4th International Conference on Agriculture and Horticulture

Measured Irrigation

Improving the water-efficiency of irrigation by changing the irrigation paradigm

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www.measuredirrigation.com

Definitions

Irrigation is referred to as ***measured*** if the volume of water delivered to each plant is controlled directly without the need to control the flow rate or the duration of the irrigation event.

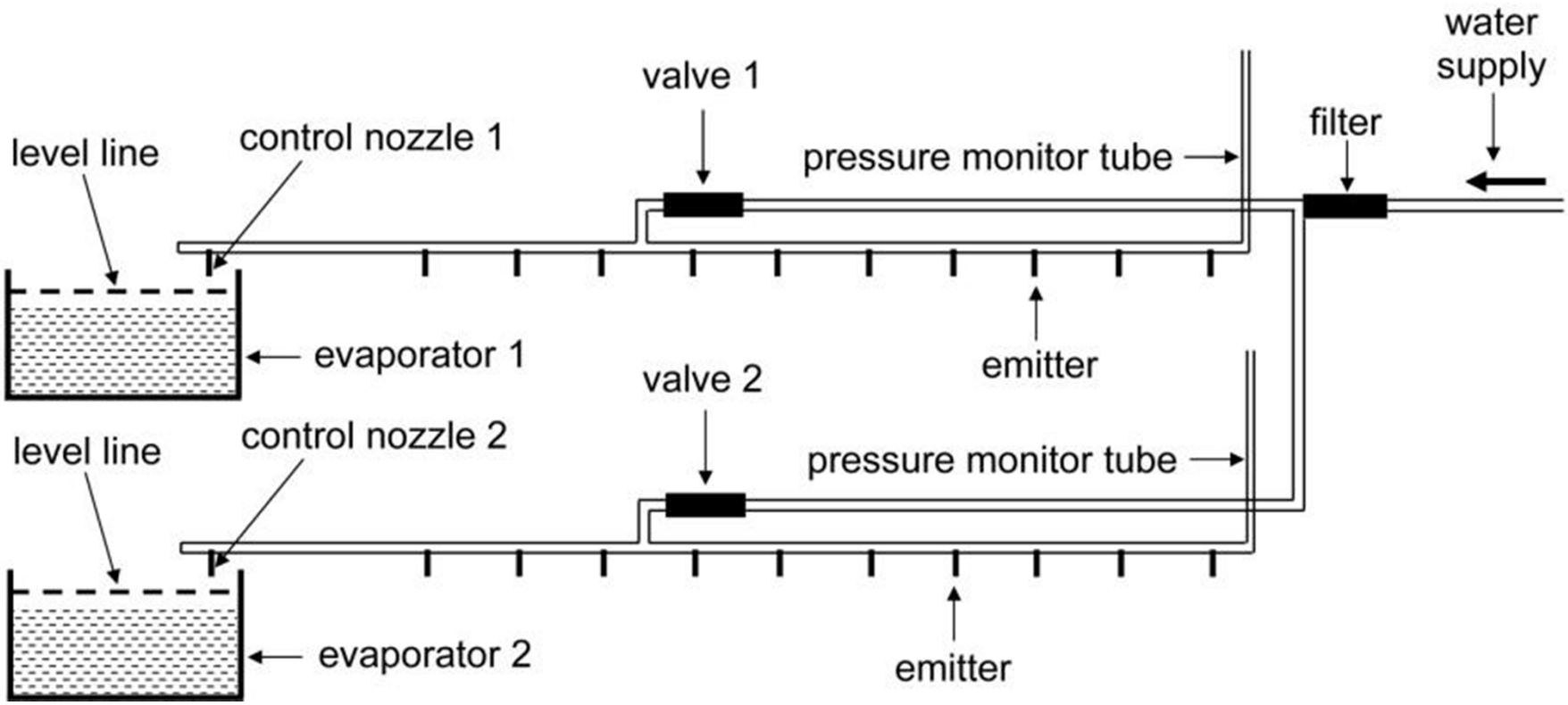
Irrigation is referred to as ***evaporative*** if the application rate to each plant throughout the year is proportional to the nett evaporation rate (evaporation rate minus rainfall rate).

Introduction

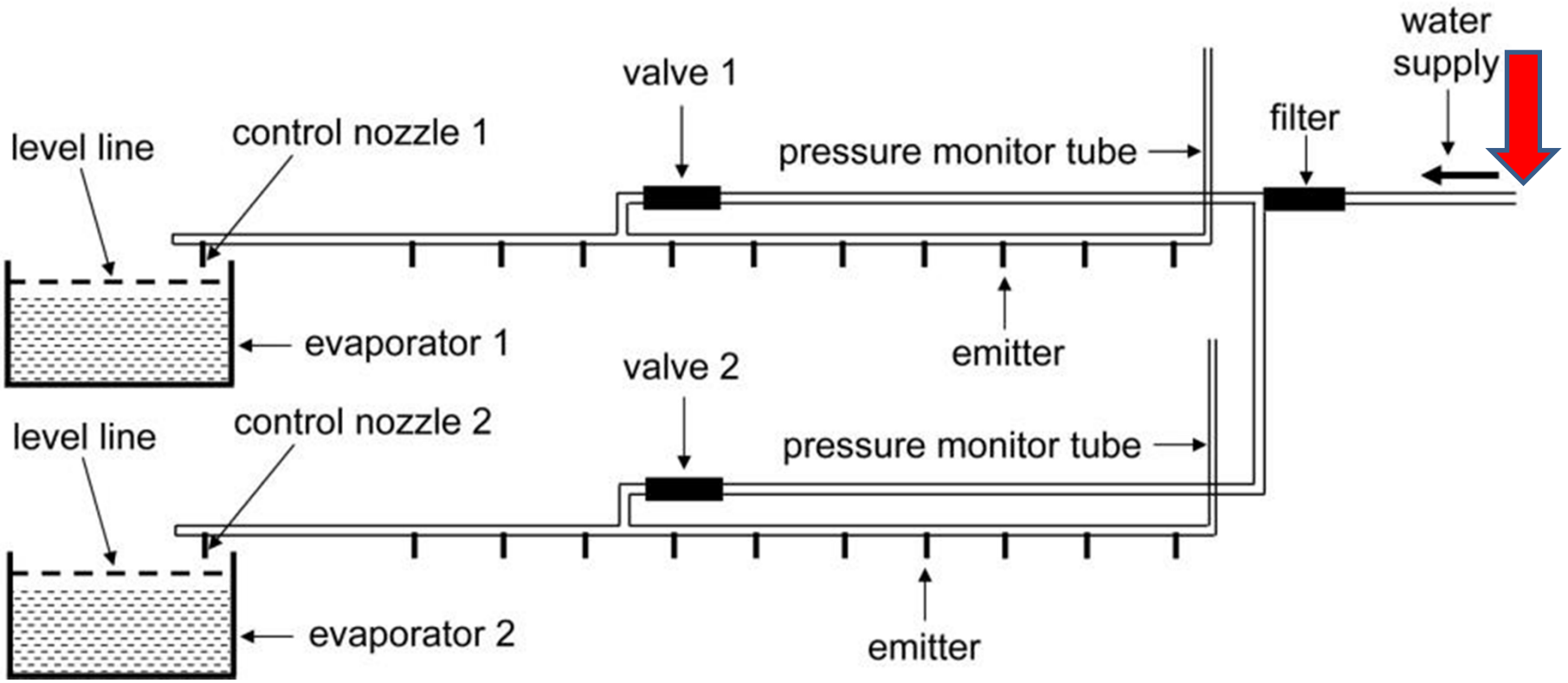
With measured irrigation the volume control paradigm is totally different.

