IRROMETER 70 YEARS OF TRUSTED MEASUREMENTS 1951-2021

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Moisture Sensor Landscape Irrigation Design Guide

Foreword

Since 1951 Irrometer 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 is even more important today than it was in 1951. The conservation and protection of our valuable water resources is a major 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 conventional 24 Volt AC, two-wire and DC control systems is easily accomplished with the Irrometer family of products.

Many moisture sensing products have come and gone over the years, but Irrometer 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 three 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 available from our website at:
https://www.irrometer.com/downloads.html#cad.

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 Irrometer Co., Inc at:
Phone: (951) 682-9505
Fax: (951) 682-9501
URL: www.irrometer.com
E-mail: techsupport@irrometer.com

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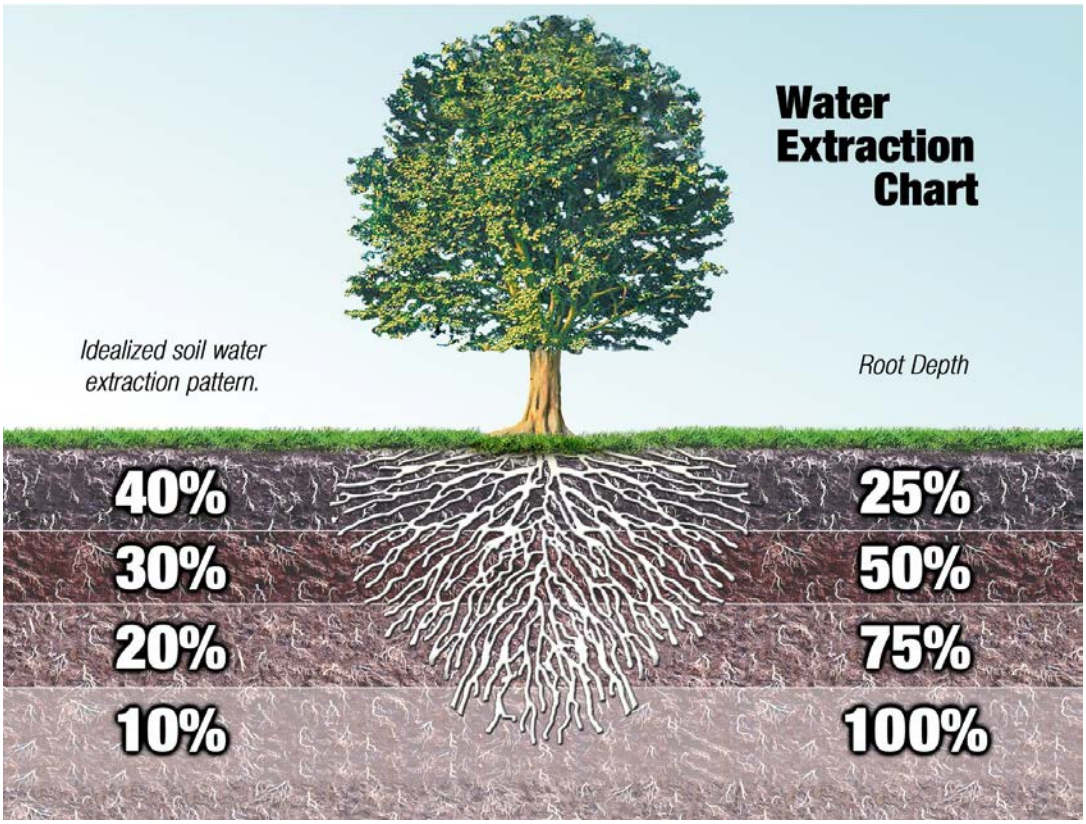
Contents

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 holding the water. The property of how tightly the water is held by the soil is soil water tension. To extract the water, the plant has to overcome this 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, 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.

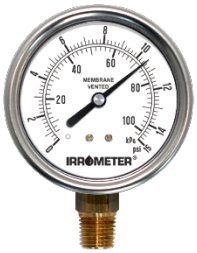
Figure 1-1 Irrometer Low Tension Tensiometer Model "LT"

Measuring Soil Moisture

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 centi-bars or kilo-pascals. One centi-bar 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 0-100cb (centi-bars) 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 Irrometer Company, Inc. (Figure 1-2) This product is calibrated to a Tensiometer and has a range of 0-200cb. Wire can be run up to 1000 feet or more. It is a low maintenance and low-cost product.

