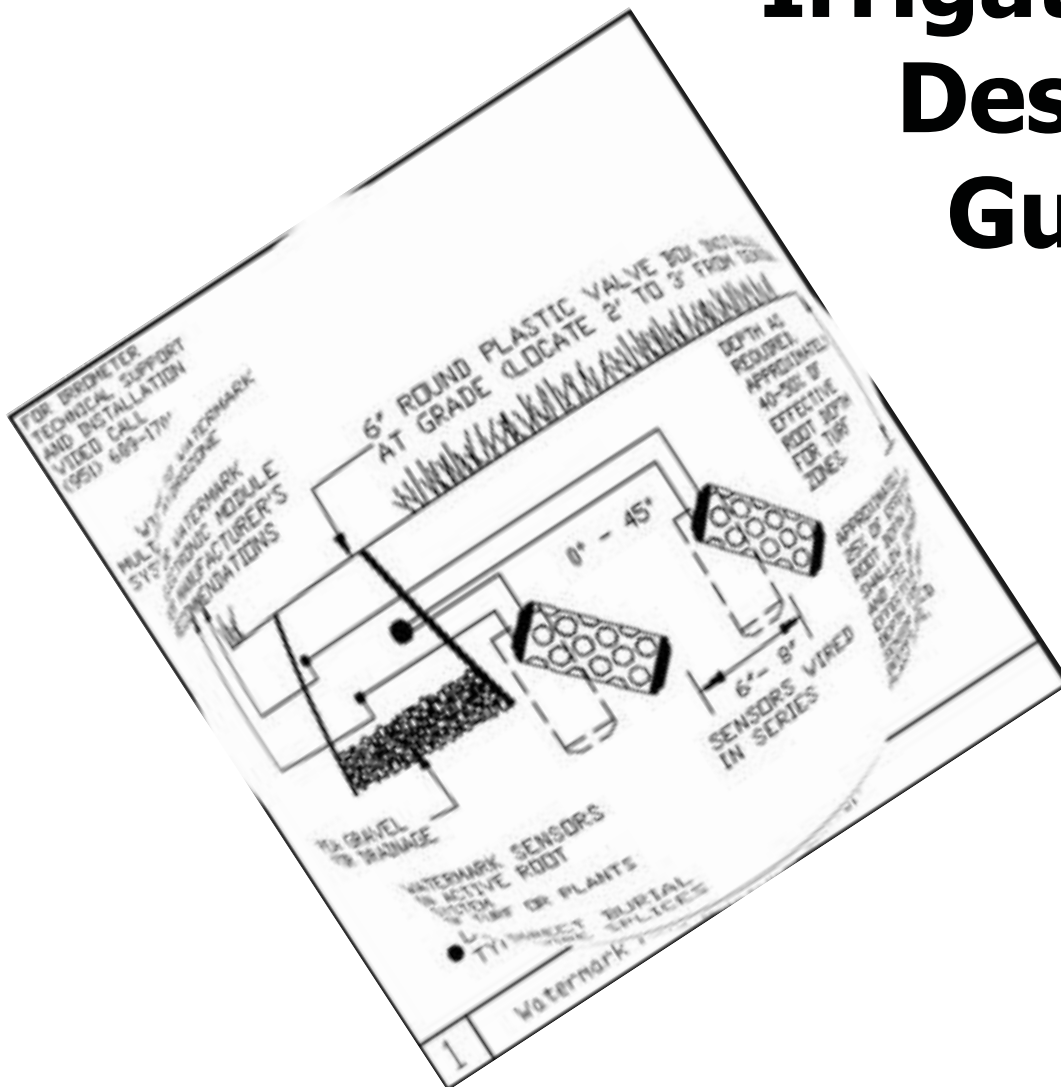


IRRIGROMETER

...simple tools for optimizing irrigation, worldwide.

Moisture Sensor Landscape Irrigation Design Guide



Foreword

Since 1951 Irrrometer Company, Inc. has provided simple tools that help answer the age old questions:

When should I irrigate? (How often)

and

How long should I irrigate? (Cycle Run Time)

The need for knowing how to answer these two questions for proper scheduling is even more important today than it was in 1951. The conservation and protection of our valuable water resources is an important consideration in design criteria today. Proper soil moisture measurement and control can help maximize your irrigation system's efficiency by allowing water to be applied only **WHEN** and **WHERE** it is needed. Such soil moisture automation of any 24 Volt AC control system is easily accomplished with the Irrrometer family of products.

Many moisture sensing products have come and gone over the years, but Irrrometer Company, Inc. continues to be synonymous with quality, high value products. You can be confident they will enhance your designs and maximize your client's irrigation system efficiency.

This manual will introduce you to some of our products. We also talk about some typical applications and illustrate how our moisture sensing products can be specified in some example projects. This manual does not show every application but feel free to call us to discuss your particular project needs.

Sample details in AutoCAD format are included on the enclosed CD, inside the back cover, for your convenience.

Lastly, when you specify a project with our products, we would be happy to send the installer and end user training materials. Please inform us who to contact, if necessary.

For more information, contact The Irrrometer Co., Inc at:

Phone: (951) 689-1701
Fax: (951) 689-3706
URL: www.irrometer.com
E-mail: sales@irrometer.com or
techsupport@irrometer.com

Information contained in this manual is based on generally accepted information and practices. If any problems, difficulties, or injury arise from or in connection with the use of this information, or if there is any error herein, typographical or otherwise, Irrrometer Company, Inc., and its agents or employees thereof, shall not be responsible or liable therefor.

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1

What is Soil Moisture Measurement and Control?

Before we talk about specifics, let us take a step back and look at the living system in which we will be working.

The Soil, Water, Plant System

Evapotranspiration moves water out of the system and rain or irrigation replaces it. The soil provides storage for the water. Typically, the plant removes water according to the chart below.



Water is pulled by the roots into the plant. The soil is attracting the water as well. This competition between the plant and soil for the water creates tension. As the water is depleted by the plant, it first takes the water that is most easily released and continues to take water that is more and more tightly held by the soil. This tension can be measured by soil moisture measurement instruments. The higher the tension created, the harder it is for the plant to extract water from the soil. Eventually there will be no more “available water” for the plant. Most landscape plants suffer from just the opposite, no oxygen in the soil because of too much water.

In most cases, the ideal situation would be to irrigate until the root zone approaches saturation. Next, allow it to dry out to a reasonable level before irrigating again. This allows the soil to “BREATHE” oxygen in, which is good for both the plant and soil organisms. It also helps minimize the impact of insect and disease problems.

Measuring Soil Moisture



Figure 1-1 Irrrometer Low Tension Tensiometer Model "LT"

Soil moisture measurement consists of determining the level of moisture in the soil by a direct or indirect method. Control involves interpreting the measurements and taking the action or actions that are most beneficial. One direct method is accomplished by using a device called a tensiometer. (Figure 1-1) This sensitive instrument measures the amount of "tension", "suction" or negative pressure in the soil. It uses units of pressure called centibars or kilo-pascals. One centibar is one hundredth of a bar. One bar is about 14.7 pounds per square inch (psi). So when you see a gauge that reads from 0-100 cb (centibars) it is roughly the same as reading 0-14.7 psi in negative pressure or suction. An indirect method of measuring soil moisture tension is by way of a Granular Matrix Sensor, called the Watermark from Irrrometer Company, Inc. (Figure 1-2). This product is calibrated to a Tensiometer and has a range of 0-200 cb. Wire can be run up to 1000 feet or more. It is a low maintenance, low cost product.

Units of Measurement



Figure 1-2 Watermark Soil Moisture Sensor by Irrrometer Company



*15 psi gauge
measures positive
pressure*

=



*100cb/kPa gauge
measures negative
pressure*

Soil Moisture Measurement and Control Products from Irrrometer



Watermark Electronic Module (WEM)

The Watermark Electronic Module (WEM) comes complete with two Watermark Sensors and an Installation and Operation Manual. It is designed to interface with 24 VAC Controllers or Valves. Individual valves can be controlled by installing sensors in the area irrigated by the same valve. It is fully adjustable from wet to dry and has an “OFF” position to override the sensor. It is water proof for valve box installation or can be installed at the controller. It can override a valve group on a separate common or the entire controller. Irrigation will occur only when soil is dryer than the set point.



Watermark Multiple Hydrozone System (MHS)

The Watermark Multiple Hydrozone System (MHS) comes complete with Watermark Sensors, Watermark Electronic Modules and an Installation/Operating Manual. It provides up to eight independent moisture sensing locations used to control the valves by “group” based on common irrigation need, on a single common wire. There is no need for separate commons with the MHS. Each moisture sensing location can be independently adjusted for desired moisture level. System Bypass Switch provides for override of sensors at the panel. LED’s on panel aid in checking system operation. Additional Jumper Cables can be added to accomodate an unlimited number of valves per group. Irrigation will occur only when soil is dryer than the user defined set point. Can be mounted in the irrigation controller enclosure or is available in its own stainless steel enclosure.



Watermark Electronic Meter (30-KTCD-NL)

The Watermark Meter is a solid state alternating current resistance bridge meter for reading Watermark Sensors. It is adjustable for soil temperature variations. This is a portable and useful tool for manually reading sensors. One meter is required to read an unlimited number of sensors, one at a time. The Meter includes: touch pad operating panel, durable case and field changeable cable assembly. Read from 0cb, WET to 199cb, Very Dry.



Watermark Monitor

The Watermark Monitor is a data-logging device that automatically records soil moisture readings. This data is periodically downloaded for graphical display on a computer, so the irrigation manager can get a vivid illustration of the effects of their irrigation scheduling. The Monitor can record up to eight sensors, either soil moisture, soil temperature and/or dry contact switch closures.

2

Why use Soil Moisture Measurement and Control Products from Irrrometer?

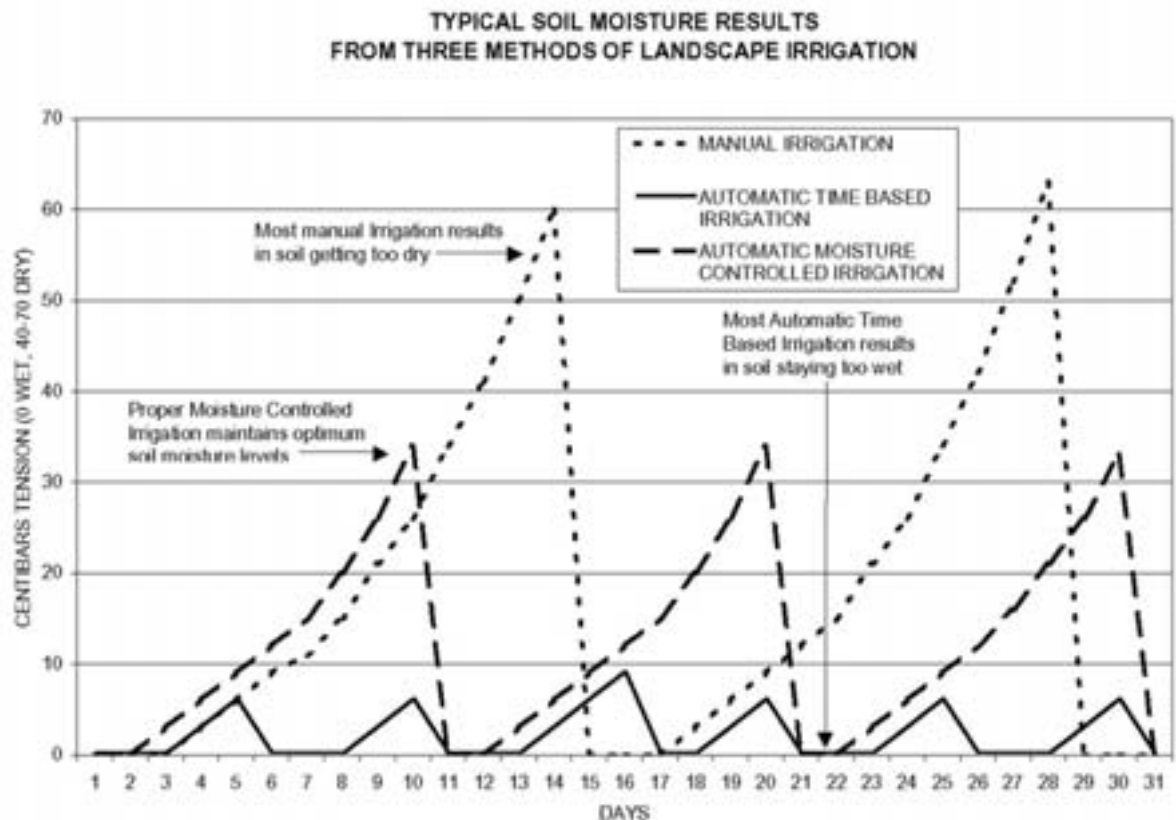
Conserving water, our most precious natural resource, is of great importance. Good water management will also result in optimizing pumping energy, as well as reprogramming labor.