The conventional volume control paradigm requires the control of two variables, namely, flow rate and time. Measured irrigation requires the control of a single variable, namely, volume. Once you change your focus of attention from flow rate and time to volume, the design of an irrigation system can change significantly.

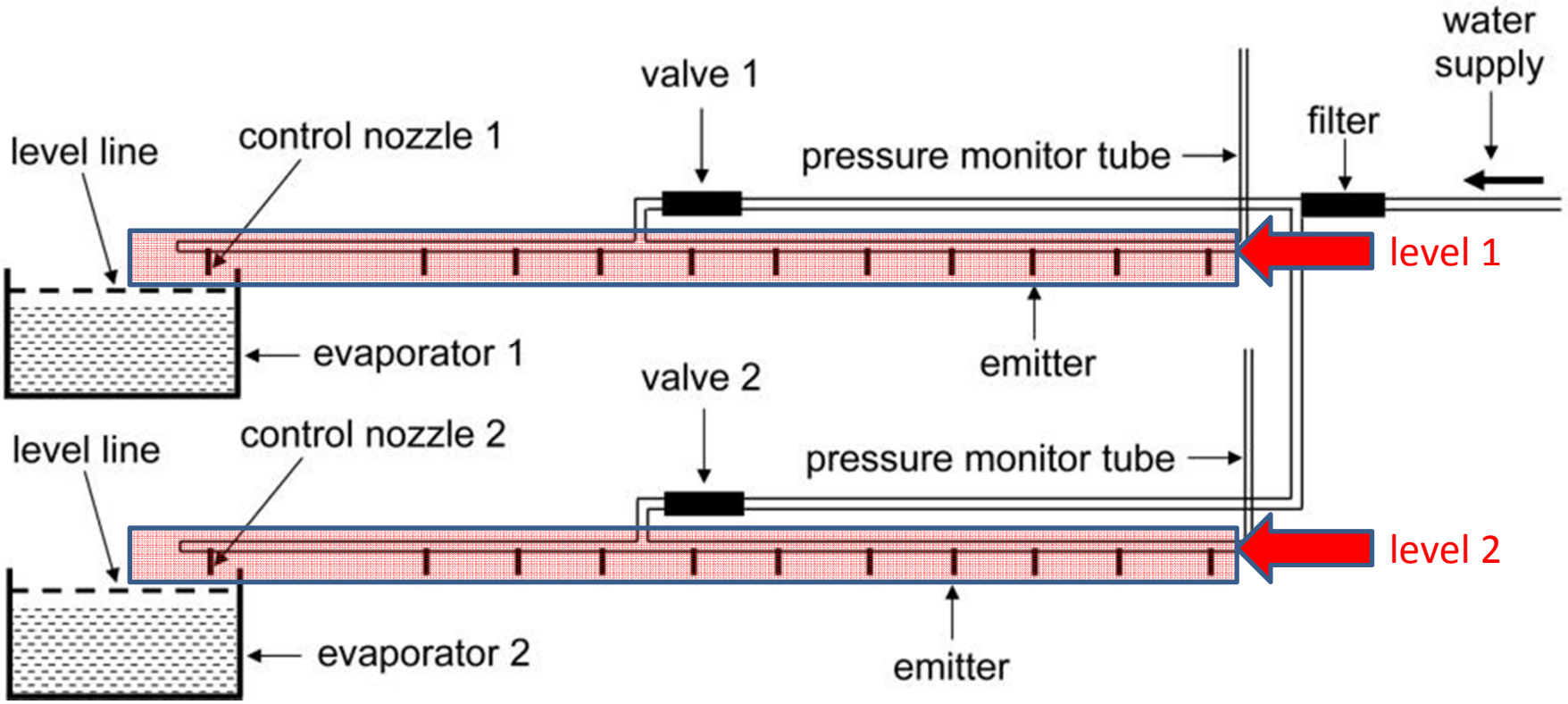
Schematic diagram for unpowered measured irrigation with 2 sectors



