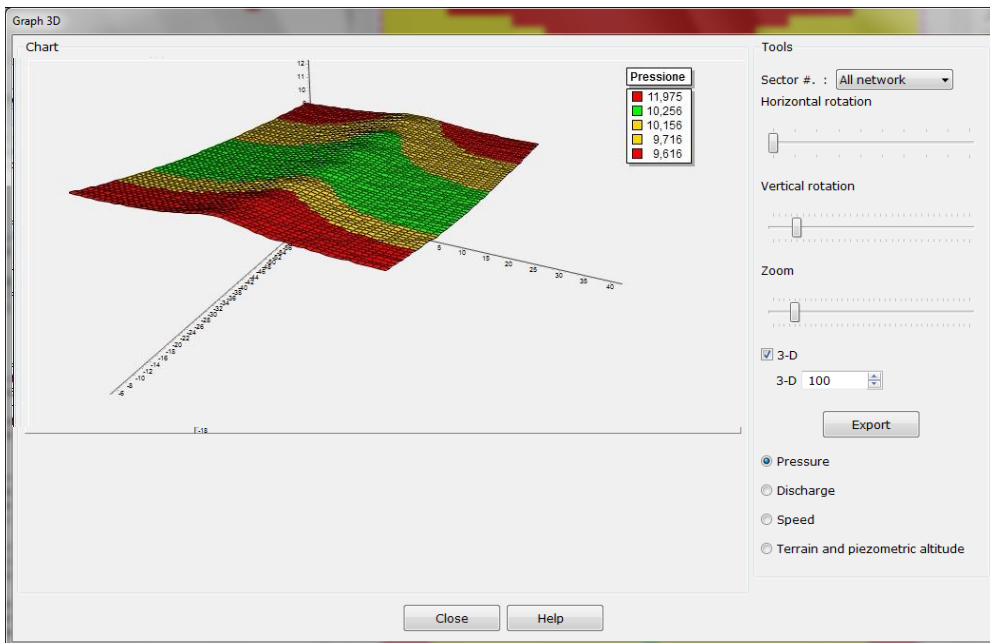
With these data it will be possible to numerically evaluate the values of uniformity (which should be increased beyond the value of 90%) and flow rate and pressure (to a minimum possible variation of the device and closest to PN).

On the right side (D) of the workspace controls are available to change zoom, display and perform the measuring operations. In the lower part are contained a tools for graphical representation and document processing.



It is possible to visualize the 2D graphic with the trend of the pressures, the flow rates (delivered) and of the speed for each type of pipe. In this case are compared a lateral placed near the left edge of the ground (No.4) with a central lateral (No.19): The green area indicates the range of acceptable pressures. Elements that are upstream of the lateral have values beyond the limit. The 2D graphical tool is useful for

evaluating the performance of the hydraulic characteristics for each pipeline and compare a pipe with another.



The 3D graphic yields a representation in the space of the various hydraulics. With a quick glance you can see that the system has too much pressure in the part closest to supply of the sector. The "Roof pitched" diagram shows how the pressure is higher in the middle and lower, on average, in emitters placed at the side.

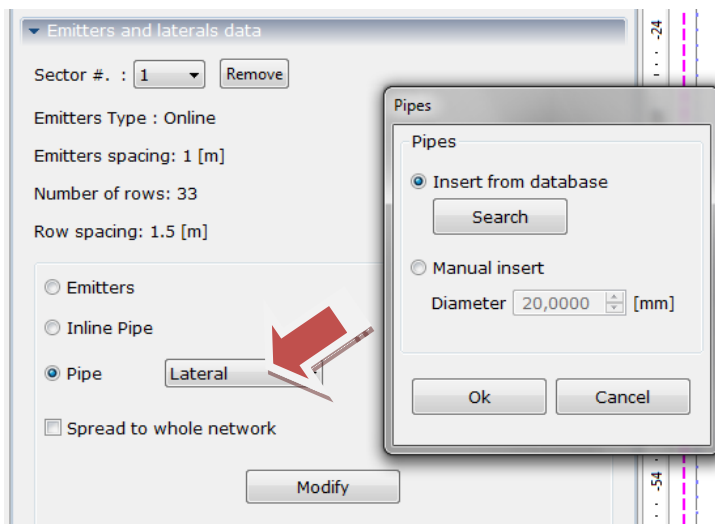
You can change the view and zoom intervening with the mouse or the cursors on the

right.

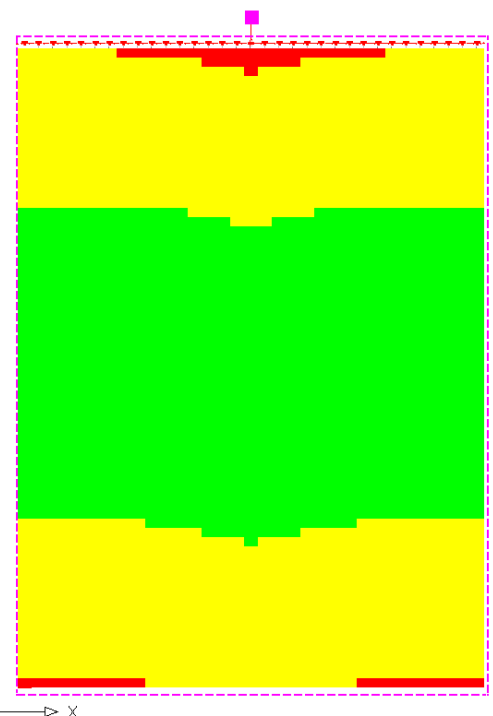
To receive a comprehensive and concise analysis on system conditions according to various evaluation criteria of pressures, flow and speed you can click on "Results window". In this case it is **not acceptable** for one of the criteria.

Results		
NOT ACCEPTABLE		
Indicator	Result	Cause
Uniformity Coefficient (WU)	ACCEPTABLE	UC Wu \geq 90%
Uniformity Coefficient (KARMELI)	NOT ACCEPTABLE	UC Karmeli $<$ 90%
Pressure Range	NOT ACCEPTABLE	Network pressure falls outside the range [Paverage \pm 10%]
Velocity	ACCEPTABLE	The velocity is within the range [0.2, 7.0] [m/s]

To improve the results of this project it is necessary to change some system components. For example, to change the diameter of the laterals you need to go back in the view "Insert / edit data" (by clicking on the tab), select the "pipe" in the bottom left, click on "Edit" and then from the dedicated window search in the



archive a new model or indicate a different internal diameter directly with the "Manual input" command. For example, to change the diameter of the lateral replacing the model Netafim PEBD PN4 DN16 with that PN4 DN32, replace the submain pipeline and secondary Camillini Idrolene Resine PEBD PN4 DN40 with model PEBD PN4 DN63 and repeat the calculation. The result will be as in the image beside.



The project after the latest changes is acceptable (except for low speed values) as evidenced by the coloring of the thematic map (the small red portion is negligible) and on the visible outcome of the results window. The uniformity coefficient value also rose to 90.61%.

The achievement of high values of uniformity must be commensurate with the needs and the sensitivity of the crop to the variations of delivery: for example, in the case of low valuable crops, resistant to differences in flow rates, uniformity values (Keller and Karmeli) of 85% and a small red part of the thematic map (less than 10% of the surface) can be deemed acceptable. For delicate cultures, very sensitive to changes in delivery can be considered necessary to move beyond the 95% of uniformity with a thematic map with no parts in red. Remember that the yellow color indicates an area that did not pass the limits of pressure and flow rate required for proper uniformity.

When you complete all the necessary changes to make the design acceptable use the "Bill of Materials" function to process the document containing the list of materials needed for the system installation.

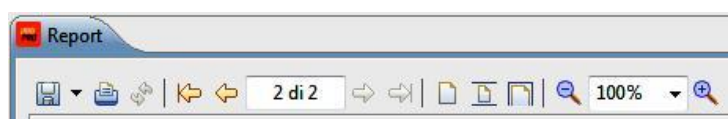
The document is divided into several sections (pipes, fittings and emitters / sprinklers), can contain multiple pages and in addition to the distinctive features of the listed items and quantities, shows the overall system price: This value considers only the price of the items listed in the database and not the generic ones. Generic means an element not assigned from the archive.

BILL OF MATERIAL											
07/04/2016 18.34.50											
powered by irriworks											
Pipes											
N.	Code	Brand	Model	Description	PN[bar]	DN / DInt.[mm]	Length [m]	QN[m ³ /h]	Spacing [m]	Number of coils/rods	Price[€]
1	PELAB05004100	Plast Project	PEAD PN4 DN50	Polyethylene pipes for irrigation PEAD PN4 DN50	4.0	50	2			1	150
2		Camillini Resine	idrolene PEBD PN4	Camillini Resine idrolene PEBD PN4	4.0	40	49.5			1	85
3		Netafim	Tubo P.E.B.D. 16 PN 4	Netafim Pipe P.E. B.D. 16 PN 4	4.0	16	2244			23	
Adapters											
N.	Code	Brand	Model	Description	Type	D1[mm]	D2[mm]	D3[mm]	D4[mm]	Number	Price[€]
1	Generic	Generic	Generic		Double Clamp	50	40	16	40	1	

IrrPro licensed to:

Pag. 1 / 2

From the console at the top with respect to the document, in addition to navigation and zoom functionalities, are available printing and exportation to various formats (pdf, xls, rtf, editable with MS Word and Excel).

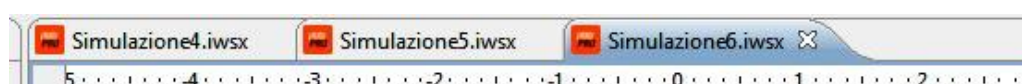


To go back on the work area, click on the "back" button on the bottom left.

The project will be saved with "save" or "save as..." in .iwsx format, with a visible button on top left of the program window. To work on a new project or open an existing file in a different editor, click the "Wizard" button (next to the save icon).



The program allows you to work with multiple editor so



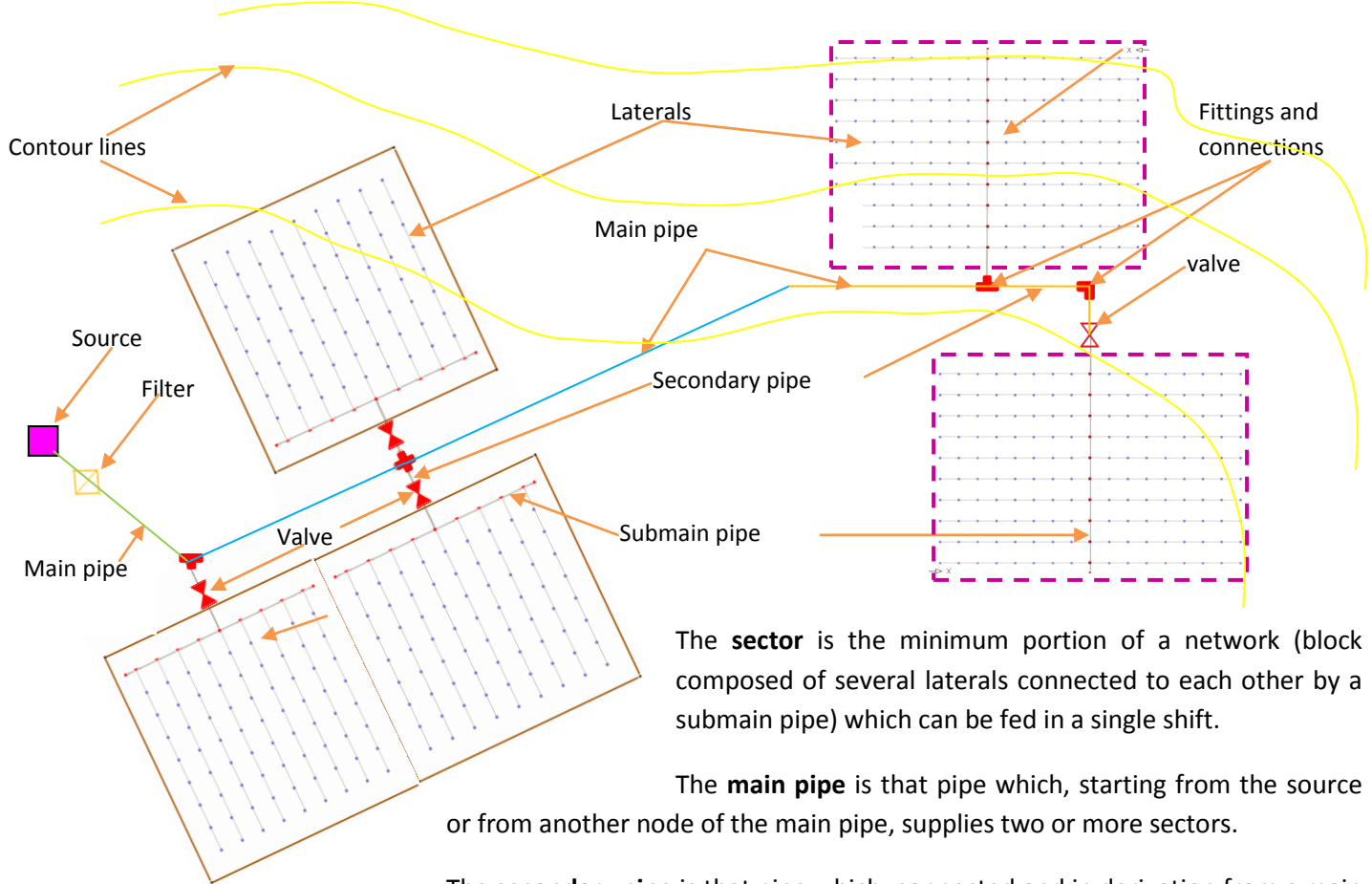
you can open multiple files, compare multiple projects and copy items from one project to another.

This and other projects are available [here](#), where you can download them already developed and make eventual changes.



multi-sector project with Google Maps

Scheme of a plant composed of several sectors connected to each other through the main pipe



The **sector** is the minimum portion of a network (block composed of several laterals connected to each other by a submain pipe) which can be fed in a single shift.

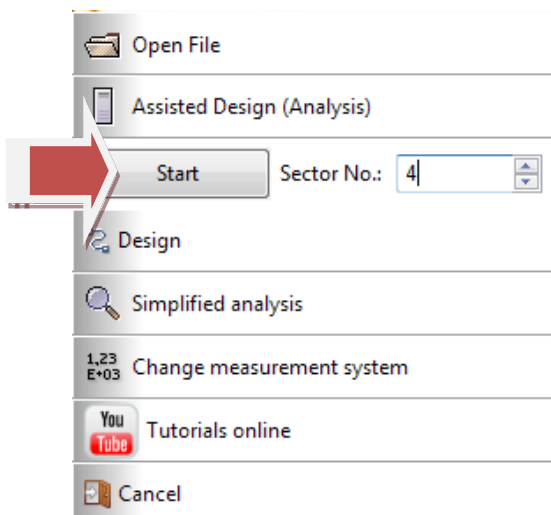
The **main pipe** is that pipe which, starting from the source or from another node of the main pipe, supplies two or more sectors.

The **secondary pipe** is that pipe which, connected and in derivation from a main pipe node, connects and supplies a single sector.

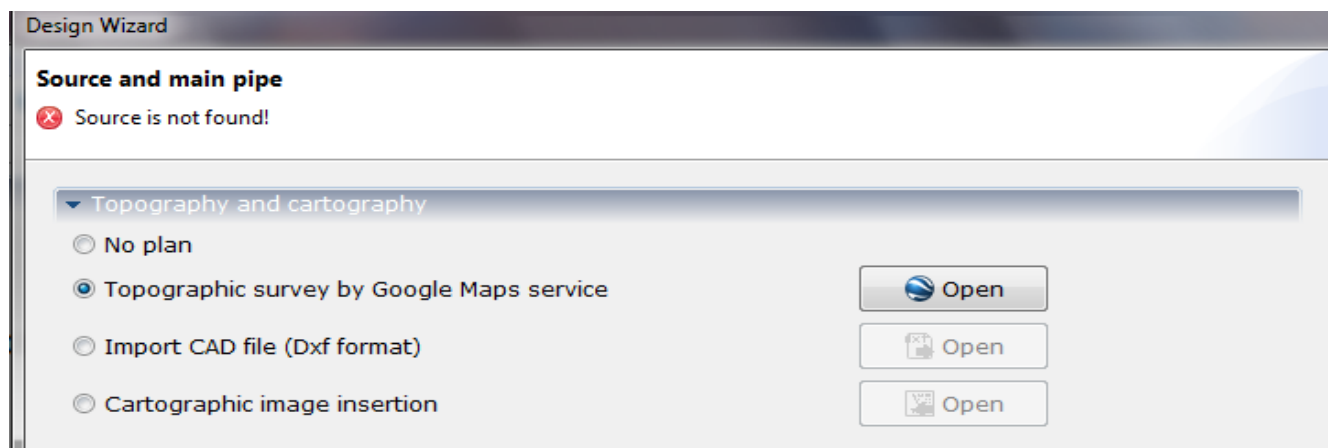
You shall now proceed with the design of a multi-sector system of about 6 Ha (12.8 acres) cultivated with arboretum, partly irrigated by drop and partly by rain according to a determined shift system with a flow rate available at the source of 16 [m³ / h] (ie 70.45 [US gpm] and 58.65 [gpm Uk]). Starting from the first window at the opening of the program (or by clicking on the "Wizard" icon) you choose the "Design (Assisted – recommended)" and

introduce a number of sectors equal to 4. This number is purely indicative and is used by the program to prepare the subsequent pages of the wizard in order to introduce all the data relating to the sectors initially declared. The number of sectors may be increased or decreased directly over the work area. Click on "Start" and expect the opening of the first wizard window. The windows of the wizard are very similar to the case of a single sector but differ for a part dedicated to the main pipe and another for connecting the sectors to the same pipe and define its characteristics.

You may move from one wizard window to the next (once the "Next" button becomes active), only after having completed the insertion of all the data needed to proceed. In the first window, for example, a message on top appears to indicate that the source has not yet been positioned and the main pipe was not drawn.

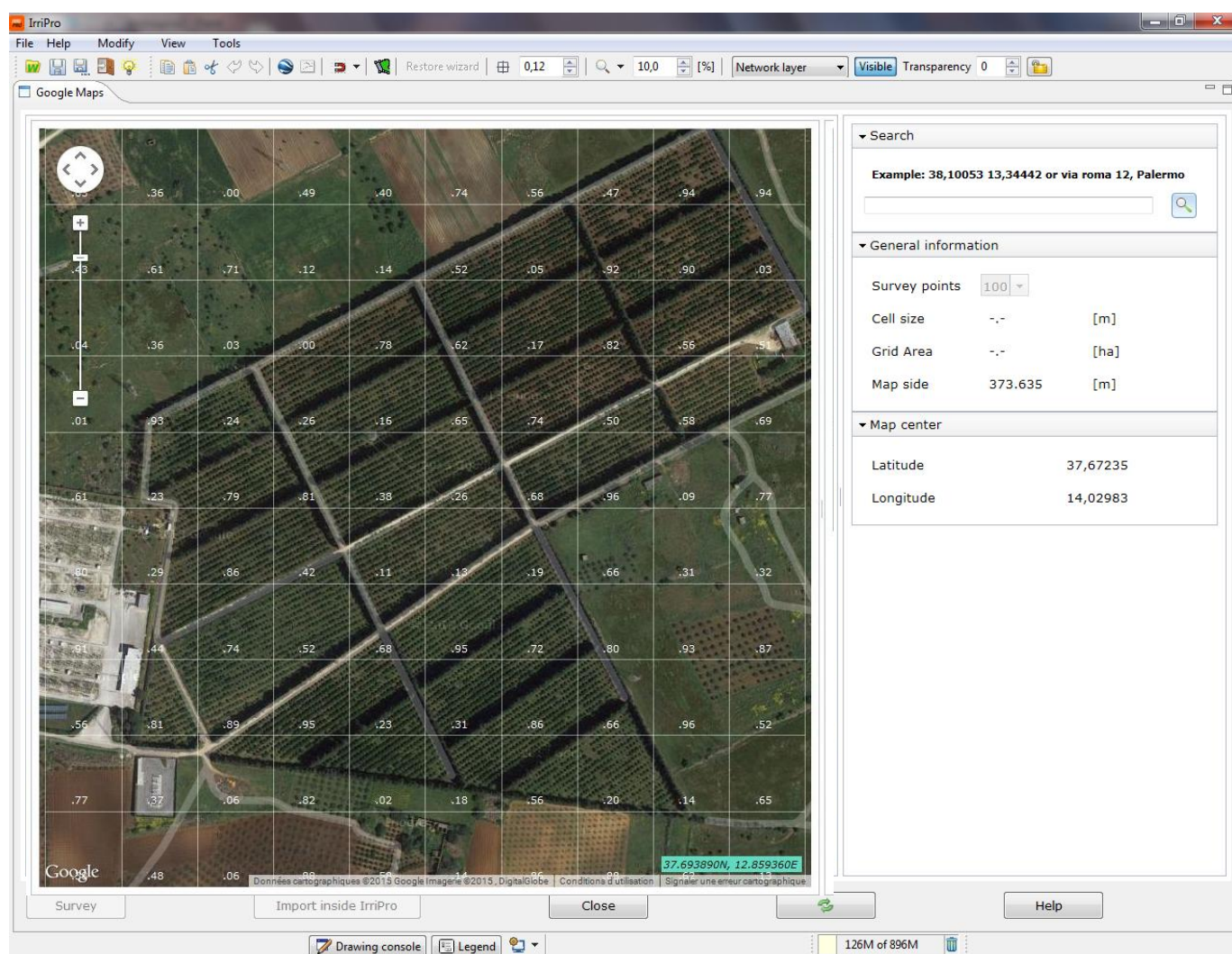


In the first box select "Topographic survey by Google Maps service".



The quality of GIS data extracted from the Google Maps service is of the same level or higher than the technical cartography at 1: 10,000 and then sufficiently reliable for the design of irrigation systems. If you feel you have a more accurate support, or if the survey area has undergone recent changes (earthworks, flattening the terrain, terraces, etc.) use the other two available import methods.

By clicking on "Open", a dedicated window will appear for navigation and for the survey of altimetric and planimetric data:

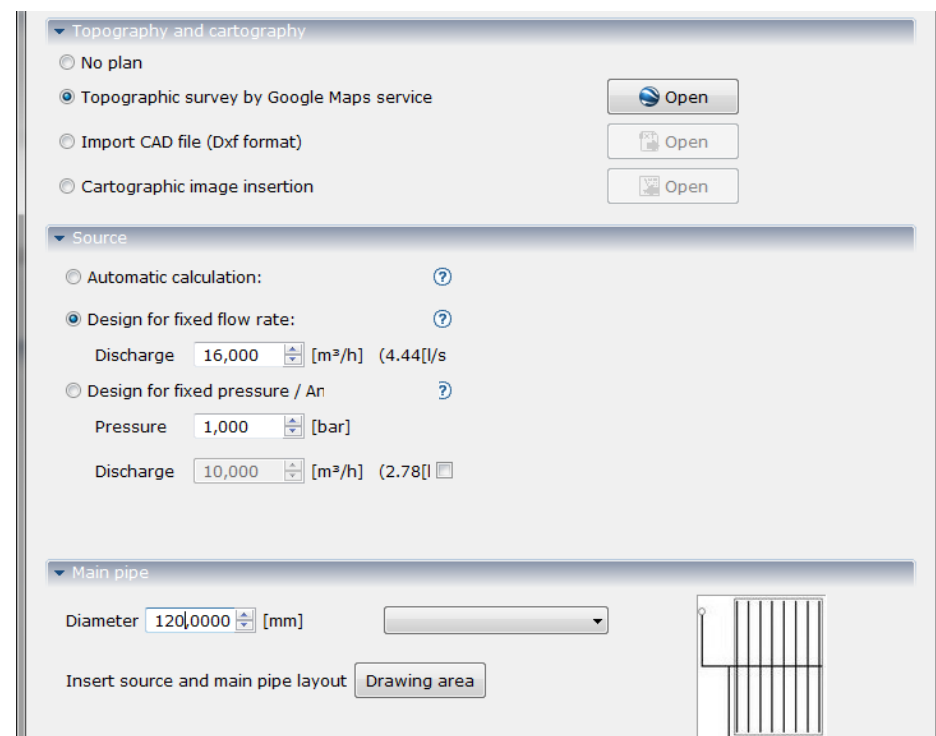


Locate the area to survey: in this example, use the coordinates **37.695940N, 12.858380E** and click on the search button. Indicate the number of points to be measured (25 to 2500): it is advisable to choose a value such as to obtain the "cell size", ie the distance between a detected point and the next, less than 40 meters. More numerous are the points and more accurate will be the survey (up to the maximum available quality from the Google service), more laborious the project management and bigger the file size. To carry out the survey *click on "Survey": wait until the*

end of the process (below the progress bar) until it becomes active the "Import inside IrriPro" button. In the case of a

satellite picture problem, click on "refresh" or on "Close" and then repeat the opening. The survey process can be repeated several times, identifying a new area and clicking again on the button "Survey". Once the process is finished click on "Import inside IrriPro": the 3D model of the terrain will be imported in the work area in order to allow the allocation of quotas and slopes to all parts of a plant.

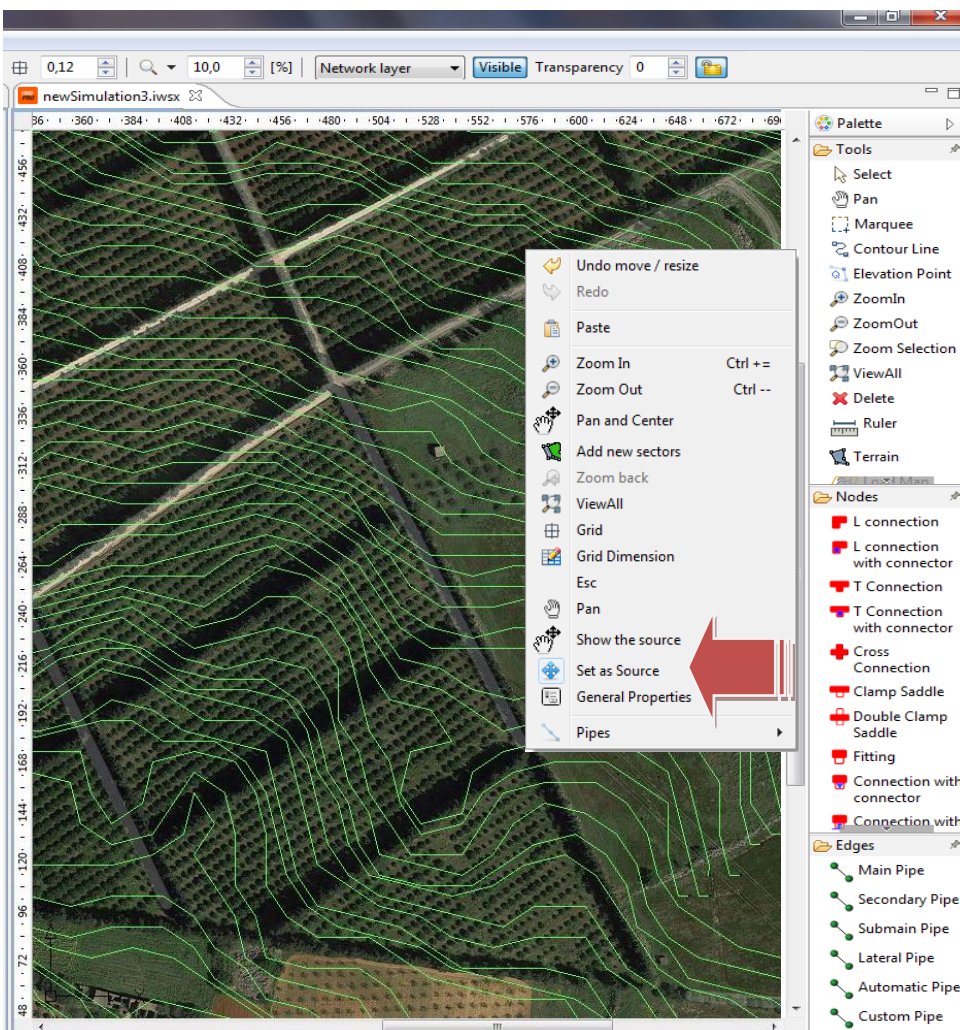
After the confirmation message "Import operation completed" the wizard window appears again: select in the source pane, the "Design for fixed flow rate" and



specify the value of $16 \text{ m}^3 / \text{h}$ (ie **70.45 [US gpm]** and **58.65 [Uk gpm]**). It is the case, for example, of a delivery point of a reclamation consortium with an assigned flow rate to each farm.

In the pane of the main pipe indicate a diameter of 120 mm (about 4"): this value can be changed later and for single stretch.

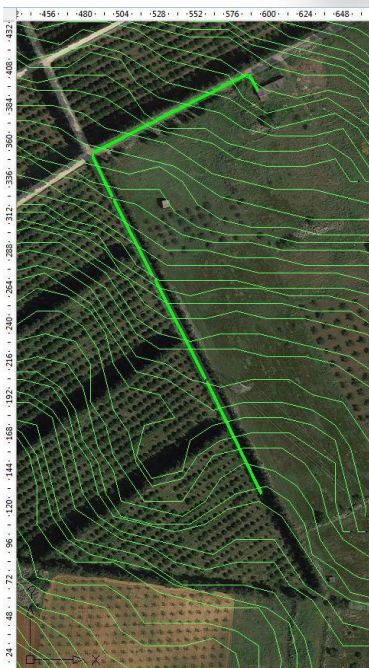
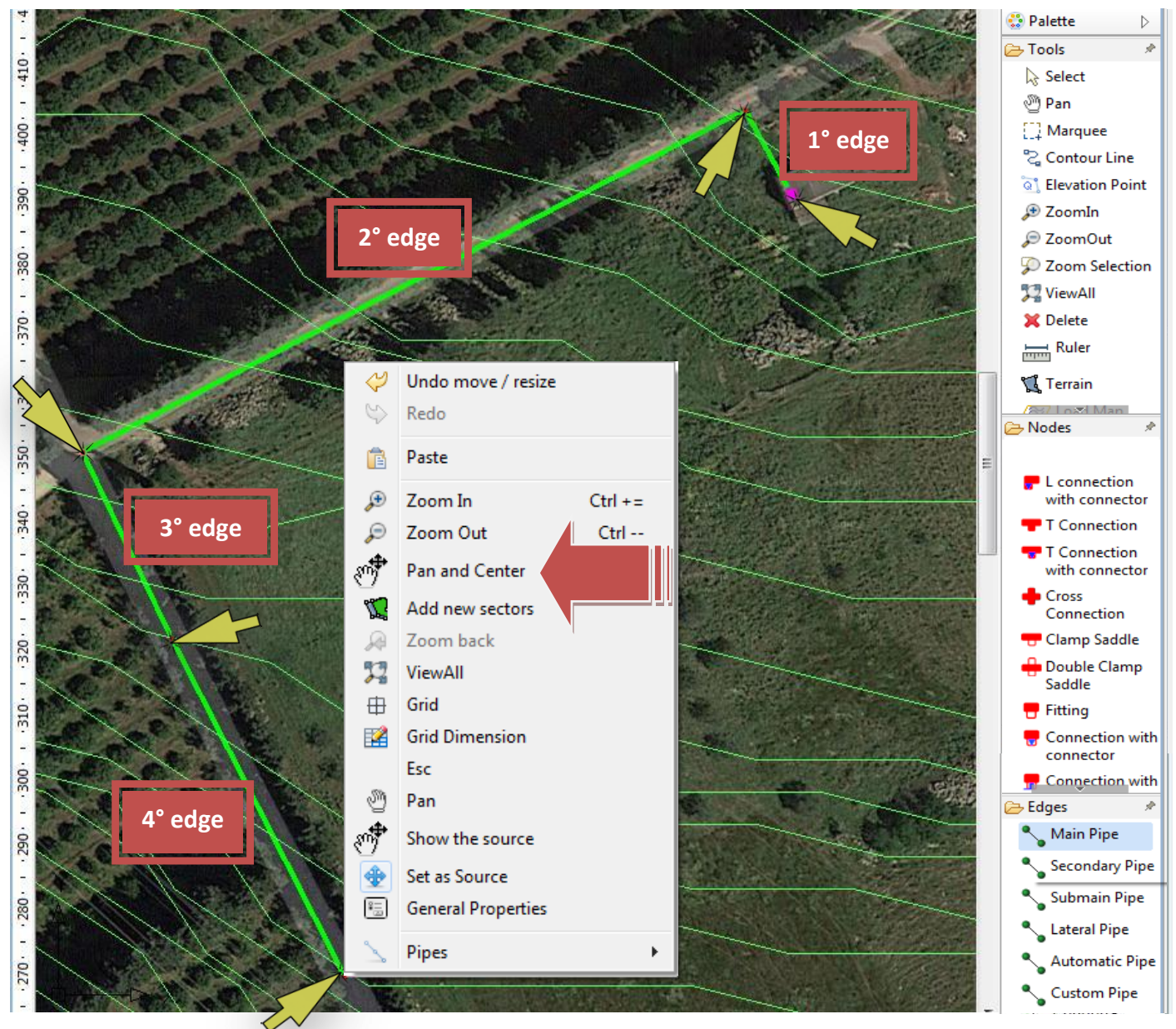
Click on "Drawing area." You will then be taken to the work area where you will indicate the source position. Use the zoom to 2% and move the picture with the PAN.