Figure 1-2 Watermark Soil Moisture Sensor by Irrometer Company

Units of Measurement



15 psi gauge measures positive pressure

=

100cb/kPa gauge measures negative pressure

Soil Moisture Measurement and Control Products from Irrometer

The **WaterSwitch AC (WS-AC)** comes complete with a Watermark #200SS-5 Sensor and an installation and operation manual. It is designed to interface with 24 VAC controllers or valves and it is compatible with some two-wire systems. Individual valves can be controlled by installing the sensor in the area irrigated by the same valve. It is fully adjustable from wet to dry and has a "BYPASS" position to temporarily 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.

The **WaterSwitch DC (WS-DC)** comes complete with a Watermark #200SS-5 Sensor and an installation and operation manual. It is designed to interface with battery powered controllers with a sensor circuit and it is compatible with some two-wire systems. It is fully adjustable from wet to dry and has a "BYPASS" position to temporarily override the sensor. It is water proof for valve box installation, such as with a two-wire sensor decoder, or can be installed at the controller. Irrigation will occur only when soil is dryer than the set point.

The **Watermark Multiple Hydrozone System (MHS)** comes complete with Watermark #200SS-5 Sensors and an installation and operation manual. It provides up to eight independent moisture sensing locations used to control the valves by "group" based on common irrigation need, all on a single common wire. There is no need for separate commons with the MHS. Each moisture sensing location can be independently adjusted for the desired moisture level. System Bypass features allow for overriding of sensors at the panel for a single use temporary period or for a recurring fixed time period. An alphanumeric display panel aids in checking system operation and status. Up to 48 stations can be soil moisture managed. Irrigation will occur only when soil is dryer than the user defined set point for each of up to eight separate moisture groups.

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 0 cb (WET) to 199 cb (very DRY).

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. Many other brands of data loggers can also read the Watermark Sensor, call Irrometer for specific information.

The flowing guide can aid in selecting the appropriate control device for your application

Product Selection Matrix

Application	Irrigation controller type	Recommendation
manage a single valve	conventional 24 VAC	WS-AC
manage all valves	conventional 24VAC	WS-AC
manage all valves	battery powered w/sensor circuit	WS-DC
manage a valve group	conventional 24VAC	WS-AC
manage multiple valve groups	conventional 24VAC	MHS
manage all valves	2-wire w/sensor circuit	WS-AC*
manage multiple valve groups	2-wire w/sensor decoders	WS-DC*
manage a single valve	2-wire w/sensor circuit	WS-AC*
manage a single valve	2-wire w/sensor decoder	WS-DC*

* 2-wire controller must be capable of accepting a dry contact type switch closure input at the main controller sensor circuit or through the use of a sensor decoder. Programming of the controller may be required to react to the switch input as desired. The number of possible valve groups is dependent on how many sensor inputs the controller supports.

Part number selection matrix

WaterSwitch Series		WS -____
Options	AC, DC	
Series		MHS-__
# Hydrozones/valves	4-16, 6-32, 8-48	

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Why use Soil Moisture Measurement and Control Products from Irrometer?