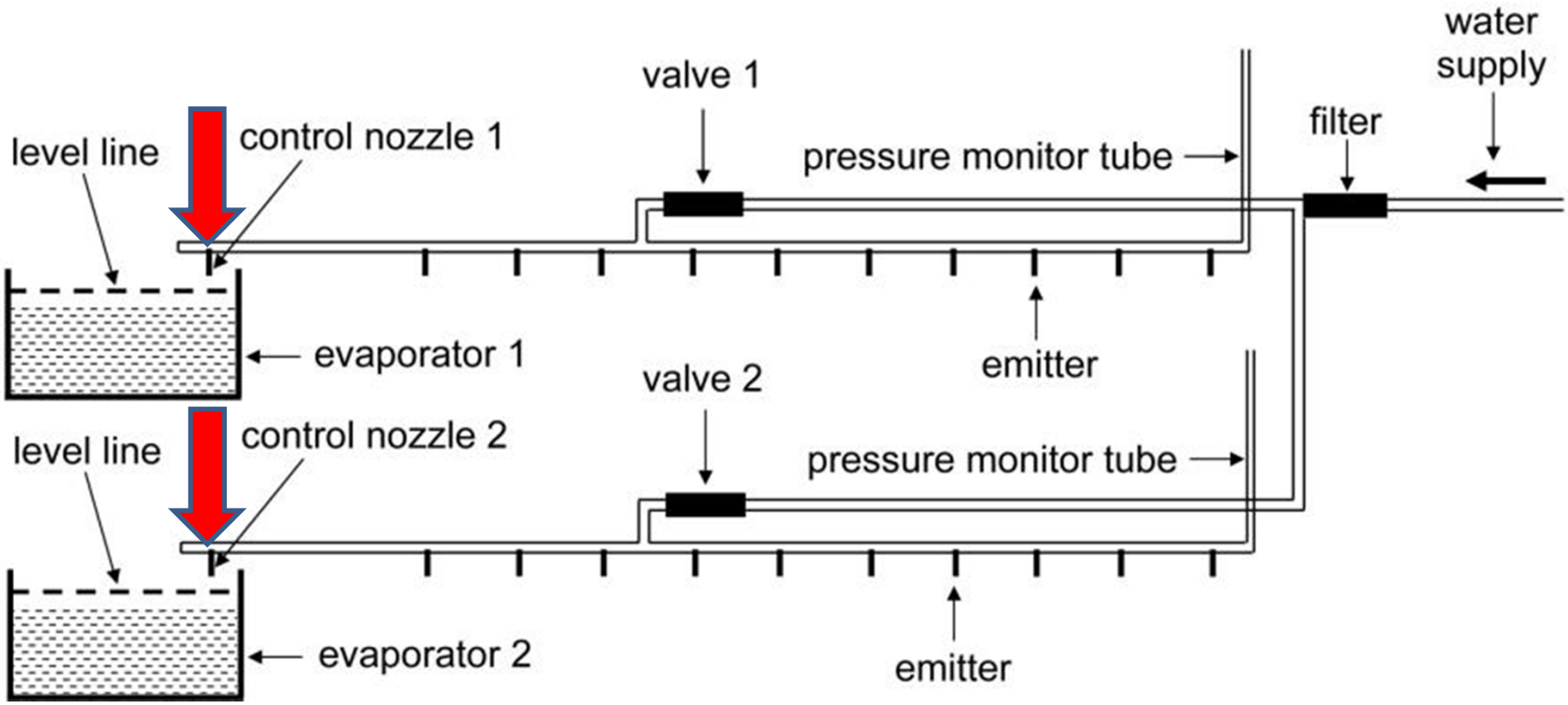
1. The water supply may be either pressurized or gravity feed.



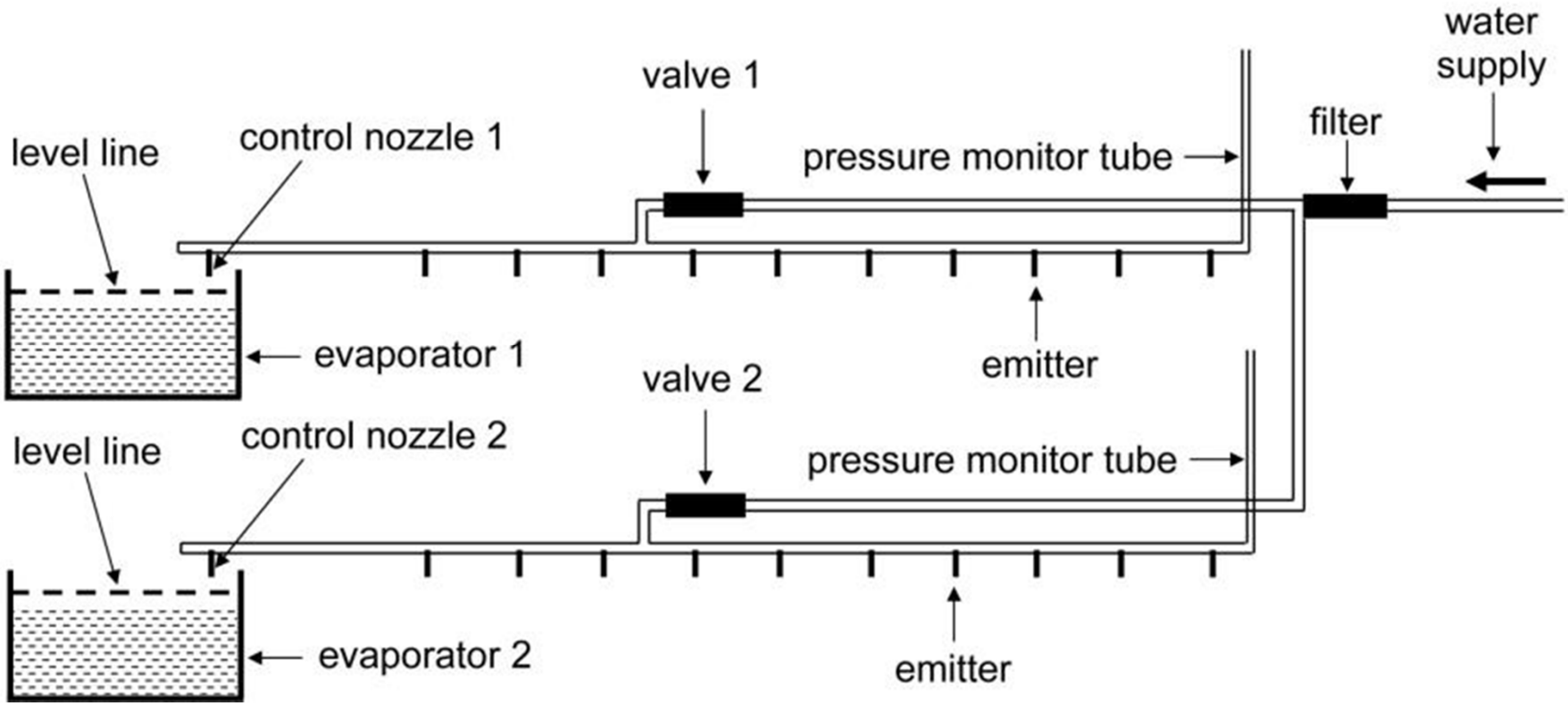
2. The emitters in each sector should all be at approximately the same level.