Then right click to open the context menu and select "Set as source".

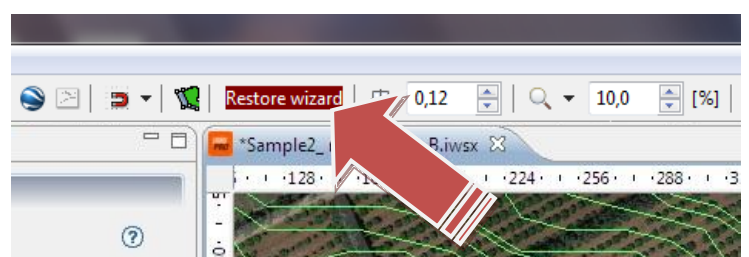
You will see a purple square that represents the source in correspondence to the position selected. Then we

proceed to trace the main pipe: Select this item at the bottom of the Palette and click, as the first node, on the source. *Proceed to trace as shown in the figure (with clicks in correspondence of the arrows).*

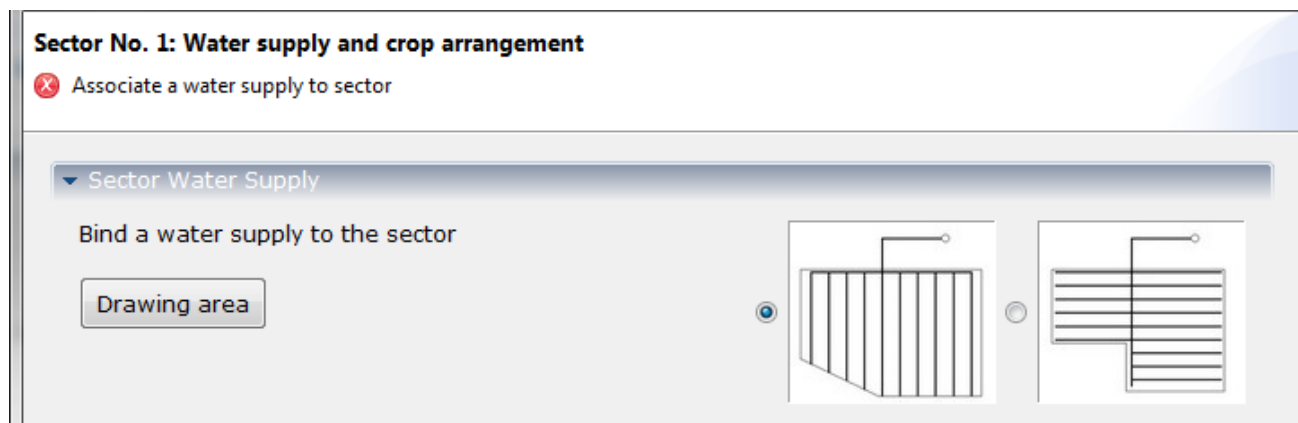


To move the display of the area (then continuing to draw) just right click and select "Pan and Center": the image will move and you can continue to trace the main pipe without interrupting the drawing process. Be sure of positioning the nodes of the pipeline at points where you want to lay the derivations to the various sectors that have yet to be drawn. The location of each node may be modified later and other nodes may be added.

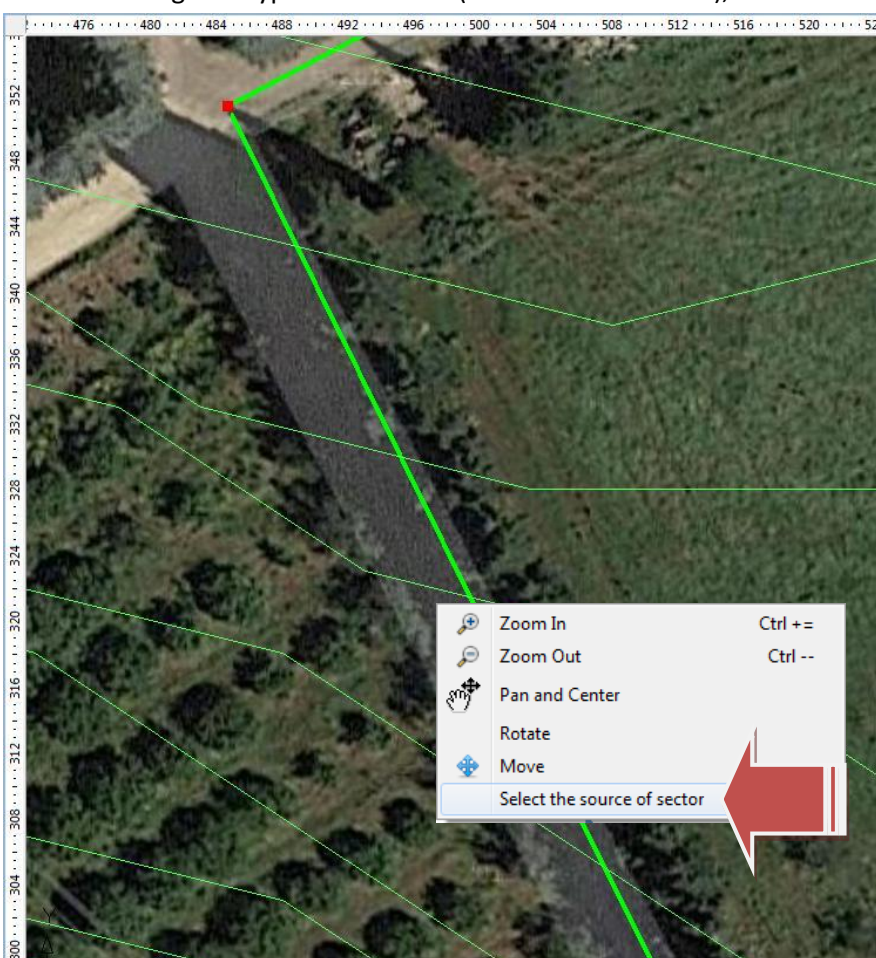
Finish the main pipe drawing with double-click on the last node or press the ESC key on the keyboard. Click on the "Restore wizard" button at the top of the screen to return to the wizard windows.



The "Next" button on the wizard becomes active and you can move on to the next window. At the top it is shown the sector N.1 (still to be drawn) and the request to associate a supply node to the sector.



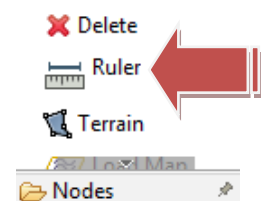
After selecting the type of network (classical in this case), click "Drawing area" to enter the editor. With "Zoom Selection" you will better see the node to which connect the first field, right click on the same node and then on "Select the source of the sector."



The node will be transformed from square to a T-shape to prepare the connection to a sector.



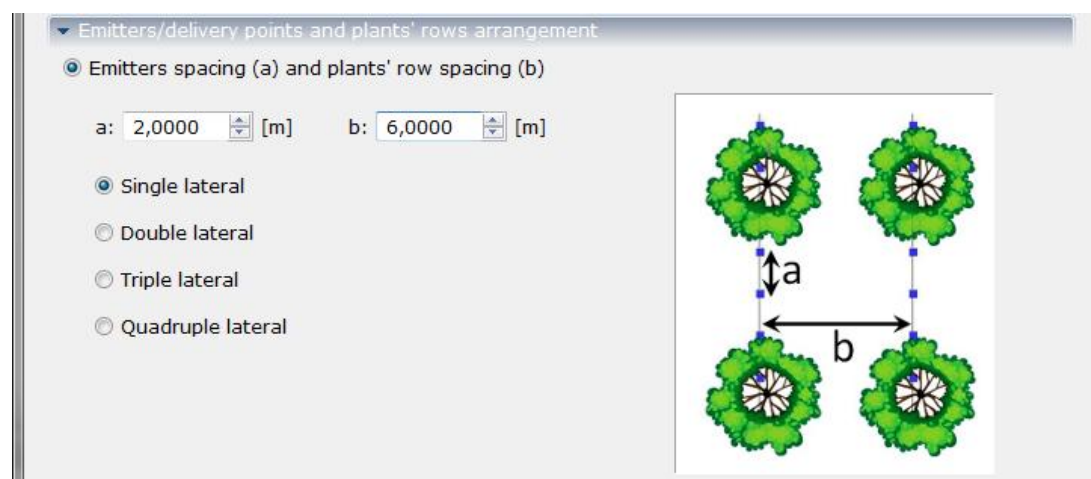
Measure with the ruler the distance between the trees (about 6 m ie 19,7ft).



Click on the "Restore wizard" button to return to complete the wizard.

Using drip emitters (not irrigating the entire surface but only along the rows, in correspondence of plants), in the box relative to the arrangement of emitters enter the value of 2 meters (ie 6,6ft) for the spacing "a"

between the emitters and the distance "b" of 6 meters (ie 19,7ft first measured) between the rows of trees.



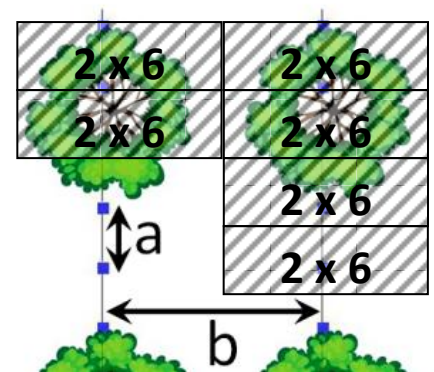
The choice of the type of emitter and the arrangement of the lateral must be made

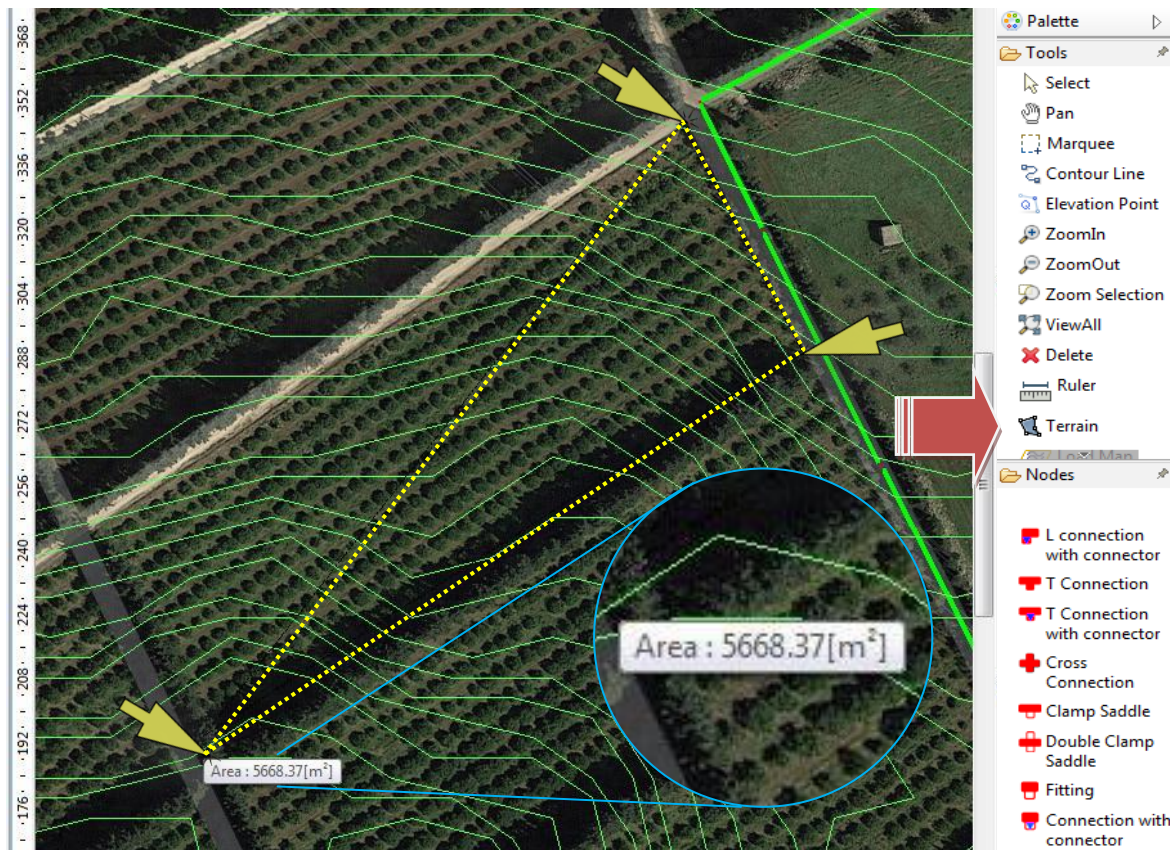
in function of the plant to be irrigated and soil, and are agronomic valuations at the user's discretion. Click the "Next" button on the wizard.

Once we moved to the window where you can enter the characteristics of the terrain select "generic sector shape"

Some preliminary considerations to determine the area of the sector

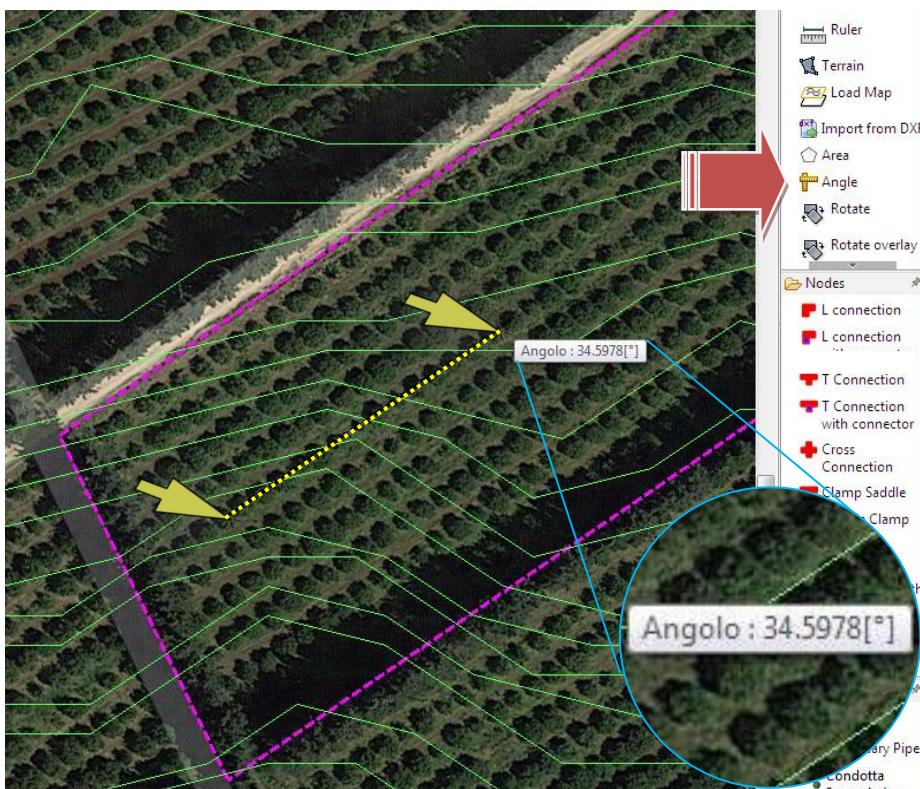
With a flow rate at the source of $16 \text{ m}^3 / \text{h}$ (ie **70.45 [US gpm]** and **58.65 [gpm Uk]**) and thinking of using an emitter with a flow rate of $8 \text{ L} / \text{h}$ (**2.11 [gph Us]**, **1.76 [gph Uk]**) we can provide about $16,000 \text{ L} / \text{h} / 8 = 2000$ emitters per shift. Since each emitter is placed every 2 meters (ie **6,6ft**, 'a' value) on the same lateral, and every 6 meters (ie **19,7ft**, 'b' value) between one row and the next, the surface which can be served in a single shift is equal to $2000 \times 6 \times 2 = 24000 \text{ m}^2$ (2.4 Ha equal to **5.9 Acre**), ie the number of emitters for the surface covered by each of them (2 x 6 meters). By dividing the area to be irrigated in sectors it is possible to feed with $16 \text{ m}^3/\text{h}$, and for each round, a sector of 2.4 Ha, or 2 sectors of 1.2 Ha (**2.9 acres**) or 4 sectors of 0, 6 Ha (**1.5 acres**) and so on. In other words, when we subdivide the farm area in sectors we try to obtain a single sector size equal to a submultiple of 2.4 ha, in order to organize the system with different shifts of irrigation. Starting from these considerations we enter the editor by clicking on "Drawing area".





Once inside the editor, select "terrain" and click on each point that represents a corner of your sector to be drawn. During the design will be displayed the size of the area at that time circumscribed by the polygon under construction. Just before placing the last vertex we try to get an area of

approximately 12,000 m² (1.2 Ha or 2.9 Acre). Once this size is reached, we will confirm the shape and size of the sector by clicking twice on the last vertex. The edge of the polygon just identified will have a fuchsia color dotted line.



The size of the surface can also be measured with the "Area" command available from Palette. If you wish to repeat the drawing of the sector, you can erase the border after you select it (or use the UNDO command) and repeat the procedure.

Now we need to measure the direction of the rows to orient the laterals: select the "Angle" tool on the Palette, click on a point of the row and then on another point belonging to the same row. A value in degrees will then be displayed: in this case about 34,59 [°].

Click on "Restore wizard" and enter the angle value in the box "Laterals angle". The "s" parameter indicates

the minimum distance between the network and the edge of the land.

Generic sector shape

s 1,000 [m]

Laterals Angle 34,59 [°]

Drawing area

In the case of example, given that all the ground slopes have been already obtained through the previous survey, there is no need to enter any value in the boxes relating to "Pipes slope" and "Laterals slope". Click on "Next" to go to the next wizard window, relative to

the emitters. As previously explained, (eg. Single sector project), find in the database a model of on-line emitter at 8L/H (2,11 [gph Us], 1,76 [gph Uk]).

Search item

Search criteria

Emitters Type
☐ Sprinkler ☒ On-Line drip ☐ Spray/Minisprinkler

Brand

Code Model

Nominal flow rate [l/h] ☒ Single searching

Nominal pressure From To [bar] ☐ Single searching

Max pressure From To [bar] ☐ Single searching

Pressure compensated ☐

Range From To [m] ☐ Single searching

PRICE From To [€]

Search results

Brand	Code	Model	Nominal flow rate	Max pressure	Nom
Irritec		iDrop normal	8.2		
Prezzario regione Emilia Romagna 2007		GOCCIOLATORE NON AUTOCOMPENSANTE	8		
Plast Project	1010.0080	Lem	8		
Plast Project	1015.0080	Lem	8		
Plast Project	1110.0080	Nike 1	8		
Plast Project	1112.0080	Nike 1 Eco	8		
Plast Project	1130.0080	Sirio 1	8		
Plastic Puglia	AGP03	PIASTRINA	8		
Plastic Puglia	ASG02	SIGARO	8		

Number of items found: 10

Let's choose the Lem model of Plast Project (no pressure compensation). We will confirm the choice by clicking on OK

Add new sectors

Sector No. 1: Pipes data

Insert main, secondary and submain pipes data

Pipes

☒ Diameters automatic calculation procedure

Diameters

Secondary pipe 61.00 [mm]

Submain 34.00 [mm]

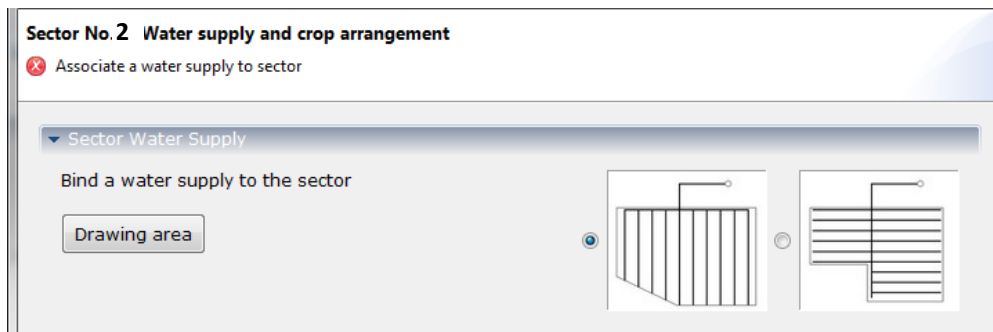
Lateral 12.00 [mm]

then click on "Next" on the wizard window to go to the window where you can enter the pipes.

Clicking on "Suggest Diameters" the system will suggest the size of the diameters to be adopted for the various types of pipelines (only those relating to the sector N.1). As previously explained you will choose the following pipes:

- Dalmine LDPE PN 6 DN 75 for secondary pipe
- Irritec HDPE PN 4 DN 40 for the submain
- Plast Project HDPE PN 6 DN 16 for the laterals

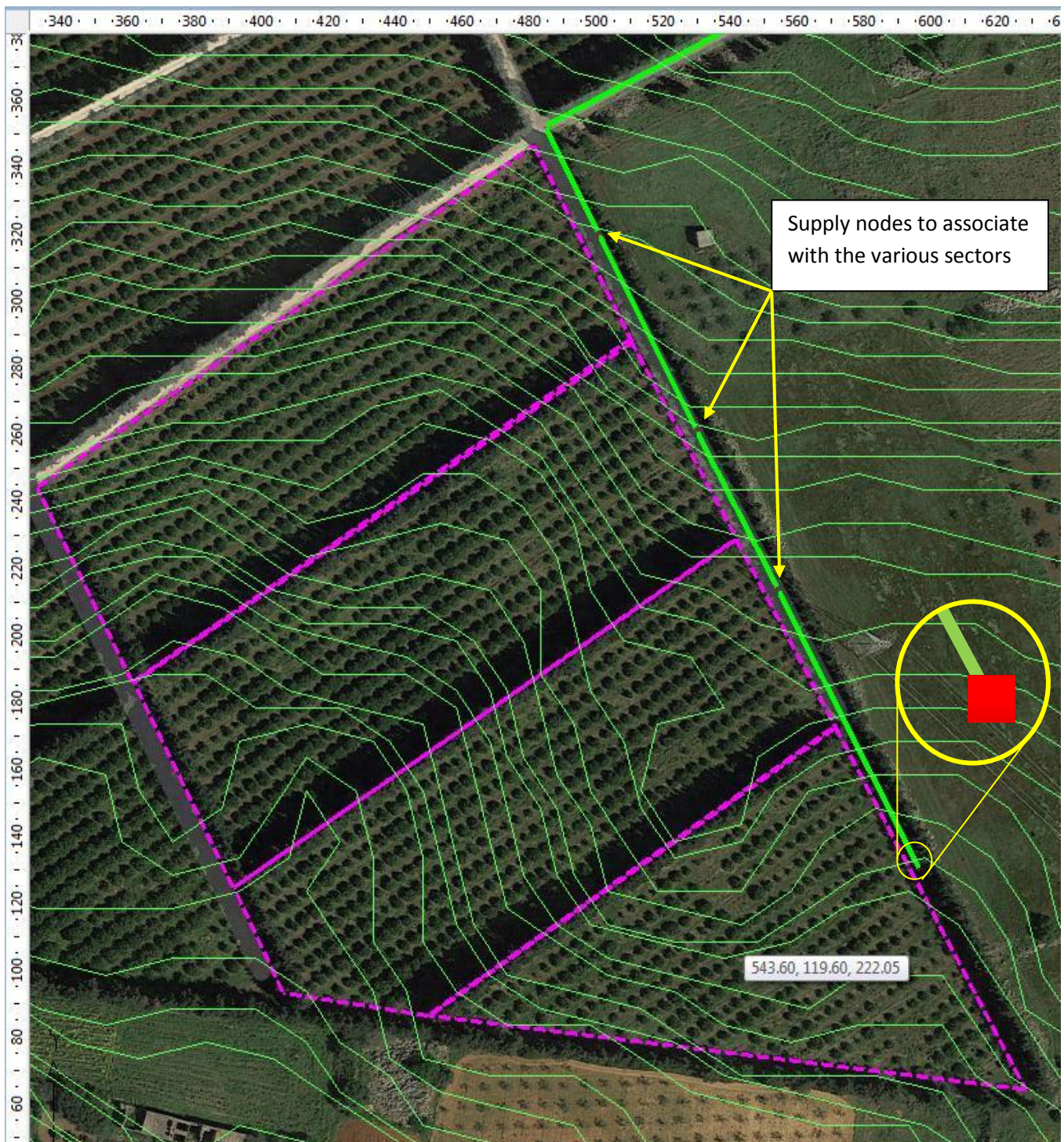
Click on "Next" to go to the next wizard window.



This window is related to the sector number 2 as shown in the header.

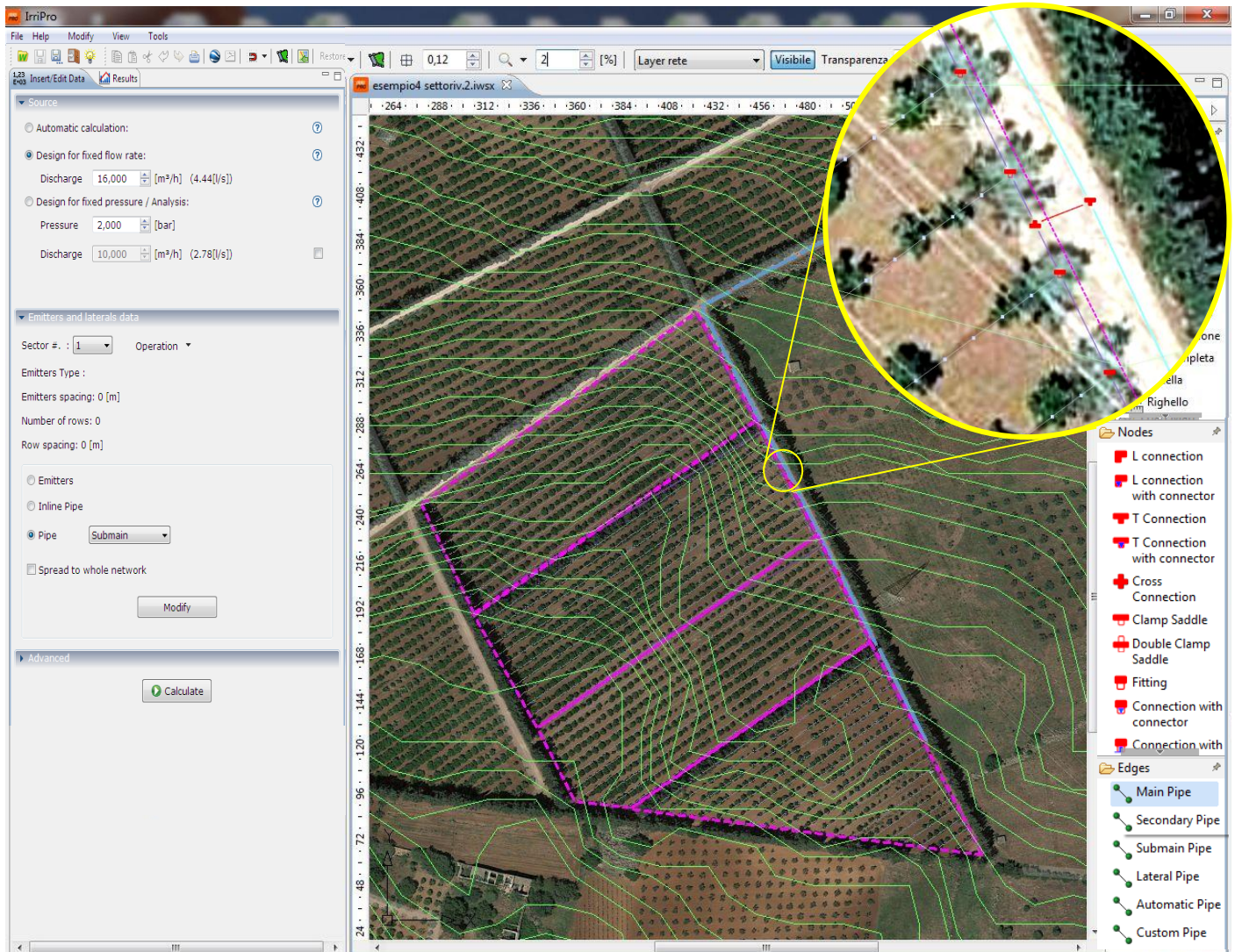
It is now necessary to repeat the same operations performed for the first sector for the remaining 3. The succession of windows and

inputs to be entered will be the same as those already seen for the first sector. Indicate the supply nodes of the sectors and draw the edges of the sectors as indicated in the figure.



Report the value of the angle of the laterals equal for all sectors, as well as the choice of emitters and pipelines models. The last wizard window will report the summary data of all inserted input, referring to each sector.

Click "Finish" to achieve automatic design of the entire system of the 4 areas complete with pipes, fittings, emitters, borders of the terrains and layout. At all pipelines (edge by edge) are assigned the slopes, and to each element its quota. By changing the position of one or more elements, the relative heights and pipelines that are connected to them are automatically updated.



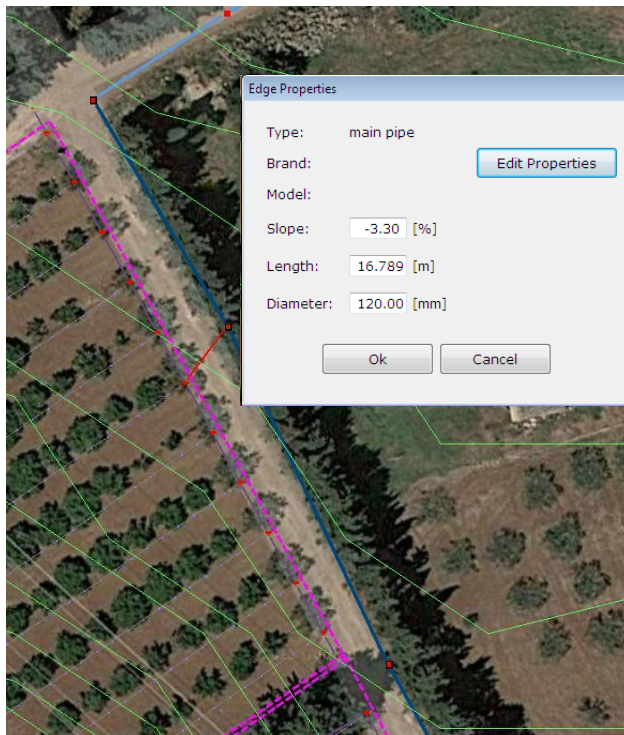
Moving the mouse within the work area coordinates X, Y and Z are displayed. X and Y are the Cartesian coordinates on the field, while the Z is the relative altitude. The same information is shown at the bottom of the program window.

To change the diameter of the main pipe that passes next to the sectors (from DN120 or 4" to DN90 or 3") you must do the following operations:

- Click on the first node and, while holding down the SHIFT key, click on the last node to edit. The selected

pipe becomes dark blue

- Right-click on a point of the selected item group to display the context menu
- Select the "Edge Properties" entry

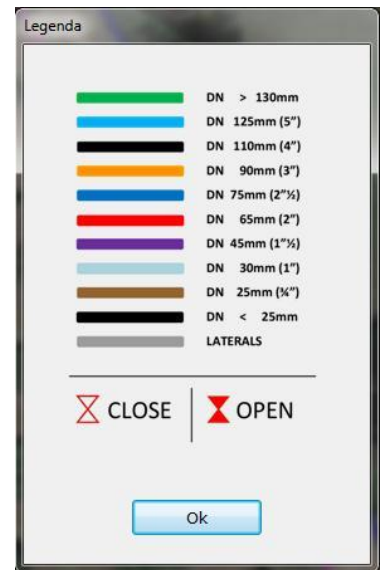


- In this window you can change the diameter from its entry, or choose a new behavior from the database by clicking on "Edit Properties".