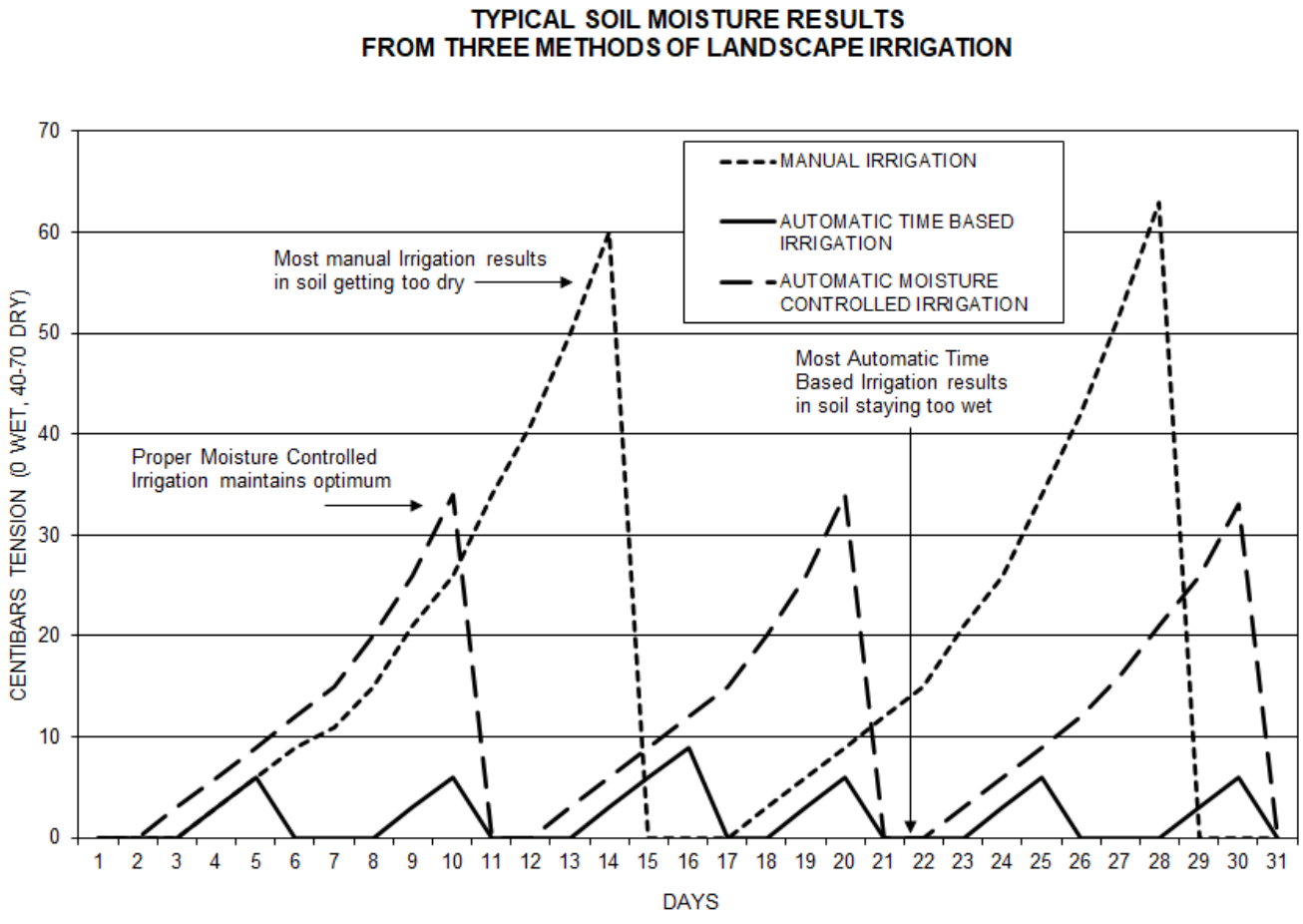
Conserving water, our most precious natural resource, is of great importance. Good water management will also result in optimizing pumping energy, as well as reprogramming labor.

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. It is very difficult to tell what the soil moisture is like underground 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



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WATERPERFECT

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

Irrometer 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.

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 valvezones.

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.

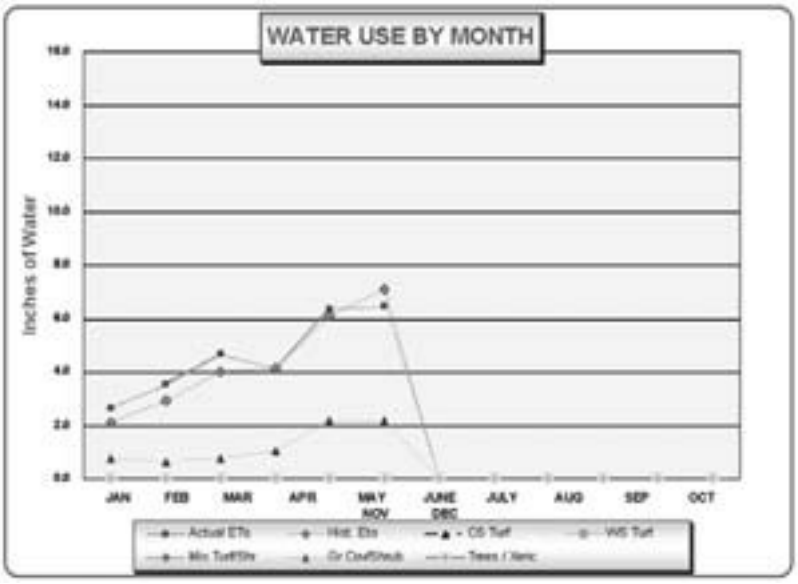


Figure 3-1
Example of a curve from WaterPerfect software showing water usage of a plant material group compared to actual and historic ET data.