More landscape plants die each year from over watering than from under watering. In fact, Arborists tell us that most specimen tree deaths are a result of improper watering. If you use specimen trees in your projects you should protect these valuable investments from overwatering and potential death. It is very difficult to tell what the soil moisture is like under ground on large trees without Moisture Sensors.

Many fill slope failures are caused by too much water in the soil. This can be avoided by using Moisture Control Products.

Over irrigation can also leach landscape chemicals into water supplies and out of the reach of plant roots. The soil moisture chart below shows research results of three methods of irrigation. These results were from trials conducted by experienced irrigation professionals.

Figure 2-1



IRRIGATOR

WATER PERFECT

When you specify Watermark Soil Moisture Automation Products in your design, your client receives many benefits.

Run times, start times, programs and moisture level settings are provided in the recommended schedule. This provides the user with a highly efficient schedule for their controller.

Percentage adjustments can be made for run times within each valve grouping, or Hydrozone, to accommodate slight variations between valve zones.

Periodic site monitoring and schedule adjustments may be necessary to accommodate individual site characteristics.

By manually inputting data from water meters or bills, ET data and water budgets, a record is kept showing water usage by Hydrozone. This tracks system performance in comparison to ET and budgets.

This reporting is valuable for the water manager's own records and can also be used for reporting purposes for water management districts that may require it for cost sharing programs.

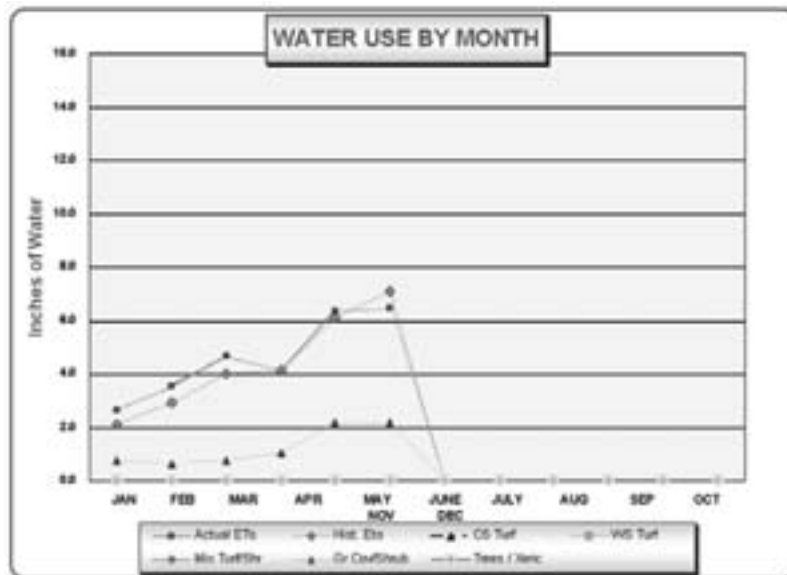
Irrigator offers software that enables the irrigation manager to properly schedule their new irrigation system using the soil moisture control equipment.

After performing a site audit, the information is input into the program, which is a Microsoft® Excel® workbook. The program then generates a schedule that the user programs into the irrigation controller to obtain maximum efficiency.

Many water management features are also included to allow the irrigation manager to track water usage.

This program, called WaterPerfect, is available, *at no charge*, to any user of Watermark Soil Moisture Automation products, the WEM and MHS.

Figure 3-1



Example of a curve from WaterPerfect software showing water usage of a plant material group compared to actual and historic ET data.

3

How to Specify Soil Moisture Measurement and Control Products.

Design Sample 1

This Conceptual Landscape Plan shows areas that should be controlled by Hydrozone, according to the different water need areas.

The Turfgrass areas are basically all sunny.

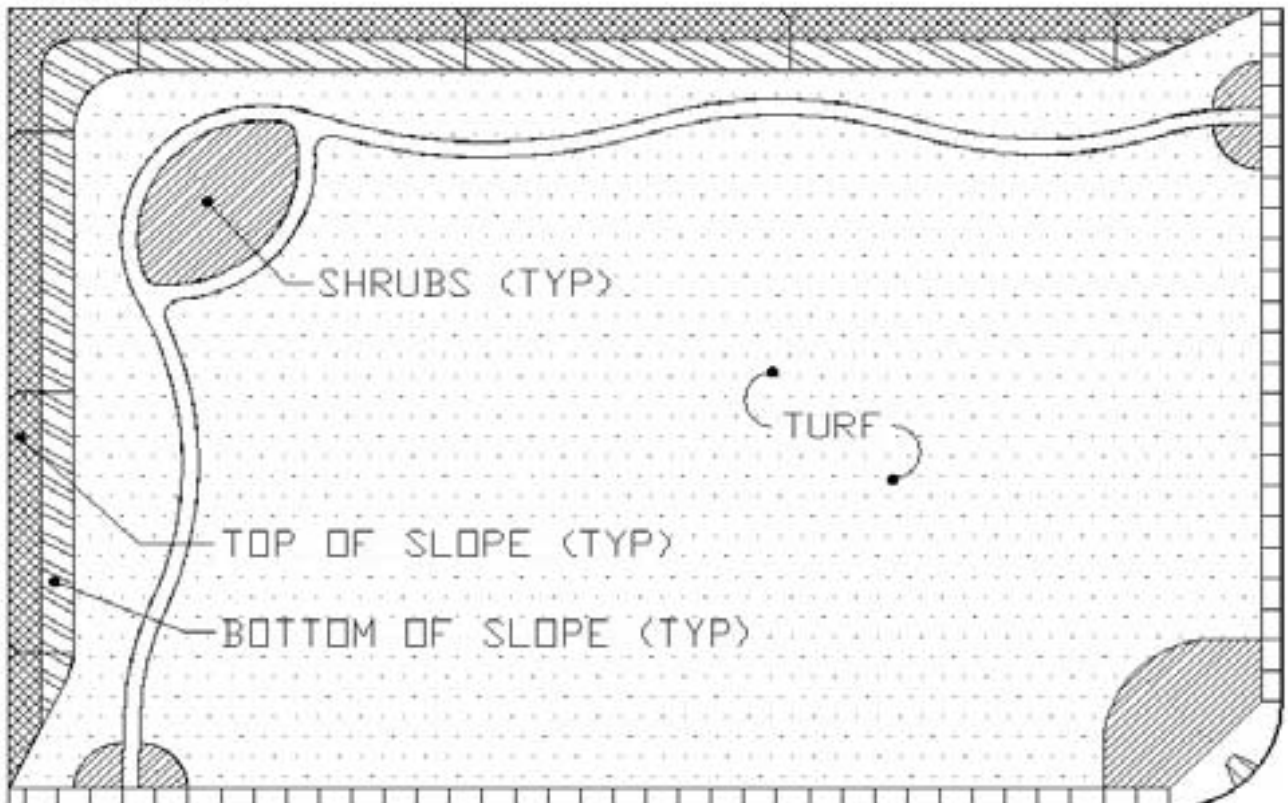
The Shrub areas away from slopes will be rooted deeper and in most cases need less water than cool season grasses.

The top of slope areas typically use more water because of more exposure to wind and the difficulty in irrigating them.

The bottom of slope areas are likely to require less water because of drainage from the slope above and less wind.

Fill slopes can fail with overirrigation.

DESIGN ONE
LANDSCAPE PLAN



Because four Hydrozones are needed in this Landscape, the Watermark Multiple Hydrozone System is the proper product for this project.

The following steps are required to complete specifications:

1. Note Moisture Sensor Locations, MS 1, MS 2, MS 3 & MS 4.

2. Note the Irrigation Legend:

Symbol	Manufacturer	Description	Model
MS	Irrometer	Multiple Hydrozone System	MHS

(Specific details for part number specification are at the back of this section in the manual)

3. Note on the Chart which valves are to be included in each Zone and note the last valve in sequence in each zone. This is where the sensor should be placed.

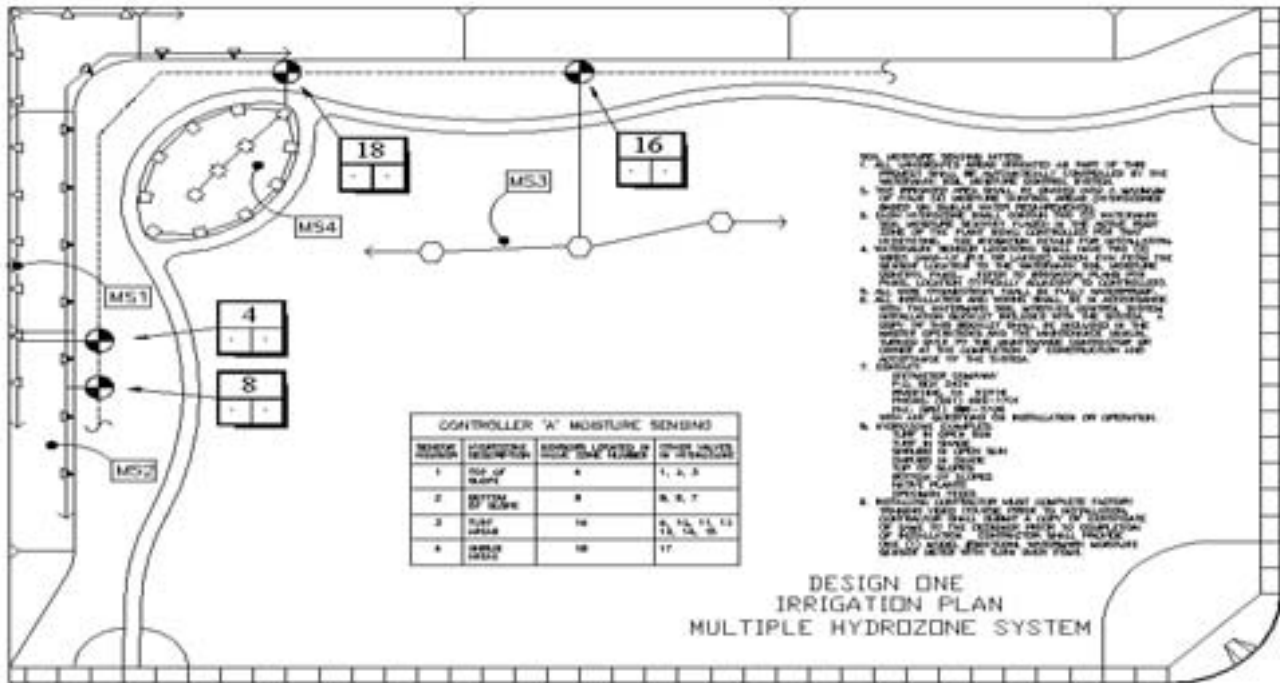
4. Note the Soil Moisture Sensing Notes on the plans.

5. Include the appropriate Installation Details. In this case you would use details 1 & 6. (Details are in the back of the Manual)

Notes, Details, Symbols and Charts are on the CD included with this Manual and can be downloaded from www.irrometer.com.



Watermark Multiple Hydrozone System (MHS)



This Conceptual Landscape Plan shows that the entire area should be controlled as one Hydrozone.