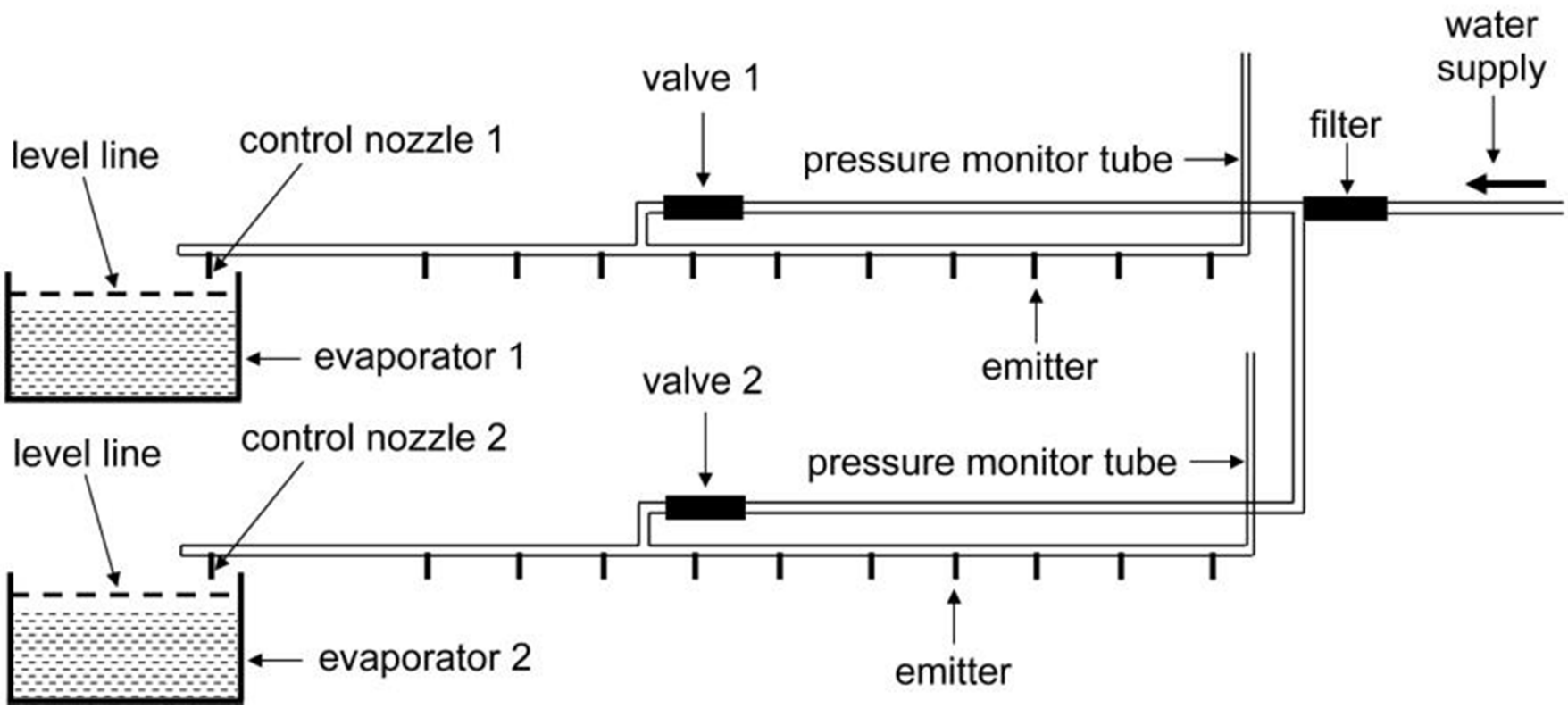
3. For each sector, a control nozzle drips water into the evaporator during the irrigation event.



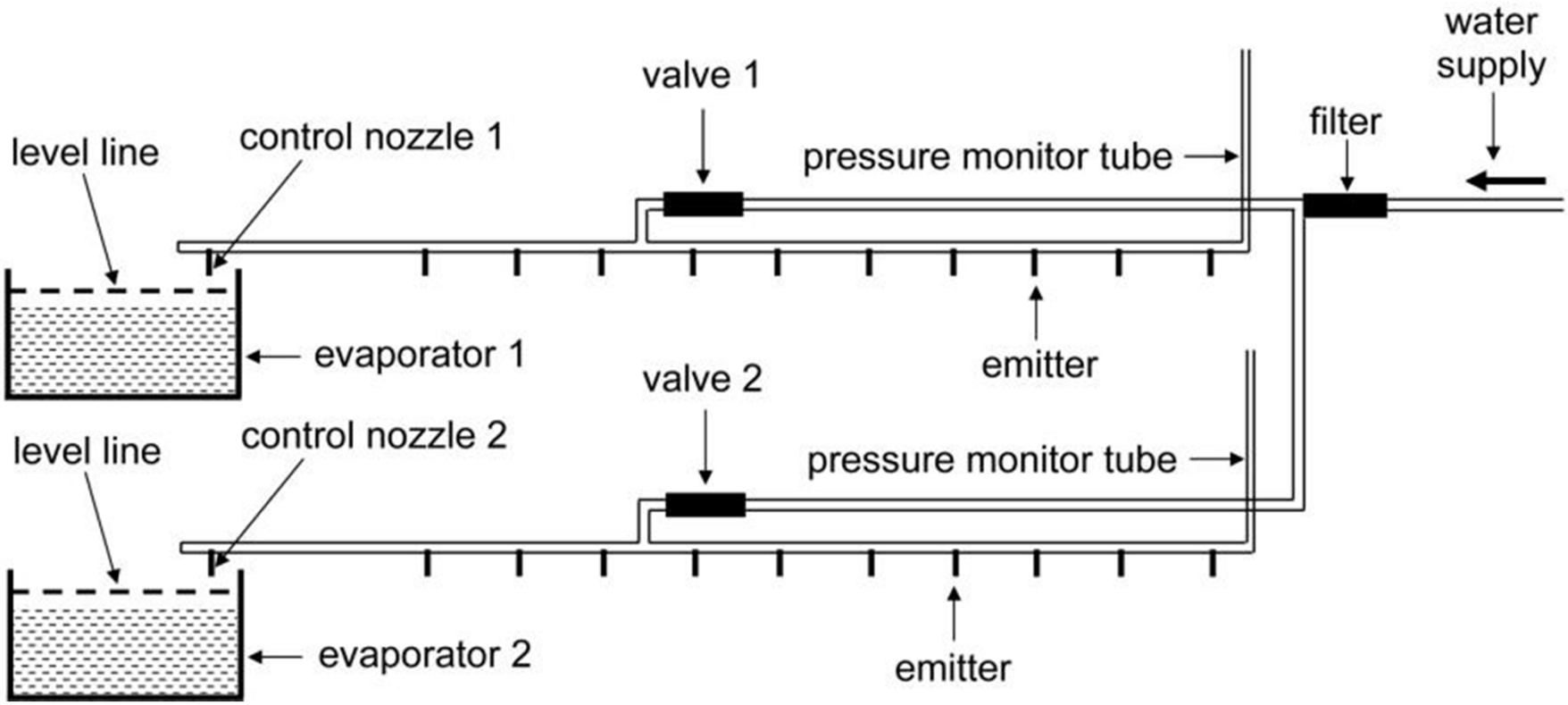
4. Any combination of emitters and control nozzles may be used. However, to keep things simple, let us assume that all the emitters and control nozzles are the same and so they will all deliver the same volume of water during the irrigation event.



5. One needs to estimate the nett evaporation in mm for the location for the hottest dry month of the year (*call this E*). For example, in Adelaide the nett evaporation is about 267 mm in January.