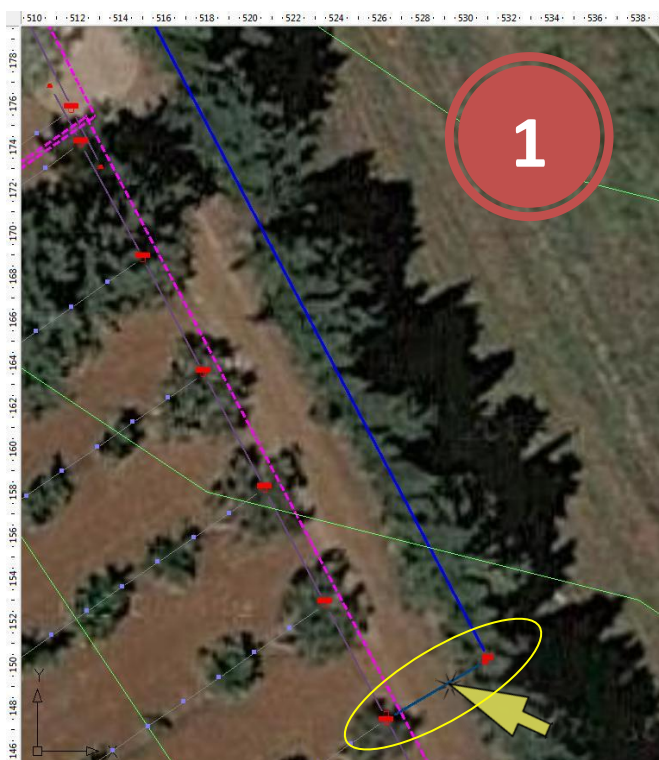
- Click on this button to search and select the *Plast Project PEAD PN6 DN90*

- Confirm your choice by clicking OK on the database window and then on the "Edge Properties" window.

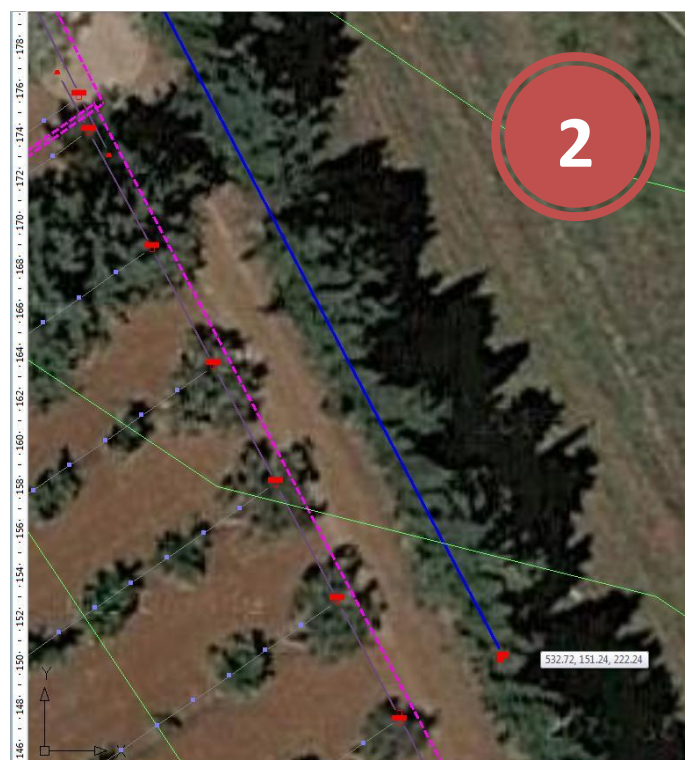
In this way, the new pipe model is assigned to the previously selected pipe, changing its color according to the legend shown at the side. The legend window can be recalled via the "Legend" button at the bottom of the program frame.



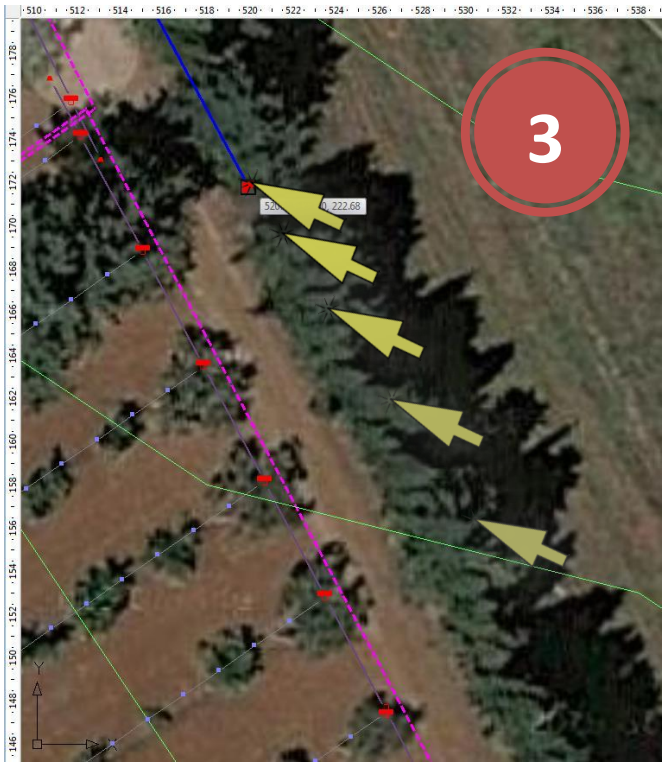
In some cases, it is useful to move the delivery point of the sector from a central position of the submain to a different position (for example, near one of the two extremes): it is a solution that is adopted if a point of the submain is at a height higher than the existing delivery point (also called root). Here below the sequence to perform the operation in the 4th sector below in the workspace:



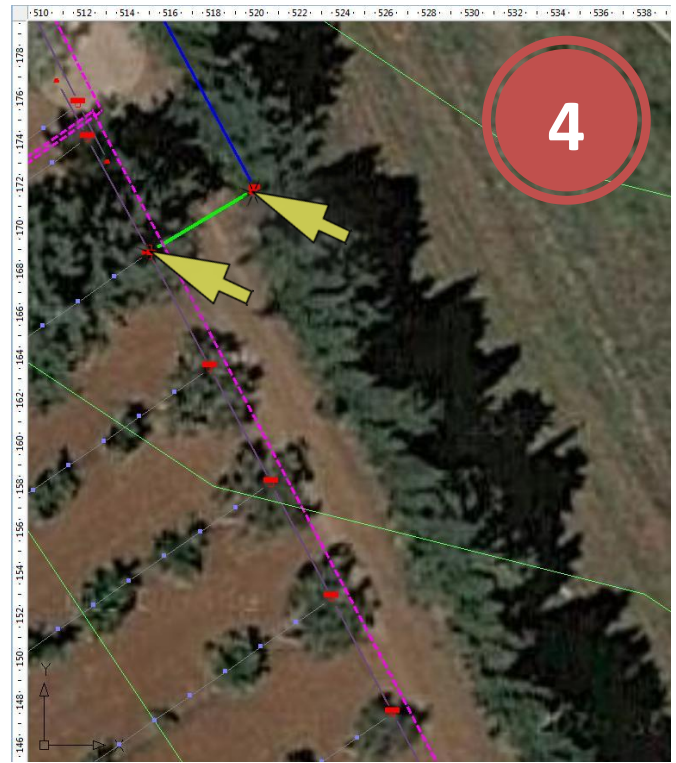
1. Select the secondary pipe that feeds the sector



2. Delete, as shown, the selected section (by using the DELETE key)



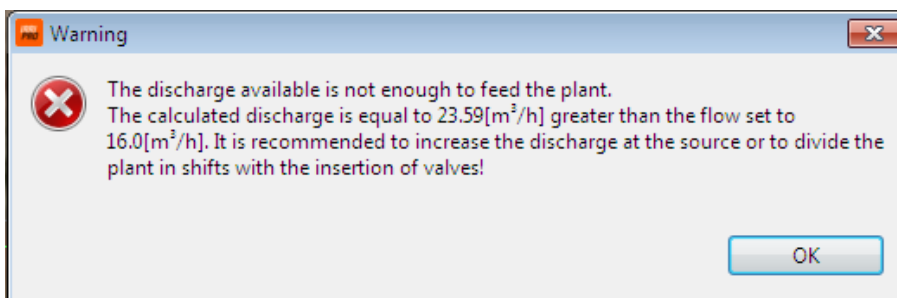
3. Select and then move, by dragging, the node in the main pipe to the desired position



4. Select from the Palette the command "Secondary Pipe" and connect the node just moved to the submain node

The connection should take place from the upstream node (main pipe) to the valley node (submain). The arrival node (root) will change from T-connection (or elbow) to a cross-connection (or T-connection). Once completed, this edge will be green since it is a generic pipe: assign, as seen above, from the "Edge Properties" the Dalmine PEBD PN 6 DN 75 model as it is done for the other pipelines.

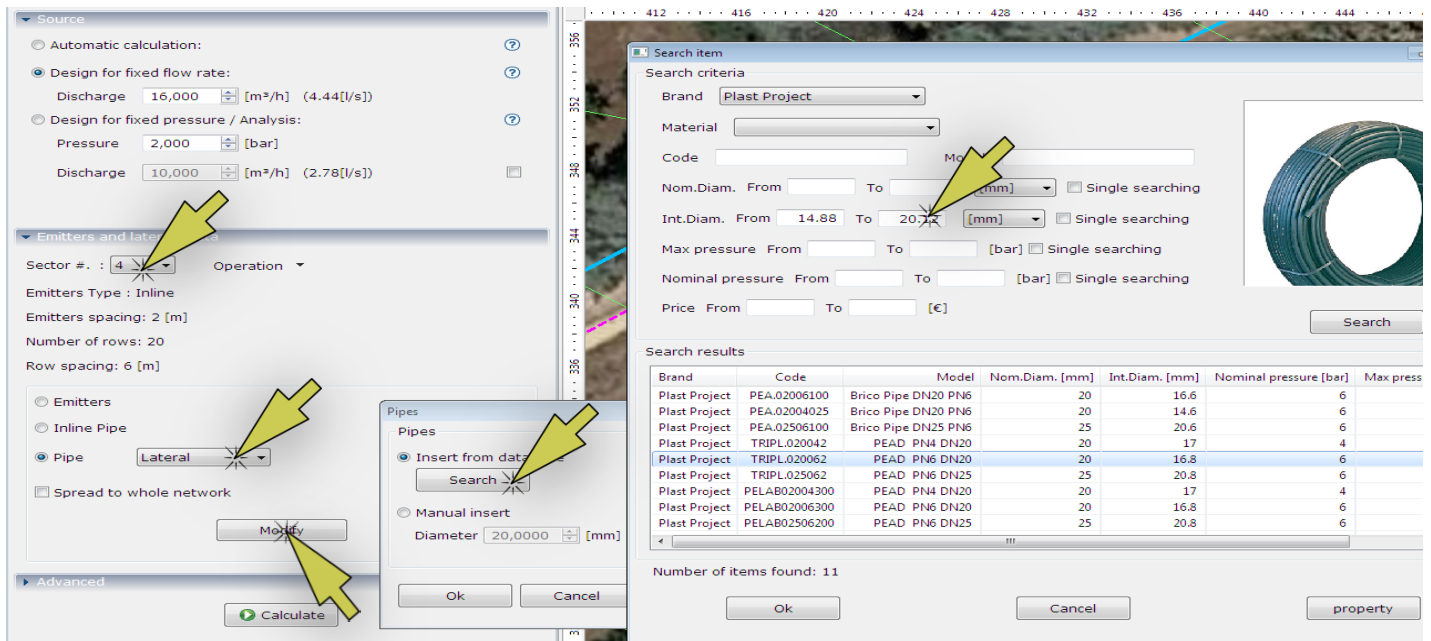
The change made will allow the water to go through the submain with the slope in favor.



Click in the Palette on the "View all" command to return to the overall layout of the system, and then click the "Calculate" button to simulate the system. In this case, the message shows that the pressure is not enough: this can happen because the pressure required to

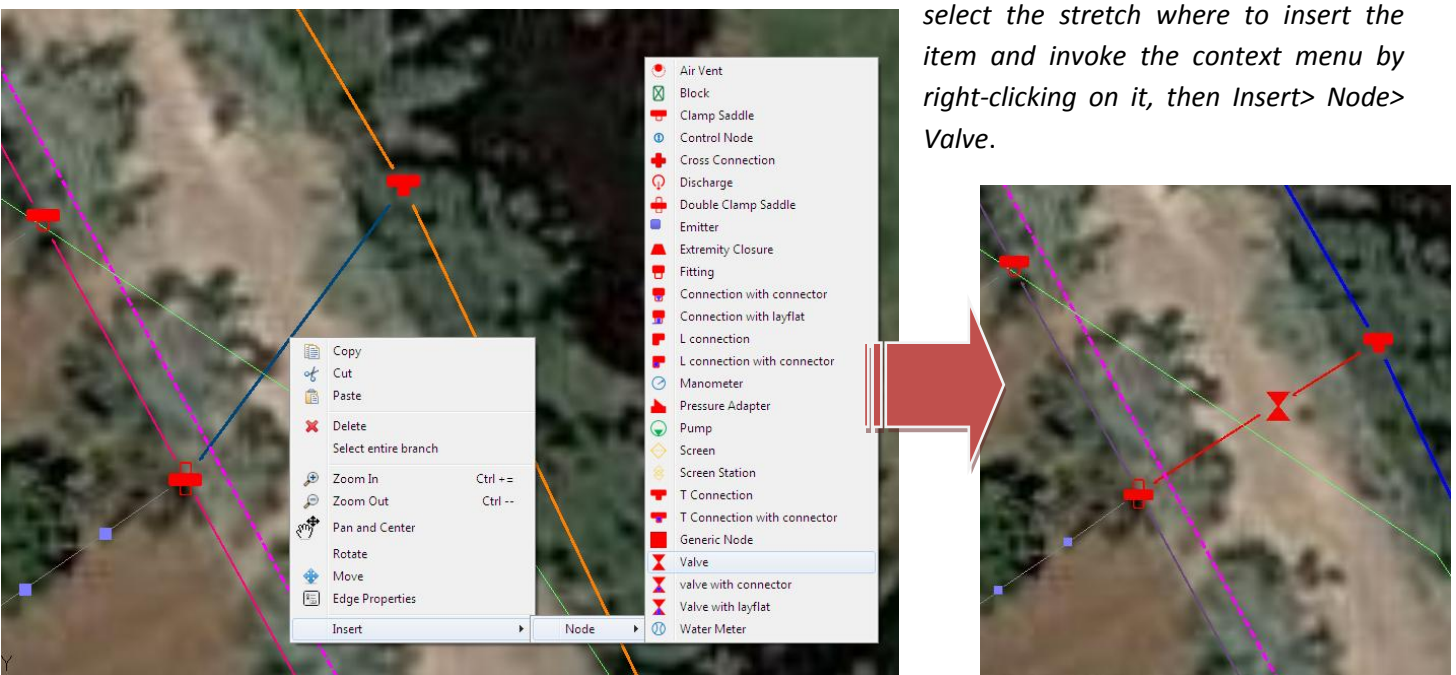
use all available discharge (of 16 m³/h) is not enough to reach the whole plant or because it is necessary to change the dimensions of the pipes for excessive head losses. Replace the Plast Project PEBD PN 6 DN 16 with Plast Project PEBD PN 4 DN 20 for all sectors and repeat the calculation by performing the following operations:

- In the side view, select from the drop-down menu the sector number where intervene (here, the number 4)
- Select the Pipe type and then Laterals on the drop down menu and click Edit
- In the window that opens, click Search to search the new pipeline inside the database
- Set new search criteria in the database window: increase the upper limit of the inner diameter (over 20 [mm] or 1/2 ") and click on" Search "
- Select the Plast Project PEBD PN 4 DN 20 model and click OK to confirm your choice
- Close the Pipes window by clicking on OK.
- The pipeline chosen has been assigned to sector 4. Repeat the operation for other sectors.



The previous considerations also included a maximum surface area of 24000 m² (2.4 ha or 5.9 Acres), which means 2 of the 4 sectors present in the plant. We need to decrease the number of sectors that are supplied in the same shift (ie, during the same simulation).

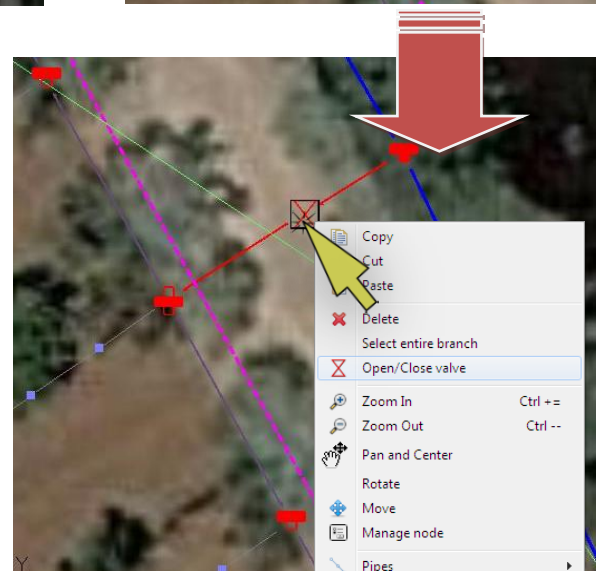
To divide the plant into shifts, introduce the valve element: as already seen with adding other types of nodes, simply select the stretch where to insert the item and invoke the context menu by right-clicking on it, then Insert> Node> Valve.

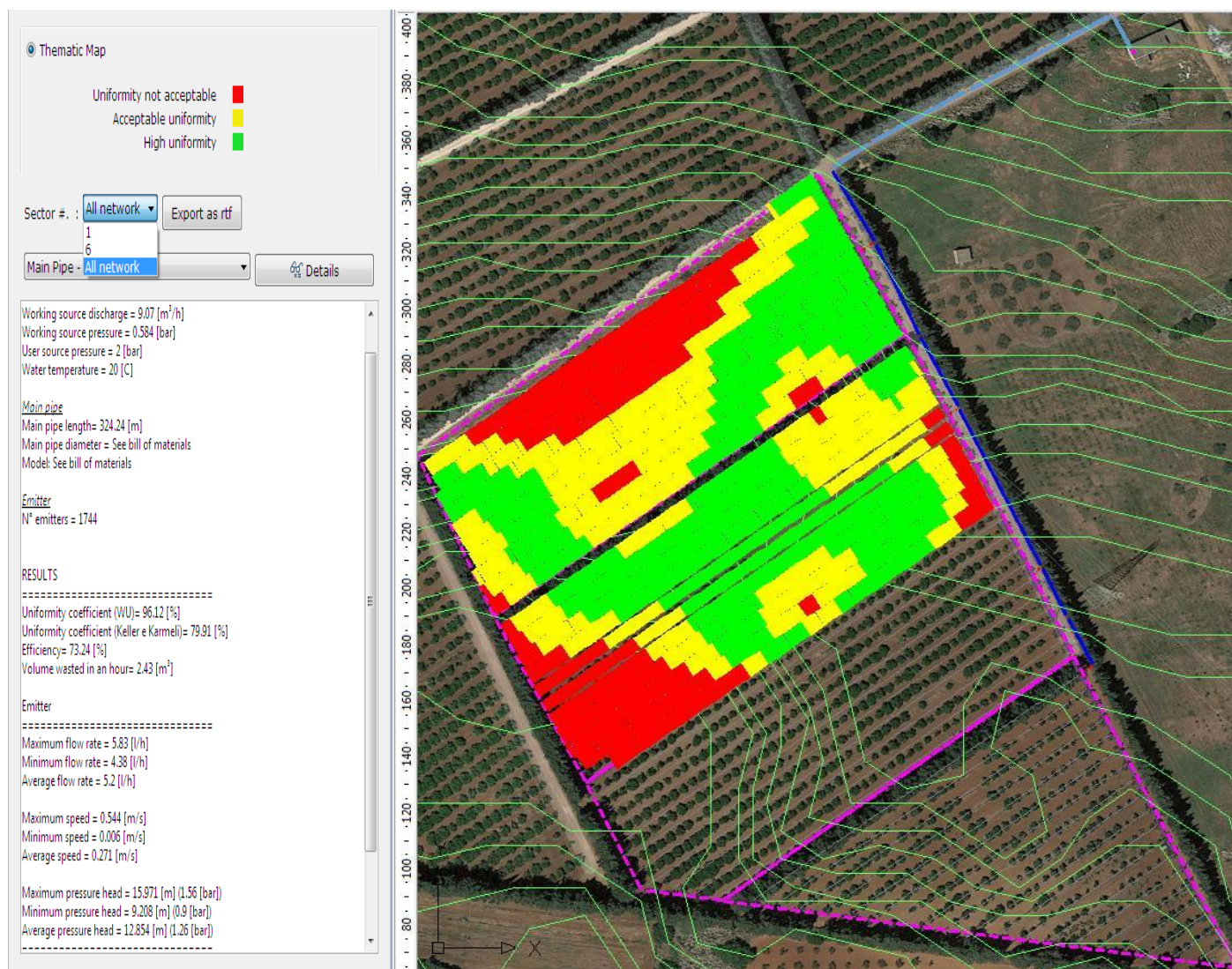


We recommend you to do this operation on the secondary pipes that supply the various sectors. Repeat for all 4 sectors. The valves so inserted are in the Open condition: to close them right click on the element and then on the context menu select "Open / close valve".



Close valves for Sections 3 and 4 leaving sectors 1 and 2 open. Click again on calculate.





Selecting from the drop-down menu in the figure the sector to be evaluated or "All network", you will get the following results:

1° SECTOR

RESULTS

Uniformity coefficient (WU)= 96.98 [%]
Uniformity coefficient (Keller e Karmeli)= 88.2 [%]

Emitter

Maximum flow rate = 9.35 [l/h]
Minimum flow rate = 8.04 [l/h]
Average flow rate = 8.65 [l/h]

Maximum speed = 0.96 [m/s]
Minimum speed = 0.011 [m/s]
Average speed = 0.46 [m/s]

Maximum pressure head = 10.046 [m] (0.984 [bar])
Minimum pressure head = 7.42 [m] (0.727 [bar])
Average pressure head = 8.606 [m] (0.843 [bar])

Sector surface = 1.06 [ha] (10572 [m²])
Average intensity of water distribution = 0.72 [mm/h]
Maximum head loss compared to source = 7.47 [m]

2° SECTOR

RESULTS

Uniformity coefficient (WU)= 97.29 [%]
Uniformity coefficient (Keller e Karmeli)= 88.12 [%]

Emitter

Maximum flow rate = 9.9 [l/h]
Minimum flow rate = 8.4 [l/h]
Average flow rate = 9.05 [l/h]

Maximum speed = 0.983 [m/s]
Minimum speed = 0.011 [m/s]
Average speed = 0.492 [m/s]

Maximum pressure head = 11.271 [m] (1.104 [bar])
Minimum pressure head = 8.112 [m] (0.795 [bar])
Average pressure head = 9.423 [m] (0.923 [bar])

Sector surface = 1.15 [ha] (11532 [m²])
Average intensity of water distribution = 0.75 [mm/h]
Maximum head loss compared to source = 7.47 [m]

1° SHIFT (SECTORS 1 and 2)

Working discharge at source=16.32 [m³/h] (i.e. 71.85 [gpm US] and 59.83 [gpm UK])

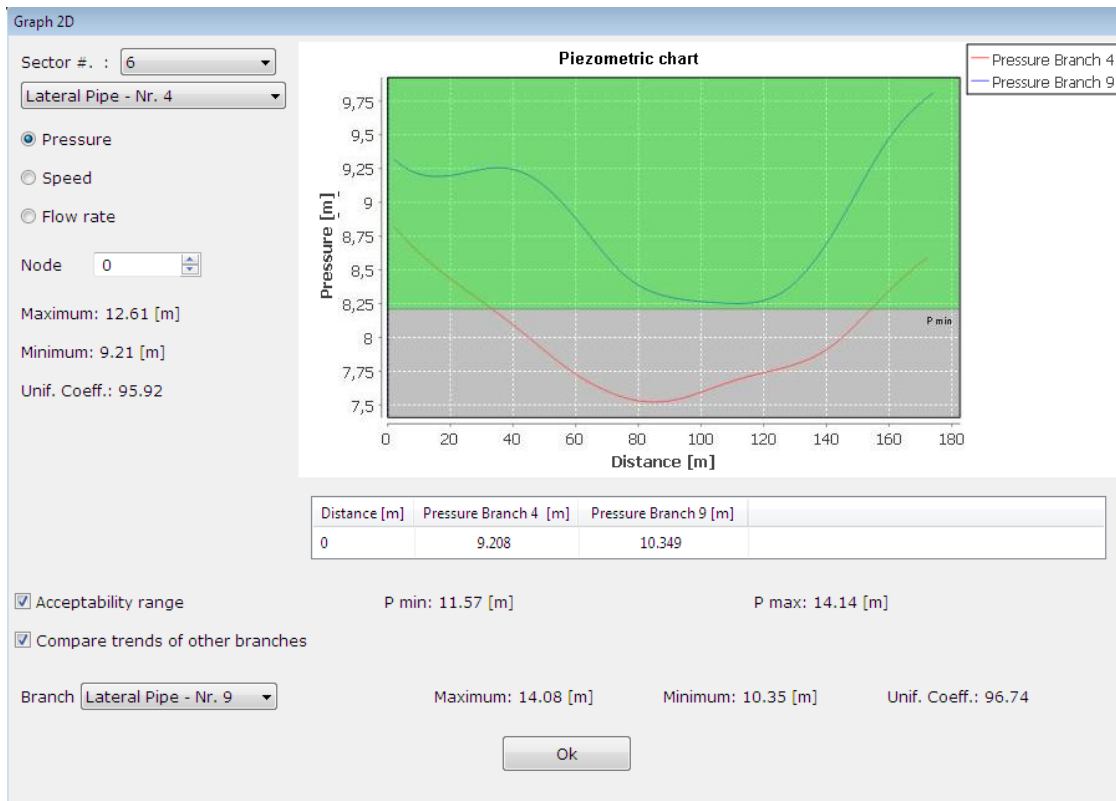
Working pressure at the source = 0.491 [bar] (i.e. 7.12 PSI)

Surface area = 2.21 [ha] (22104 [m²]) (i.e. 5.56 Acri)

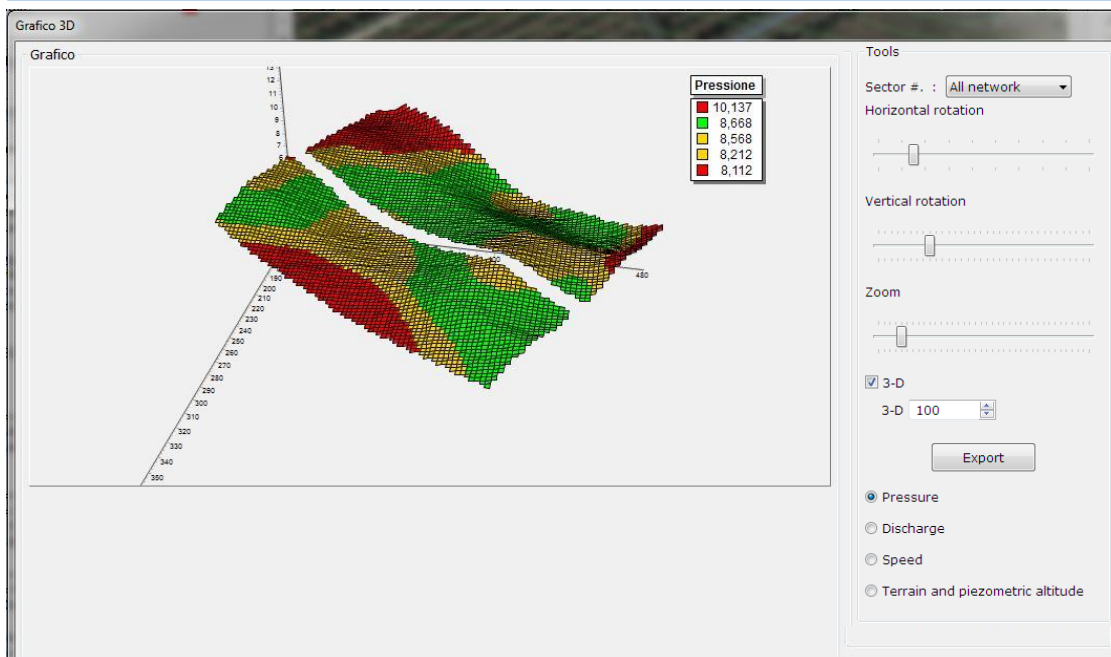
Average distribution intensity= 0.74 [mm/h]

Maximum head loss from the source = 7.47 [m] (i.e. 24.50ft)

This analysis can be deepened with 2D and 3D graphics, always confirming a non-positive evaluation of uniformity (the results shown may differ for small variations in the drawing):



By comparing two laterals of the first sector, it is possible to see how a portion of the laterals is below the minimum pressure limit (the permissible area is indicated by the green color).



The 3D chart highlights the red areas and it is possible to distinguish the parts subjected to excessive pressure from those with insufficient pressure.

The results window summarizes the various criteria by showing those who are satisfied and those that are not.

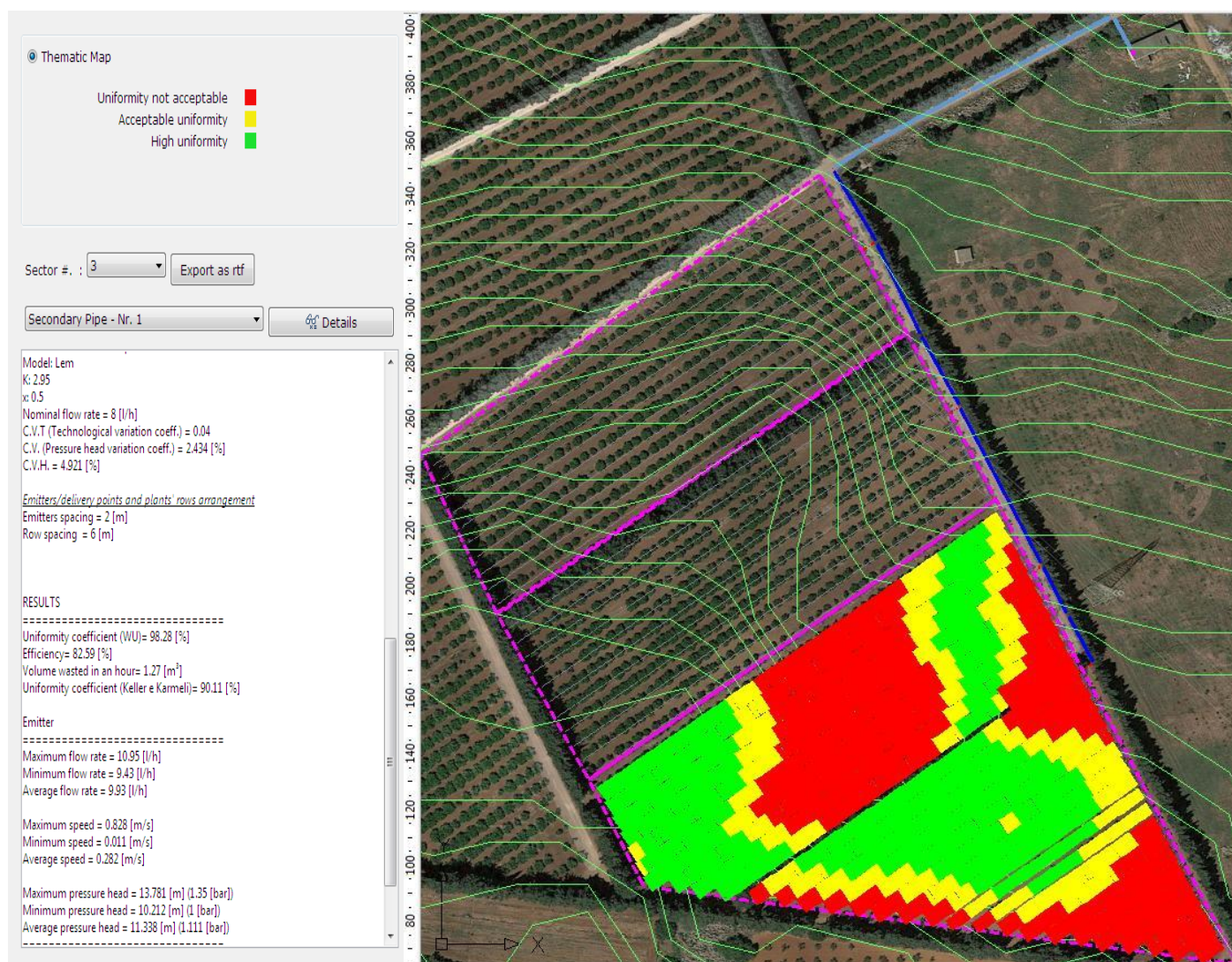
Results

⊗ NOT ACCEPTABLE

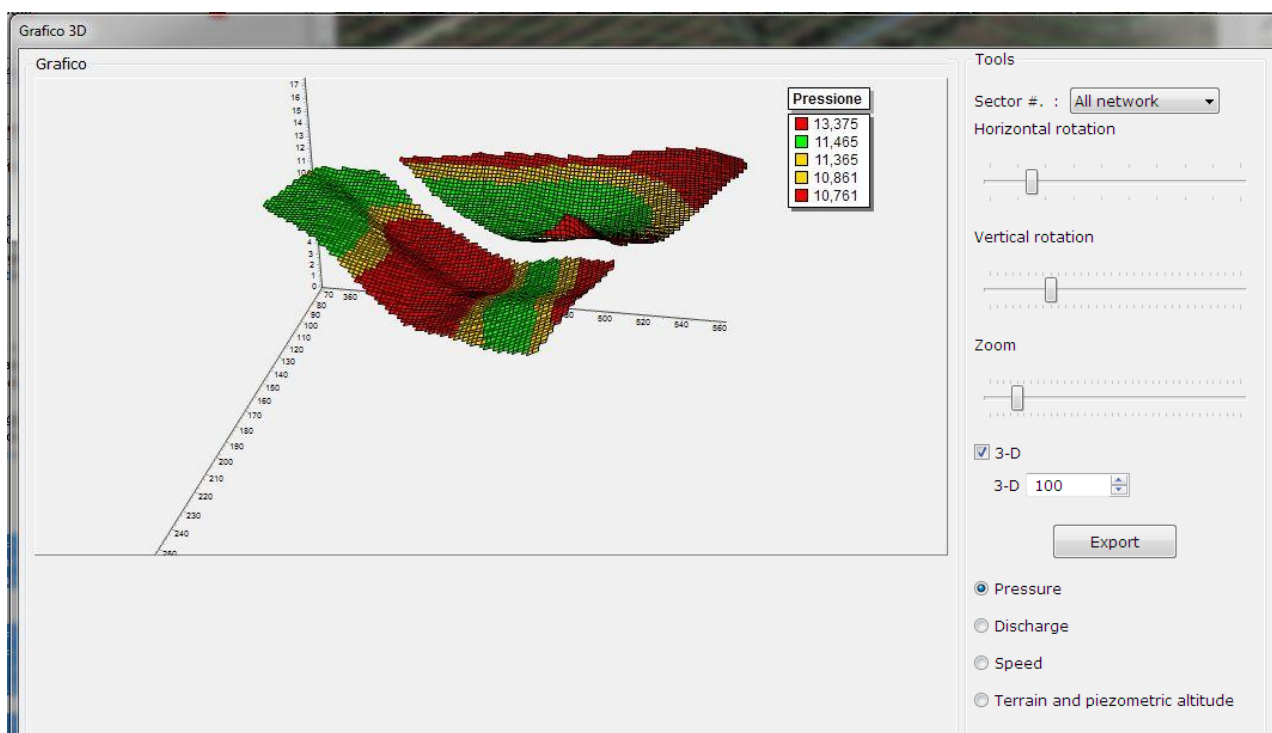
Indicator	Result	Cause
Uniformity Coefficient (WU)	ACCEPTABLE	UC Wu ≥ 90%
Uniformity Coefficient (KARMELI)	NOT ACCEPTABLE	UC Karmeli < 90%
Pressure Range	NOT ACCEPTABLE	Network pressure falls outside the range [Paverage ± 10%]
Velocity	ACCEPTABLE	The velocity is within the range [0.2, 7.0] [m/s]

Ok

Returning to the "Insert / Edit Data" view, close the sector valves 1 and 2 and open those of sectors 3 and 4 and then repeat the calculation of the 2nd shift:



The results are similar to those of the first shift. 3D graphics also confirm unacceptable uniformity.