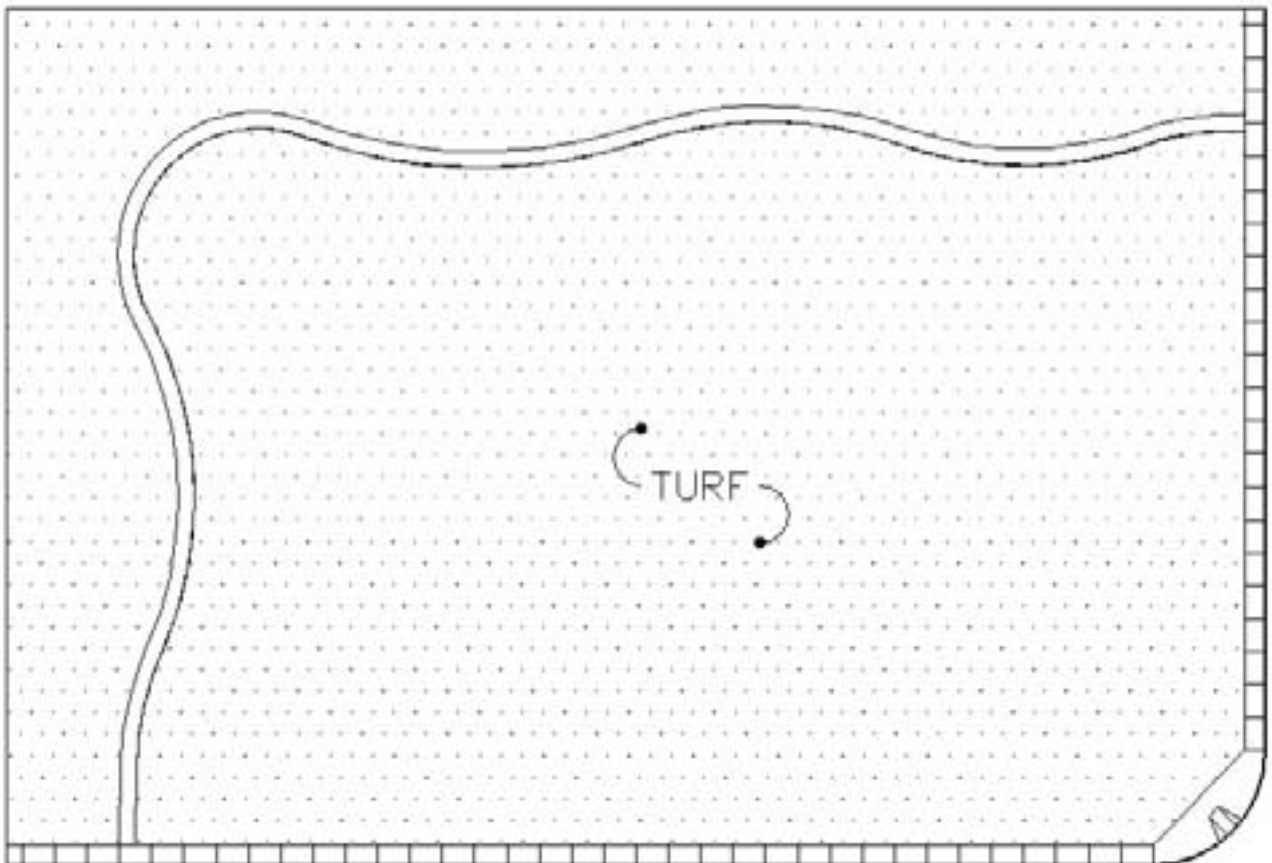
Design Sample 2

The Turfgrass areas are basically all sunny.

Open Turfgrass represents most of the water used in Landscape Irrigation.

An average five acre park in Southern California, for example, can pay back the cost of a Watermark Electronic Module in just a few weeks.

DESIGN TWO
LANDSCAPE PLAN



IRROMETER



Watermark Electronic Module (WEM)

Because one Hydrozone is needed in this Landscape, the Watermark Electronic Module is the proper product.

The following steps are required to complete specifications:

1. Note Moisture Sensor Location, MS 1.

2. Note the Irrigation Legend:

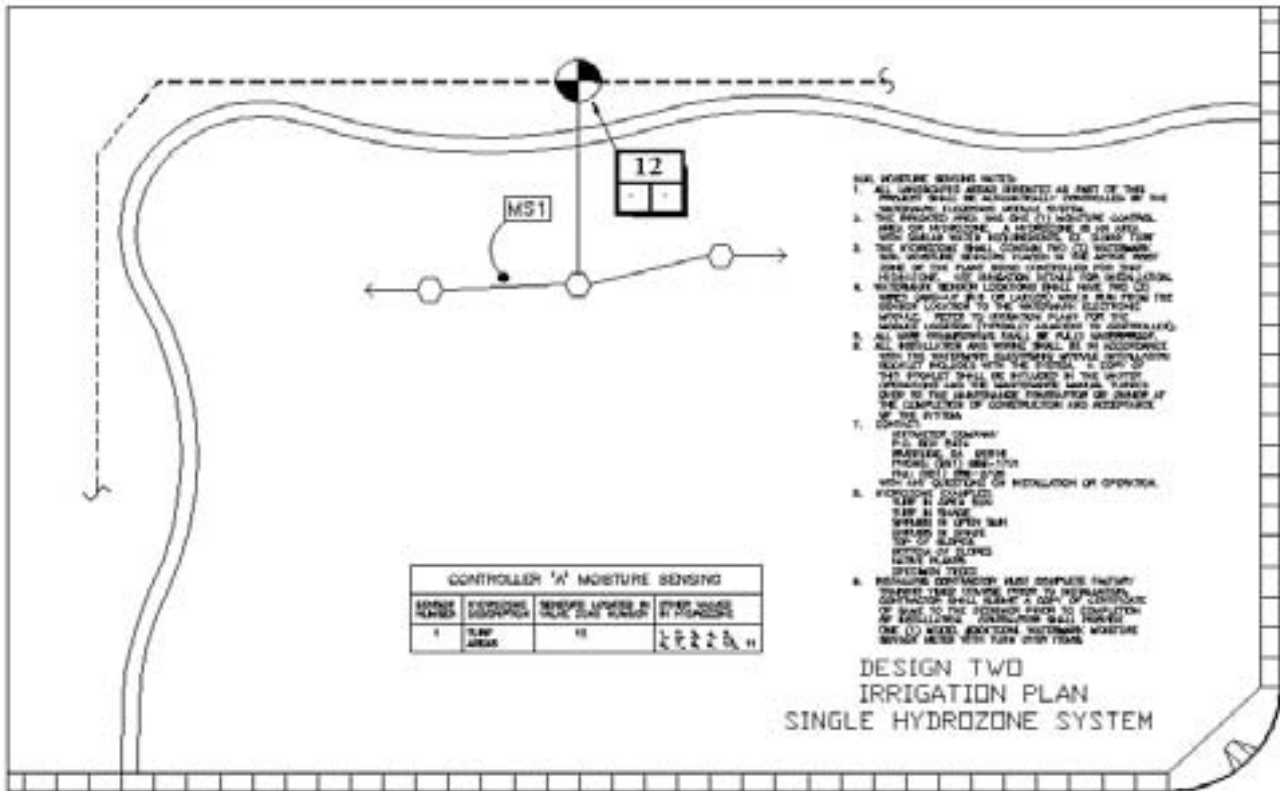
Symbol	Manufacturer	Description	Model
MS	Irrrometer	Watermark Electronic Module	WEM

3. Note on the Chart that all valves are to be included and note the last valve in sequence. This is where the sensor should be placed.

4. Note the Soil Moisture Sensing Notes on the plans.

5. Include the appropriate Installation Details. In this case you would use details 1 & 3 . (Details are in the back of the Manual)

Notes, Details, Symbols and Charts are on the CD included with this Manual and can be downloaded from www.irrometer.com.





Specimen Trees should be irrigated separately from the rest of the Landscape. They should also have their own Soil Moisture Control.

The best way to protect your investment in Specimen Trees is to have separate valves and or valve groups dedicated to proper irrigation of the trees.

If your project does not have a separate valve for trees, you can specify a “Manual Soil Moisture Reading Station.” Simply by using Detail #8 and having the Moisture Sensor Wires placed in a six inch round valve box will allow the Contractor, Arborist or End User to monitor and adjust the irrigation.

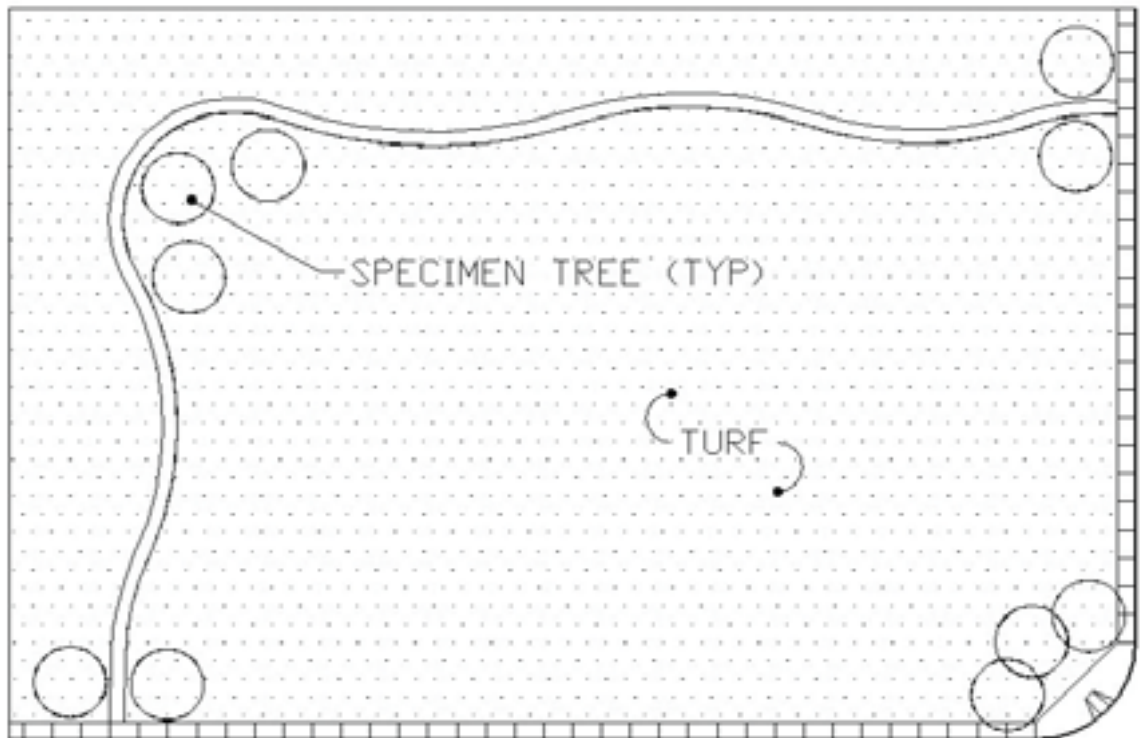
This Conceptual Landscape Plan shows areas that should be controlled by Hydrozone, according to the different water need areas.

Design Sample 3

The Specimen Trees are deeper rooted than the Turfgrass areas and require “Precise Irrigation”. Ask for Irrrometer “Urban Tree” newsletter for additional information

The Turfgrass areas should be on their own zone.

DESIGN THREE
LANDSCAPE PLAN





Because two Hydrozones are needed in this Landscape, the Watermark Electronic Module is the proper product for this project.

The following steps are required to complete specifications:

1. Note Moisture Sensor Locations, MS 1 & MS 2.
2. Note the Irrigation Legend:

Symbol	Manufacturer	Description	Model
MS	Irrrometer	Watermark Electronic Module	WEM

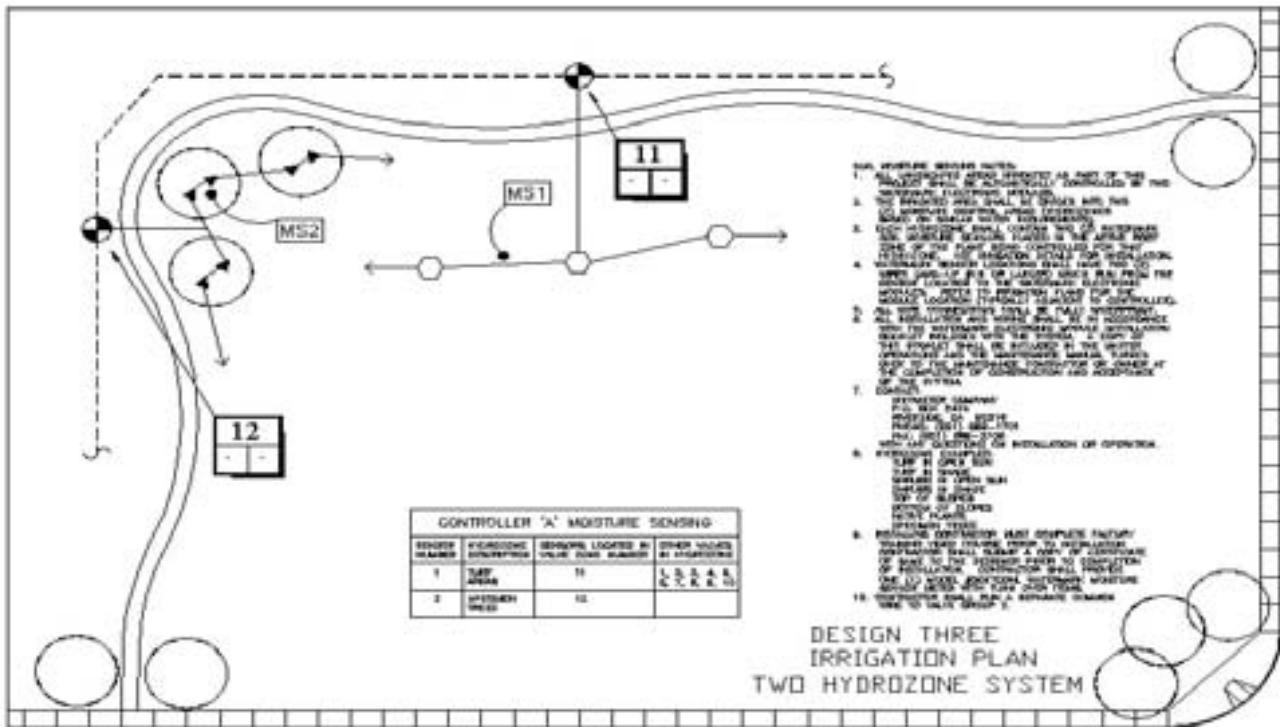
3. Note on the Chart which valves are to be included in each Zone and note the last valve in sequence in each zone. This is where the sensor should be placed.