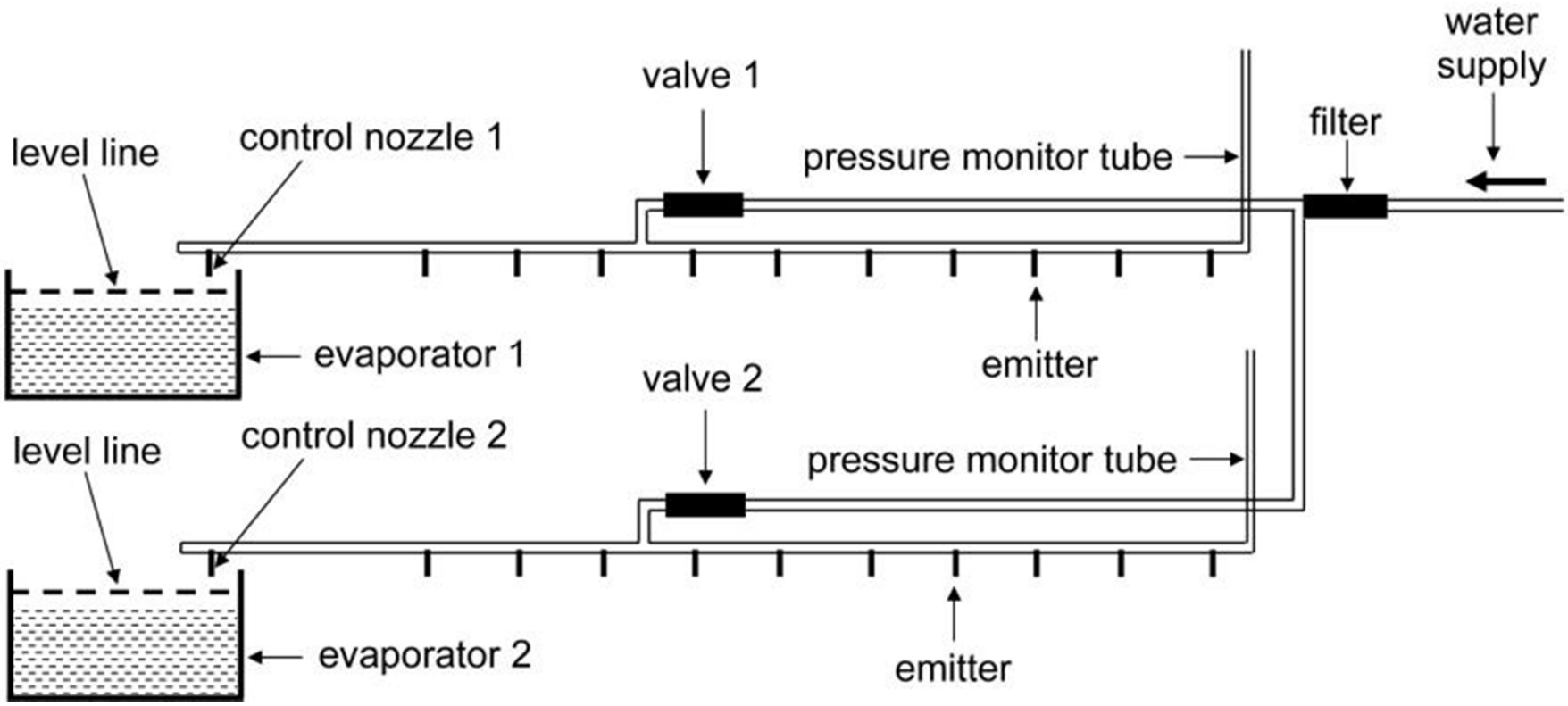
6. One needs to choose the desired number of litres per week per dripper during the hottest dry month (*call this A*).



7. The following formula is used to calculate the surface area of evaporation required to deliver the desired litres per week per dripper during the hottest dry month.

*surface area of evaporation = (n*A)/(E*7)*

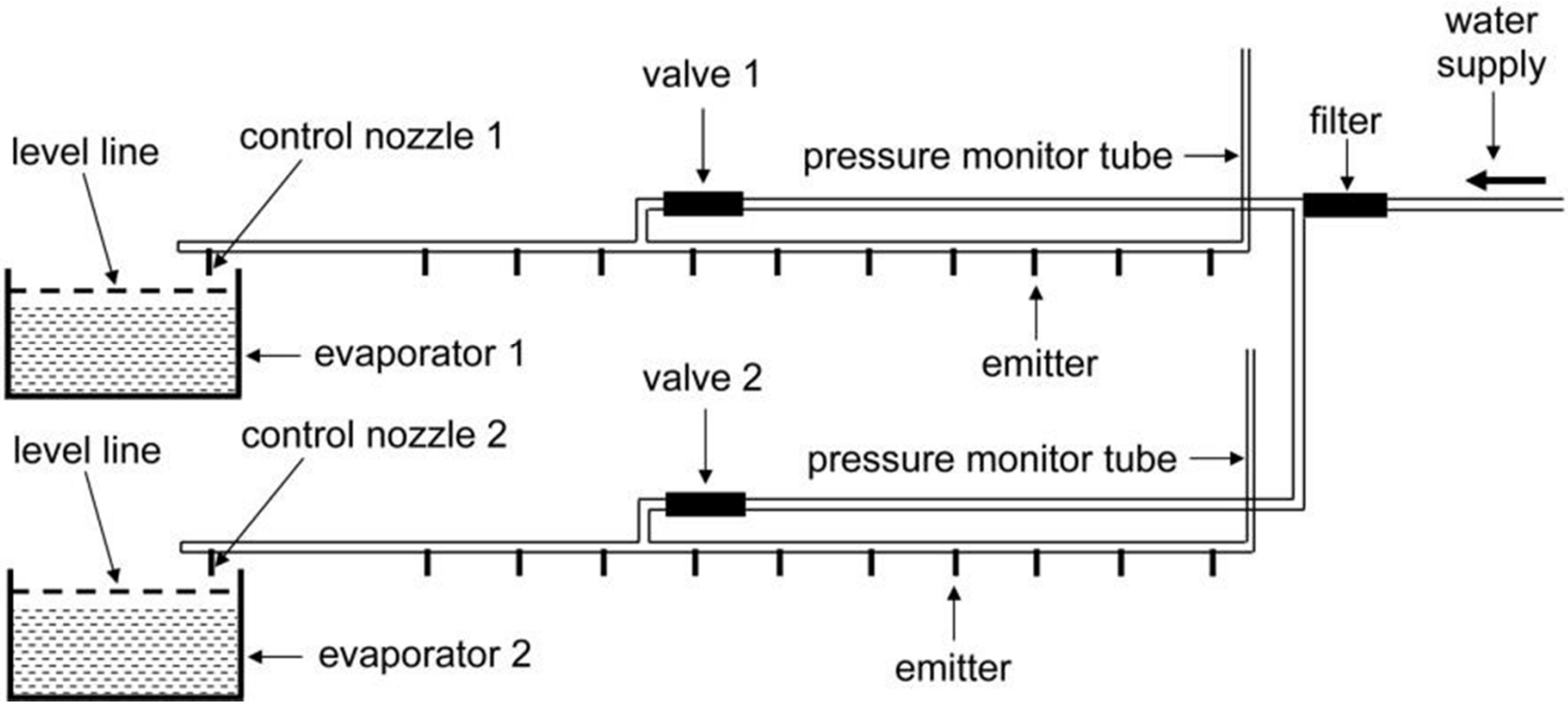
where *n* is the number of days in the hottest dry month.