The numerical results for the various sectors and overall for the 2nd shift are:

3° SECTOR	4° SECTOR
RESULTS ===== <p>Uniformity coefficient (WU)= 95.89 [%] Uniformity coefficient (Keller e Karmeli)= 87.31 [%]</p> <p>Erogatore</p> ===== <p>Maximum flow rate = 11.16 [l/h] Minimum flow rate = 9.14 [l/h] Average flow rate = 9.94 [l/h]</p> <p>Maximum speed = 1.066 [m/s] Minimum speed = 0.013 [m/s] Average speed = 0.521 [m/s]</p> <p>Maximum pressure head = 14.305 [m] (1.401 [bar]) Minimum pressure head = 9.606 [m] (0.941 [bar]) Average pressure head = 11.379 [m] (1.115 [bar])</p> ===== <p>Sector surface = 1.02 [ha] (10176 [m²]) Average intensity of water distribution = 0.83 [mm/h] Maximum head loss compared to source = 9.4 [m]</p>	RESULTS ===== <p>Uniformity coefficient (WU)= 97.33 [%] Uniformity coefficient (Keller e Karmeli)= 89.56 [%]</p> <p>Erogatore</p> ===== <p>Maximum flow rate = 11.6 [l/h] Minimum flow rate = 9.98 [l/h] Average flow rate = 10.57 [l/h]</p> <p>Maximum speed = 0.914 [m/s] Minimum speed = 0.013 [m/s] Average speed = 0.314 [m/s]</p> <p>Maximum pressure head = 15.449 [m] (1.514 [bar]) Minimum pressure head = 11.439 [m] (1.121 [bar]) Average pressure head = 12.863 [m] (1.26 [bar])</p> ===== <p>Sector surface = 0.88 [ha] (8832 [m²]) Average intensity of water distribution = 0.88 [mm/h] Maximum head loss compared to source = 9.4 [m]</p>

2° SHIFT (SECTORS 3 and 4)

Working discharge at source=16.21 [m³/h] (i.e. 71,37 [gpm US] and 59,43 [gpm UK])

Working pressure at the source = 0.807 [bar] (i.e. 11,70 PSI)

Surface Area = 1.9 [ha] (19008 [m²]) (i.e. 4,69 Acri)

Average distribution intensity = 0.85 [mm/h]

Maximum head loss from the source = 9.4 [m] (i.e. 30,84ft)

If this condition is to be improved, it is necessary to keep in mind the slopes of the terrain: the lateral edges have slopes varying from -10% to + 1%. This variation implies significant differences in the altitudes (and therefore pressures) to which the emitters are subjected and, consequently, of the flow rates. One possible solution is to adopt pressure compensated emitters which allow a good uniformity even in the case of severe slopes. *Insert an in-line dripline with Netafim pressure compensated drippers Uniram 20 of 3.5 [L/h] (0.92 [gph US], 0.77 [gph UK]) in place of the standard on-line drippers:*

Source

☐ Automatic calculation:

☒ Design for fixed flow rate:

Discharge 16,000 [m³/h] (4.44 [l/s])

☐ Design for fixed pressure / Analysis:

Pressure 2,000 [bar]

Discharge 10,000 [m³/h] (2.78 [l/s])

Emitters and lateral

Sector #: 1 Operation

Emitters Type: Inline

Emitters spacing: 2 [m]

Number of rows: 10

Row spacing: 6 [m]

☐ Emitters

☒ Inline type

☐ Pipe Secondary

☐ Spread to whole network

Modify

Advanced

Calculate

Search item

Search criteria

Emitters Type

☒ Driplines integrals ☐ Tape

Brand Netafim

Material

Code Model

Nom.Diam. From To [mm] ☐ Single searching

Int.Diam. From 14.88 To 20.12 [mm] ☐ Single searching

Nom.Disch. From To [l/h] ☐ Single searching

Max pressure From To [bar] ☐ Single searching

Nom.Press. From To [bar] ☐ Single searching

Pressure compensated

Emit.Spac. 2 [m]

PRICE From To [€]

Search

Search results

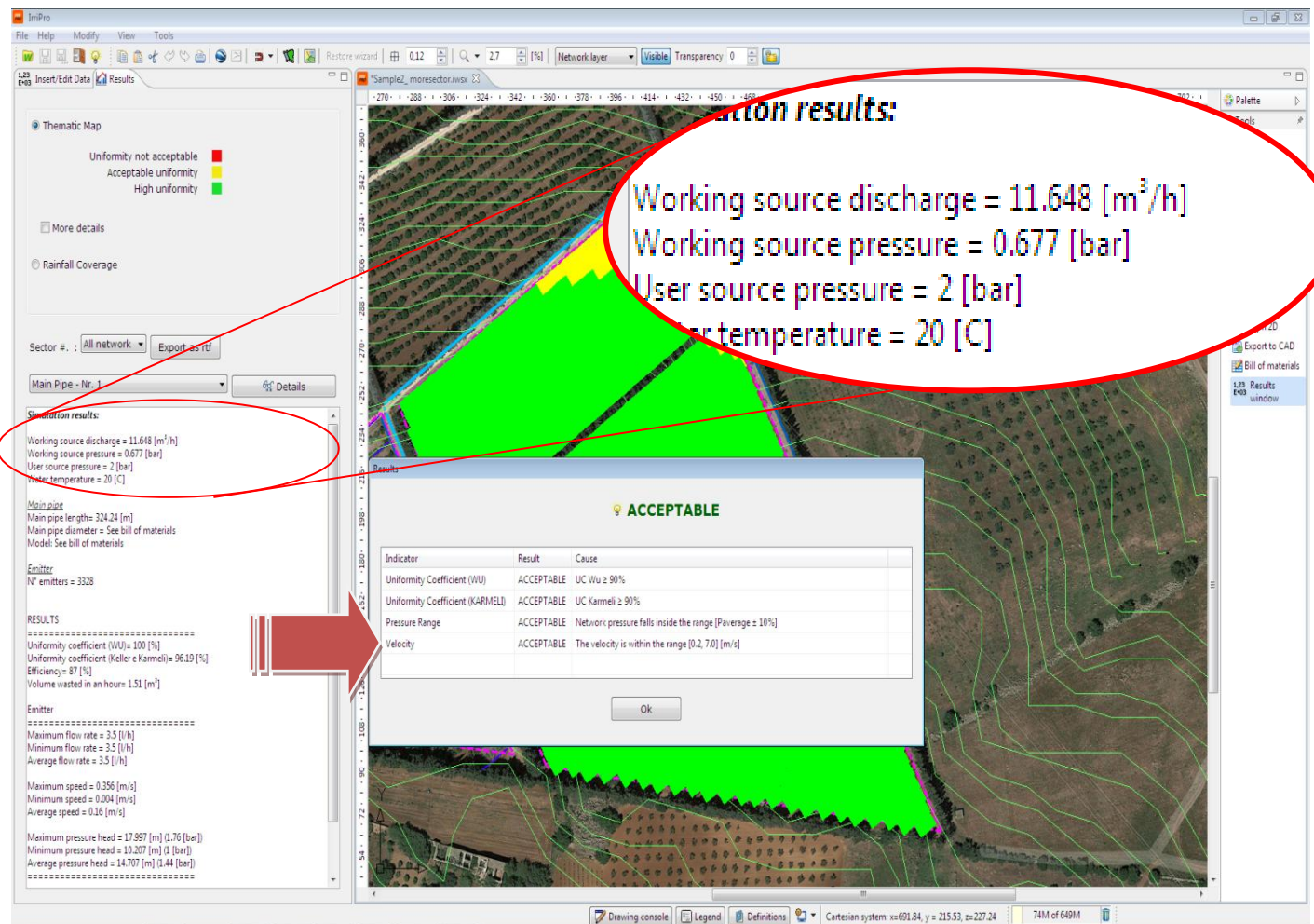
Brand	Code	Model	Nom.Disch. [l/h]	Nom.Press. [bar]	Max pressure [bar]	Press.from [bar]	Press.to [bar]	Nom.Diam. [mm]
Netafim		Uniram 20	1	1		1	4	
Netafim		Uniram 20	1.6	1		1	4	
Netafim		Uniram 20	2.3	1		1	4	
Netafim		Uniram 20	3.5	1		1	4	
Netafim		RAM 20	1.2	1		0.5	4	
Netafim		RAM 20	1.6	1		0.5	4	
Netafim		RAM 20	2.3	1		0.5	4	
Netafim		RAM 20	3.5	1		0.5	4	
Netafim		TIRAN 20	1	1		1	1	

Number of items found: 11

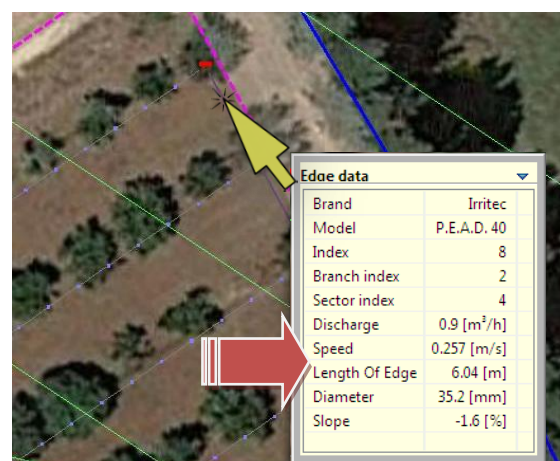
Ok Cancel property

This operation will not only replace the emitter, but also the laterals integrated with the emitter itself. Be careful to indicate a 2-meter distance in the choice of the dripline (as it was before): this value can not be changed after the sector design and the insertion of a different distance will result in inconsistency between the element chosen by the database and the Network design. To change the value of the distance between emitters (as well as the distance between rows) you need to remove the sector and draw it again.

Repeat the assignment of the dripline to all sectors. Since the flow rate delivered by each emitter is 3.5 [L/h] (less than 8 [L/h] of the on-line emitter) the available flow to the source can supply no more 2 but 4 sectors simultaneously (but It will be necessary to double irrigation time to ensure the same volume). Let's see if this statement is true by opening all valves and performing the calculation:



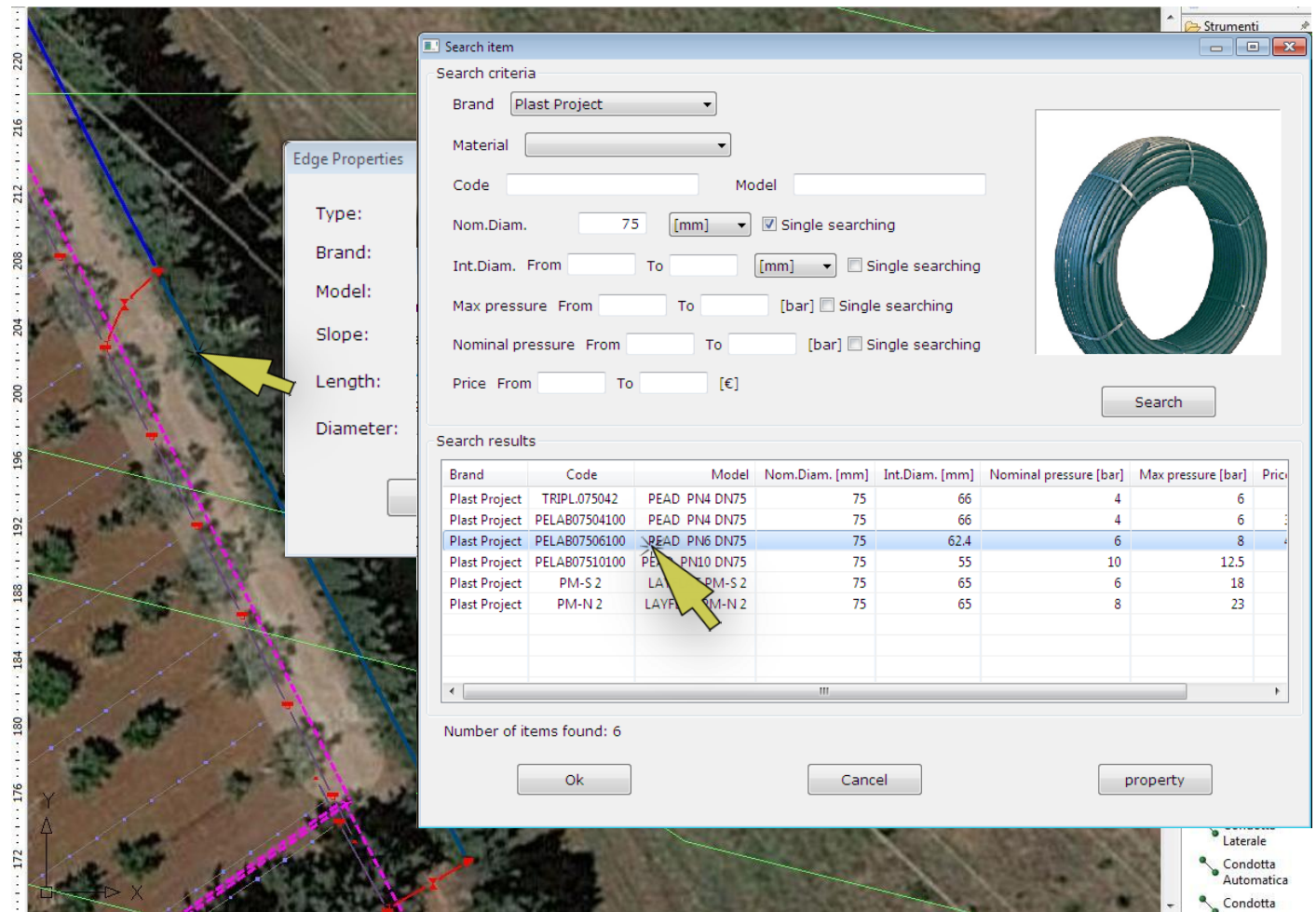
The calculated operating flow rate is 11.65 [m³ / h], which is lower than the available 16 [m³/h]. However, in the



results window we have the criterion of speed which could be not satisfied: it evaluates that in all the pipeline sections (excluding the lateral pipes) the velocity is between 0.2 [m/s] or 0.66 [ft/s] (Under which sedimentation phenomena occur) and 7.0 [m/s] or 22.97 [ft/s] (over which speed is considered excessive). Returning to the "insert/edit data" view and scrolling through the various pipe sections, the tooltip will show the speed. This value could be inferior to 0,2 m/s for:

- the last section of the main pipeline
- the extreme sections of the submain tube.

Modify the main pipe section with the Plast Project PEAD PN6 DN75 (compared to the previous DN90):



Search item

Search criteria

Brand: **Plast Project**

Material: **[dropdown]**

Code: **[text]** Model: **[text]**

Nom.Diam.: **75** [mm] ☒ Single searching

Int.Diam. From **[text]** To **[text]** [mm] ☐ Single searching

Max pressure From **[text]** To **[text]** [bar] ☐ Single searching

Nominal pressure From **[text]** To **[text]** [bar] ☐ Single searching

Price From **[text]** To **[text]** [€]

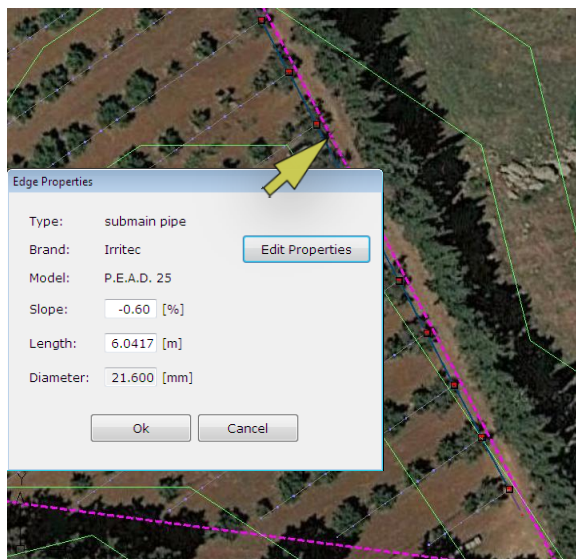
Search

Search results

Brand	Code	Model	Nom.Diam. [mm]	Int.Diam. [mm]	Nominal pressure [bar]	Max pressure [bar]	Price
Plast Project	TRIPL075042	PEAD PN4 DN75	75	66	4	6	
Plast Project	PELAB07504100	PEAD PN4 DN75	75	66	4	6	
Plast Project	PELAB07506100	PEAD PN6 DN75	75	62.4	6	8	
Plast Project	PELAB07510100	PEAD PN10 DN75	75	55	10	12.5	
Plast Project	PM-S 2	LAYER PM-S 2	75	65	6	18	
Plast Project	PM-N 2	LAYER PM-N 2	75	65	8	23	

Number of items found: 6

Ok **Cancel** **property**



Edge Properties

Type: **submain pipe**

Brand: **Irritec** **Edit Properties**

Model: **P.E.A.D. 25**

Slope: **-0.60** [%]

Length: **6.0417** [m]

Diameter: **21.600** [mm]

Ok **Cancel**

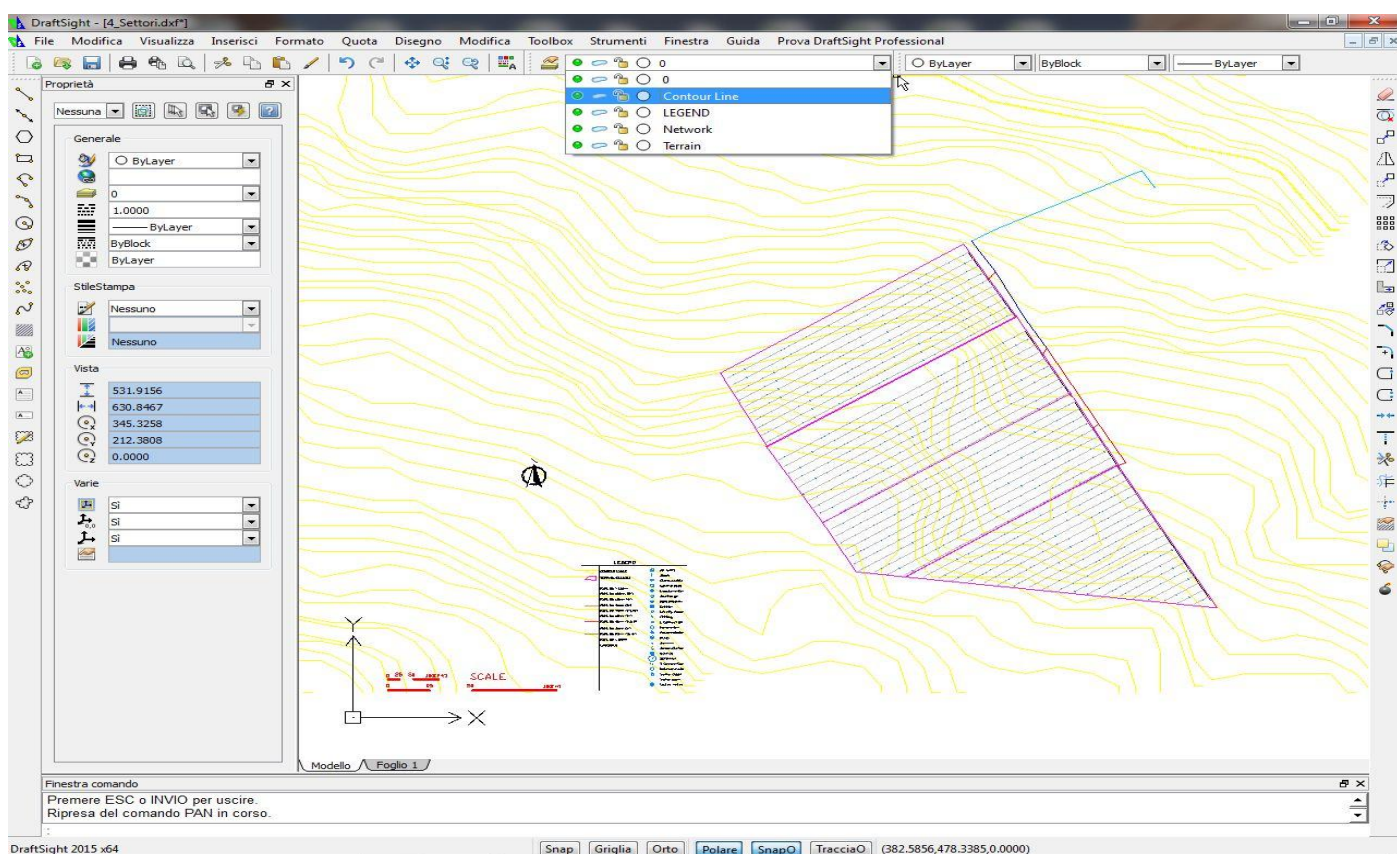
Modify the extremities of the submain piping with the Irritec PEAD PN4 DN25 (compared to the previous DN40). Make this change to the last 2 sections of the right and left of the rectangular sectors and the last 8 sections of the triangular sector. Repeat the calculation and check if other sections with speeds less than 0.2 m/s remain.

Unfortunately, in the triangular sector, while decreasing the diameter, the speed in some parts will remain below 0.2 m/s: this result is due to the end portion of the submain that supplies very short laterals. Apart from these exceptions, the plant can be considered acceptable, pointing out to who will manage the facility, potential sedimentation problems on sections with low speed.

The project results are as follows:



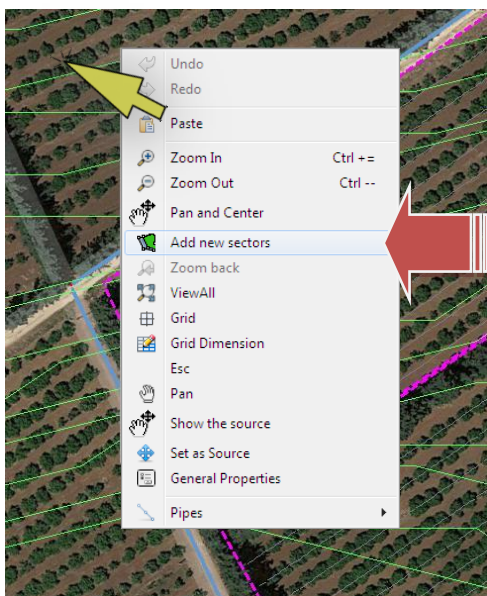
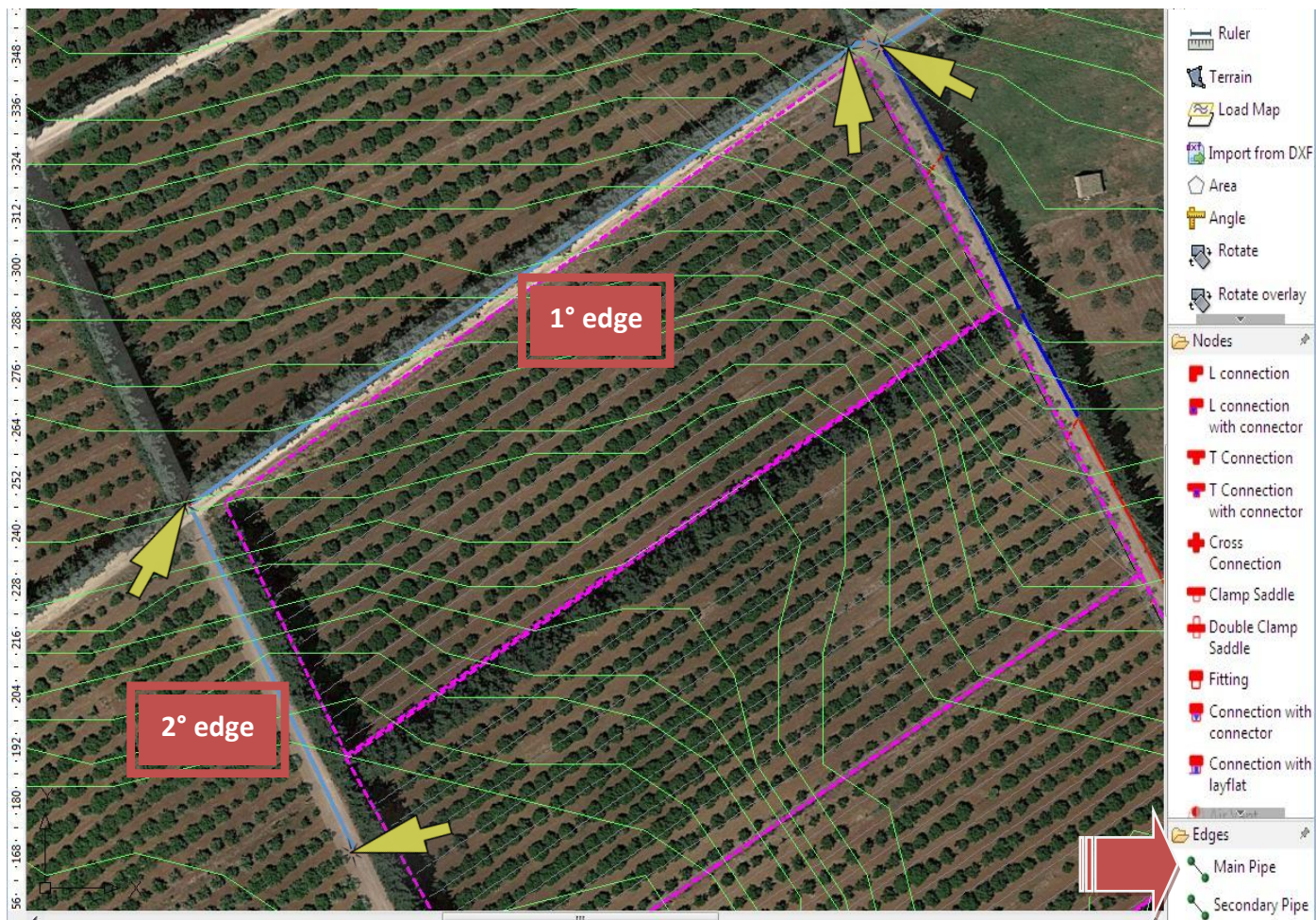
For this project you can get the bill of materials to save it, edit and print it, or the CAD plan (dxf) via the "Export to CAD" command: this operation may take several minutes.



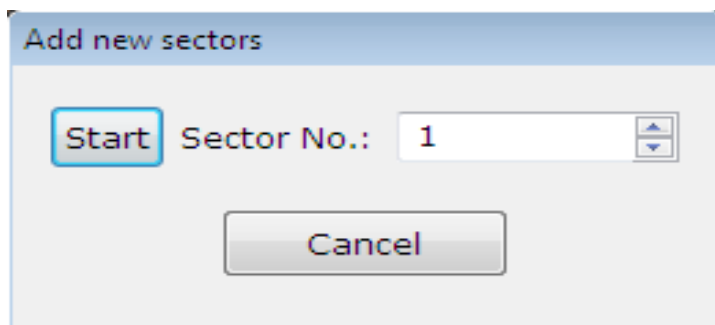
In the figure, opening through the [Draftsight](#) program that is recommended for full compatibility with dxf files generated by IrriPro. This representation contains the elements divided into the different layers with the different colors and symbols shown in a lower right legend along with the North direction and the scale of measurements. Each element of the design can be edited, quoted, deleted, printed.

If, in the newly designed system, you want to add another part, for example, adding new sectors to existing ones. For example, to add a new sector with rainfall sprinklers underneath the previous ones:

- 1) As seen previously draw other main pipe branches (according to the figure, with clicks in correspondence of the arrows) to connect the existing network to a new sector:



- 2) Enter a new sector by *right clicking on an empty area of the editor and using the "Add new sectors" function*. A window will be so open to choose the number of sectors to add: *leave value 1 and click on "Start"*.



The windows that will follow are the same ones already seen in the case of creating multiple sectors from wizards.