Design Sample 1

How to Specify Soil Moisture Measurement and Control Products.

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.

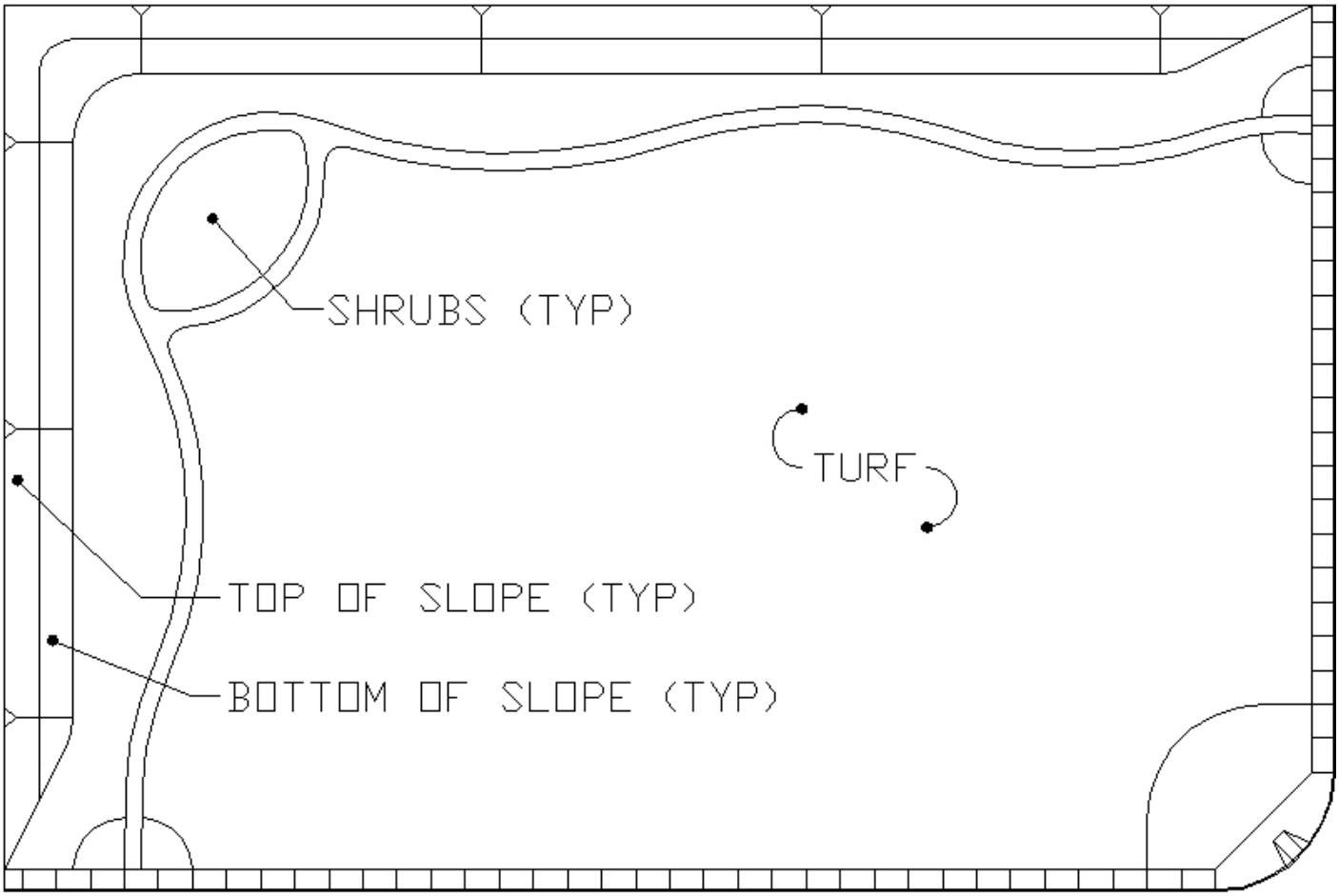
The Shrub areas away from slopes will be rooted deeper and, in most cases, need less water than cool season grasses.