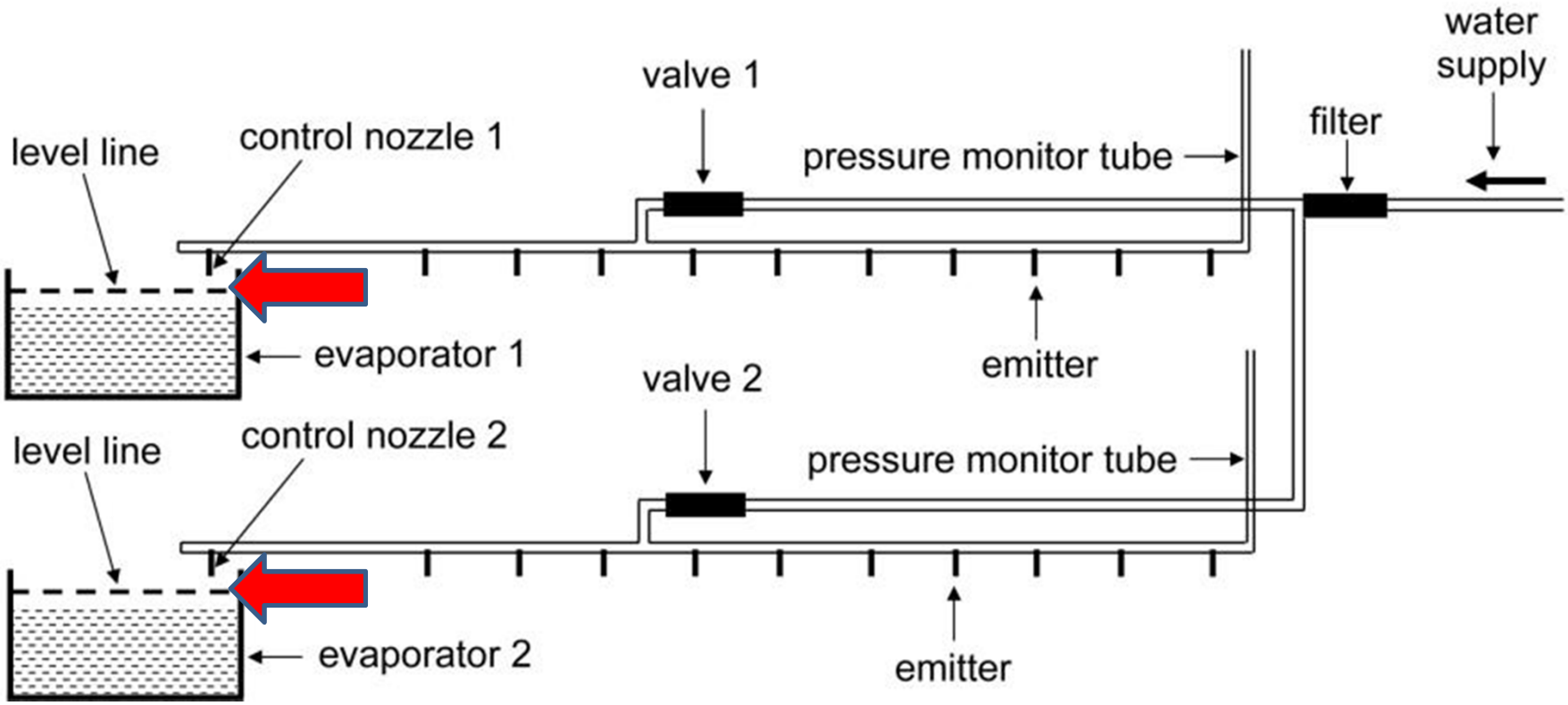
8. Suppose that many different emitters are used and for each emitter one knows the nozzle ratio

nozzle ratio = (flow rate of irrigation nozzle) / (flow rate of control nozzle)

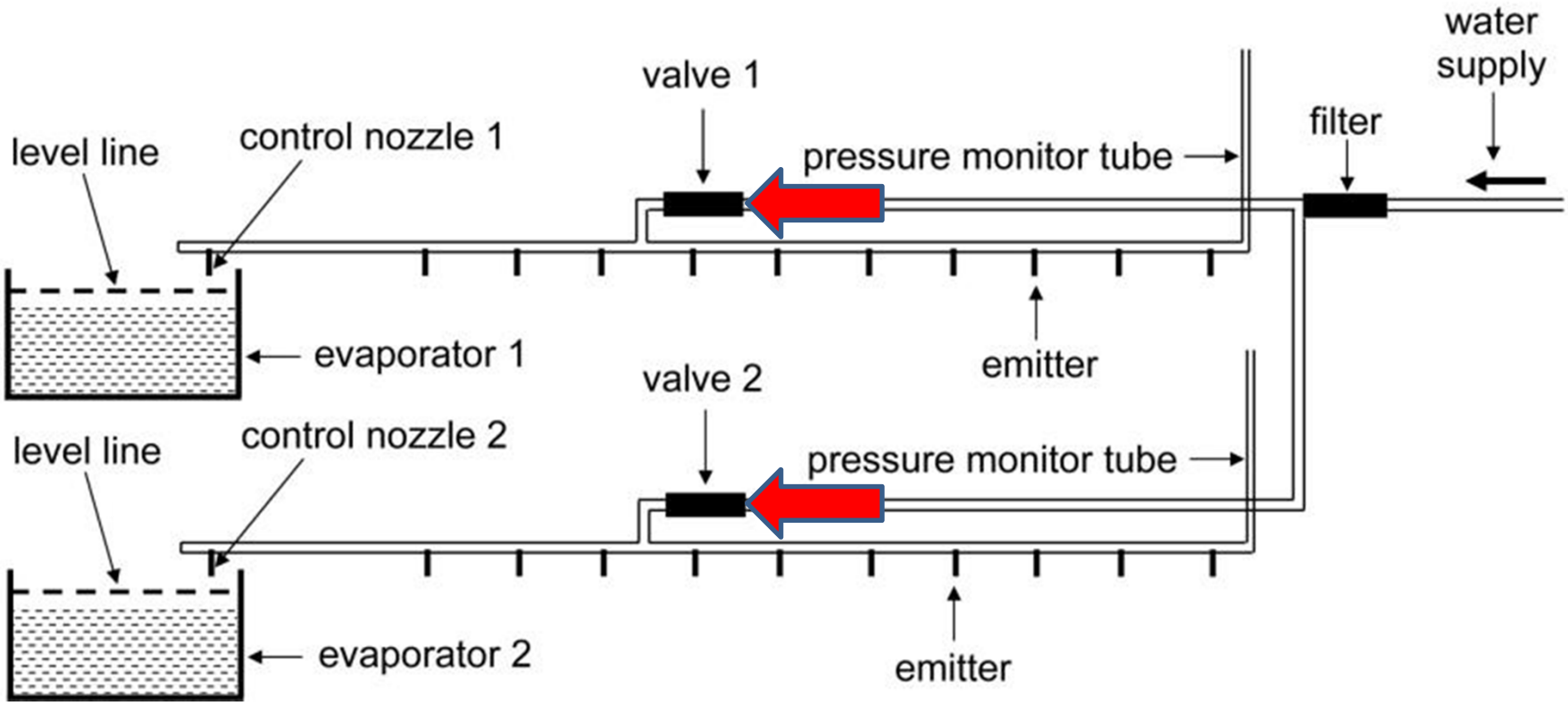
To calculate the surface are of evaporation in this case one needs to choose the desired number of litres per week for the control nozzle during the hottest dry month.