Add new sectors

Sector No. 7: Water supply and crop arrangement

Associate a water supply to sector

Sector Water Supply

Bind a water supply to the sector

Drawing area

Irrigation water temperature

T 20,0 [C]

Discretization

Not active

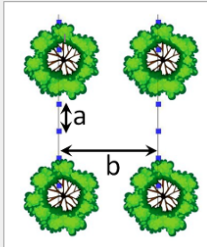
Emitters/delivery points and plants' rows arrangement

Emitters spacing (a) and plants' row spacing (b)

a: 12,0000 [m] b: 12,0000 [m]

☒ Single lateral
☐ Double lateral
☐ Triple lateral
☐ Quadruple lateral

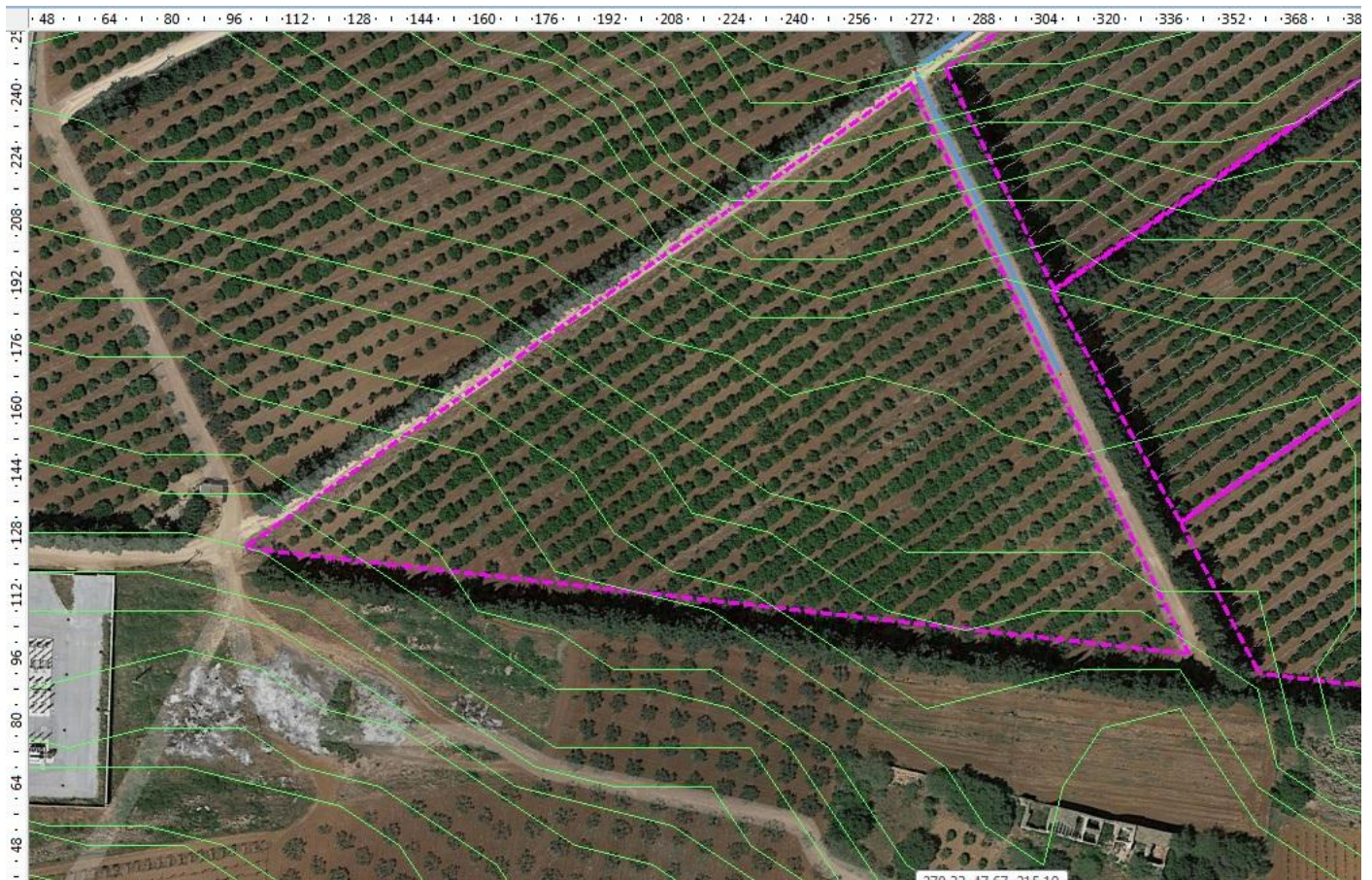
Geometry of distribution: Rectangular



1. Assign as the sector supply node the last element designed for the main pipe (and only to this type of node, not to those of the secondary pipe)

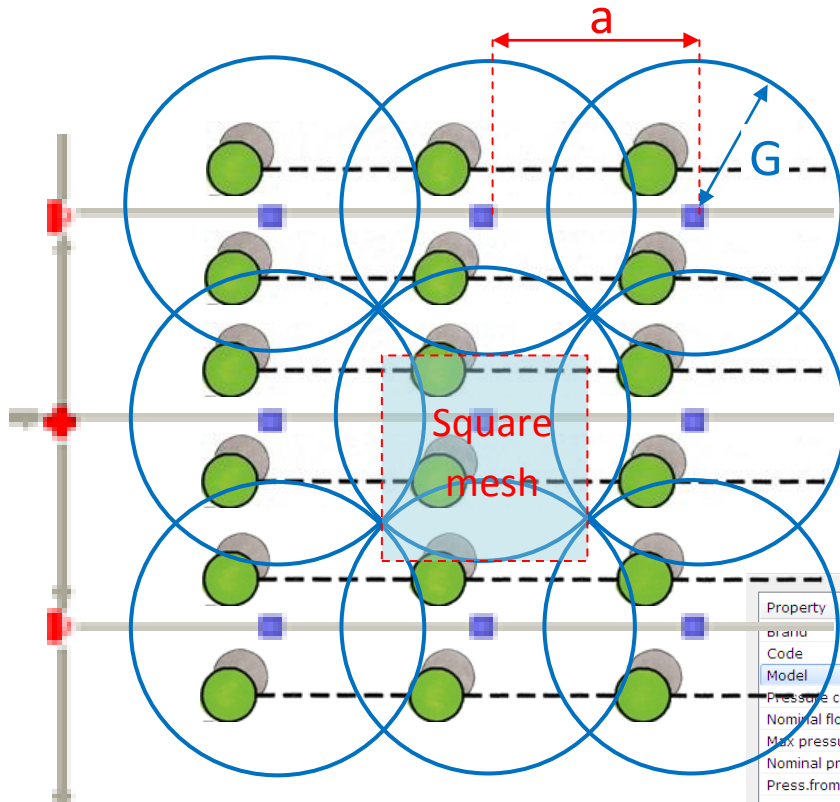
2. Insert one lateral every two rows of plants (you can also choose multiple measurements of this distance) ie with an "a" interdistance of 12 meters so as to form a square mesh between the irrigators.

3. Draw a shape of a triangular plot (directly on the editor with the option "Generic shape sector") with laterals in the same direction of the preceding laterals (34.59°) as shown in Figure:



4. In the emitters page, select the "sprinkler" type and look for the sprinkler model according to the following instructions.

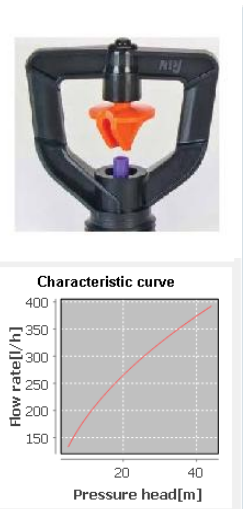
Typically in agriculture you should adopt an overlap of 70% wet circles ie a G range equal to 70% of the spacing "a" between the sprinklers (in this case equal to the distance "b" between the laterals):



$G = a \times 0.7 = 12\text{m} \times 0.7 = 8.4\text{m}$ (i.e. 27,56 ft)
 → Calculation of the sprinklers range from the distance between the rows and the percentage of overlapping.

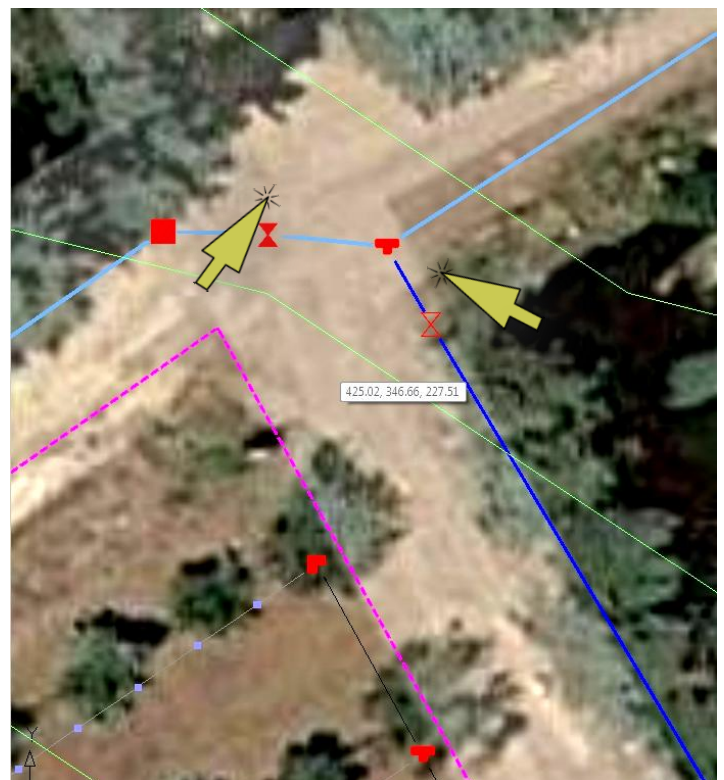
This overlap allows the best uniformity of rainfall across the covered area thanks to the contribution provided by the sprinklers opposed on the same line and between the lines. A model that meets this requirement is the NaanDanJain AG Opal Z11 15 ° Orange (which has a range of 8.5m).

Property	Value
Brand	NaanDanJain
Code	-
Model	AG Opal Z11 15° orange
Pressure compensated	No
Nominal flow rate	350 [l/h]
Max pressure	-
Nominal pressure	2.5 [bar]
Press.from	2.5 [bar]
Press.to	2.5 [bar]
Closing emitter pressure	-
Opening emitter pressure	-
Hole diameter	-
Kind of coupling	FILM
Mesh	-
Micron	-
Orifice diameter	2.2 [mm]
CV	-
K	59.82 [l/(h·m ^{1/2})]
X	0.497
Range	8.5 [m]



In addition to the square mesh there is the triangular and rectangular mesh that follow other proportions in the overlapping.

- In the pipe page, use the "Suggest Diameters" function, finding: 70mm (2"1/2) for the secondary pipe and the submain, and 38mm (1"1/2) for the side. These values could also not be assigned to the pipes, so they remain generic: the calculation will be made by considering their diameters as internal and maintaining the generic term in the batch of materials. In any case, the assignment can also be done in the editor as well as the simple modification of the diameter.
- Once the wizard has been completed and the new sector is drawn, insert two valves at the two main pipe branches (as shown), in order to separate the water supply of the droplet from the rainfall. Close the valve in the direction towards the drop-watered sector.



Bearing in mind that available discharge is 16 m³/h using sprinklers with a nominal flow of 350 L/h (92.31 [gph Us], 77 [gph Uk]) we can supply about 16,000 L/h/350 = 45 Sprinklers (approx.) per shift. The newly designed sector contains about 100 sprinklers: we will have to divide the sector into 2 or more sectors.

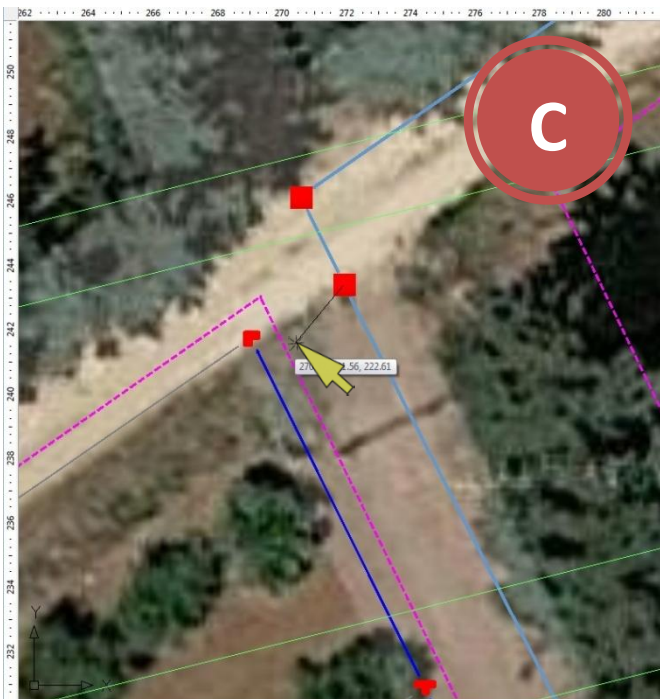
Here below it's shown the sequence to perform the splitting operation of a sector into several sectors:



A. Select and then delete the secondary pipe supplying the triangular sector



B. Delete a section of submain pipe to divide the sector into two parts with a number of similar sprinklers



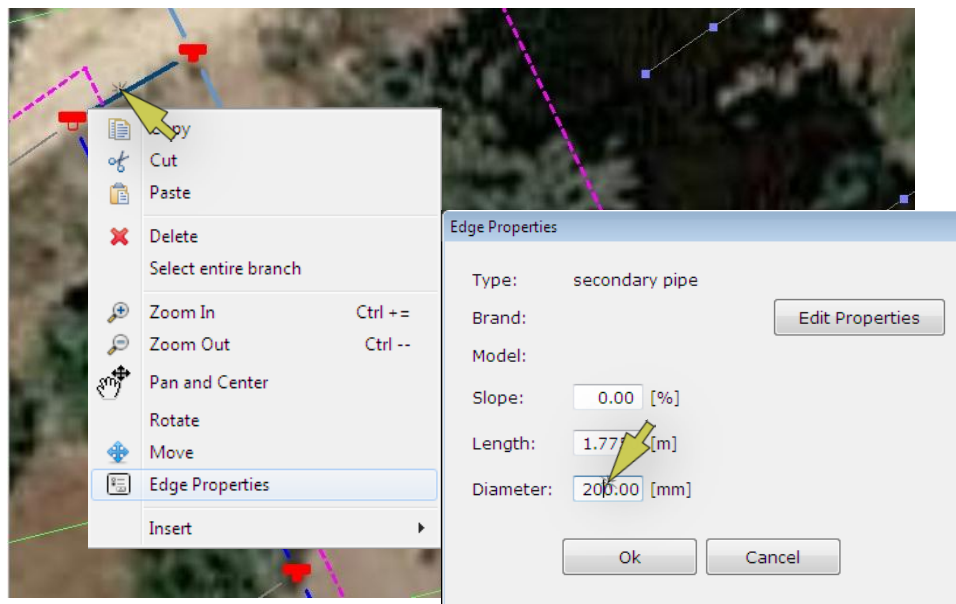
C. Connect, with a secondary pipe, a main pipe node (if not present) with one of the head tubing



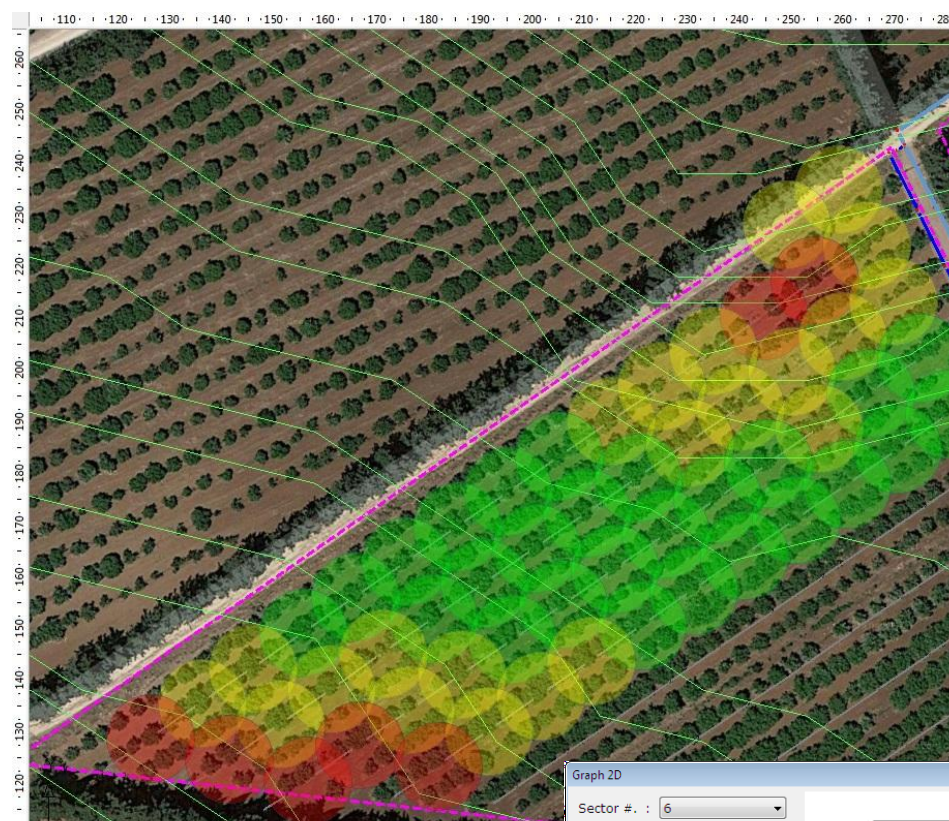
D. Repeat the operation on the second part of the sector. Once connected, the two parts will be acquired as two independent sectors

- After finishing the division into sectors, assign the diameter of 70mm or 2 "1/2 (select the edge→ right-click→ select “Edge Properties”→ Change the diameter value and add a valve to the secondary pipe sections added before.

- Close one of the two valves and perform the calculation. Repeat the operation with the second valve, closing the first one.



The result for the first rain sector is:



5° SECTOR

Working source discharge = 16.14 [m³/h]
Working source pressure = 1.406 [bar]

N° laterals = 5
N° emitters = 55

RESULTS

Uniformity coefficient (WU) = 97.18 [%]
Uniformity coefficient (Keller e Karmeli) = 90.64 [%]

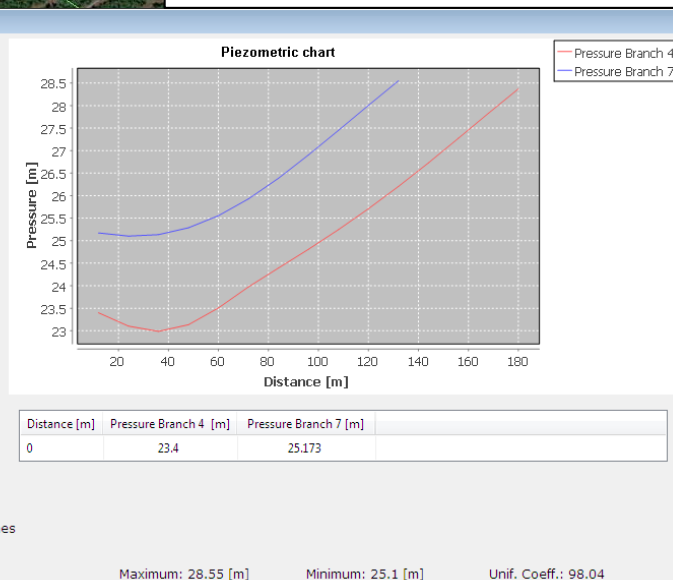
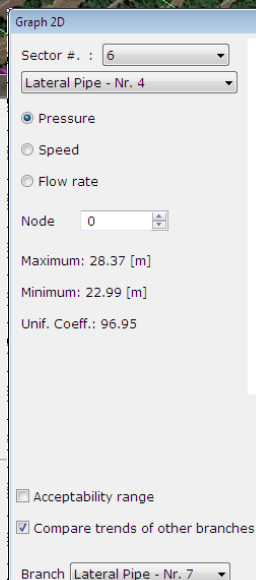
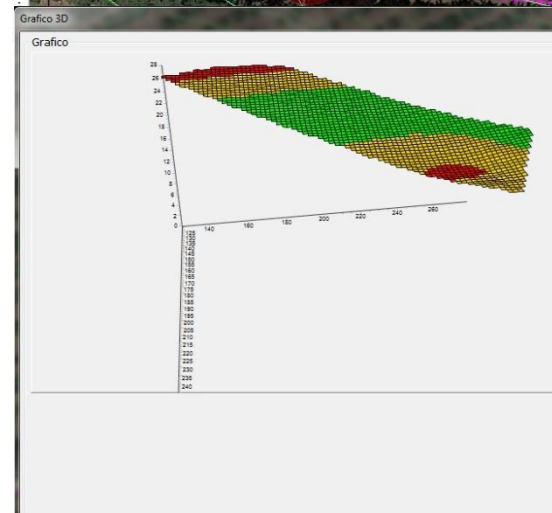
Emitter

Maximum flow rate = 311.26 [l/h]
Minimum flow rate = 277.7 [l/h]
Average flow rate = 293.51 [l/h]

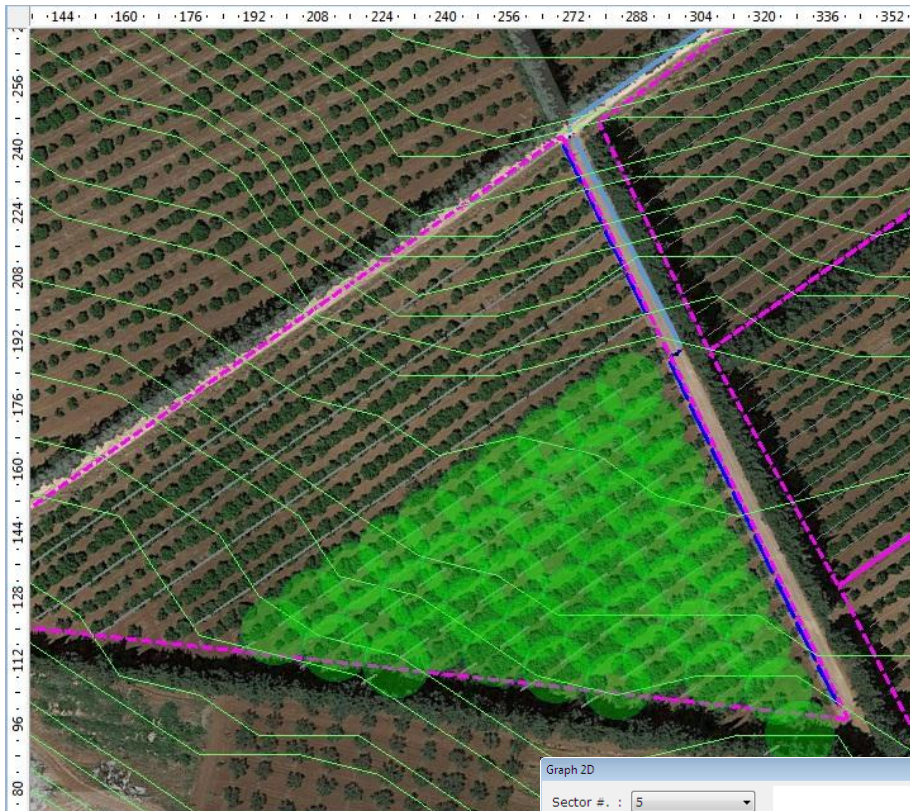
Maximum speed = 1.068 [m/s]
Minimum speed = 0.069 [m/s]
Average speed = 0.512 [m/s]

Maximum pressure head = 27.619 [m] (2.706 [bar])
Minimum pressure head = 21.954 [m] (2.151 [bar])
Average pressure head = 24.568 [m] (2.407 [bar])

Sector surface = 0.79 [ha] (7920 [m²])
Average intensity of water distribution = 2.04 [mm/h]
Maximum head loss compared to source = 3.49 [m]



By closing the first valve and opening the second the result becomes:



6° SECTOR

Working source discharge = 15.99 [m³/h]
Working source pressure = 2.224 [bar]

N° laterals = 9
N° emitters = 46

RISULTATI

Uniformity coefficient (WU)= 99.08 [%]
Uniformity coefficient (Keller e Karmeli)= 96.67 [%]

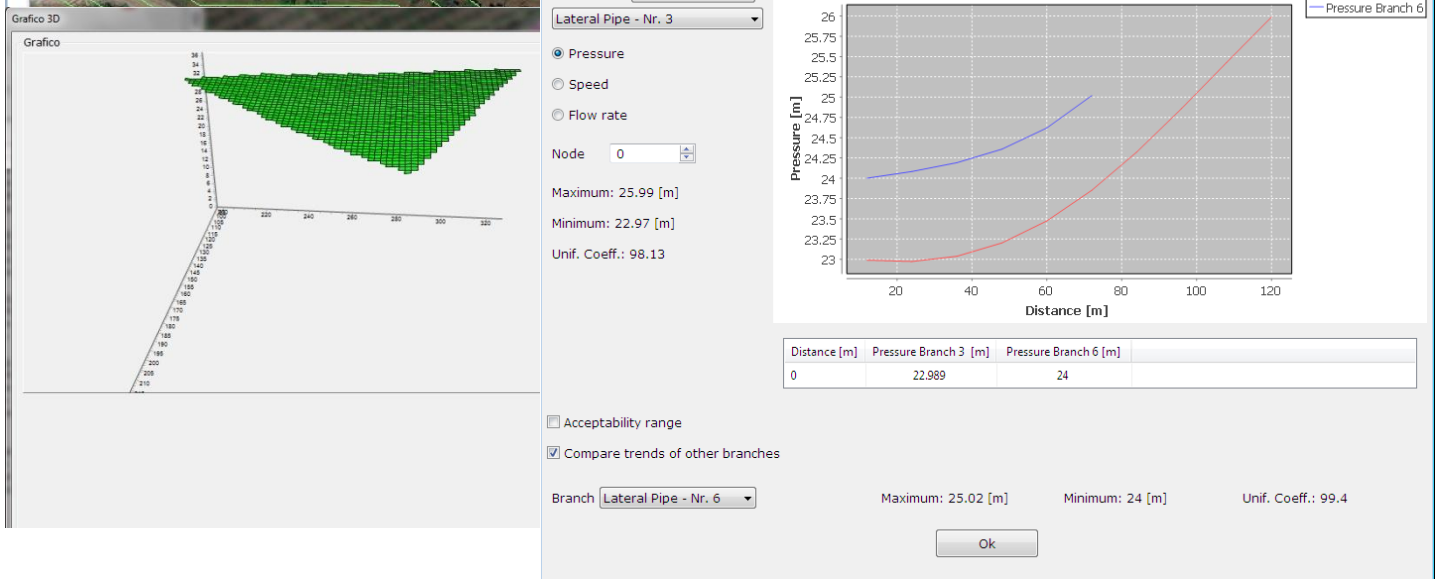
Erogatore

Maximum flow rate = 354.92 [l/h]
Minimum flow rate = 340.64 [l/h]
Average flow rate = 347.5 [l/h]

Maximum speed = 0.846 [m/s]
Minimum speed = 0.086 [m/s]
Average speed = 0.347 [m/s]

Maximum pressure head = 35.966 [m] (3.524 [bar])
Minimum pressure head = 33.114 [m] (3.244 [bar])
Average pressure head = 34.474 [m] (3.377 [bar])

Sector surface = 0.66 [ha] (6624 [m²])
Average intensity of water distribution = 2.41 [mm/h]
Maximum head loss compared to source = 2.07 [m]



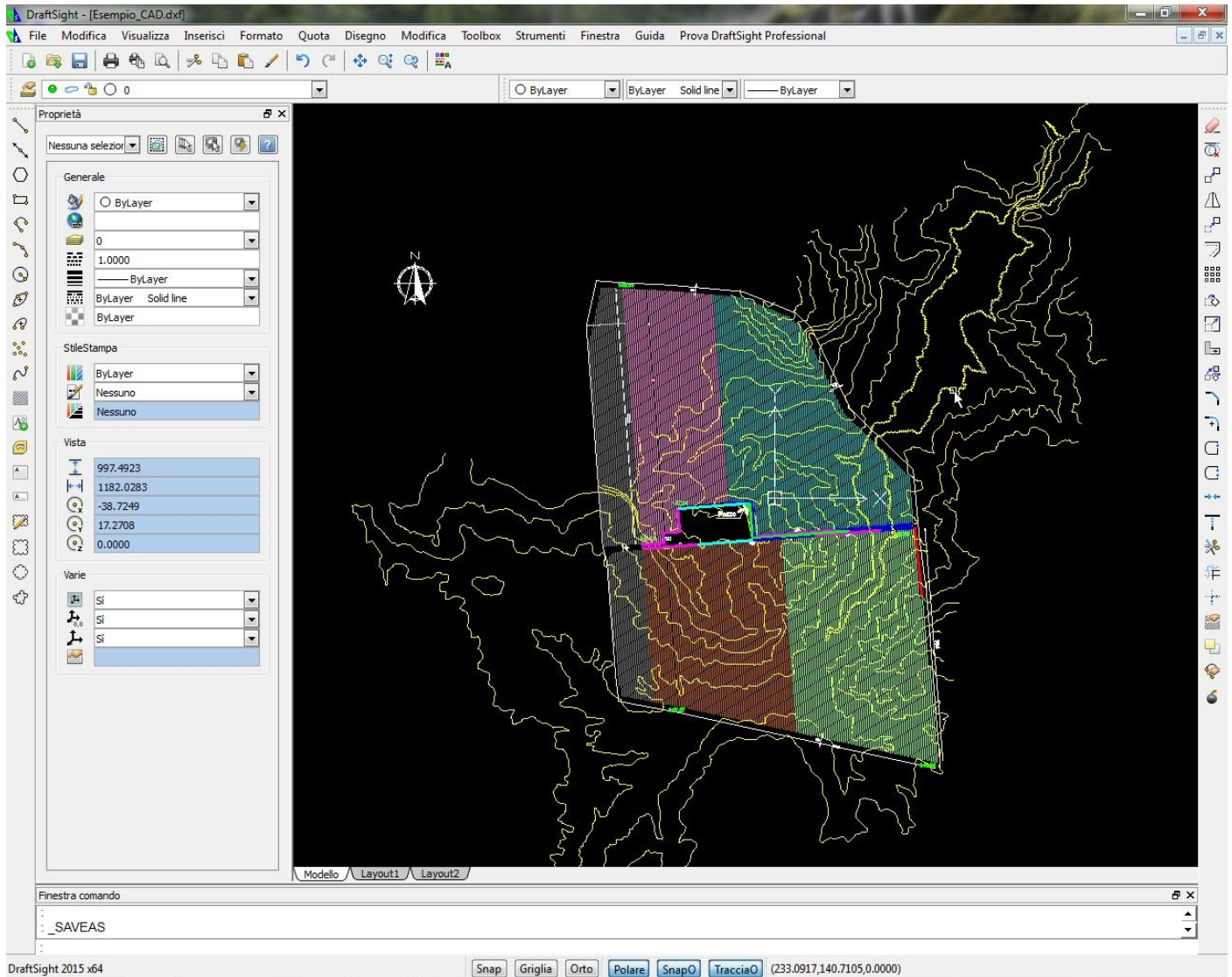
The first rain sector comes with a uniformity (90%) less than the second (96%), probably due to the greater amount of supplied sprinklers. The user will be able to make any changes he may deem necessary to improve the project results.

These and other projects are available [at this link](#), where you can download them already processed and make any changes.

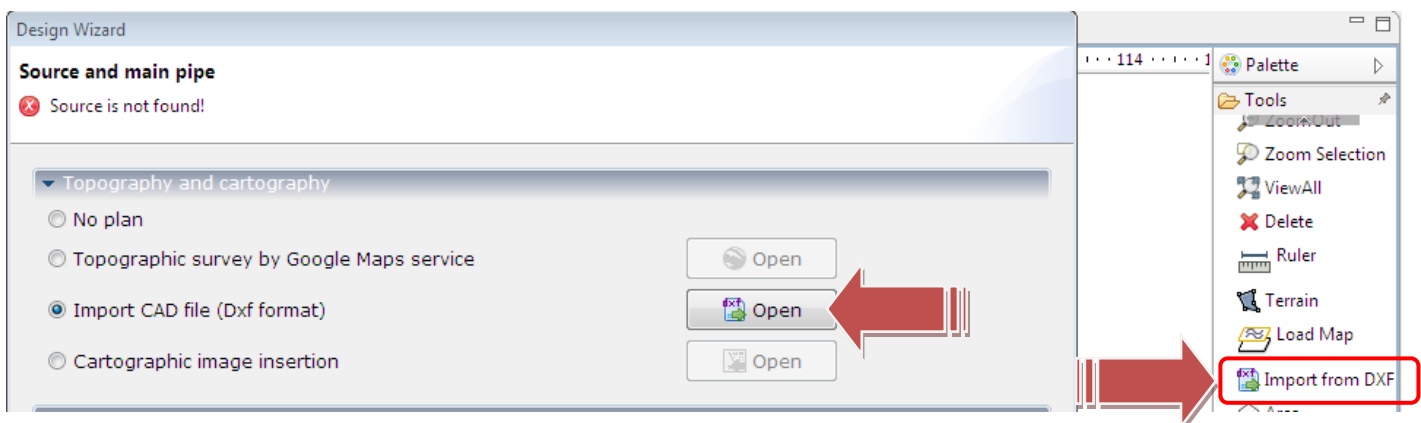


file CAD elaboration

Procedure to import a CAD file containing (optionally) a survey with contour lines, the network with terrain borders and possible symbolism. Download [this file](#) to continue with the project example. Below is a preview of the file obtained with a CAD program.



For importing, proceed with the function "Import CAD file (DXF format)" on the wizard or directly in the editor by calling the Palette "Import from DXF file".