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

The bottom of slope areas is 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



Watermark Multiple Hydrozone System (MHS)

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

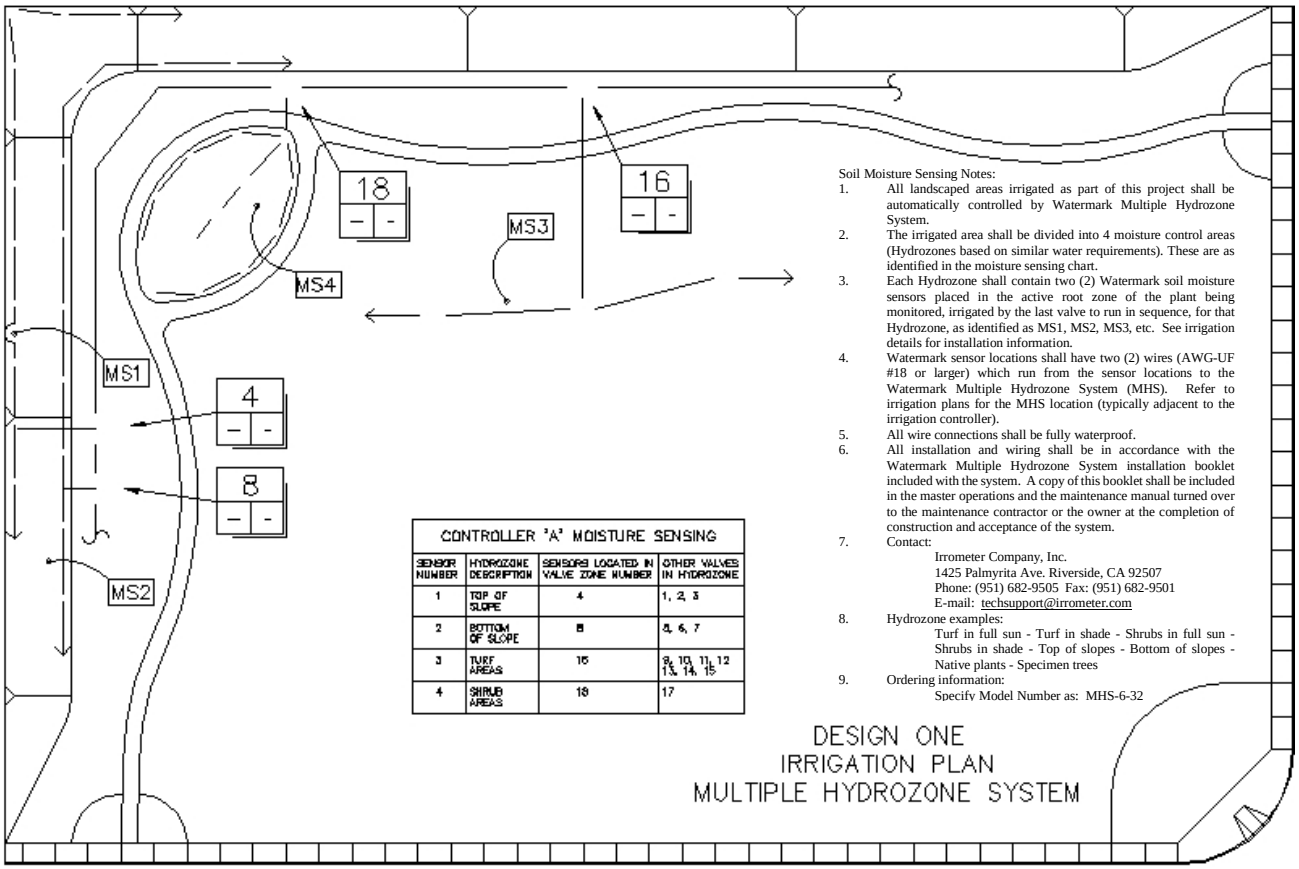
The following steps are required to complete specifications:

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

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.