9. A level line is marked on the inside of the evaporator about 3 cm below the overflow level.



10. For each sector, open the valve when the water level in the evaporator is about 1 cm below the level line. Close the valve when the water level reaches the level line. The cycle continues indefinitely.



Advantages of unpowered evaporative measured irrigation

Advantages

1. Save more water by controlling the application rate for each plant during the hottest dry month of the year, taking account of all relevant factors such as evapotranspiration, soil type, and leaf area .
2. Save more water by allowing the prevailing weather conditions to control the variations in the application rate for each plant throughout the year. The irrigation is evaporative, that is, the application rate for each plant is proportional to the nett evaporation rate.
3. The application rate is not affected by the water level at which the irrigation starts and the water level at which the irrigation stops.

Advantages

4. You can adjust the irrigation frequency by adjusting the water level at which the irrigation starts. For example, if you require more frequent irrigation with less water, then start the irrigation when the water level is less than 1 cm below the level line.
5. For those months of the year when the rainfall exceeds evaporation, the water level will be above the level line and so there is no irrigation.
6. Gravity feed irrigation requires that the head of water in the water tank is higher than the emitters. As the water tank empties, the flow rate at the emitters will decrease. This would be a problem with conventional irrigation because of the need to control the flow rate.

Advantages

7. Measured irrigation does not need to be pressurized and so it is more energy-efficient and no hose clamps are needed.
8. For conventional gravity feed systems in developing countries, a minimum head of water is recommended (greater than one metre). Measured irrigation is more energy-efficient because the head may be much lower.
9. Evaporative measured irrigation is an example of a low cost simple technology with a high level of control over the application rate to each plant.

Applications of measured irrigation

1. Low cost measured irrigation for smallholders in developing countries.
2. Measured irrigation from a rainwater tank.
3. Upgrading drip irrigation to measured irrigation.
4. Measured irrigation of seedlings in nurseries.
5. Solar-powered multi-sector measured irrigation.

Low cost measured irrigation for smallholders in developing countries
Part 1. Introduction



Low cost measured irrigation for smallholders in developing countries
Part 2. The evaporator



Low cost measured irrigation for smallholders in developing countries
Part 3. Irrigation frequency