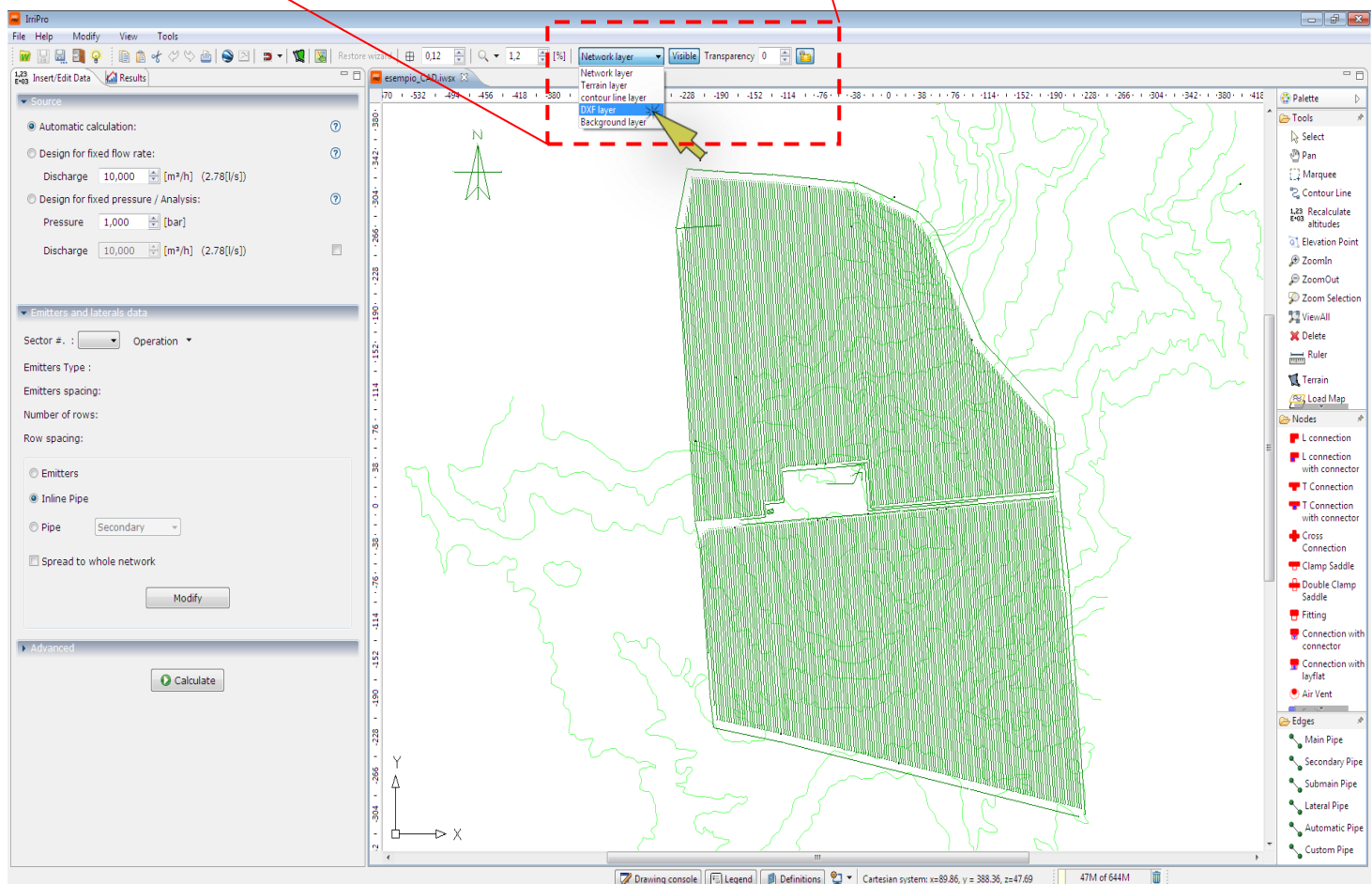
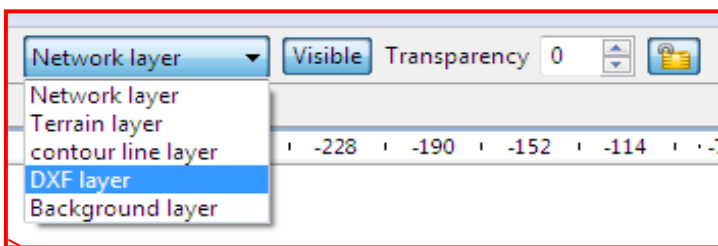
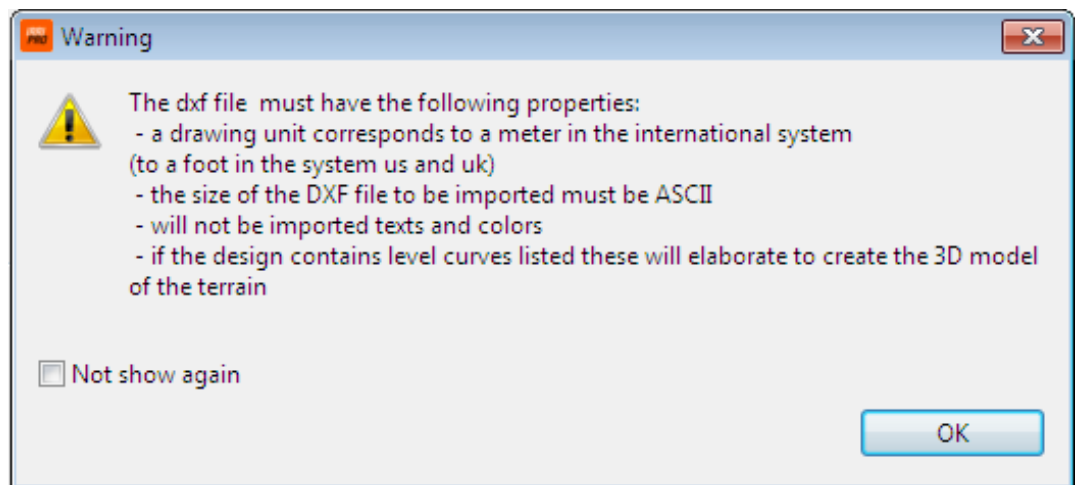
The file to be imported must have certain features as reported by the warning that appears (shown on the right).

Once imported into IrriPro's editor, all content will be shown in green. It will be the contour lines through which altitudes and

slopes will be automatically processed, and the rest of the graphics will be part of the DXF layer. This layer will represent the basis on which the user will be able to position the system by following the shape of the sectors, the direction of the sides and of each other pipe or fitting element.

Through the Layer Management Console, you can decide which layer to display and then hide, at the end of the system design, the DXF layer no longer needed in the project.

The user could start a new project by entering one or more sectors with the "add sectors" function.

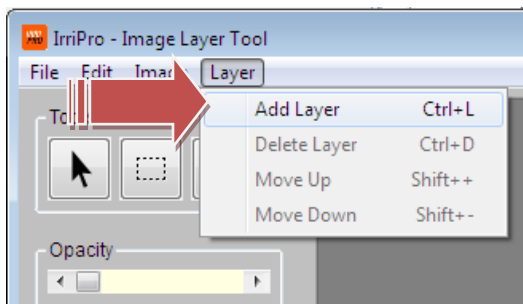
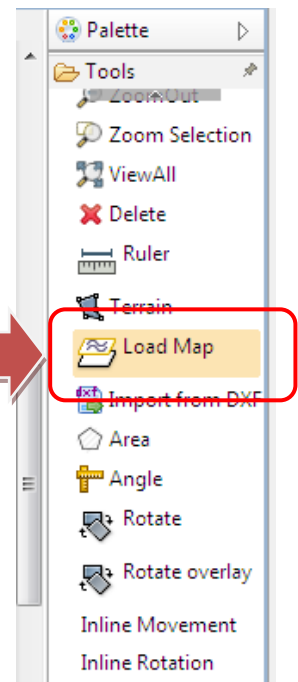
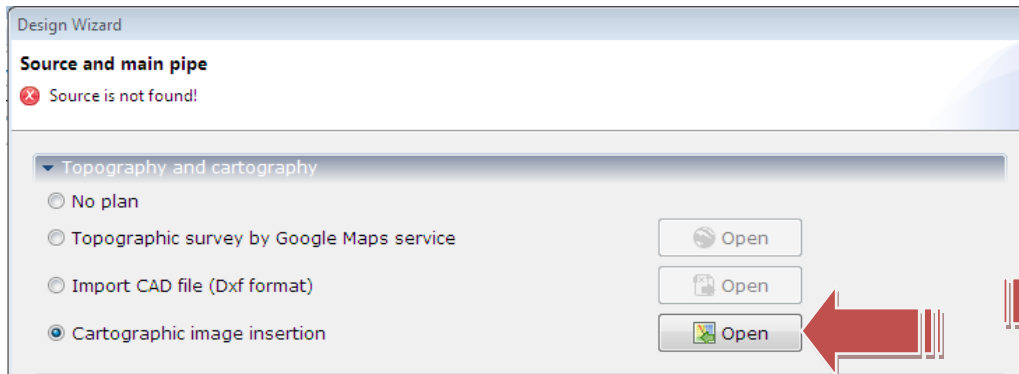




Importing cartographic images

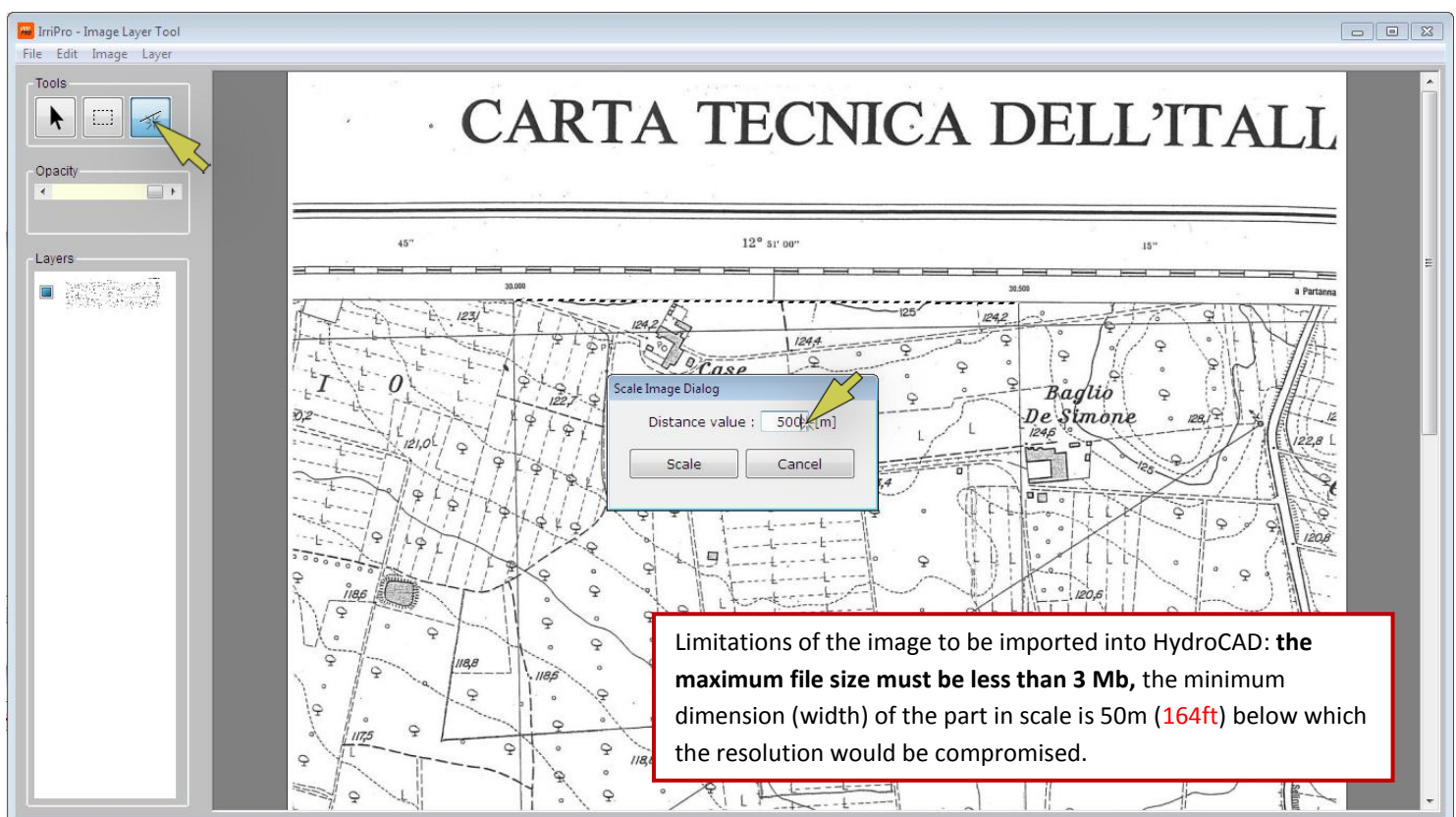
Procedure for importing and dimensioning a cartographic image so as to give the correct dimensions and slopes of the area where the implant works. Download [this file](#) to continue with the project example.

For importing, you will go through the "Insert Cartographic Image" feature on the wizard or directly in the editor by calling from Palette "Map Import".

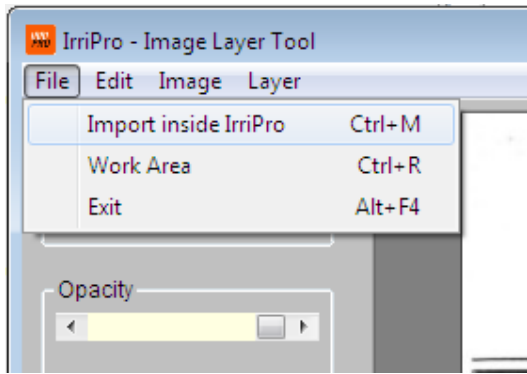


An image management window will open. To process the file, click on Layer → Add layer → Enter the location of the file.

After clicking the "Scale" button, indicate a known distance between 2

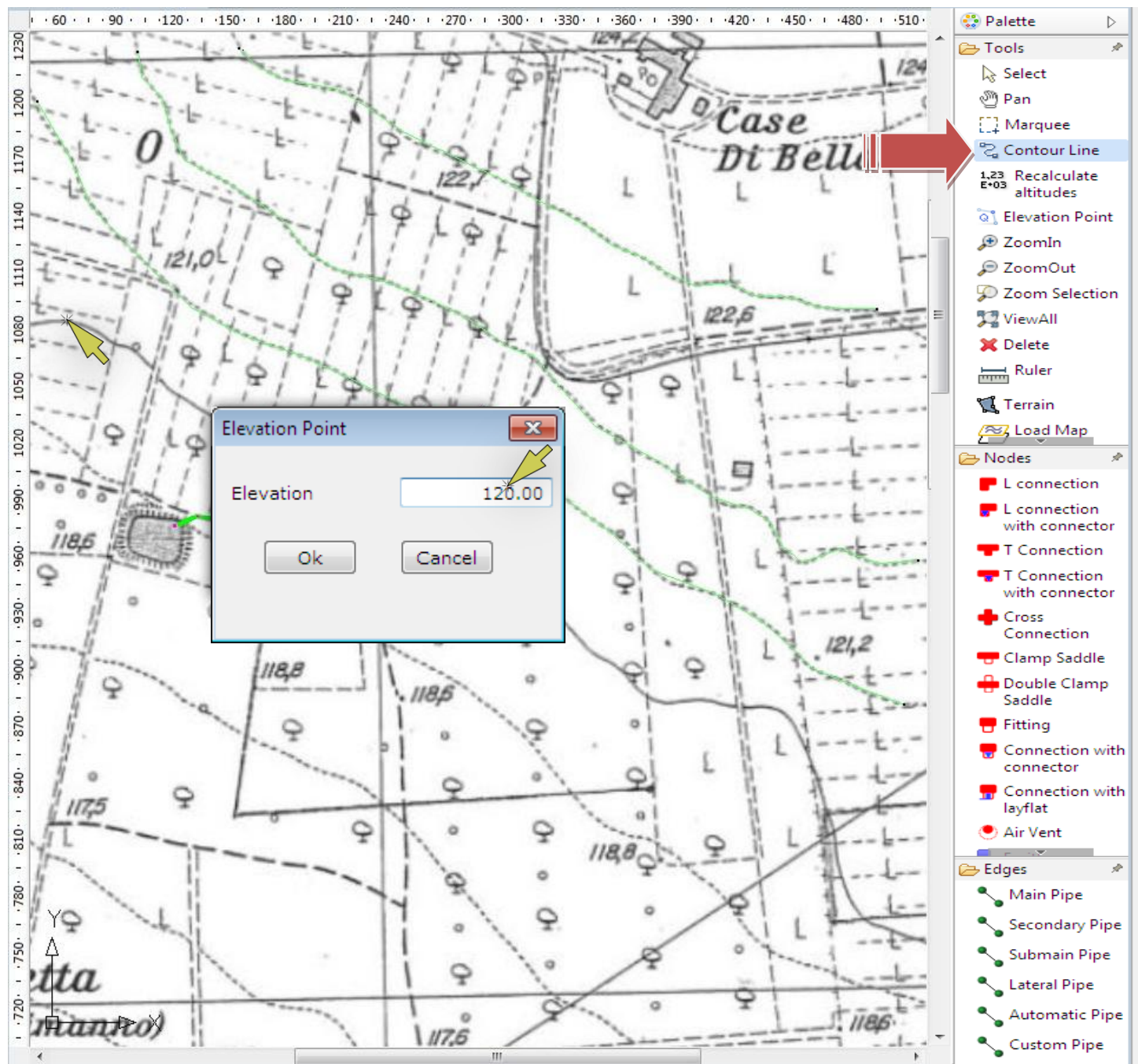


points by clicking on the first and second points: a window will open to indicate this value. This measurement can be taken in any direction and between two points (eg 2 buildings) of which you know the distance. In the example, indicate one side of the kilometer grid and enter the value of 500m (1640ft).



The program scales the image. Once the process is completed, click *File* → *Import to IrriPro*. You will then be asked for the coordinates on the editor where to insert the image. Leave values 0, 0.

Once the cartography has been introduced in the editor, frame the top left part of the work area through the zoom and pan controls, move the source at the hilly pond, and draw the main pipe as shown in the image below.



Select the Layers Curve command on the Palettes and proceed as follows:

1. Click on the first point of the contour line that must be traced,

2. In the window that will appear, indicate the value of the relative altitude (120m = 393.7ft) and confirm with OK
3. Retrace point-to-point the contour line path
4. End the contour line by double clicking on the last point.

Repeat steps 1 to 4 for each contour line you want to trace. At the end of the drawing of all the contour lines, click on the ESC key on the keyboard to process the dimensions on each point of the area and assign all slopes to the elements present on it. Some advices:

- It is not necessary to draw the contour lines on the entire map but only on the area necessary for the system
- Additional contour lines can be added at a later time: altitudes will be updated
- Known points can also be added by using the "Known Points" command from Palette and positioning each point on the affected area
- The more the contour lines and the known points, the more accurate the slopes of the system will be

Proceeding with the rest of the example, finish the tracing of the contour lines and recall the "add sector" function to get the system shown below according to the data shown.



Assign as source of sector the last drawn node in main pipe.

Spacing (a) = 1.5 m (i.e. 4.92ft)

Rows distance (b) = 2m (i.e. 6.56ft)

Sector of any shape as drawn on the left

Laterals angle 90°

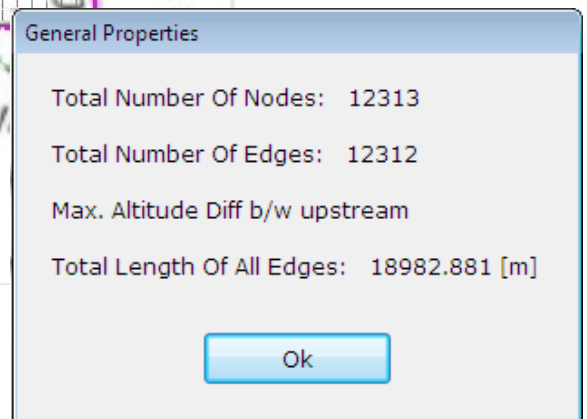
Emitters page left with default values

Pipes page, click "Suggest diameters"

Confirm the last page of the wizard.

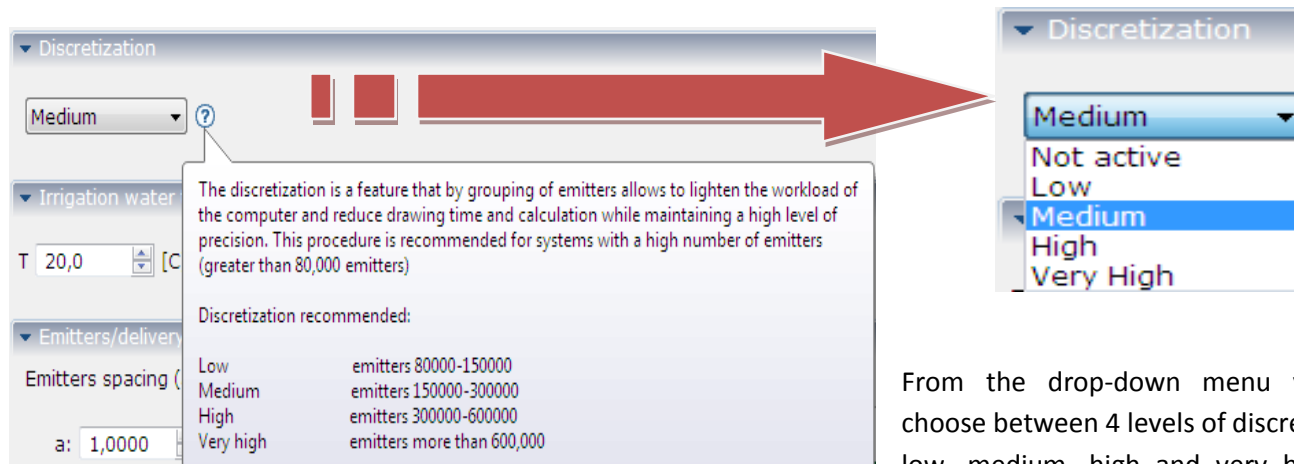
Once the system is

drawn, right-clicking on any part of the workspace and then on general properties opens a window that will show the quantities that affect the whole plant including the number of nodes.



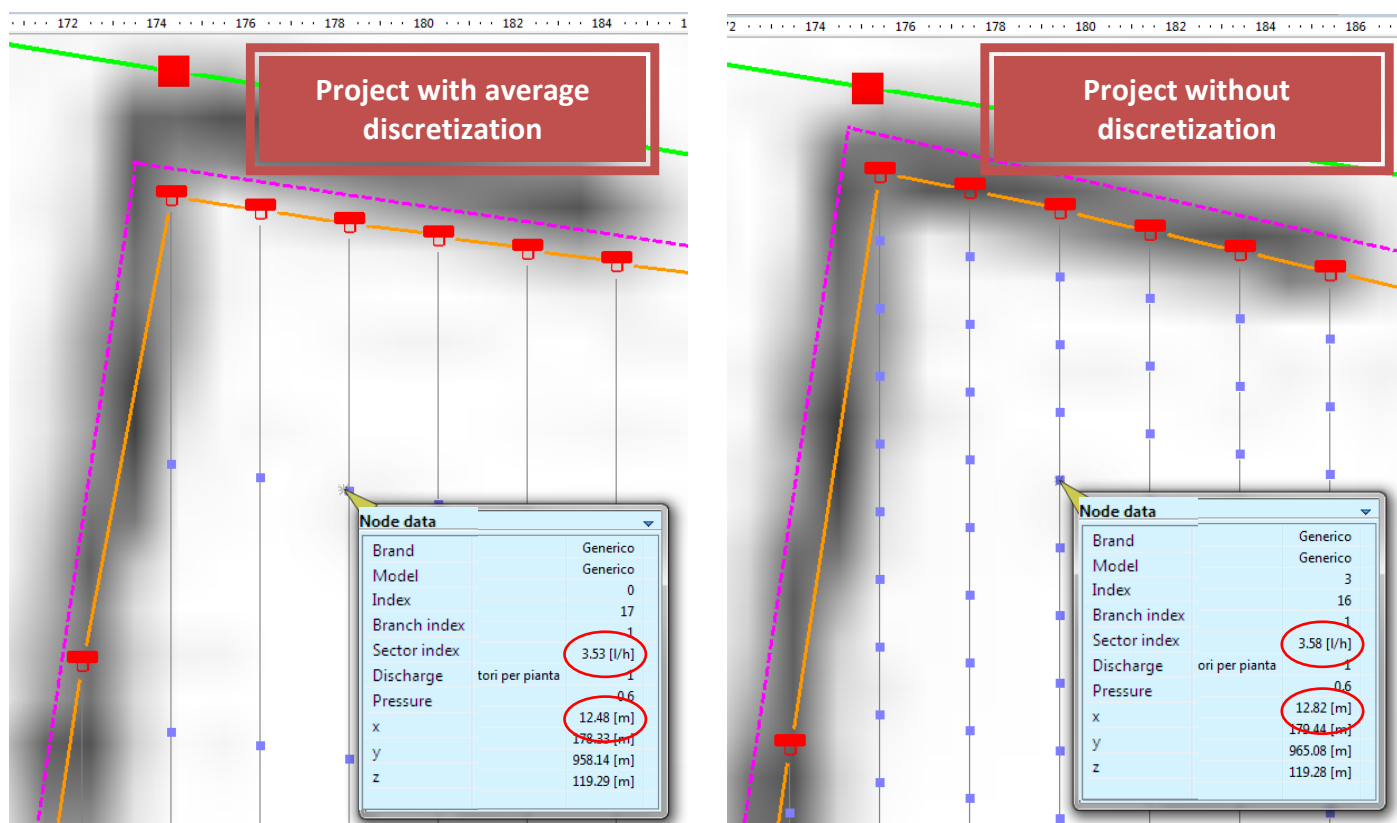
A node number of 12,313 is reported: the node represents an element of the network as an emitter or a connection element. The higher the number of nodes (and thus the amount of dispensers) the more the system load, both for the size of the file and for the project management (slowing down the software operation). To lighten the workload, you can use a feature called **discretization** that allows you to create a functionally equivalent network that is obtained by grouping more emitters for each node. The new plant obtained after discretization will behave as the previous (with negligible variations) showing the same trend of pressures and flows and will present devices delivering a flow equal to the sum of the flow rates of the emitters grouped in each node. To show this functionality repeat the previous example by adopting discretization.

In the first page of wizard in the case of single sector (or in the first window about any sector in the case of multi-sector) you can select the desired level of discretization:



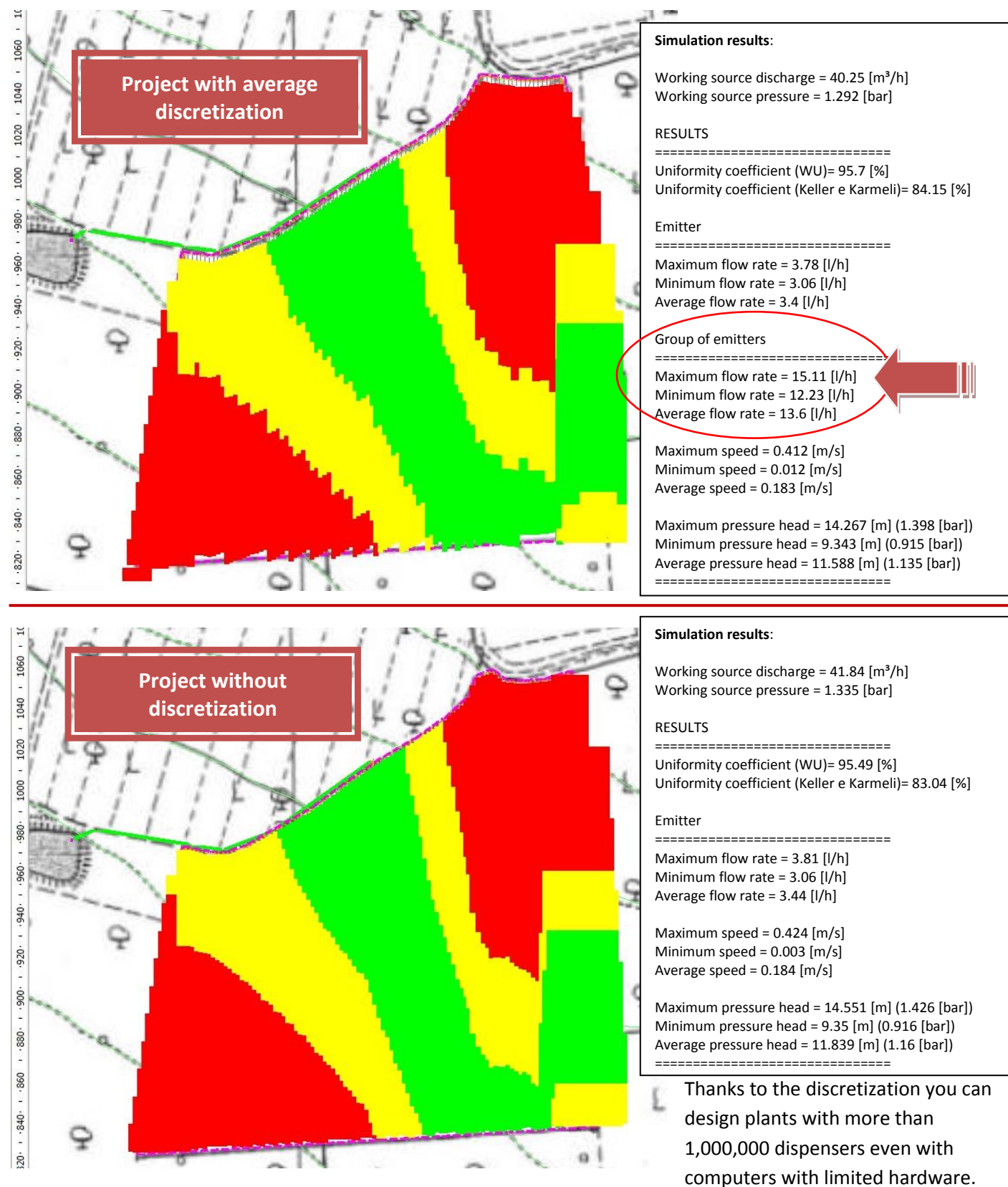
From the drop-down menu you can choose between 4 levels of discretization: low, medium, high and very high. The

recommended level depends on the number of emitters from which the plant will be composed. For example, for a plant consisting of a number of emitters ranging from 150,000 to 300,000, an average discretization level is recommended. In this case, *a medium discretization level (for demonstration purposes) will be used and the same data of the previous not-discretized project will be inserted.* Once the wizard has finished and examining a network node, you can compare the results obtained with and without discretization:



As shown by the tooltip, at the same node (which in the case of average discretization will correspond to a group of 4 emitters), the flow and pressure values are very close. Note that the value of the distance between the nodes will be 4 times and the total number of system nodes will be 1/4 with respect to the case without discretization (as shown in the general properties with a number of nodes equal to 3.097).