Watermark Electronic Module (WEM)

4. Note the Soil Moisture Sensing Notes on the plans.

5. Include the appropriate Installation Details. In this case you would use details 1 & 4 (or 1 & 8 if doing the trees manually). (Details are in the back of the Manual)

Notes, Details, Symbols and Charts are on the CD included with this Manual and can be downloaded from www.irrometer.com.



Multiple Hydrozone System Part Number Specification Details



Watermark Multiple Hydrozone System (MHS)

The Watermark Multiple Hydrozone System (MHS) can be ordered as individual components to be assembled by the installer or as a factory mounted and wired sub-assembly, ready to be mounted in a control enclosure.

The components which comprise a MHS are:

The Multiple Hydrozone System Module (MHS), one per controller.

Watermark Electronic Modules (WEM), one per Hydrozone, or group of valves with like water demand (two Watermark sensors are included with each WEM). Up to eight can be used with the Multiple Hydrozone System.

Jumper cables (JC), which connect the MHS to the 24 VAC irrigation controller, one per irrigation zone (valve).

These components can be specified and ordered factory assembled, to facilitate installation. The components will be mounted on an aluminum backpanel and pre-wired so that the installer need only make connections to the controller and field sensor wires at labeled terminal strips. The entire assembly measures 11” x 16” x 2” and can be easily mounted in a control enclosure or on a wall, typically under or beside the controller.

To specify this factory assembled version, create a part number, such as:

MHS- 4 - 18

The first number, here 4, denotes the number of Hydrozones

The second number, here 18, denotes the number or irrigation zones or valves total

This system would consist of :

1 MHS

4 WEM

18 JC

and would be mounted on the backpanel and wired for terminal strip connection like the picture in the margin.

MHS - _____ - _____
 # Hydrozones # Valves

IRROMETER

Cabinet Mounted Option for the Watermark Multiple Hydrozone System



The Multiple Hydrozone System (MHS) is available mounted in a stainless steel enclosure for indoor or outdoor installation separate from the irrigation controller enclosure, if desired. The stainless steel enclosure is a Strong-Box[®] manufactured by V.I.T. Products. This sturdy box with a lockable hinged door is easily wall mounted. The MHS is factory mounted inside, standing off from the back, so that wiring can be protected underneath the panel. Operating instructions, and general system information, are attached inside the hinged door for easy reference by maintenance personnel.



Specify as Model MHS- * - ** -CM

* indicates the number of Hydrozones

** indicates the number of total valves

CM indicates the Cabinet Mount option

The label below is attached inside the door of the enclosure for informational purposes for the end user and any maintenance personnel who may service the system.

WATERMARK MULTIPLE HYDROZONE SYSTEM SOIL MOISTURE CONTROL PANEL

This panel automates the programmed irrigation schedule based on soil moisture status. This control maximizes the irrigation system efficiency by only allowing irrigation to occur when the soil moisture is sufficiently depleted. This provides for optimum plant health, while conserving irrigation water.

The irrigation valves have been grouped together into two or more "Hydrozones" or groups with similar watering demand. Two Watermark soil moisture sensors are located in a representative area in the root zone of the last valve to run in each grouping.

These sensors are wired back to this panel for each of the "Hydrozones." Each "Hydrozone" is individually adjustable by rotating the selector knob on each Watermark Electronic Module on the Multiple Hydrozone System panel. The panel is labeled to indicate which valves are grouped together in each type of "Hydrozone."

The single toggle switch, on the panel, allows the maintenance person to switch the system from SENSOR CONTROLLED to MANUAL for periodic manual operation or during establishment periods for new plantings. Once manual system checks or plant establishment periods are finished, the system should be switched into the SENSOR CONTROLLED position.

The indicator lights on the central panel illustrate whenever the irrigation controller is supplying power to one of the valves within that "Hydrozone." The indicator lights on the individual moisture controls (Watermark Electronic Modules) illuminate when the soil moisture status is drier than the setting, allowing irrigation to occur. When both lights are illuminated, the sprinklers should be operating in that "Hydrozone."

Any number of valves can be assigned to a "Hydrozone" by attaching a Watermark Jumper Cable from the irrigation controller terminal for that valve to the appropriate "Hydrozone" terminal on the top terminal strip of this panel. Be sure the black end of the Jumper Cable is attached to the Multiple Hydrozone System end of the connection.

The common ground of the irrigation system runs through this panel to return back to the irrigation controller. The Multiple Hydrozone System acts as a switch on the common ground to only allow irrigation when necessary, based on the selected moisture levels for each valve grouping.

IRROMETER Co., Inc.

P.O. Box 2424

Riverside, CA 92516-2424

Phone: (951) 689-1701 Fax: (951) 689-3706

www.irrometer.com techsupport@irrometer.com

Irrrometer offers a product submittal form to the contractor for use when submitting the equipment they intend to install on a project. This form is shown below. It allows the designer or project manager to be certain the appropriate equipment is being utilized. These submittal forms are available upon request directly from The Irrrometer Co., Inc. or any of their authorized distributors.

MULTIPLE HYDROZONE SYSTEM PRODUCT SUBMITTAL

The Watermark Multiple Hydrozone System being submitted for this project is a model number:

MHS- _____ - _____ - _____

This system will divide the irrigated area into _____ moisture control areas (Hydrozones) based on similar water requirements, controlling the _____ irrigation valves operated by the controller so irrigation will only be applied when soil moisture is sufficiently depleted. Each Hydrozone's moisture status is independently adjustable.

- Each Hydrozone will contain two (2) Watermark soil moisture sensors placed in the active root zone of the plant material being monitored in the last irrigation zone to run for that Hydrozone.
- Watermark sensor locations will have two (2) wires (AWG-UF #18 or larger) which run from the sensor location to the Watermark Soil Moisture Control System.
- All wire connections will be waterproof.
- All installation and wiring will be in accordance with the Watermark Soil Moisture Control System installation instructions, which are supplied from the manufacturer. A copy of these instructions will be included in the master operations and maintenance manual turned over to the maintenance contractor or the owner at the completion of construction and acceptance of the system.

This Watermark Multiple Hydrozone System (MHS) will be supplied from the manufacturer as:

- _____ A Factory Wired and Mounted sub-assembly, installed in a stainless steel enclosure
- _____ A Factory Wired and Mounted sub-assembly, ready to be installed in a control enclosure
- _____ Individual components to be assembled by others and mounted in a control enclosure

The components that comprise this Watermark Soil Moisture Control System are:

- The Multiple Hydrozone System Module (MHS), one per controller.
- Watermark Electronic Modules (WEM), one per Hydrozone, or group of valves with like water demand. Two Watermark sensors are included with each WEM. Up to eight WEMs can be used with the MHS.
- Jumper cables (JC) connect the MHS to the 24 VAC irrigation controller, one per irrigation zone (valve).

When these components are supplied factory assembled, to facilitate installation, the components will be mounted on an aluminum backpanel and pre-wired so that the installer need only make connections to the controller and field sensor wires at labeled terminal strips. The entire assembly measures 11" x 16" x 2" and can be easily mounted in a control enclosure or on a wall, typically under the controller, or can be ordered in its own enclosure.

IRROMETER Co., Inc.
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www.irrometer.com - techsupport@irrometer.com

IRROMETER



Watermark
Monitor



The Watermark Monitor is a data-logging device that automatically records soil moisture readings. This data is periodically downloaded for graphical display on a computer so the irrigation manager can view a vivid illustration of the effects of the irrigation scheduling. The Monitor can record up to eight sensors, either soil moisture, soil temperature and/or dry contact switch closures. This allows the soil moisture and temperature readings as well as various switch closures to be easily displayed for analysis. Soil temperature readings are used to compensate the soil moisture readings for increased accuracy. Typically one temperature per station of soil moisture sensors is recommended. Large depth variances may require additional sensors to accommodate temperature differences. The Monitor can be battery powered or installed with a transformer, for sites where AC power is readily available.

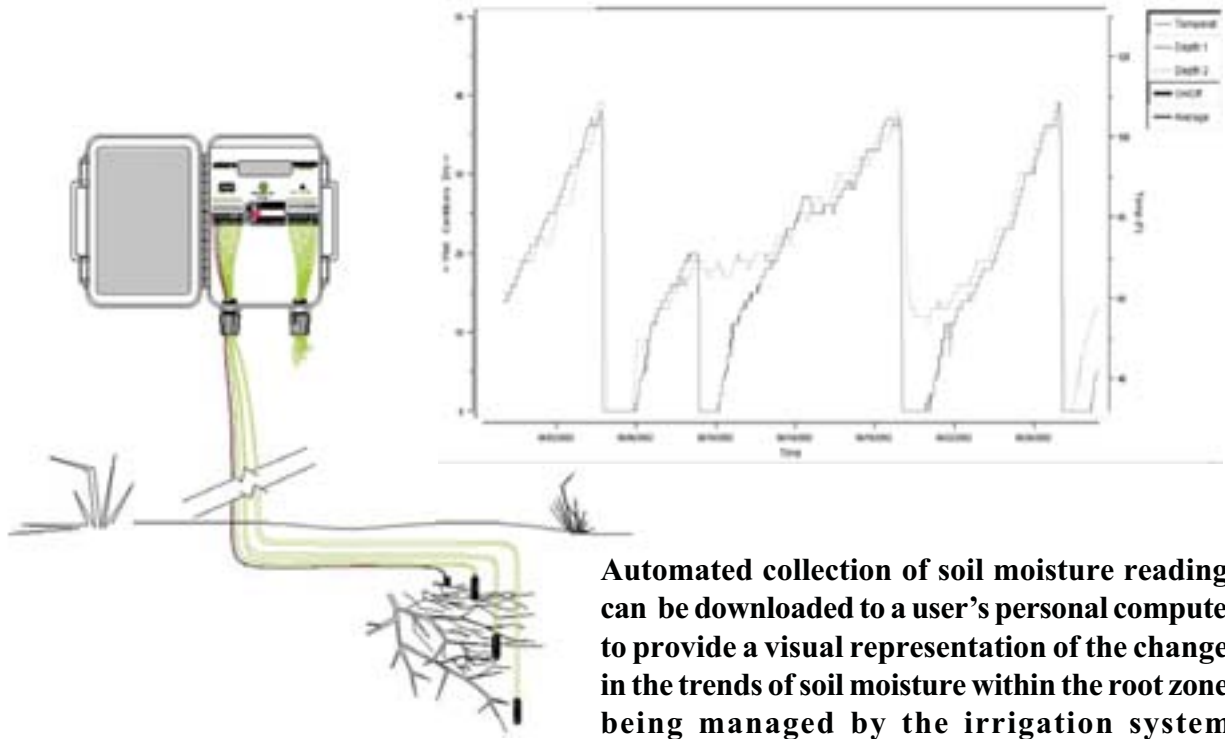
Soil Moisture Sensing Notes:

1. Watermark Monitors shall be used to automatically record the soil moisture status of representative areas of this landscaping project.
2. Eight (8) sensors shall be installed per Watermark Monitor as per the details in the legend.
3. Each sensor location shall have two (2) wires (AWG-UF #18 or larger) which run from the sensor location to the Watermark Monitor. Refer to irrigation plan for locations.
4. All wiring connections shall be fully waterproof.
5. All installation and wiring shall be in accordance with the Installation and Operation User's Manual included with the Watermark Monitor. A copy of which shall be included with the master operations and the maintenance manual turned over to the maintenance contractor or the owner at the completion of construction and acceptance of the system.
6. Contact:
Irrrometer Co., Inc.
P.O. Box 2424
Riverside, CA 92516-2424
Phone: (951) 689-1701
Fax: (951) 689-3706
www.irrometer.com
techsupport@irrometer.com
7. Sensor placement examples (shallow and deep sensors at):