Measured irrigation from a rainwater tank
Part 1. Introduction



Measured irrigation from a rainwater tank
Part 2. Nozzles



Measured irrigation from a rainwater tank
Part 3. Application rates



Measured irrigation from a rainwater tank
Part 4. The irrigation industry



Measured irrigation from a rainwater tank
Part 5. Automation



Measured irrigation from a rainwater tank
Part 6. Irrigation frequency



Measured irrigation from a rainwater tank
Part 7. Nozzle ratios



Upgrading drip irrigation to measured irrigation
Part 1. Introduction

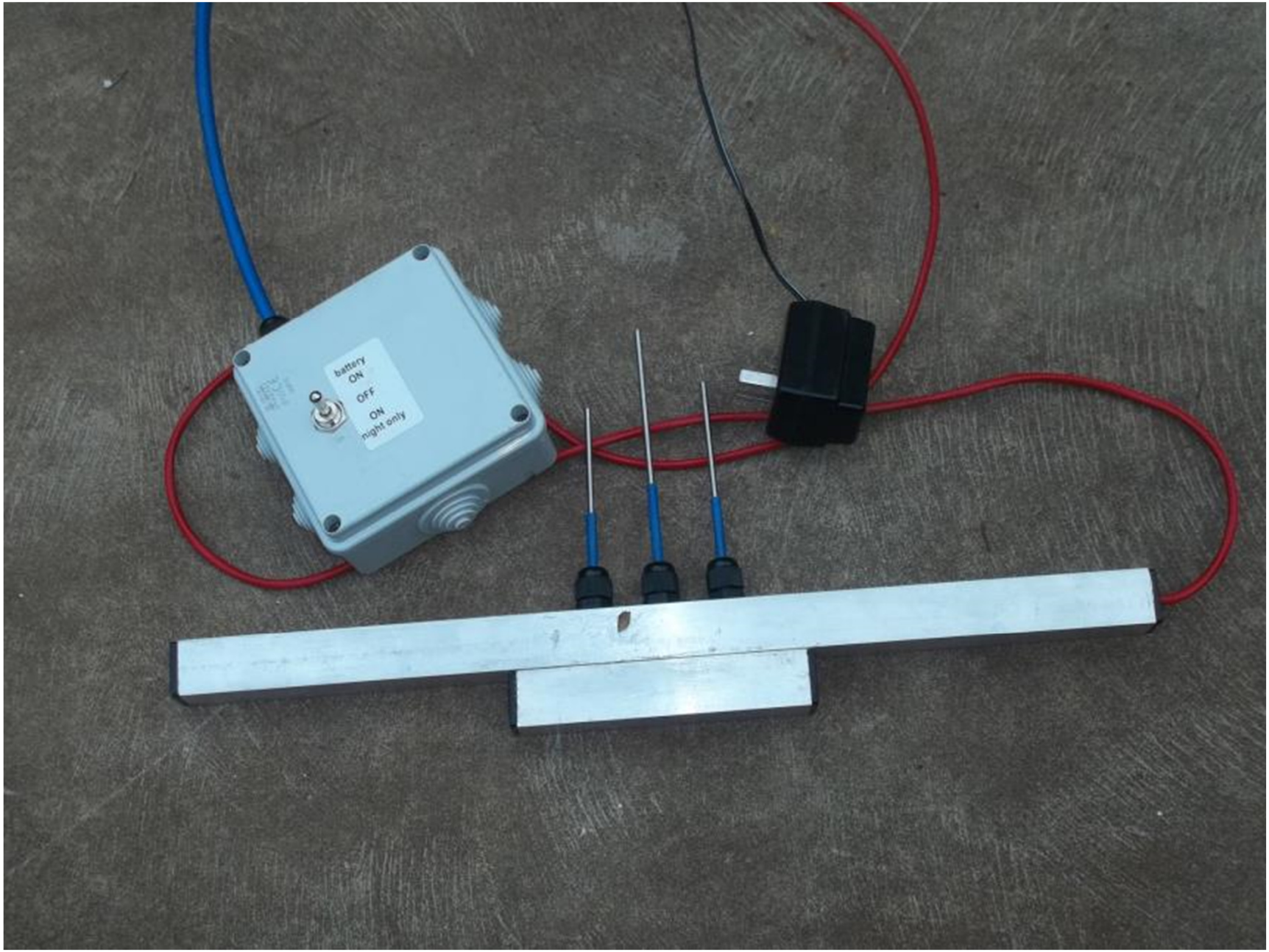


Upgrading drip irrigation to measured irrigation
Part 2. Measured Irrigation Nozzle Selector Tool



Upgrading drip irrigation to measured irrigation
Part 3. Choosing an evaporator




battery
ON
OFF
ON
night only

Measured irrigation of seedlings in nurseries
Part 1. Introduction



Measured irrigation of seedlings in nurseries
Part 2. Measured irrigation on a boom



Solar-powered multi-sector measured irrigation

More than eight community gardens in Australia are using solar-powered multi-sector measured irrigation.

I will now show some slides of the installation at *Sophie's Patch* at Mount Barker in South Australia.



Sophie Thomson and Dr Bernie Omodei celebrate the successful installation of measured irrigation at “Sophie’s Patch”



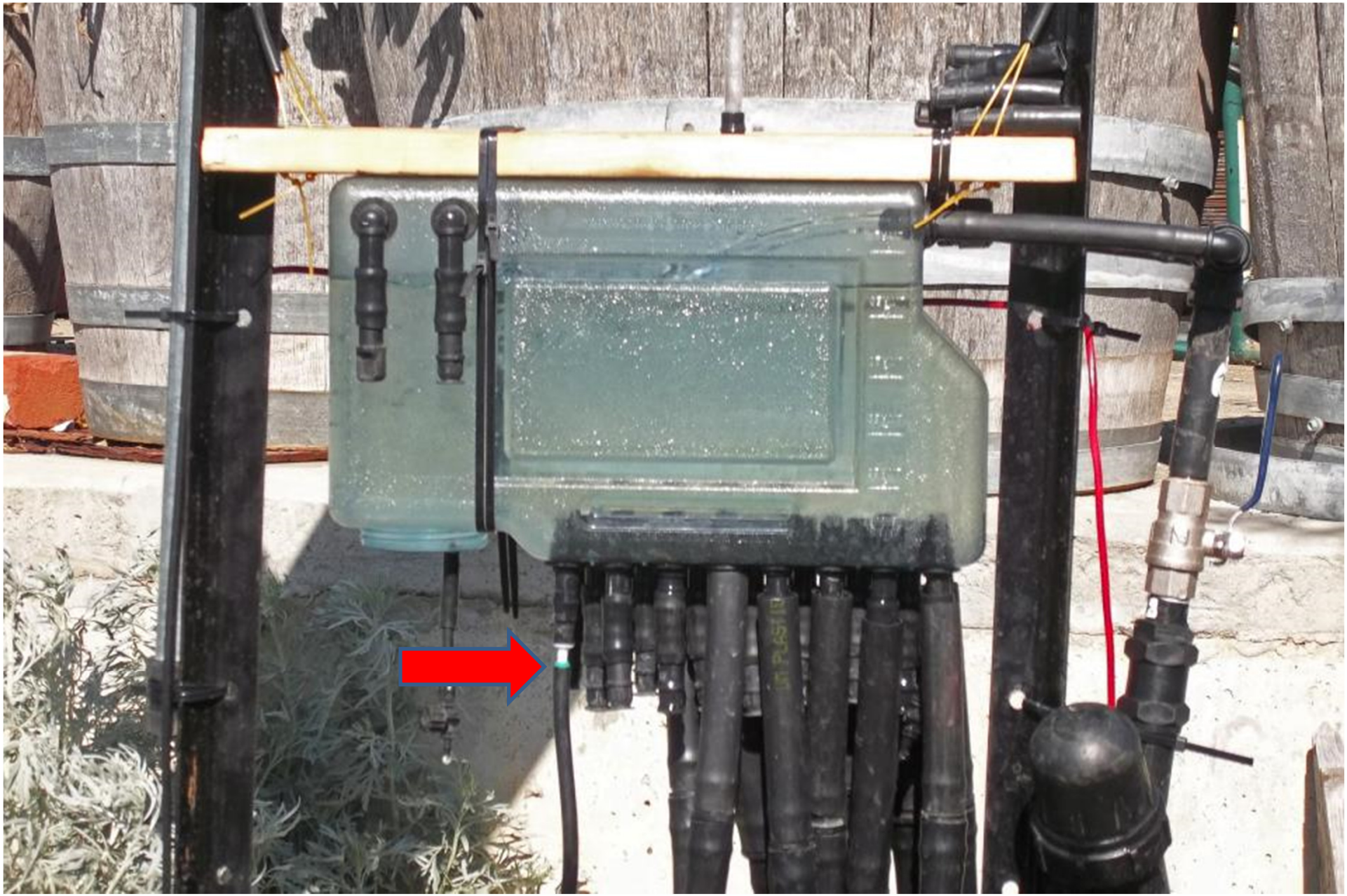
Dr Omodei explaining the evaporator and level sensor



Level sensor and evaporator



Flow splitter delivering water to 11 sectors



Green control nozzle delivering water to the evaporator



Flow-splitter nozzles available from Measured Irrigation



All the power needed comes from a 20 watt solar panel



Sectors following the contours on sloping ground



Vegetable garden sector using Netafim Landline 8 dripperline



Pressure monitor tube indicates the head of water for the sector



Demonstrating measured irrigation at the Garden Open Day

Accuracy and Uniformity

Published trials of measured irrigation have demonstrated

accuracy greater than 95% and uniformity greater than 90%.

Agri 2015

Measured Irrigation
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Thank You

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