By doing the calculation you can see how the thematic maps and the results for the two cases are very similar:

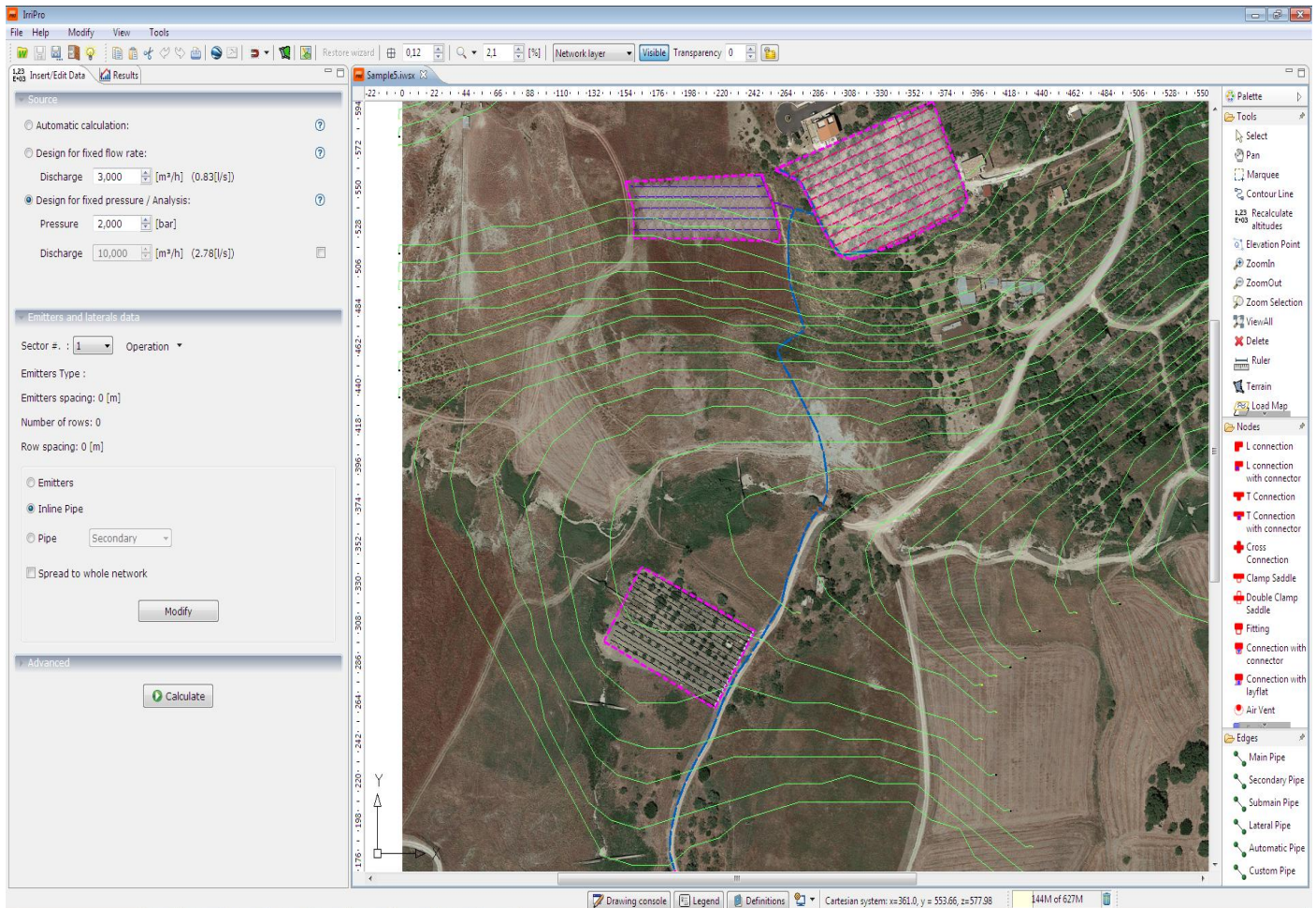


The project with and without discretization is available [at this link](#) where you can download the two files already processed and make any changes.



managing new elements

Download [this project file](#) before continuing with the example. In this case project you will see how to insert new elements, such as a pressure adapter and a pump, and how to handle a fitting through the window dedicated to the elements and their connections. Once this file is opened, this window will appear:

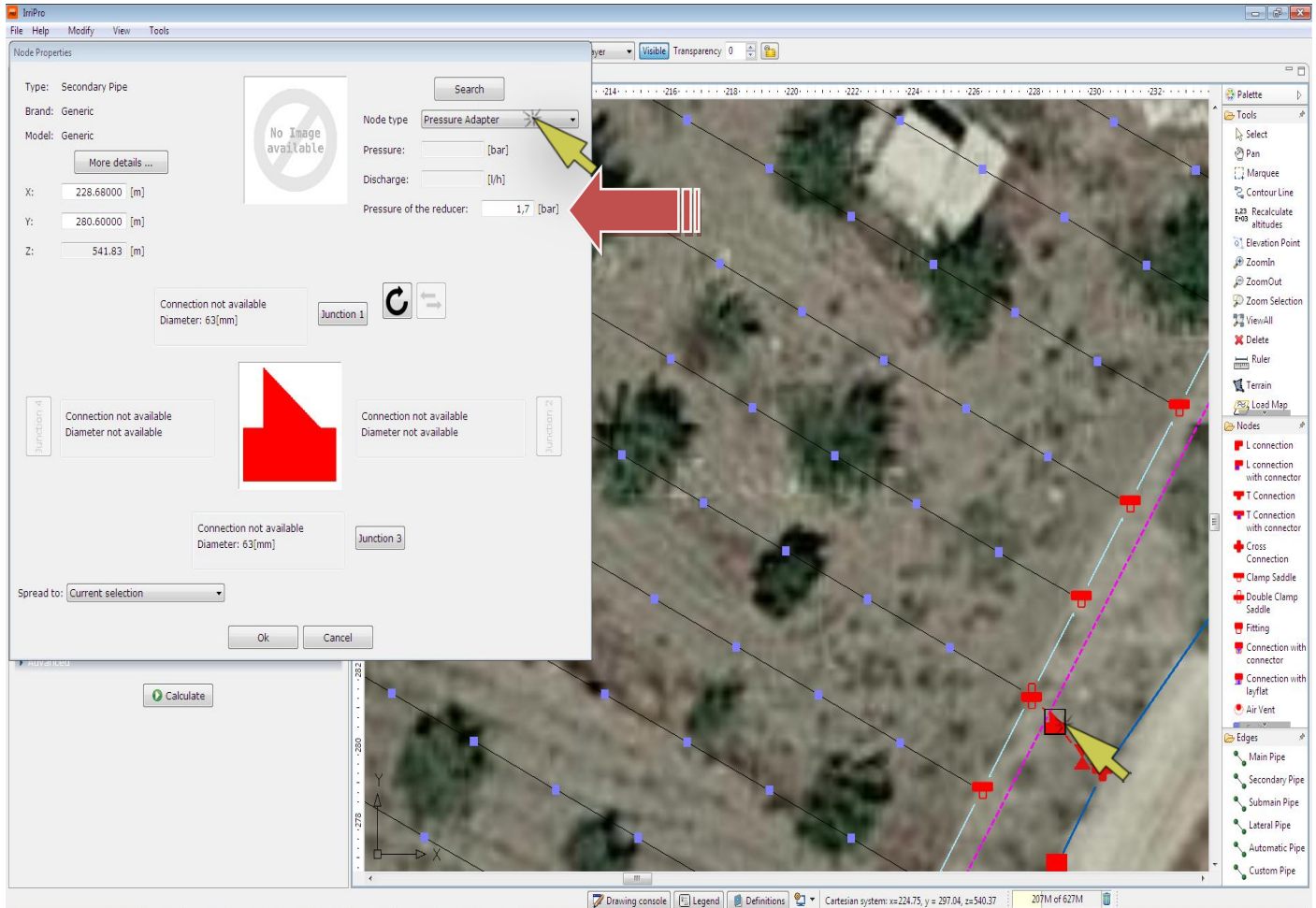


The plant shown is made up of 3 sectors on a sloping land: a sector (drop) at a lower point than the source and two sectors (rain) more distant and located at a greater height than the source. The available pressure at the source is 2 [bar] (29 [PSI]) (calculation type with "fixed pressure").

Under these conditions, and only supplying the first sector (closing the valves of the farthest sectors), the emitters are subjected to an average pressure of about 3.38 bar ([49] [PSI]) very high compared to a nominal pressure of 1 bar (14.5 [PSI]). To reduce the pressure to which this sector is subjected we can insert a pressure adapter by doing the following:

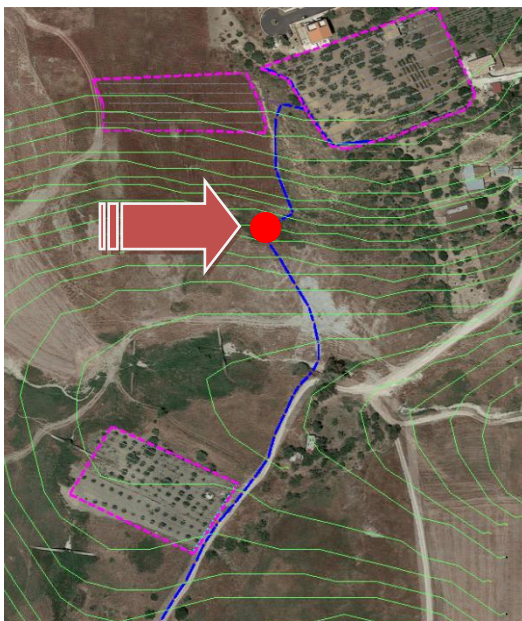
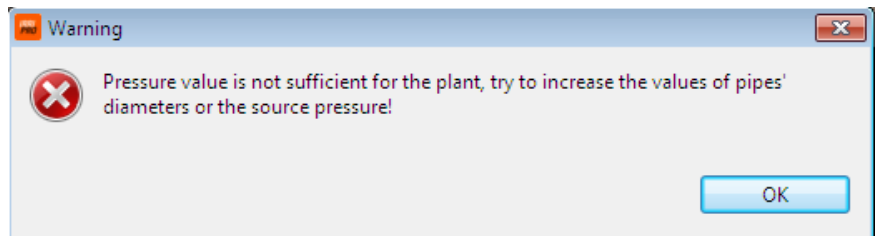
Click on the secondary pipe supplying the sector and on the context menu that appears, select items "insert> node > pressure adapter "

By double-clicking on the symbol of the pressure adapter just inserted, this window will appear:



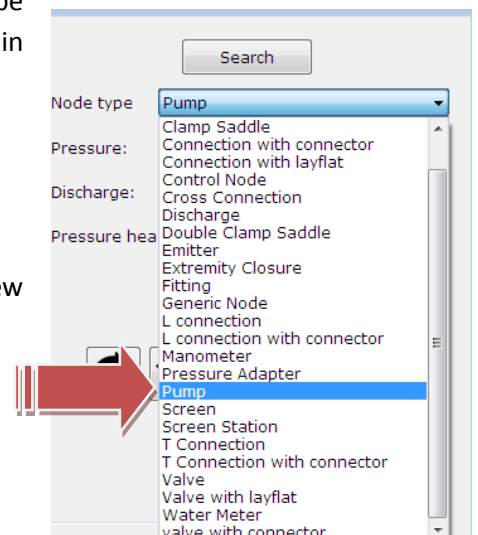
In the figure, the window where the limit pressure of the pressure adapter is set. Enter a value of 1.7 bar which will be the allowable pressure over this unit. If we repeat the calculation, the average pressure of the emitters drops to 1,882 bar.

Moving on to subsequent rounds close this sector valve and open the valve of the second sector. Re-run the calculation to verify the capacity of the source to supply the new sector. In this case, the window will appear indicating that there



is not enough pressure to supply the plant. In this case a pump must be inserted. The pump will be inserted in the position shown in the figure below.

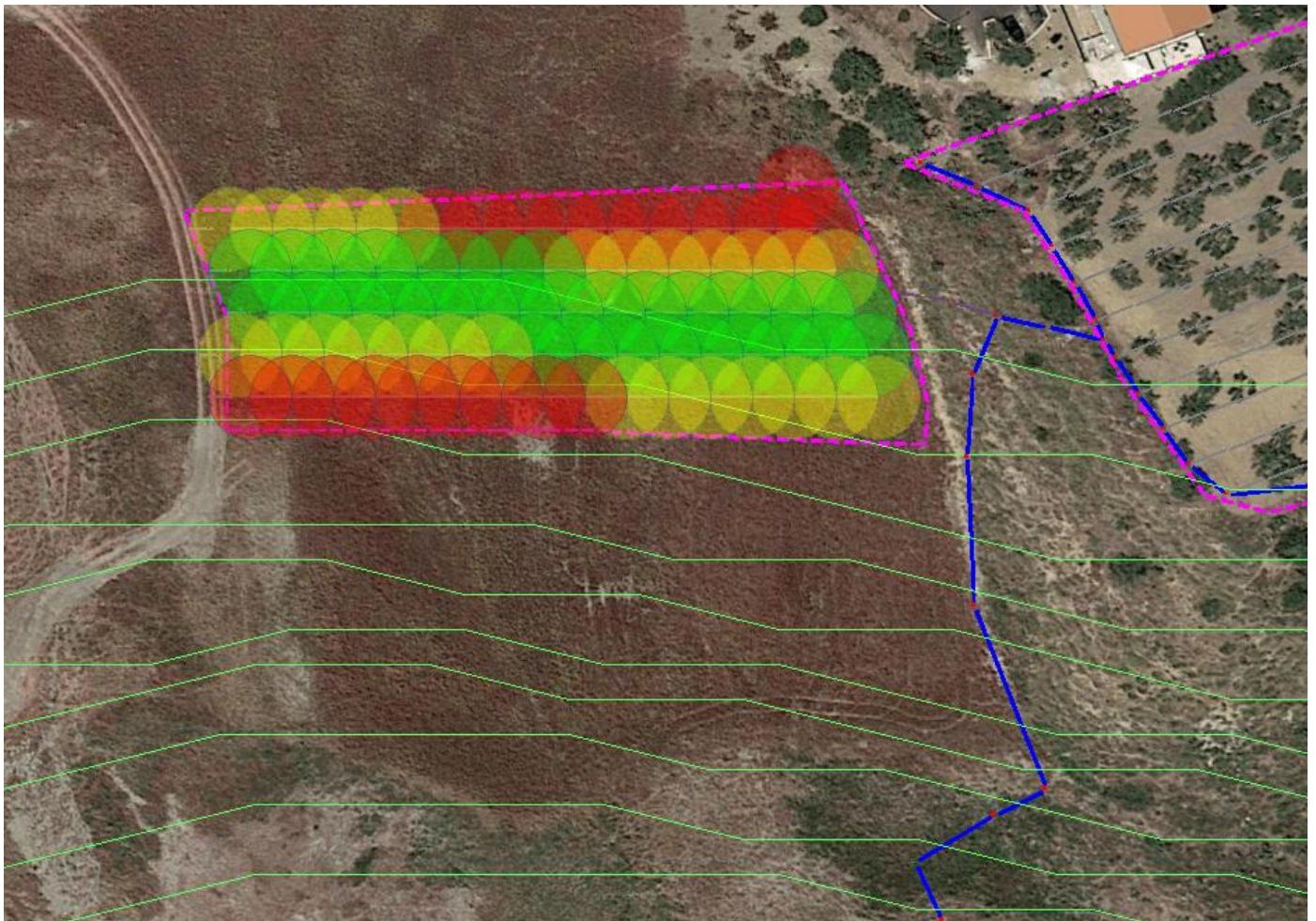
By double-clicking on a node (new or editing an existing one), the node management window opens. From the drop-down menu, *change the typology to "Pump"*.



To indicate to the program the head pressure of the pump, *set the value of 4 bars* in the box:

It should be noted that each pump model has a specific characteristic curve of flow vs. head pressure and therefore a different head pressure value for each passing flow. The value to be assigned is relative to the pump model to be used and the flow rate through the branch where the pump is inserted.

Once the pump has been inserted, repeat the calculation checking that the second sector is supplied.



With the new pressure regime due to the pump, every emitter in the industry can be supplied even if not uniformly. Insert a screen for this sector:

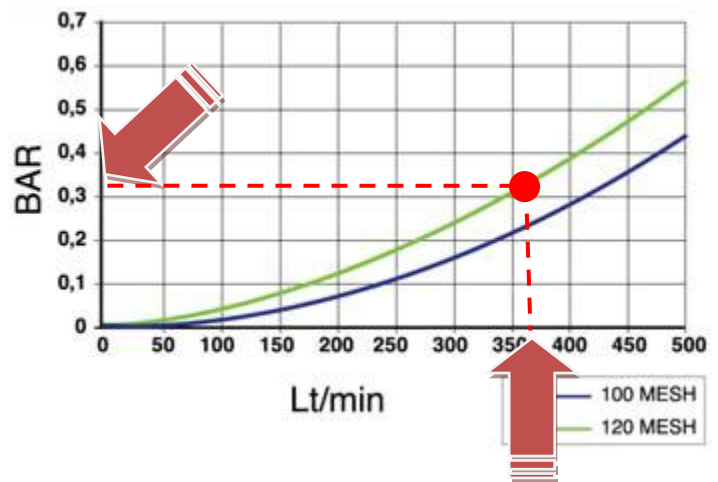
Click on the secondary pipe supplying the sector and on the context menu that appears select items "insert>node > screen". Double-clicking on the screen symbol just entered this window will appear:



To enter the value of the pressure loss due to the screen (a default value of 0.5 bar), change the value of the head loss.

To find the correct pressure value to be assigned to this field, see the technical data sheet of the screen by looking at the pressure-flow curve: choose the value corresponding to the flow rate in the branch where the screen is inserted.

Since the introduction of the screen element (such as the introduction / modification of any other type of element) involves a change in the downstream pressure regime, it is necessary to repeat the calculation to verify the new behavior of the system. If new conditions require it, it may be necessary to choose a pump with a higher prevalence.



Assign as submain and laterals respectively a pipe DN50 (1 "1/2) and a DN40 (1 "1/4). To assign T-fittings in the same sector, double-click on any item of this type that belongs to the submain, in order to open the element management window:

Click on search to go to the window where to choose the model brand and model. This window automatically populates the pipeline diameter search fields for the element. Assign an item that presents all connections with compression joint.

If the selected item has one or more connections that need additional intermediate fittings to connect to the pipeline, click the "Connection" button and select the additional element.

At the bottom left of the window, you can use the drop-down menu to select "Whole network" or "Full Sector" to extend the selection of the fitting to all sectors or only to the one to which the item belongs. This prevents you from repeating the procedure for selecting and assigning to all the elements by performing it only once for items of the same type.

This and other projects are available [at this link](#), where you can download them already processed and make any changes.

Search item

Search criteria

Typology: T Connection Brand: Plast Project

Material: [dropdown]

Code: [text] Model: [text]

Nominal flow rate: From [text] To [text] [m³/h] [checkbox] Single searching

Nominal pressure: From [text] To [text] [bar] [checkbox] Single searching

Kind of coupling1: [dropdown]

Diam1: 50.00 [mm] [dropdown]

Kind of coupling2: [dropdown]

Diam2: 50.00 [mm] [dropdown]

Kind of coupling3: [dropdown]

Diam3: 40.00 [mm] [dropdown]

Price: From [text] To [text] [€]

Power supply: [checkbox]

Search

Search results

Brand	Code	Model	Nominal pressure [bar]	Nominal discharge [m³/h]	Kind of coupling1	Diam1 [mm]
Plast Project	90205014		10		Compression PN6-PN10	50
Plast Project	97105014		10		Compression PN6-PN10	50
Plast Project	98105040		10		Compression PN6-PN10	50
Plast Project	LF1085.00GF		10		Compression for Layflat PN 4-Pn 10	50
Plast Project	LF1090.00GF		10		Compression for Layflat PN 4-Pn 10	50

Number of items found: 5

Ok Cancel property

Node Properties

Type: Secondary Pipe Brand: Plast Project Model: Generic

More details ...

X: 254.26000 [m] Y: 541.08000 [m] Z: 577.74 [m]

Node type: T Connection

Pressure: 2.25 [bar] Discharge: 0.00 [l/h]

Connection not available Diameter not available

Junction 1

Junction 2

Junction 3

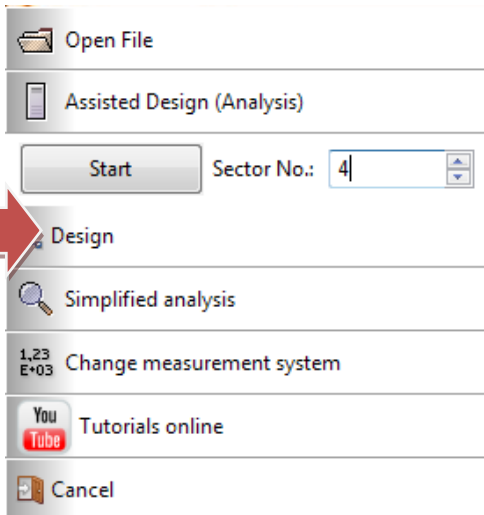
Spread to: Current selection

Ok Cancel



free hand/gardening design

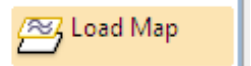
Procedure to switch immediately to the workspace, bypassing the wizard, where all the functionalities to draw and design a system from scratch are already operating.



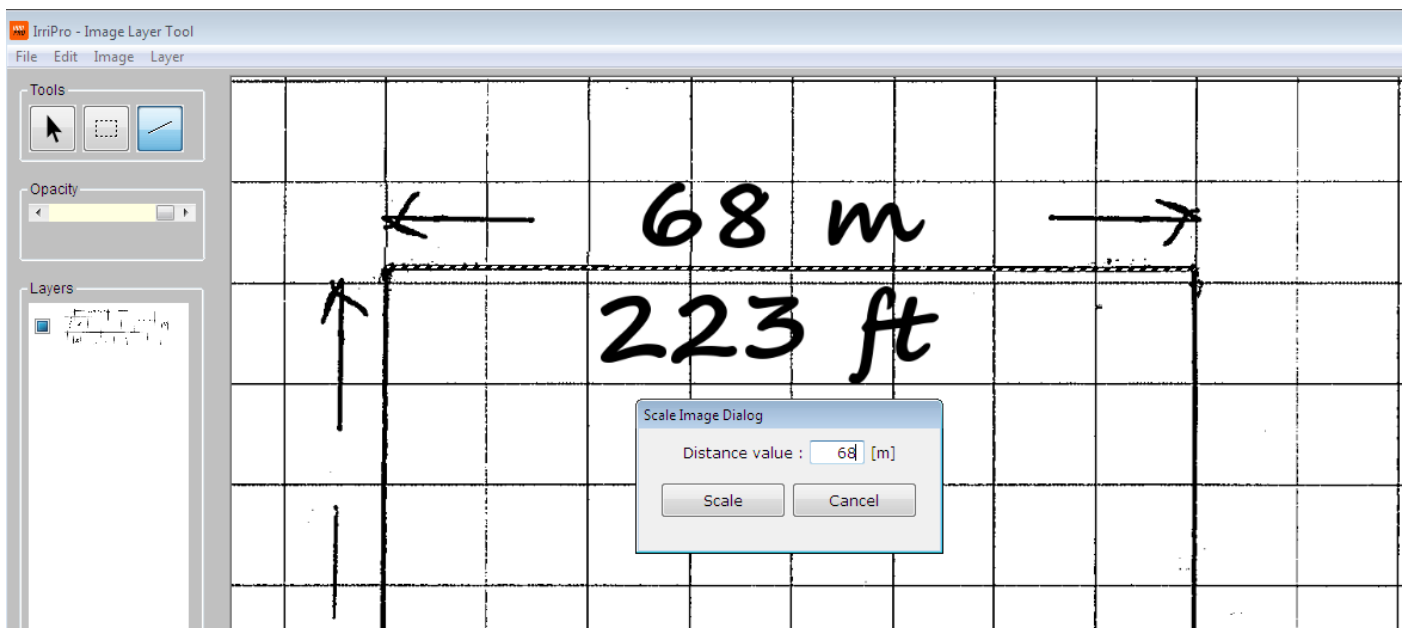
In the first window at the opening of the program choose "Design" to enter directly in the editor. The work area will be empty except for the source at the center. You can embed a relief with Google Maps through the button.



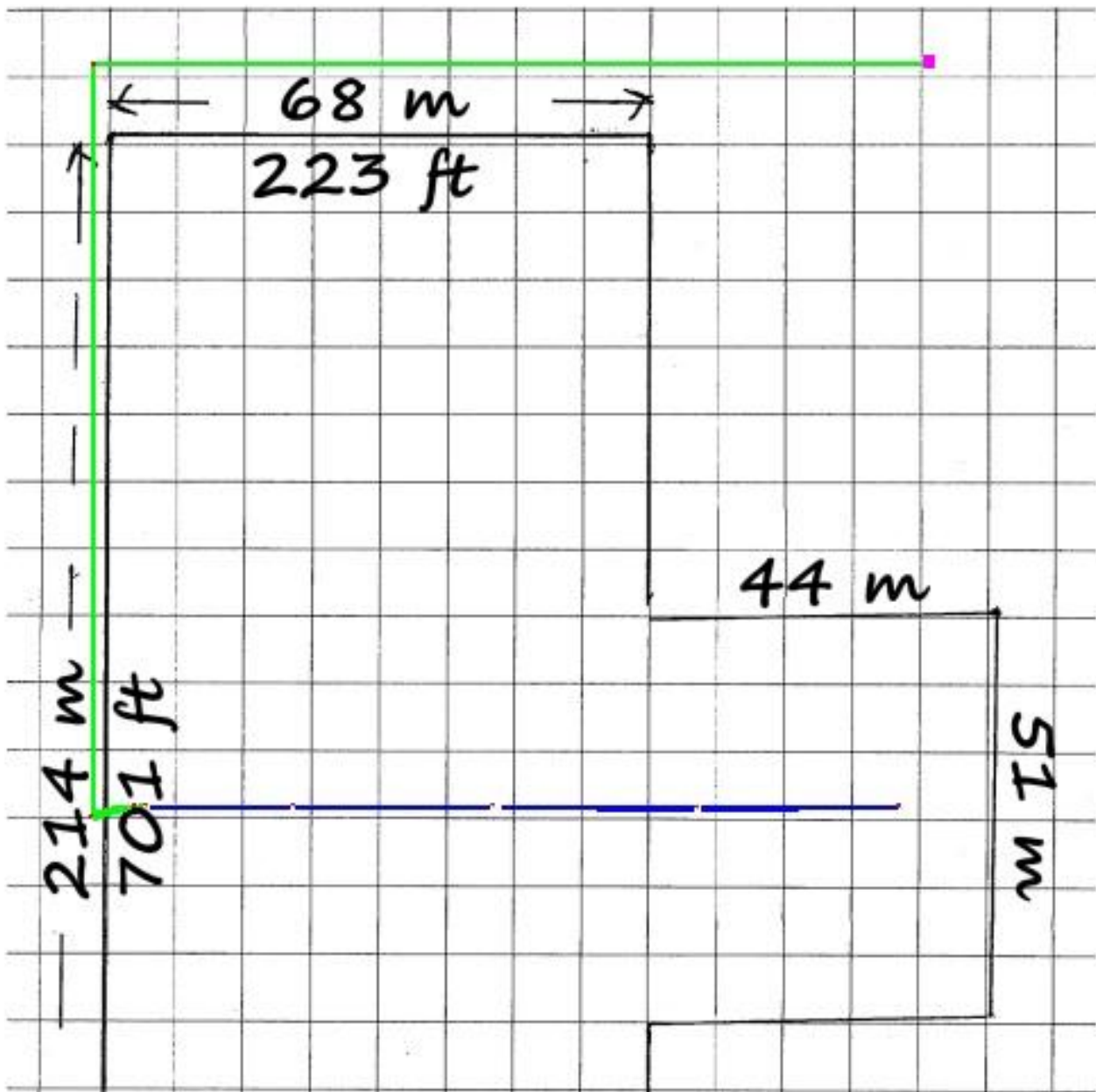
Or a planimetry, such as the scanned drawing that will be used in this example, through its Palette command.



Use [this file](#) as the image (PNG) to continue with the example project.

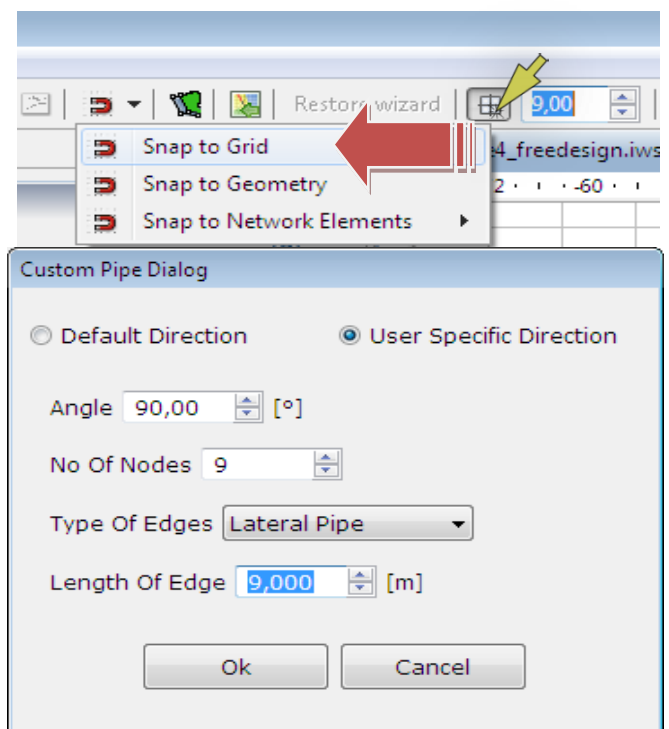


Assign length to an element you already know the size to import the scaled image inside the IrriPro editor. After zooming at 4%, locate the source and draw the main, secondary and submain pipe as shown in the figure:



Insert the laterals using the drawing assist with either of the two methods:

- With grid function (indicating an appropriate step) and activated snap to grid. Each click of the mouse to draw the lateral will place the node at a grid vertex.
or
- with custom pipe function (Palette) following these steps:
 - o Click the "Custom Pipe" command
 - o Click a submain node
 - o In the window that appears, indicate direction (90 ° or 270 °), number of nodes (9-15) and lateral length (9m ie 29.52ft)
 - o Repeat the operation for the other laterals



The laterals can also be pasted after copying them by following this sequence:

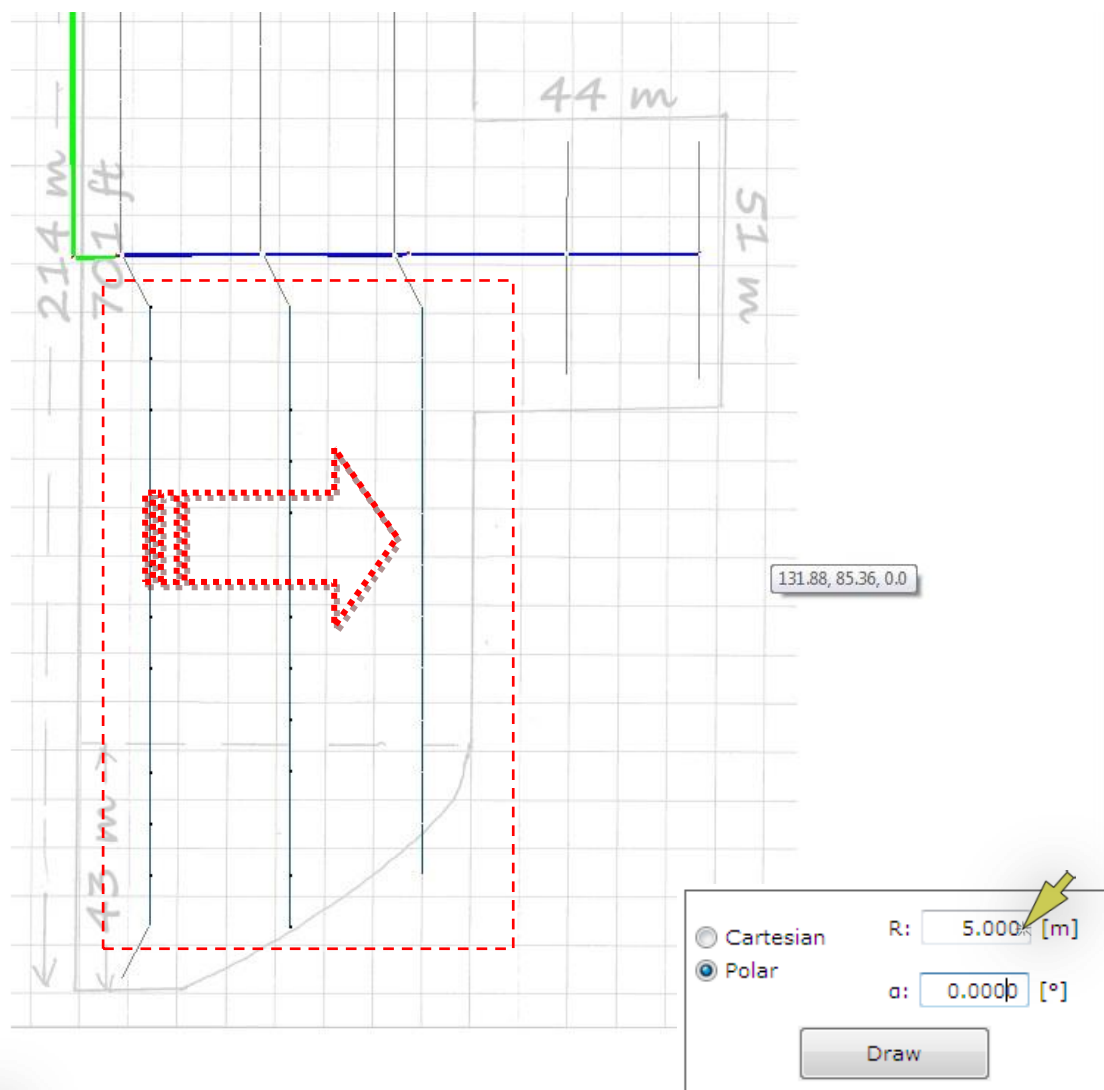
- Select an element of a lateral and then use command "select full lateral" (right click)
- Select a point on the side of the submain and click on Paste
- Or
- Paste the lateral to a different position
- Connect the submain node using lateral pipe with the first node of the pasted lateral

Each set of elements composed of a submain and more laterals, just connected to the rest of the network (and hence the source), will acquire a sector index (shown on the tooltip) becoming a new sector.