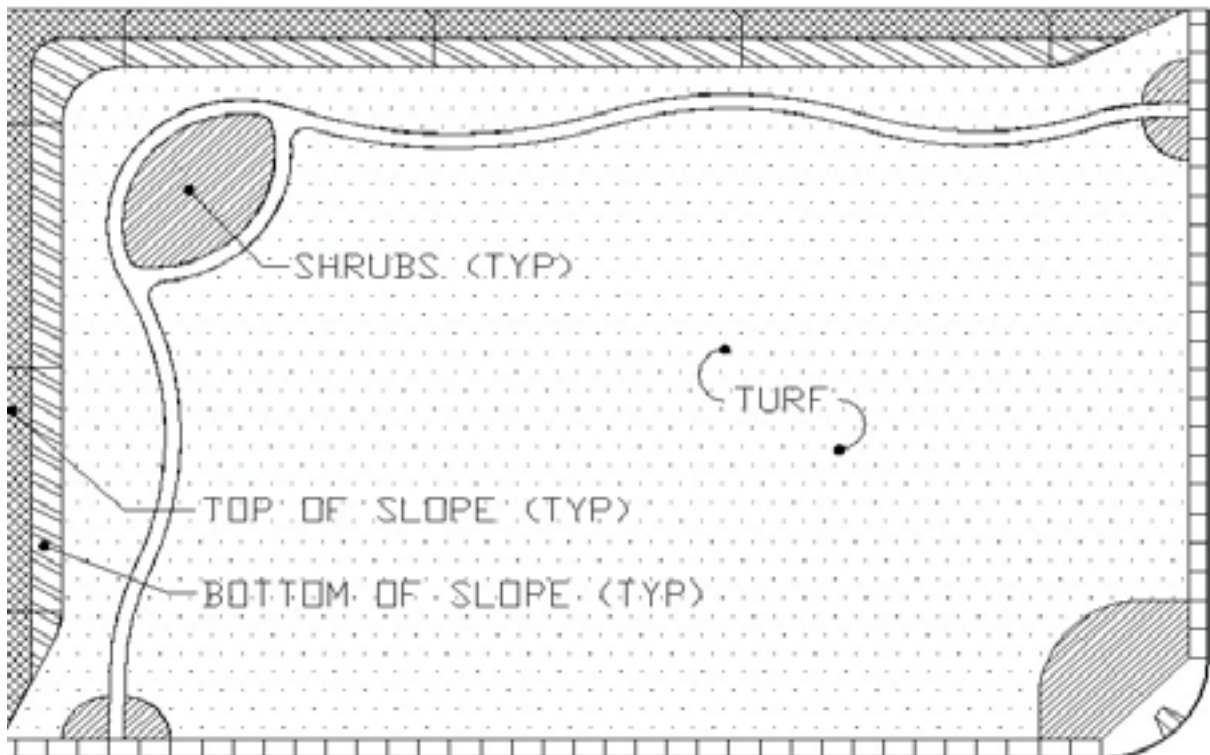
Turf areas	Drip Zones
Shrub areas	Sprinkler Zones
Tree areas	Full Sun
Top of slopes	Shaded Areas
Bottom of slopes	Specimen trees
8. Ordering information:
Specify Model Number as 900M- * - **
* = Number of Temperature Sensors
** = Number of Watermark Soil Moisture Sensors
Adding -AC to the Model Number denotes a Watermark Monitor with AC transformer for locations with readily available electric power. For example: a 900M-2-6-AC denotes a Monitor with 2 Temperature Sensors and 6 Watermark Sensors equipped with an AC transformer. This will create a permanently powered site with two (2) independently temperature compensated soil moisture areas of three (3) sensors each.

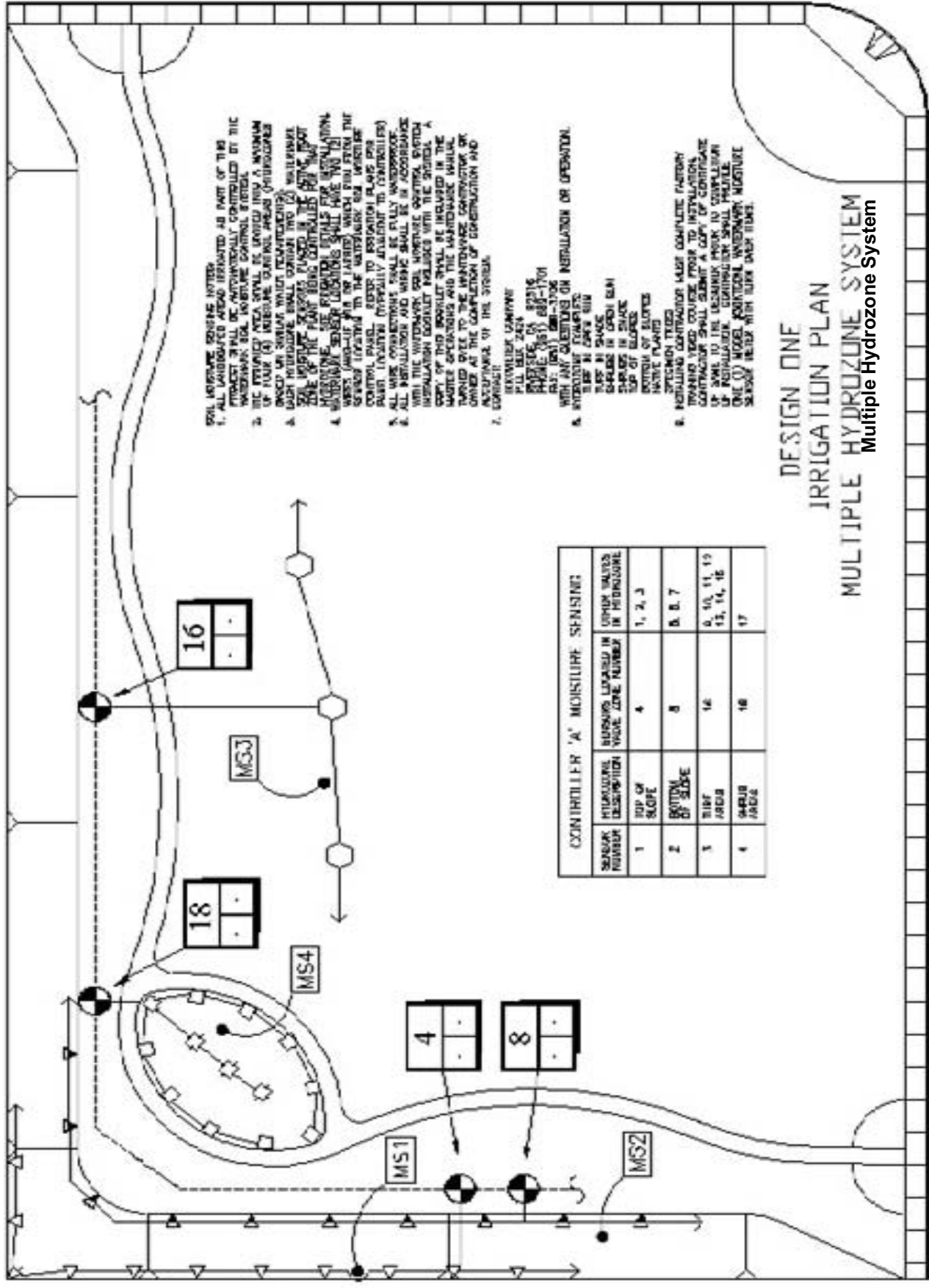
Design Sample 4

This Conceptual Landscape Plan shows four areas being automatically monitored with a data-logger, the Watermark Monitor.



DESIGN FOUR
LANDSCAPE PLAN



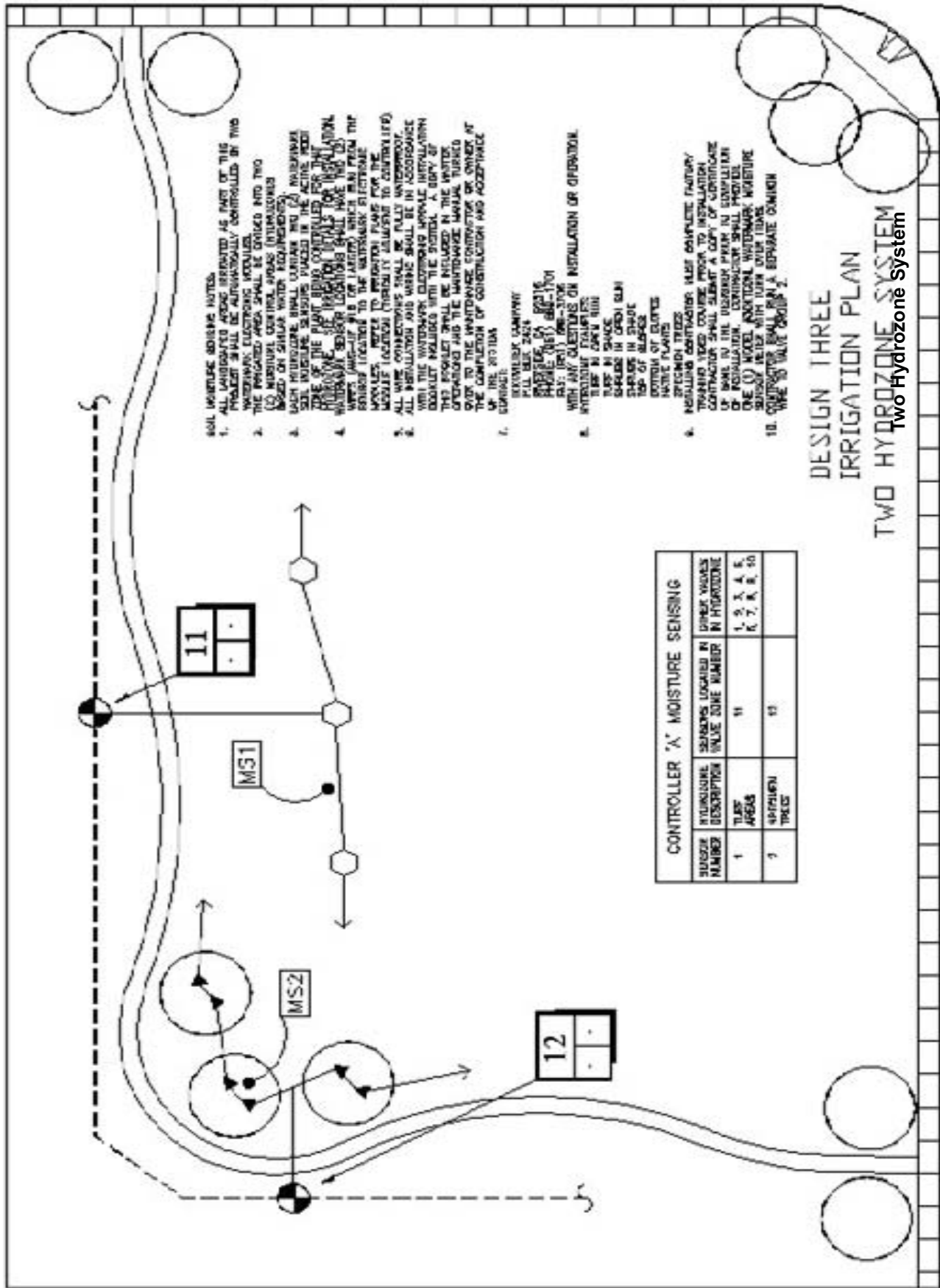


CONTROLLER 'A' MOISTURE SENSING			
SENSOR REGION	HYDROZONE DESCRIPTION	SUBSUNS LOCATED IN VALVE ZONE NUMBER	OTHER VALUES IN HYDROZONE
1	TOP OF SLOPE	4	1, 2, 3
2	BOTTOM OF SLOPE	8	6, 7
3	TIER /SLOPE	16	9, 10, 11, 12, 13, 14, 15
4	GRASS /SLOPE	18	17

SOIL MOISTURE SENSING SYSTEMS:

- ALL IRRIGATED AREAS IRRIGATED AS PART OF THIS PROJECT SHALL BE AUTOMATICALLY CONTROLLED BY THE WYDOMARK SOIL MOISTURE CONTROL SYSTEM.
- THE PRIMARY AREA SHALL BE IRRIGATED WITH A MAXIMUM OF FIVE (5) IRRIGATION ZONES PER HYDROZONE BASED ON SOIL TYPE, SLOPE, PLANTING, AND SOIL MOISTURE. SMALL ZONES TWO (2) TO THREE (3) FEET IN DIAMETER SHALL BE PLANTED IN THE SAME ZONE AS THE PLANT BEING CONTROLLED BY THE MOISTURE SENSING SYSTEM.
- MOISTURE SENSING DEVICES SHALL HAVE TWO (2) WIRE WOUNDS (WOUND-UP OR TAPPED) WHICH WILL FEED THE SIGNAL TO THE WYDOMARK SOIL MOISTURE CONTROL SYSTEM. REFER TO INSTALLATION PLANS FOR WIRE TAPPING PROCEDURES.
- ALL WIRE CONNECTIONS SHALL BE FULLY WATERPROOFED WITH THE WYDOMARK SOIL MOISTURE CONTROL SYSTEM INSTALLATION DOCUMENTS PROVIDED WITH THE SYSTEM. A COPY OF THIS MANUAL SHALL BE INCLUDED IN THE WATER OPERATIONS AND THE MAINTENANCE MANUAL TURNED OVER TO THE MAINTENANCE CONTRACTOR OR OWNER AT THE COMPLETION OF CONSTRUCTION AND ACCEPTANCE OF THE SYSTEM.
- CONTACT:
 - TELEPHONE: 604-271-2424
 - FAX: 604-271-2424
 - ADDRESS: 2000 17th Street, S.W. Vancouver, BC V6C 2S4
 - PHONE: (604) 683-1701
 - FAX: (604) 683-3706
- WITH ANY QUESTIONS ON INSTALLATION OR OPERATION.
- INDICATED TEMPERATURES SHALL BE TAKEN WITHIN THE FOLLOWING AREAS:
 - TOP OF SLOPE
 - BOTTOM OF SLOPE
 - TIER /SLOPE
 - GRASS /SLOPE
- IRRIGATION CONTRACTOR MUST COMPLETE FACTORY TRAINING AND OBTAIN PROPER TOOLS FOR INSTALLATION. CONTRACTOR SHALL SUBMIT COPY OF CERTIFICATE OF TRAINING TO THE SENIOR PROJECT ENGINEER UPON INSTALLATION. CONTRACTOR SHALL SUBMIT ONE (1) MODEL CONTROLLER WYDOMARK MOISTURE SENSING RELAY WITH USER BOOKS.