The MHS Instruction Manual can be downloaded from www.irrometer.com.



Design Sample 2

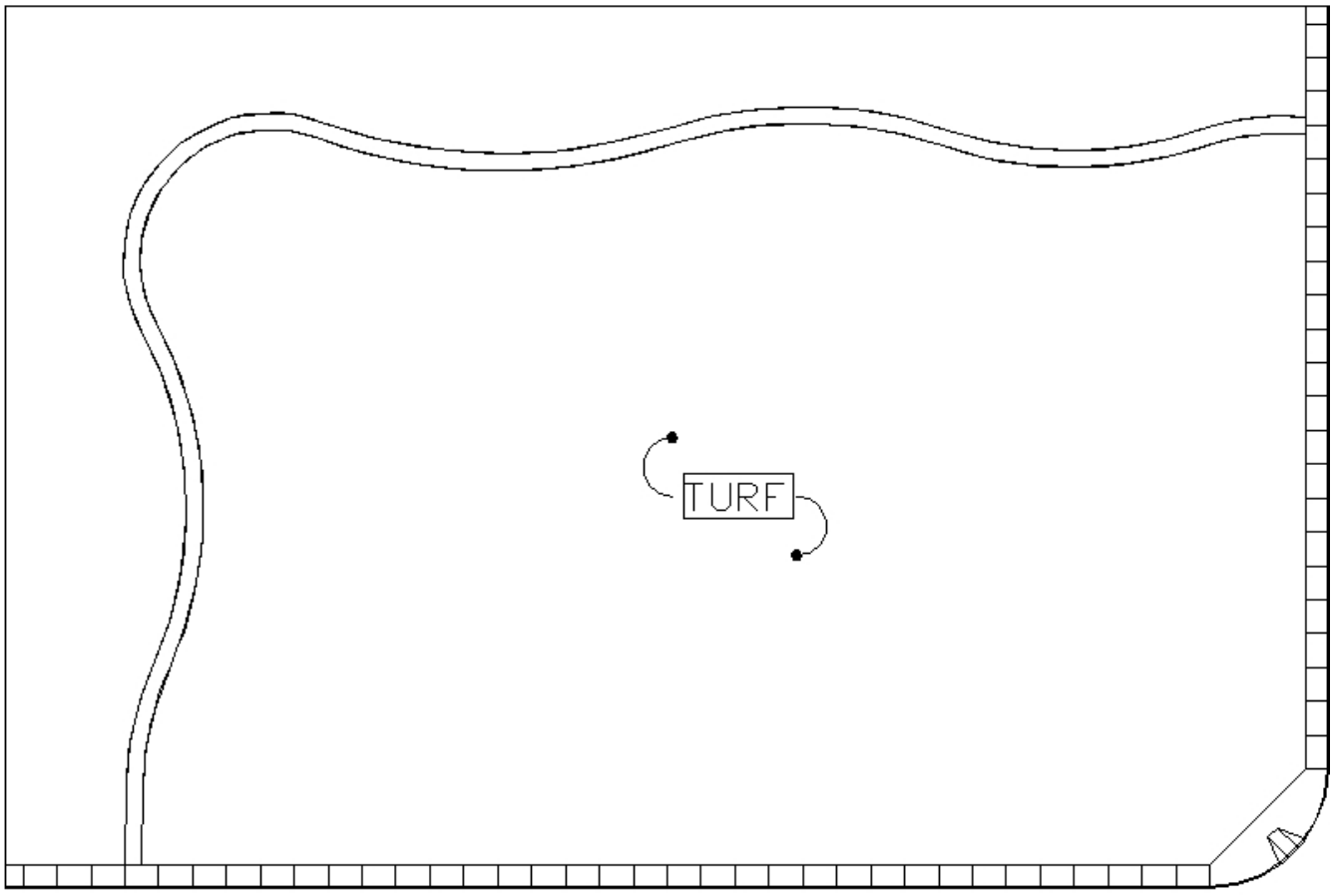
This Conceptual Landscape Plan shows that the entire area should be controlled as one Hydrozone.

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 WaterSwitch in just a few weeks.

DESIGN TWO
LANDSCAPE PLAN



WaterSwitch WS-AC

Because one Hydrozone is needed in this Landscape, the WaterSwitch WS-AC is the proper product.