You can use another design tool (more precise than the previous one) to move and rotate the selected elements by indicating the shift values and rotation angle by performing the following operations:

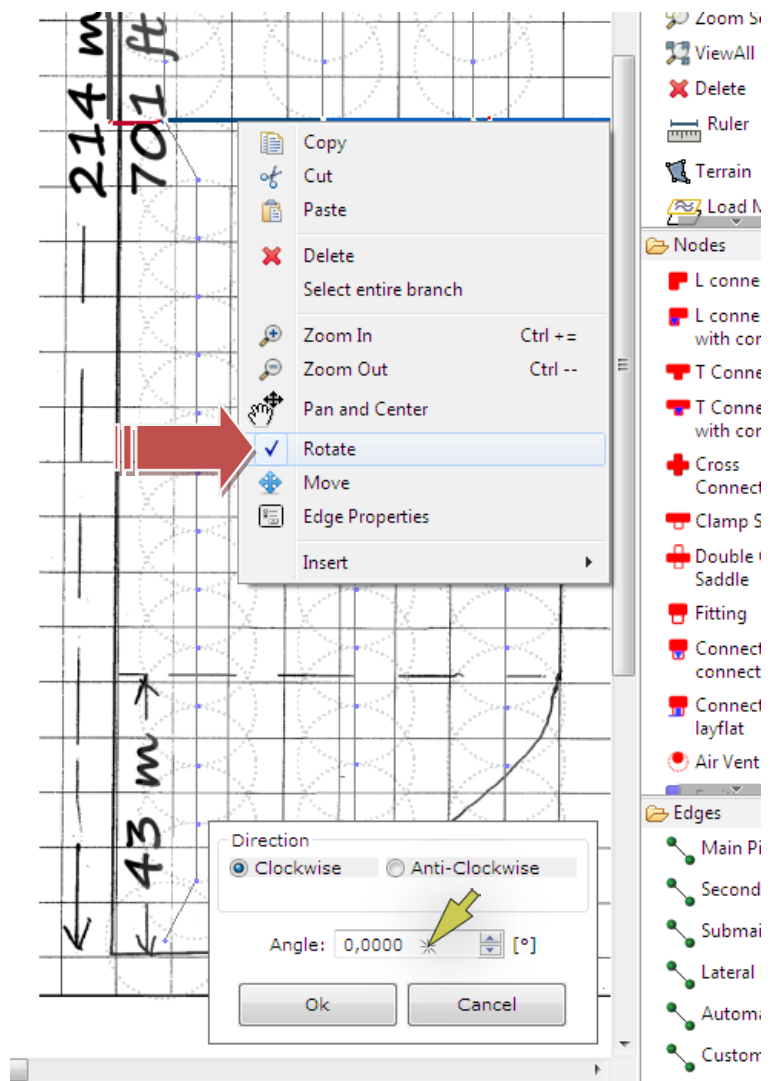
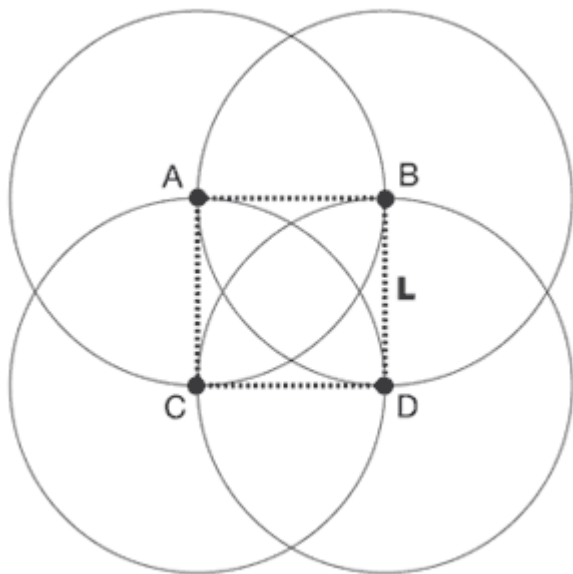
- select objects to move
- recall the Move command (from the context menu) or by pressing the "drawing console" button at the bottom of the workspace
- Click OK to execute the command

For example, perform this operation on a part of the laterals below (the selected part is enclosed in the dotted rectangle) to achieve a horizontal displacement of 5 m (16.4 ft) as shown in the figure



Recalling from the context menu the rotation command we can get the precise rotation of the elements previously selected.

It should be remembered that in gardening, for proper coverage of the surface, overlap of 100% of the wet areas between 2 sprinklers is required, that is, in the case of square mesh, the "a" interdistance between the sprinklers (equal to the distance between the Laterals) is equal to the value of the range G.



If you want to determine the flow rate needed to supply this plant, you need to choose an emitter/sprinkler model with a given nominal flow rate and multiply this value by the number of appliances that make up the plant.

This and other projects are available [at this link](#), where you can download them already processed and make any changes.

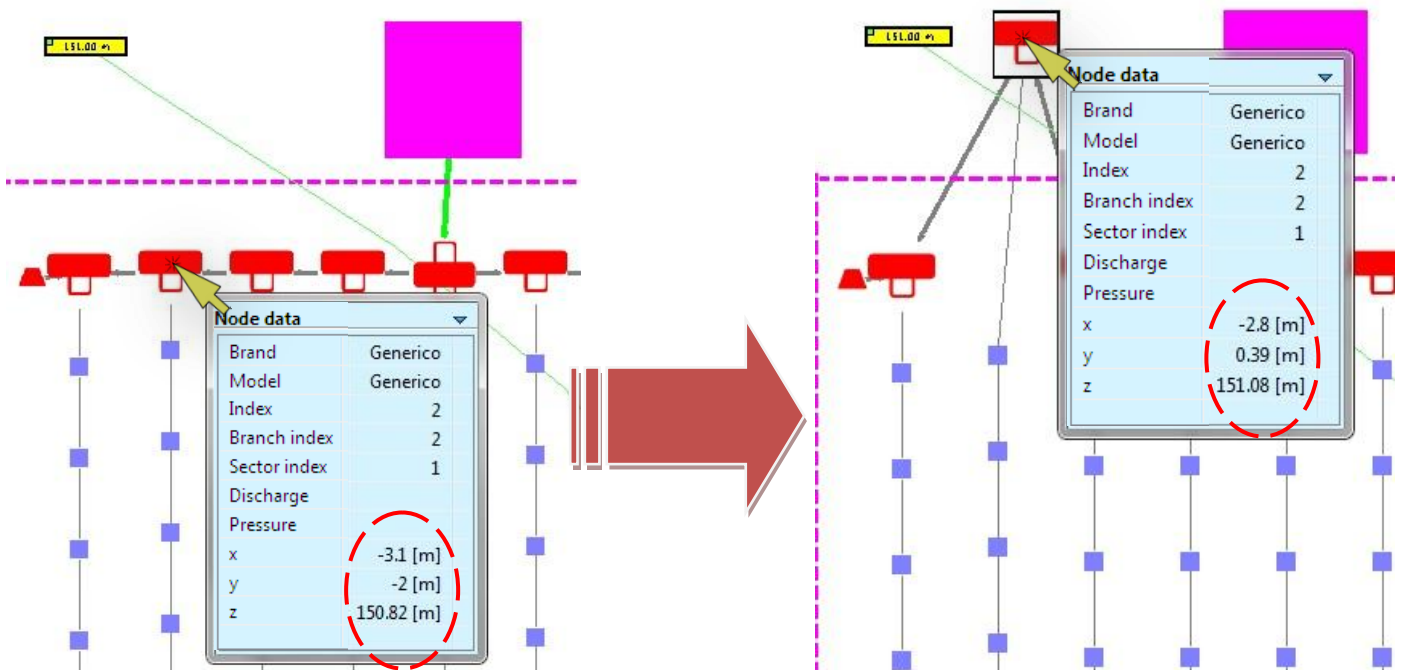


trip and tricks for designing

Element property

Any editing, even graphics, on one or more elements will automatically update all properties. For example, if you move a submain node you will see an update on:

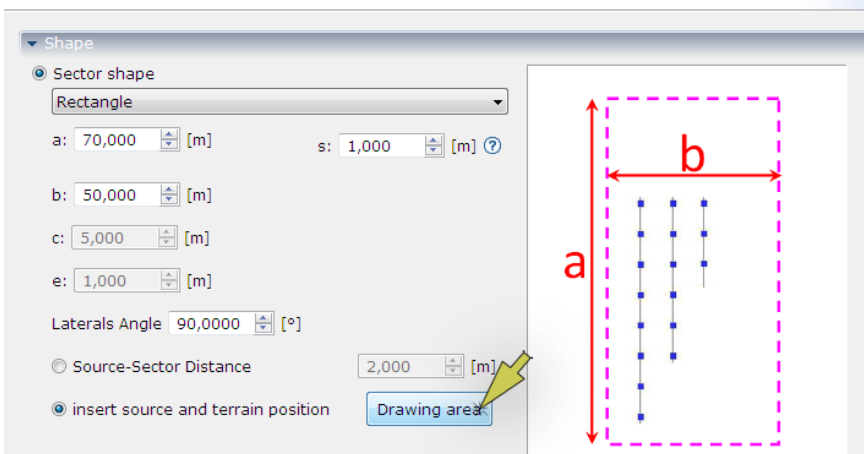
- position
- the lengths of all the pipes connected to the node (2 sides of submain and one of laterals)
- altitude
- Slopes of all pipes connected to the node



Moving/rotating sectors

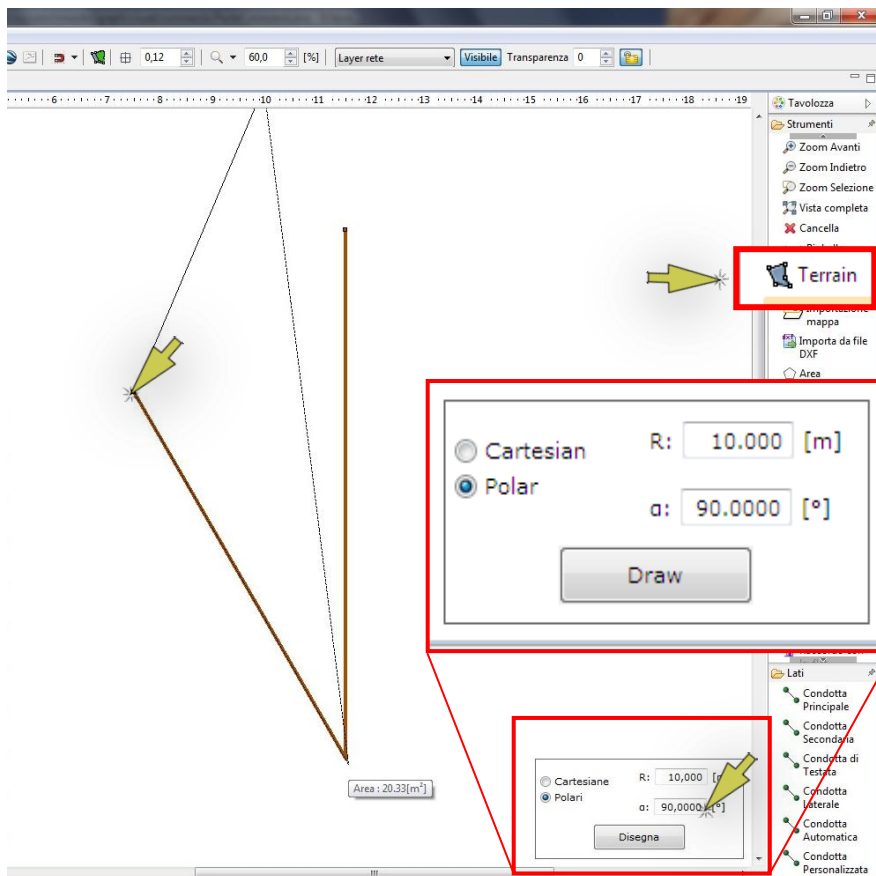
Terrain features

Insert sector shape and slope



If you know the dimensions of the sector you can point it to the wizard then move and/or rotate directly into the workspace. To proceed, just click the "Drawing area" button (shown in the figure), then in the workspace, select the border of the displayed sector, and then move and / or rotate by invoking the command from the context menu.

Drawing through the drawing console



coordinates.

For example, to draw a pipeline or the shape of a sector, follow these steps:

- Select the command from the palette (in the figure, the design of the border of a sector)
- Clicking on a point on the screen to indicate the first node / Vertex
- Open the drawing console and, in the case of polar coordinates, indicate the relative distance and direction of the next node relative to the one already in the editor
- Continue to insert distances and relative angles into the console until you finish the drawing
- Remember that the first point can be placed manually while, through the drawing console, the other points will be identified with coordinates relative to the previous point. This can also be done through Cartesian

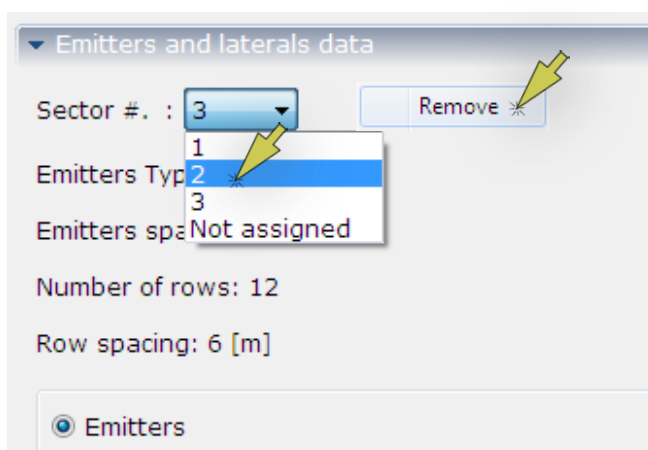
Union of 2 sectors in 1

1. Select and then delete one of the two secondary pipes that supply the sectors
2. Attach, with a submain pipe, a submain end node of the still connected sector to another disjoint (floating) submain end node.
3. Verify that the sectors of the connected sector at a later time have different indices than "-1". Once connected, the two parts will be acquired as a single sector with the same index.

Difficulty of selection

It may be difficult to select an item (or to invoke the context menu on it), especially for high zoom. To find out the right time to make the selection click on the mouse when the tooltip appears next to the cursor.

Deleting a sector



To remove an existing sector network, in the view next to the workspace, select the sector index to be deleted from the drop down menu and click "Remove". To find the correct index of the sector, see the tooltip on one of the sector elements. The removal operation will eliminate the pipes, the emitters and the connecting elements but not the border of the sector (which can be deleted at a later time).

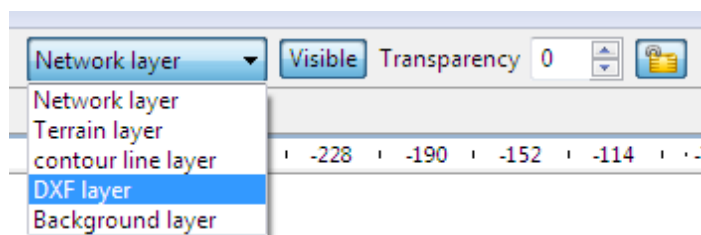
Il settore cancellato può essere ripristinato con il comando Redo.

Transfer from one editor to another

A plant (or only certain elements) can be copied from one editor. Contour lines and background image can not be transferred. To do this, follow these steps:

- Hide contour lines layer
- Disconnect the source of the plant to be copied
- Select the system you want to copy (without selecting the source) from the first editor
- Go to the other editor
- Paste the system to any point (the operation can take several minutes)
- Move the system to the desired point (also through the drawing console)
- Reconnect the system to the new source (already in the editor)

Layer manager



For more comfortably handle the display of items use the manager of the layer being able to display/hide the following layers: network, contour lines, DXF and image. It is also possible to adjust the transparency of the elements within the same layers.

Google Maps Survey and CAD



You can overlay a drawing of an imported DXF file with the survey performed by the Google Maps service. To move and rotate the CAD file in order to get a proper overlapping with the survey, you must use the drawing console after selecting the elements. In this case, the drag-and-drop function of the items to be moved is not available.

Efficiency



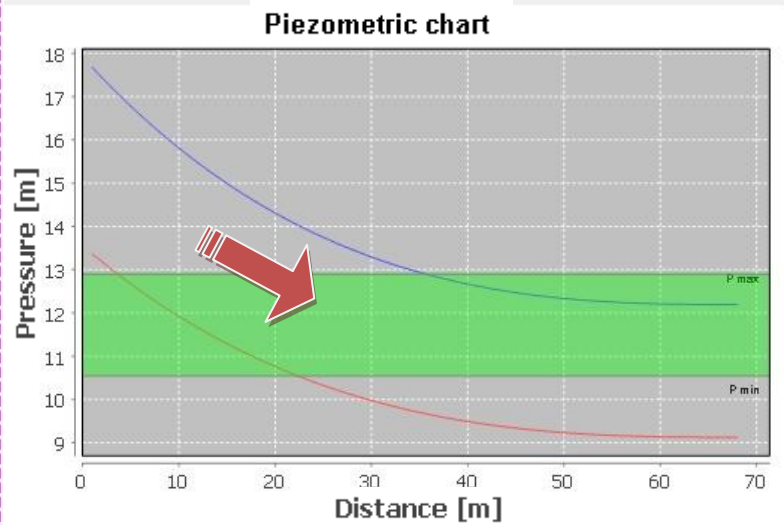
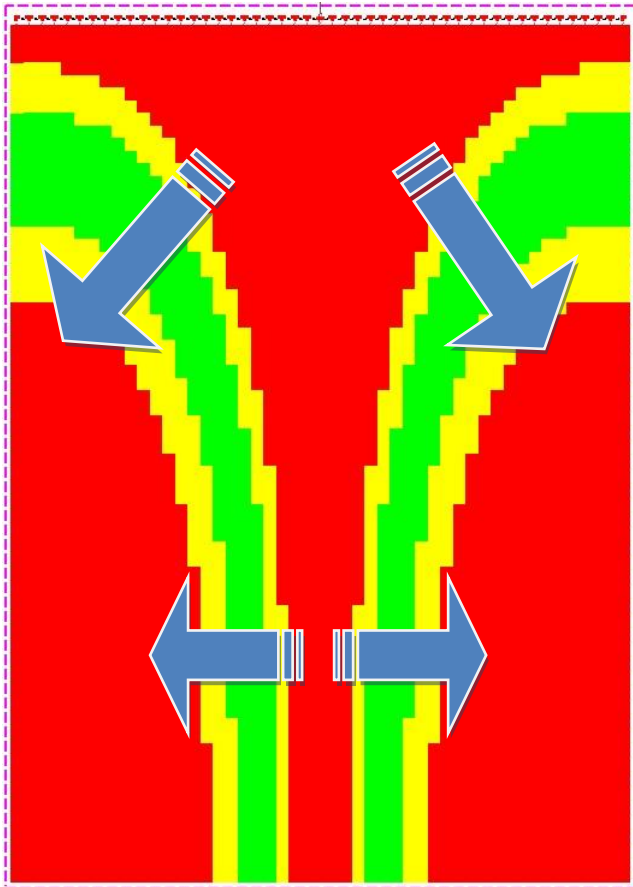
Among the results of a project, in addition to the pressure, flow rate, velocity and uniformity coefficients, the value of distribution efficiency is shown, strictly dependent on the irrigation method employed, expressing the ratio between the volume of water which can be used by the plants and the volume entered into the network (in the source). 75% is the highest value in the case of a rainfall plant and is 87% of that in the case of a drop plant.

A wasted volume is defined as the value obtained in an irrigation time as a volume of water not used by the plant compared to that entered in the plant.

SAMPLE CASES

A number of project cases are shown here, which show the thematic map and the 2D chart (of the first lateral and the middle lateral), and their solutions to improve the conditions.

CASE 1



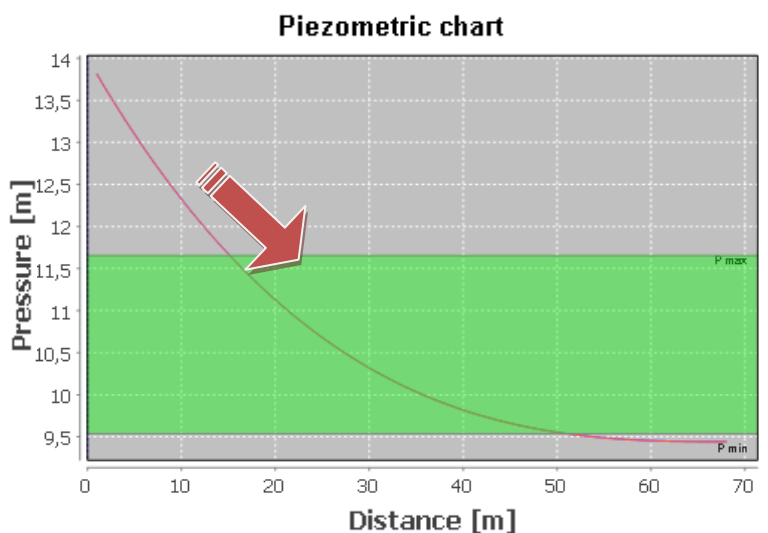
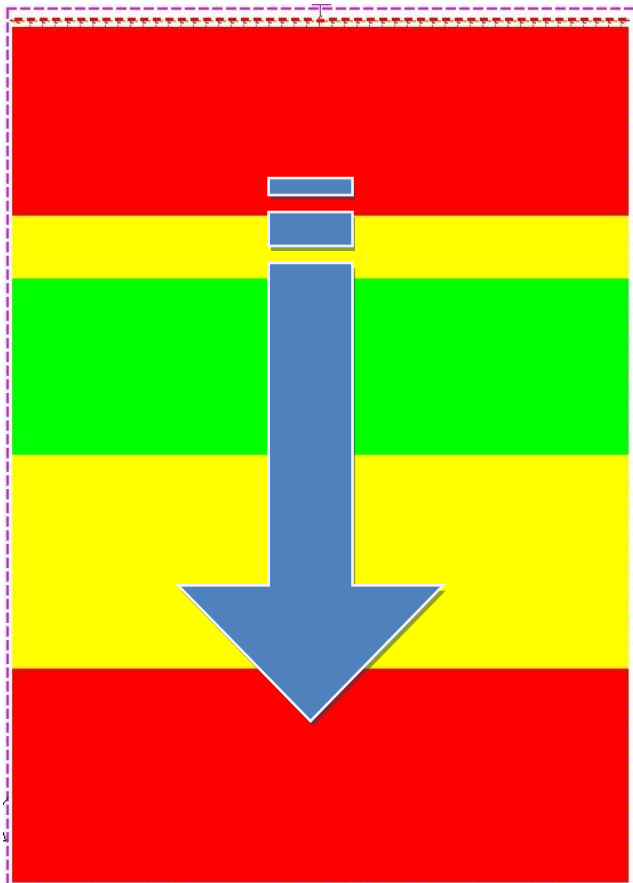
PROBLEM

Excessive pressure variation in the direction of submain and laterals. The pressure decreases along the lateral and along the central part of the submain towards the extremes.

SOLUTION

Increase the diameter in both the submain and the lateral in order to obtain a lower pressure variation and lower continuous load losses.

CASE 2

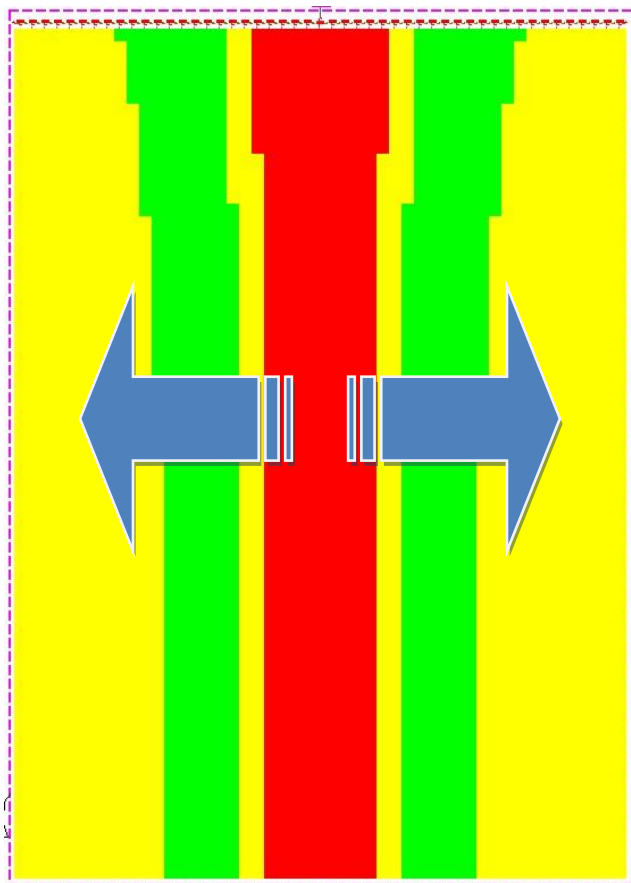


PROBLEM

Excessive pressure variation only in the direction of laterals. There is a small variation within the laterals. The pressure decreases along the lateral.

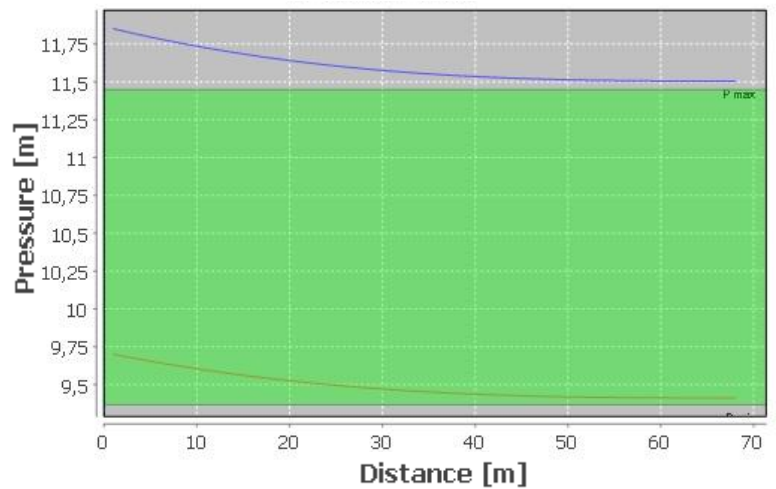
SOLUTION

Increase the diameter of the laterals in order to obtain a lower pressure variation and lower load losses.



CASE 3

Piezometric chart

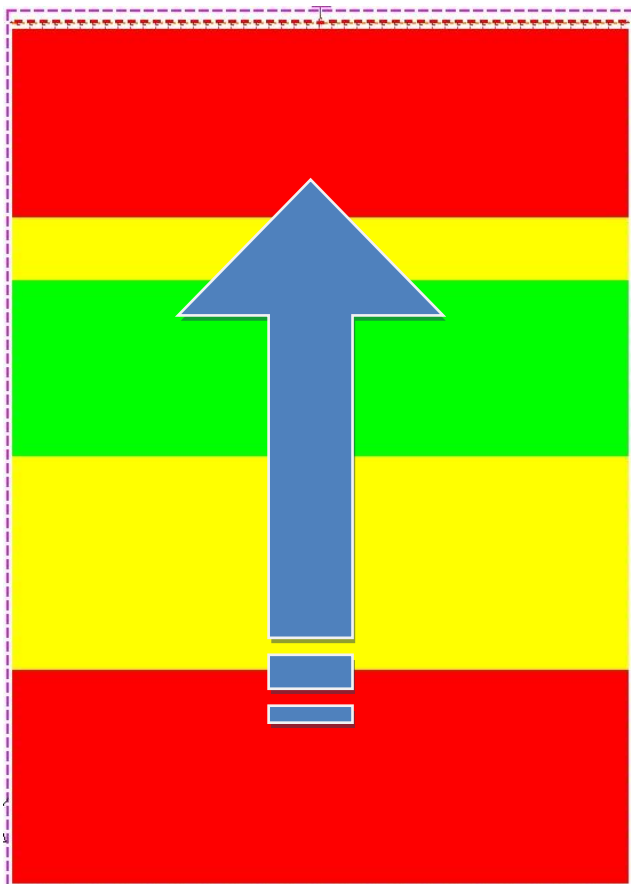


PROBLEM

Excessive variation in pressure only in the direction of the submain. There is an excessive variation within the laterals.

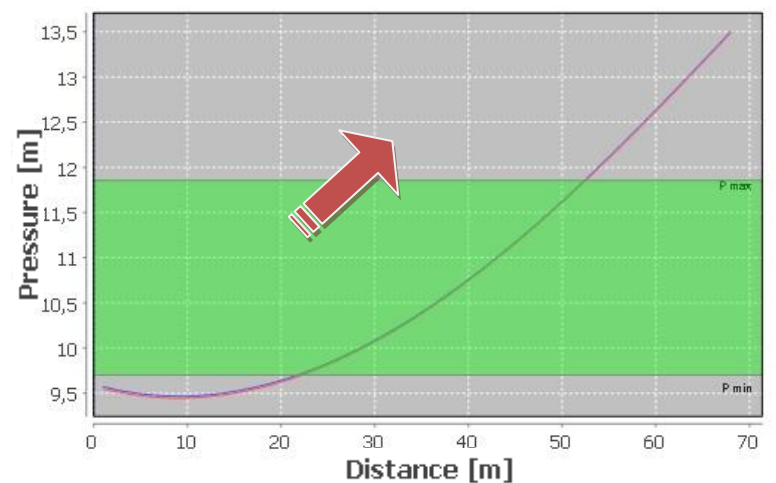
SOLUTION

Increase the submain diameter to achieve a lower pressure variation and lower load losses.



CASO 4

Piezometric chart



PROBLEM

Excessive pressure variation only in the direction of laterals. There is a small variation within the laterals. The pressure increases along the lateral.

SOLUTION

Decrease the diameter of the laterals in order to obtain a pressure variation such as to increase the load losses.

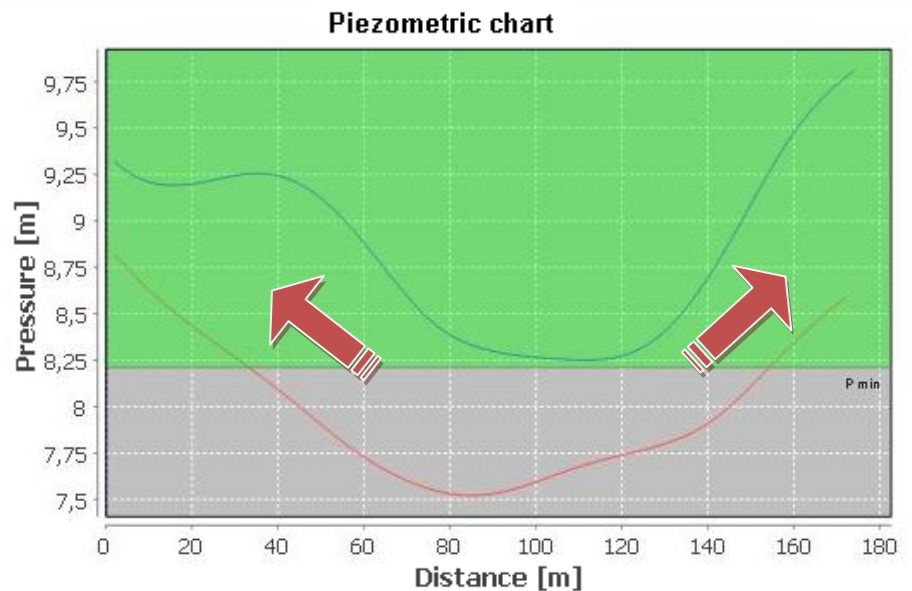
CASE 5

PROBLEM

After making various changes in the diameter, it is not possible to obtain a good uniformity and the lateral pressures have a U shape. The pressure decreases in the first part of the lateral to increase in the final part.

SOLUTION

Apply pressure-compensating emitters.



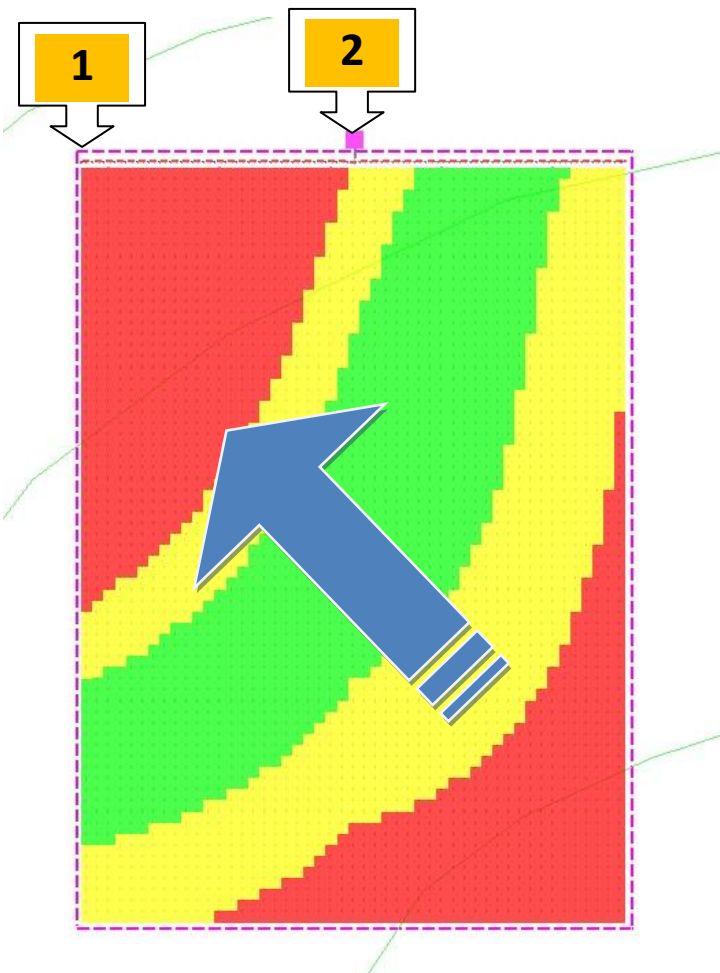
CASE 6

PROBLEM

In all cases where, after making the diameter change (as suggested in the previous cases), you can not get a good uniformity and the pressure trend continues to be all ascending or descending.

SOLUTION

Apply pressure-compensating emitters.



CASE 7

PROBLEM

Slope on submain pipe: the point 1 is at highest altitude than point 2. Part of submain is counterslope respect to the direction traversed by water.

SOLUTION

Move the supply point from point 1 to point 2 so that the water runs down the submain pipe. A similar solution will be adopted if the higher point is at the other end, moving the supply point to this new position.