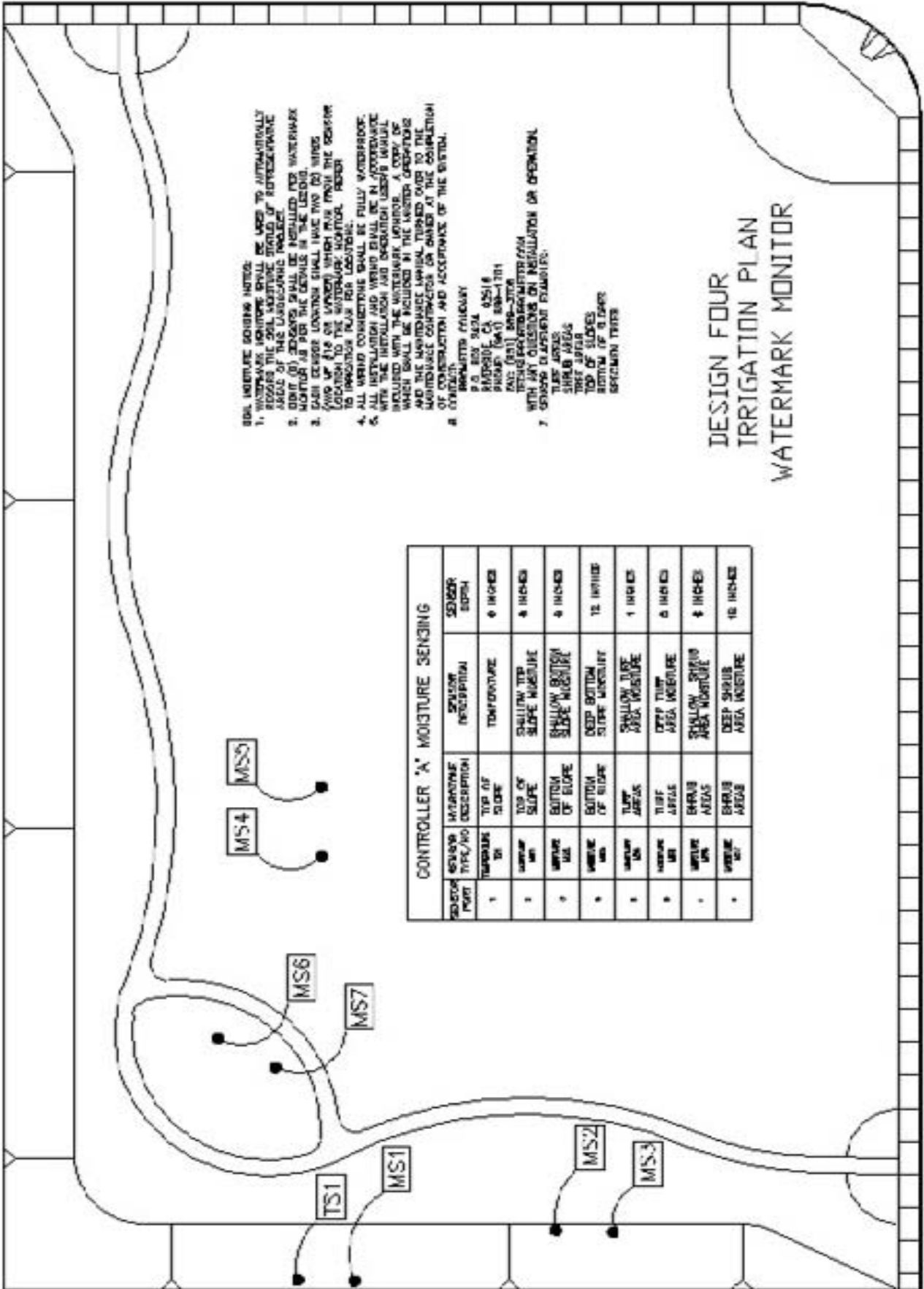
DESIGN ONE
IRRIGATION PLAN
MULTIPLE HYDROZONE SYSTEM
 Multiple Hydrozone System



- SOIL MOISTURE SENSING NOTES:**
1. ALL IRRIGATED AREAS REPRESENTED AS PART OF THIS PROJECT SHALL BE AUTOMATICALLY CONTROLLED BY TWO WATERSHEDS ELECTRONICALLY MONITORED.
 2. THE IRRIGATED AREA SHALL BE DIVIDED INTO TWO WATERSHEDS: (1) NORTHERN CONTROL AREAS (HYDROZONES) BASED ON SIMILAR WATER REQUIREMENTS.
 3. EACH HYDROZONE SHALL UTILIZE TWO (2) WATERSHED SOIL MOISTURE SENSORS PLACED IN THE ACTIVE ROOT ZONE OF THE PLANT BEING CONTROLLED FOR THAT HYDROZONE. THE POSITION SHALL BE FOR INSTALLATION. WATERSHED SENSOR LOCATIONS SHALL HAVE TWO (2) MARKERS (ONE 1/2" W/8 OR LARGER) WHICH WILL FROM THE SENSOR LOCATION TO THE WATERSHED ELECTRONIC MONITORS. NOTES TO POSITION PLANS FOR THE WATERSHED LOCATIONS (TYPICALLY 1/4" TO 1/2" DIA.)
 4. ALL WIRE CONNECTIONS SHALL BE FULLY WATERPROOF. ALL INSTALLATION AND WIRING SHALL BE IN ACCORDANCE WITH THE WATERSHED ELECTRONIC SPECIAL INSTALLATION BOOKLET PROVIDED WITH THE SYSTEM. A COPY OF THIS BOOKLET SHALL BE INCLUDED IN THE WATER OFFERING AND THE MAINTENANCE MANUAL TURNED OVER TO THE MAINTENANCE CONTRACTOR OR OWNER AT THE COMPLETION OF CONSTRUCTION AND ACCEPTANCE OF THE SYSTEM.
 5. CONTRACTOR SHALL RUN A SEPARATE CONDUIT FOR EACH WIRE GROUP 2.
6. INSTALLING CONTRACTOR MUST COMPLETE FACTORY TRAINING VIDEO COURSE PRIOR TO INSTALLATION. CONTRACTOR SHALL SUBMIT A COPY OF CERTIFICATE OF COMPLETION TO THE IRRIGATOR PRIOR TO COMMENCEMENT OF INSTALLATION. CONTRACTOR SHALL PROVIDE ONE (1) MODEL ADDITIONAL WATERSHED MOISTURE SENSOR WITH EACH OTHER IRRIGATOR.
7. CONTRACTOR SHALL RUN A SEPARATE CONDUIT FOR EACH WIRE GROUP 2.

SENSOR NUMBER	HYDROZONE DESCRIPTION	SENSORS LOCATED IN VALUE ZONE NUMBER IN HYDROZONE	OTHER VALUES IN HYDROZONE
1	TRIF AREA	11	1, 2, 3, 4, 5, 6, 7, 8, 9, 10
2	40'PHEN TRICE	12	

DESIGN THREE
IRRIGATION PLAN
TWO HYDROZONE SYSTEM
Two Hydrozone System



CONTROLLER 'A' MOISTURE SENSING

SENSOR POINT	SENSOR TYPE/NO.	INSTALLATION DESCRIPTION	SENSOR DESCRIPTION	SENSOR DEPTH
1	TEMPERATURE T-1	TOP OF SLOPE	TEMPERATURE	6 INCHES
2	SHALLOW SLOPE MS	TOP OF SLOPE	SHALLOW TOP SLOPE MOISTURE	6 INCHES
3	SHALLOW SLOPE MS	BOTTOM OF SLOPE	SHALLOW BOTTOM SLOPE MOISTURE	6 INCHES
4	DEEP SLOPE MS	BOTTOM OF SLOPE	DEEP BOTTOM SLOPE MOISTURE	18 INCHES
5	SHALLOW TUB MS	TUB AREA	SHALLOW TUB AREA MOISTURE	1 INCHES
6	DEEP TUB MS	TUB AREA	DEEP TUB AREA MOISTURE	6 INCHES
7	SHALLOW TUB MS	SHALLOW TUB AREA	SHALLOW TUB AREA MOISTURE	6 INCHES
8	DEEP TUB MS	DEEP TUB AREA	DEEP TUB AREA MOISTURE	18 INCHES

SOIL MOISTURE SENSING NOTES:

1. WATERMARK SENSORS SHALL BE USED TO AUTOMATICALLY REDUCE THE SOIL MOISTURE LEVELS OF IRRIGATED AREAS OF THE LANDSCAPE. INSTALLATION SHALL BE AS FOLLOWS:
 - a. SENSORS SHALL BE INSTALLED FOR WATERMARK MONITOR AS PER THE DETAILS IN THE LEGEND.
 - b. EACH SENSOR LOCATION SHALL HAVE TWO (2) WIRING TUBES UP (1" OR LARGER) WHICH TAKE FROM THE SENSOR LOCATION TO THE WATERMARK MONITOR. REFER TO DRAWINGS FOR SENSOR LOCATIONS.
2. ALL WIRING CONNECTIONS SHALL BE FULLY WATERPROOF.
3. WITH THE INSTALLATION AND DEMONSTRATION USER'S MANUAL INCLUDED WITH THE WATERMARK MONITOR. A COPY OF WHICH SHALL BE INCLUDED IN THE MONITOR OPERATIONS AND THE MAINTENANCE MANUAL, TURNED OVER TO THE LANDSCAPE CONTRACTOR OR OWNER AT THE COMPLETION OF INSTALLATION AND ACCEPTANCE OF THE SYSTEM.
4. CONTACT:
 - IRRI-METER COMPANY
 - P.O. BOX 9424
 - MENARD, CA 95251-9424
 - PHONE: (916) 898-1781
 - FAX: (916) 898-3708
 - TELEPHONE: (916) 898-3708
5. WITH ANY QUESTIONS ON INSTALLATION OR OPERATION, CONTACT:
 - TUBS AREAS
 - SHRUB AREAS
 - TOP OF SLOPES
 - TUB AREA
 - BOTTOM OF SLOPES
 - SENSOR TUBS

**DESIGN FOUR
IRRIGATION PLAN
WATERMARK MONITOR**

IRROMETER

4

Irrrometer Gauges



**Hermetically Sealed
Pressure Gauge**

These durable, specially constructed hermetically sealed gauges have a molded water-tight cover and shatter proof plastic face designed to greatly lengthen gauge life.



Liquid Filled Pressure Gauge

These gauges provide superior performance in applications where vibration, pulsation, mechanical shock and pressure spikes are common factors.

The Irrrometer Company has manufactured sealed pressure and vacuum gauges for over fifty years. These gauges are warranted to be water tight, dust proof and rust proof. They give years of continuous service under conditions in which ordinary gauges would last only months.

Irrrometer's pressure gauges add value for your client. Whether the use is for irrigation, swimming pool, wastewater, canning, food processing, dairy, brewery or industrial, these gauges hold up.

Irrrometer Hermetically Sealed Pressure Gauges have two inch face, are ASME B40.1 Grade B commercial gauge accuracy ($\pm 3-2-3\%$ of span), with $\frac{1}{4}$ " NPT brass bottom connection and a bronze Bourdon tube mechanism. Available in six pressure ranges from 0-15 PSI to 0-400 PSI with dual scale of PSI and kPa on dial under polycarbonate internal face. Gauge is sealed for protection with clear butyrate outer face and Thermo Plastic Rubber (TPR) cover. Operating range of -40° to 150° F (-40° to 65° C) ambient.

Part Numbering for Series 7 Hermetically Sealed Gauges:

7-15	0-15 psi range
7-30	0-30 psi range
7-60	0-60 psi range
7-100	0-100 psi range
7-200	0-200 psi range
7-400	0-400 psi range

Irrrometer Liquid Filled Pressure Gauges have $2\frac{1}{2}$ " (63mm) face, are ASME B40.1 Grade B commercial gauge accuracy ($\pm 3-2-3\%$ of span), with $\frac{1}{4}$ " NPT brass bottom connection and a bronze Bourdon tube mechanism. Available in four pressure ranges from 0-60 PSI to 0-400 PSI with dual scale of PSI and kPa in 304 stainless steel case with polycarbonate face and glycerin filling. Operating range of 20° to 150° F (-7° to 65° C) ambient.

Part Numbering for Series 7LF Hermetically Sealed Gauges:

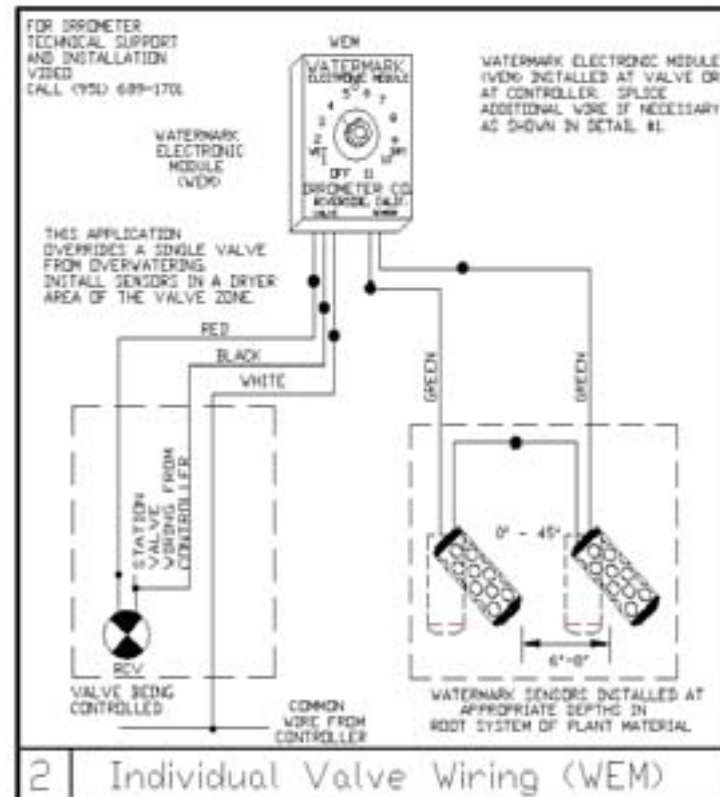
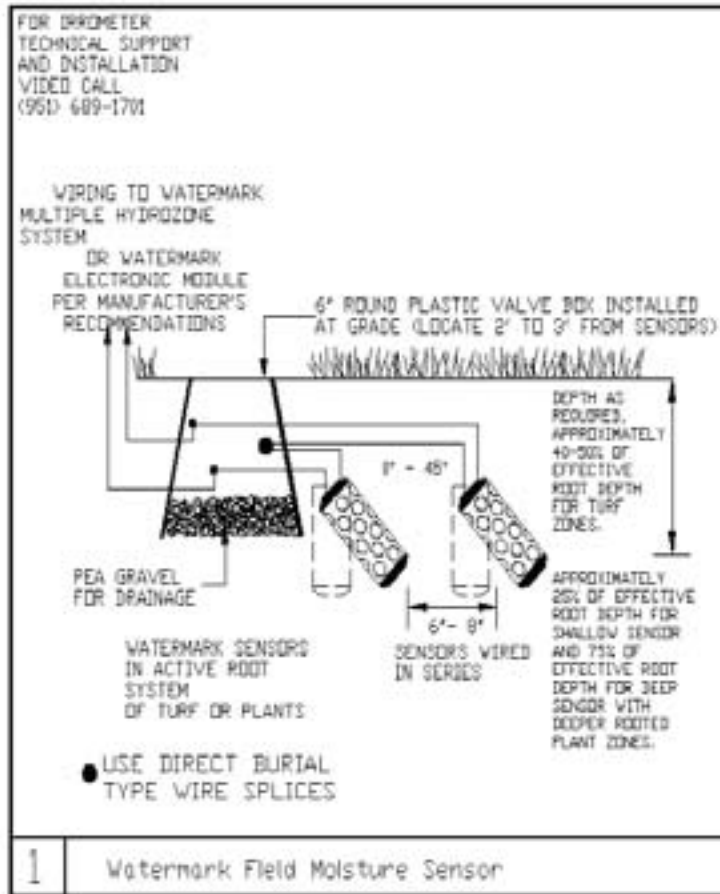
7-60LF	0-60 psi range
7-100LF	0-100 psi range
7-200LF	0-200 psi range
7-400LF	0-400 psi range

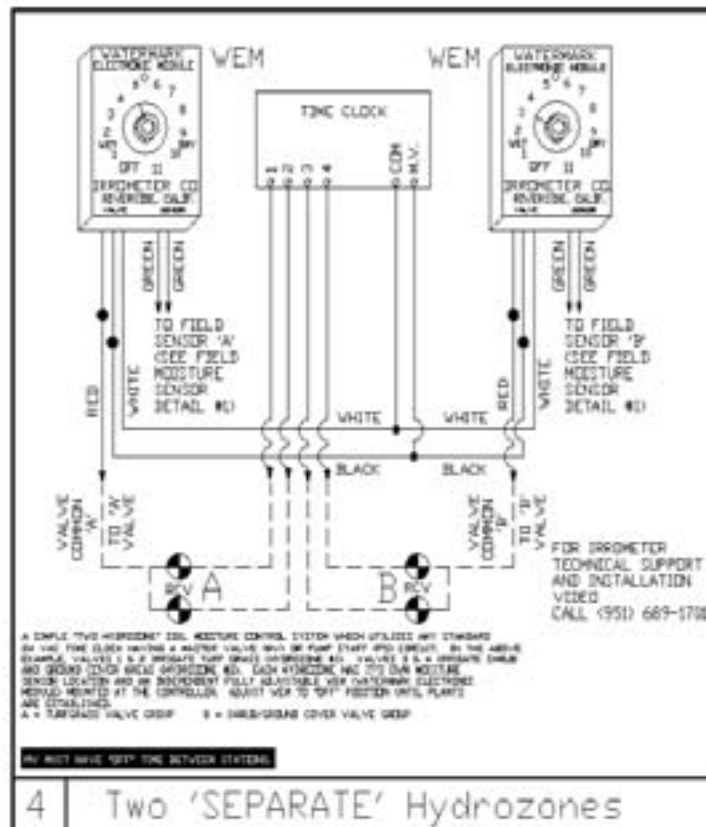
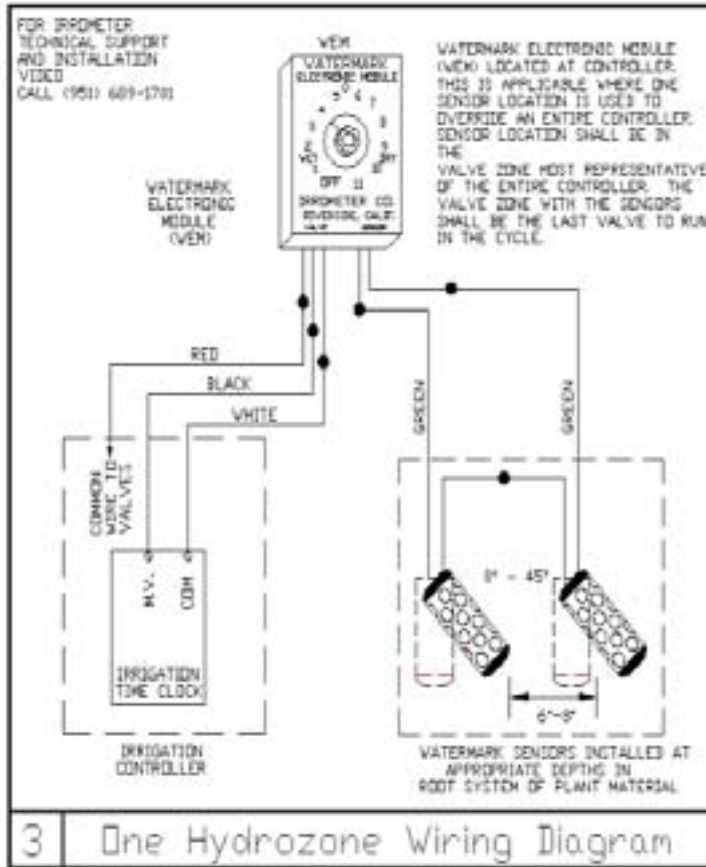
Factory installed internal snubber is available for both series of gauges to help absorb surges. Snubber is removable for cleaning. Add 'S' to part number. For example, a 0-100 PSI Hermetically Sealed Pressure Gauge with internal Snubber is part number 7-100S.

Irrrometer Pressure Gauges are NOT disposable, they are repairable and can be re-calibrated as necessary.

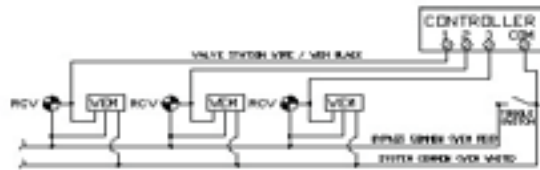
When durability, accuracy and longevity are important ...specify Irrrometer gauges.

Hermetically Sealed Vacuum Gauges also available in 0-100 centibar and kPa (0-1 bar, equivalent to 0-15 in mercury) a 0-40 centibar and kPa (0-4 bar equivalent to 0-12 in mercury).





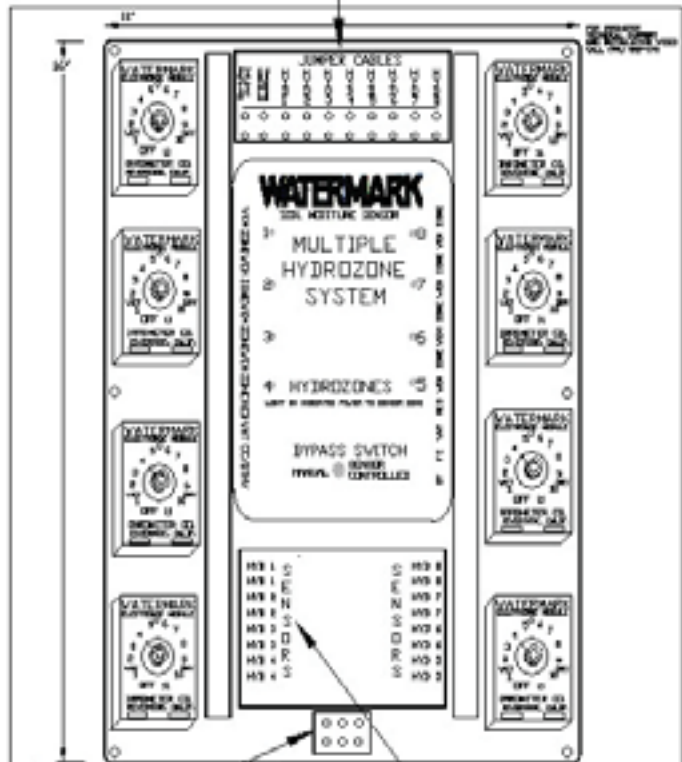
FOR IRRIGATOR
TECHNICAL SUPPORT
CALL (951) 689-1701



NOTES: THIS BYPASS CIRCUIT ALLOWS OVERRIDE OF SENSORS AT THE CONTROLLER WHEN WEM'S ARE USED ON AN INDIVIDUAL VALVE (DETAIL 2).

5 Optional WEM Bypass Circuit

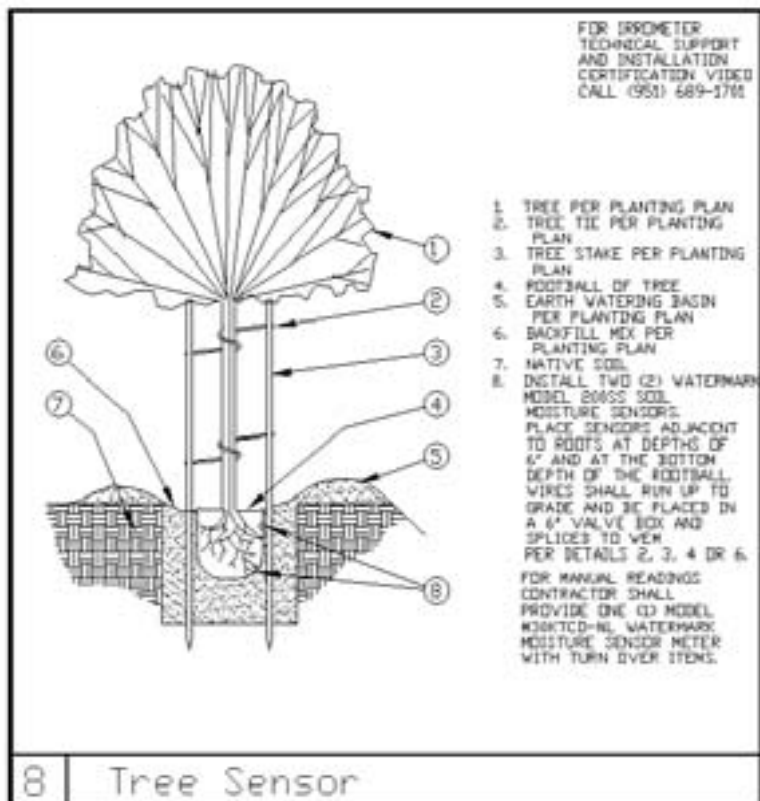
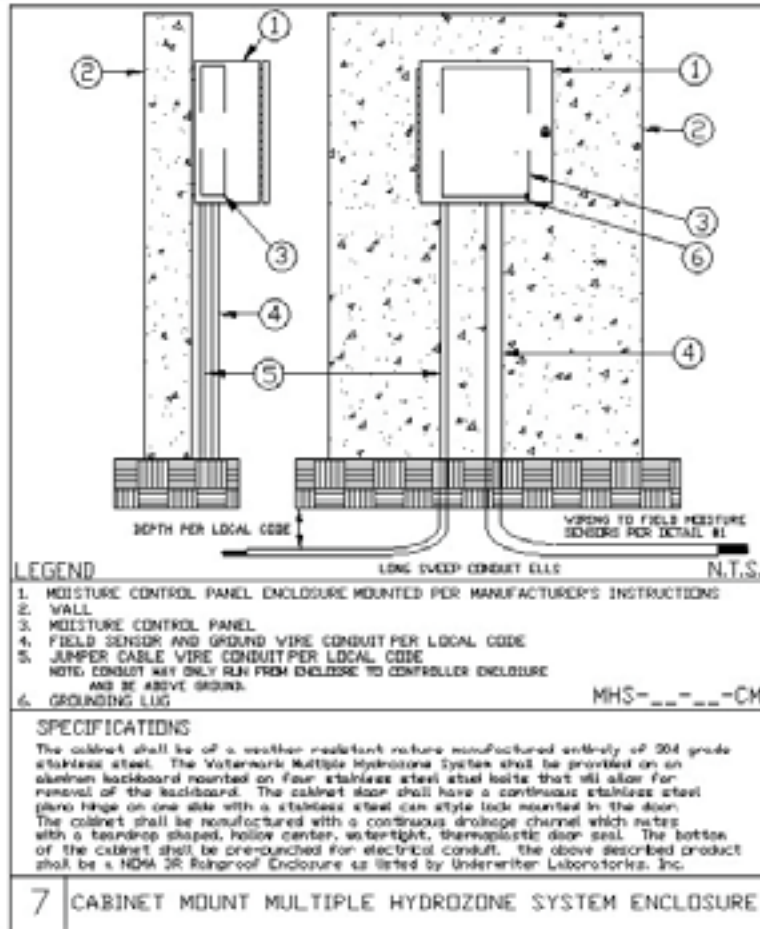
Wiring connections to the Solenoid controller per detailed table. Jumper cables supplied for valve connections.



Wiring connections to the common ground from the field valves. Wiring connections to the field sensors. (Wiring to WATERMARK FIELD MOISTURE SENSOR DETAIL #1)

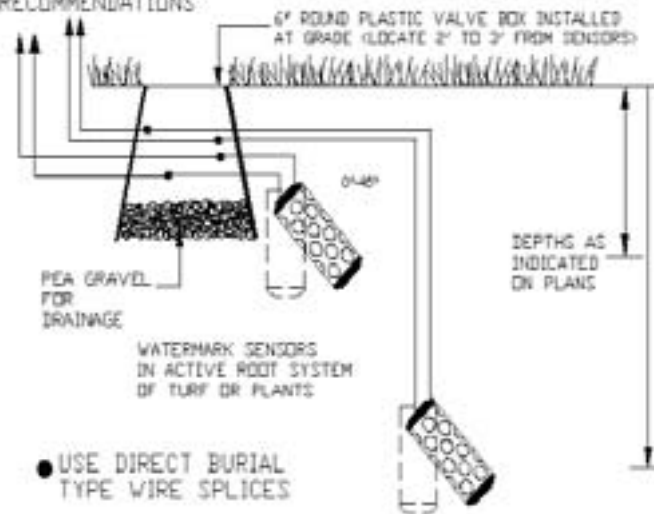
INSTALLED IN CONTROLLER CABINET OR WALL MOUNTED INDOORS

6 Multiple Hydrozone System (MHS)



FOR IRRIGATOR
TECHNICAL SUPPORT
AND INSTALLATION VIDEO
CALL (951) 689-1700

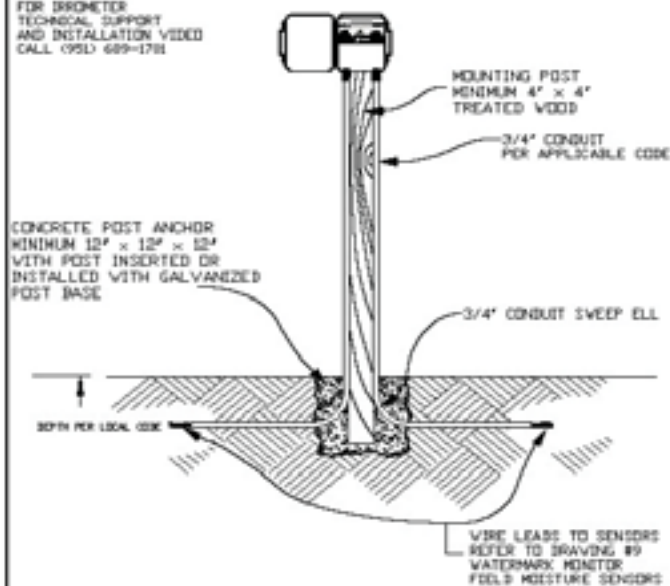
TO WATERMARK MONITOR
PER MANUFACTURER'S
RECOMMENDATIONS



9

Watermark Monitor Field Moisture Sensors

FOR IRRIGATOR
TECHNICAL SUPPORT
AND INSTALLATION VIDEO
CALL (951) 689-1700

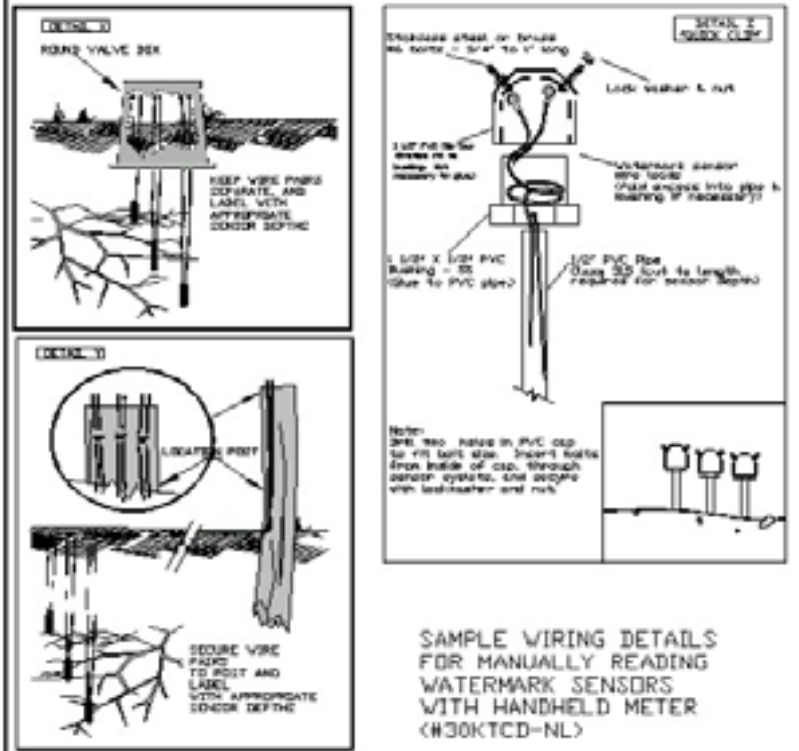


LOCATED IN FIELD NEAR SENSORS MOUNTED ON A POST, AS SHOWN, OR ON A WALL OR IN A CONTROLLER CABINET PER MANUFACTURER'S RECOMMENDATIONS

10

Watermark Monitor Field Installation

FOR IRRIGATOR
TECHNICAL SUPPORT
CALL (951) 689-1701



11 Watermark Sensor Wiring Details

FOR IRROMETER
TECHNICAL SUPPORT
CALL (951) 689-1711



WATER TIGHT
RUST PROOF
DUST PROOF
SHATTER PROOF FACE

THIS DURABLE, SPECIALLY
CONSTRUCTED HERMETICALLY
SEALED GAUGE IS DESIGNED
TO GREATLY LENGTHEN
SERVICE LIFE

HERMETICALLY SEALED 2" PRESSURE GAUGE
PRESSURE RANGE(S)

- ___ 0-15 PSI
- ___ 0-30 PSI
- ___ 0-60 PSI
- ___ 0-100 PSI
- ___ 0-200 PSI
- ___ 0-400 PSI

AVAILABLE WITH FACTORY
INSTALLED INTERNAL SNUBBER
TO HELP ABSORB SURGES
(SNUBBER IS REMOVABLE
FOR CLEANING)
___ S

ALL GAUGES ARE DUAL SCALE WITH PSI AND kPa
ASME B40.1 GRADE B COMMERCIAL SERIES
1/4" NPT BRASS BOTTOM CONNECTION
INTERNAL COMPONENTS:
BRASS WITH NYLON GEAR AND PHOSPHORUS BRONZE BOURDON TUBE
CLEAR BUTYRATE OUTER FACE AND POLYCARBONATE INTERNAL FACE
THERMO PLASTIC RUBBER (TPR) COVER

12 Irrrometer Sealed Pressure Gauge

FOR IRROMETER
TECHNICAL SUPPORT
CALL (951) 689-1711



STAINLESS STEEL COVER
LIQUID FILLED

THIS GAUGE PROVIDES
SUPERIOR PERFORMANCE
IN APPLICATIONS WHERE
VIBRATION, PULSATION,
MECHANICAL SHOCK AND
PRESSURE SPIKES ARE
COMMON.

AVAILABLE WITH FACTORY
INSTALLED INTERNAL SNUBBER
TO HELP ABSORB SURGES
(SNUBBER IS REMOVABLE
FOR CLEANING)
___ S

LIQUID FILLED 2 1/2" PRESSURE GAUGE
PRESSURE RANGE(S)

- ___ 0-60 PSI
- ___ 0-100 PSI
- ___ 0-200 PSI
- ___ 0-400 PSI

ALL GAUGES ARE DUAL SCALE WITH PSI AND kPa
ASME B40.1 GRADE B COMMERCIAL SERIES
1/4" NPT BRASS BOTTOM CONNECTION
INTERNAL COMPONENTS:
BRASS WITH NYLON GEAR AND PHOSPHORUS BRONZE BOURDON
TUBE
304 STAINLESS STEEL CASE WITH BUNA-N VENT PLUG
POLYCARBONATE FACE
GLYCERIN FILLING (20-150 F AMBIENT)

13 Irrrometer Liquid Filled Pressure Gauge

IRROMETER

...simple tools for optimizing irrigation, worldwide.



*For information on precision irrigation, contact us
on the web <http://www.irrometer.com>*

phone: (951) 689-1701 fax: (951) 689-3706

E-Mail: sales@irrometer.com

Mail: P.O.Box 2424

Riverside, CA 92516-2424

August 2004