The following steps are required to complete specifications:

1. Note Moisture Sensor Location, MS 1.

2. Note the Irrigation Legend:

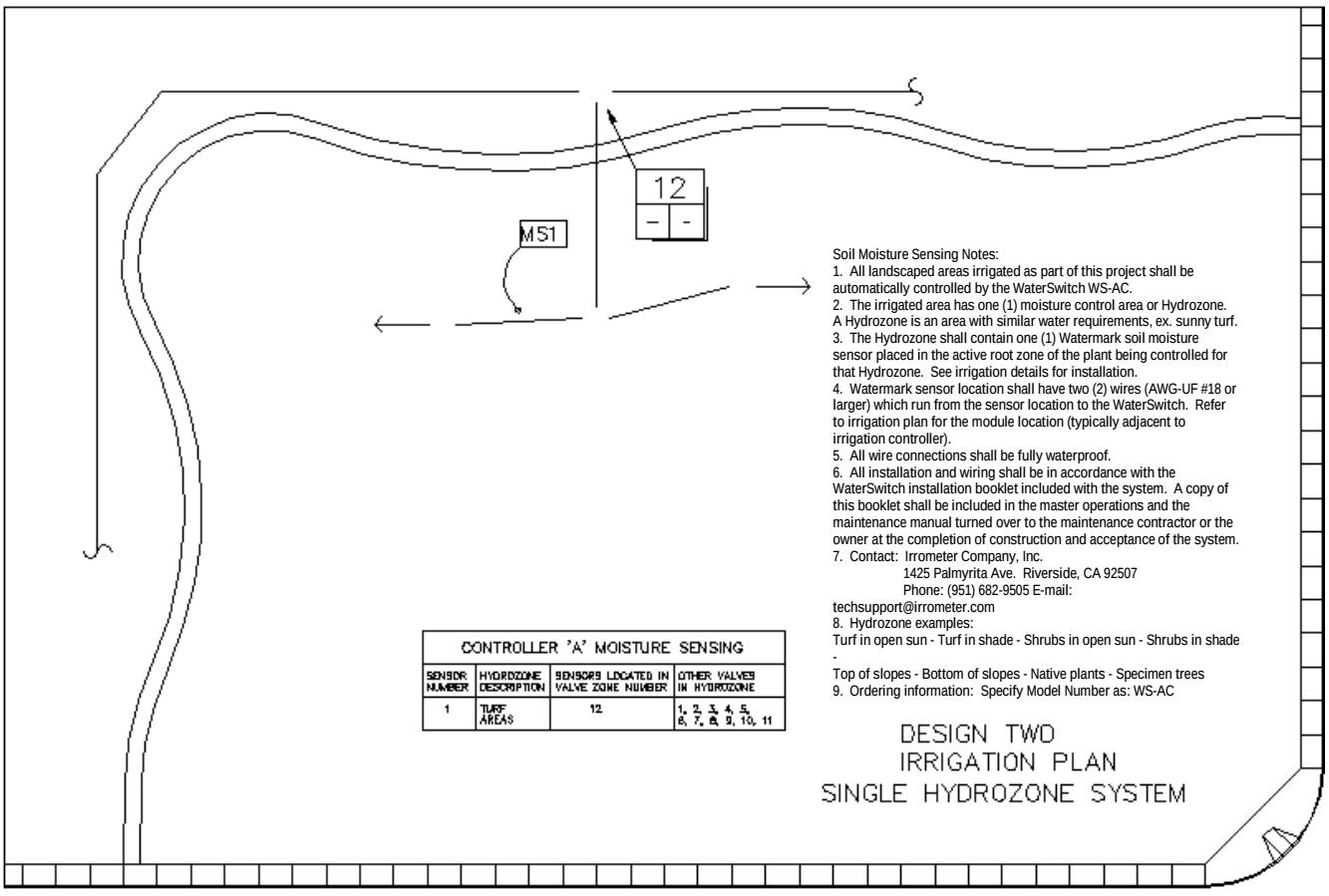
Symbol	Manufacturer	Description	Model
MS	Irrometer	WaterSwitch	WS-AC

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.

The WS-AC Instruction Manual can be downloaded from www.irrometer.com.



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Design Sample 3

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.

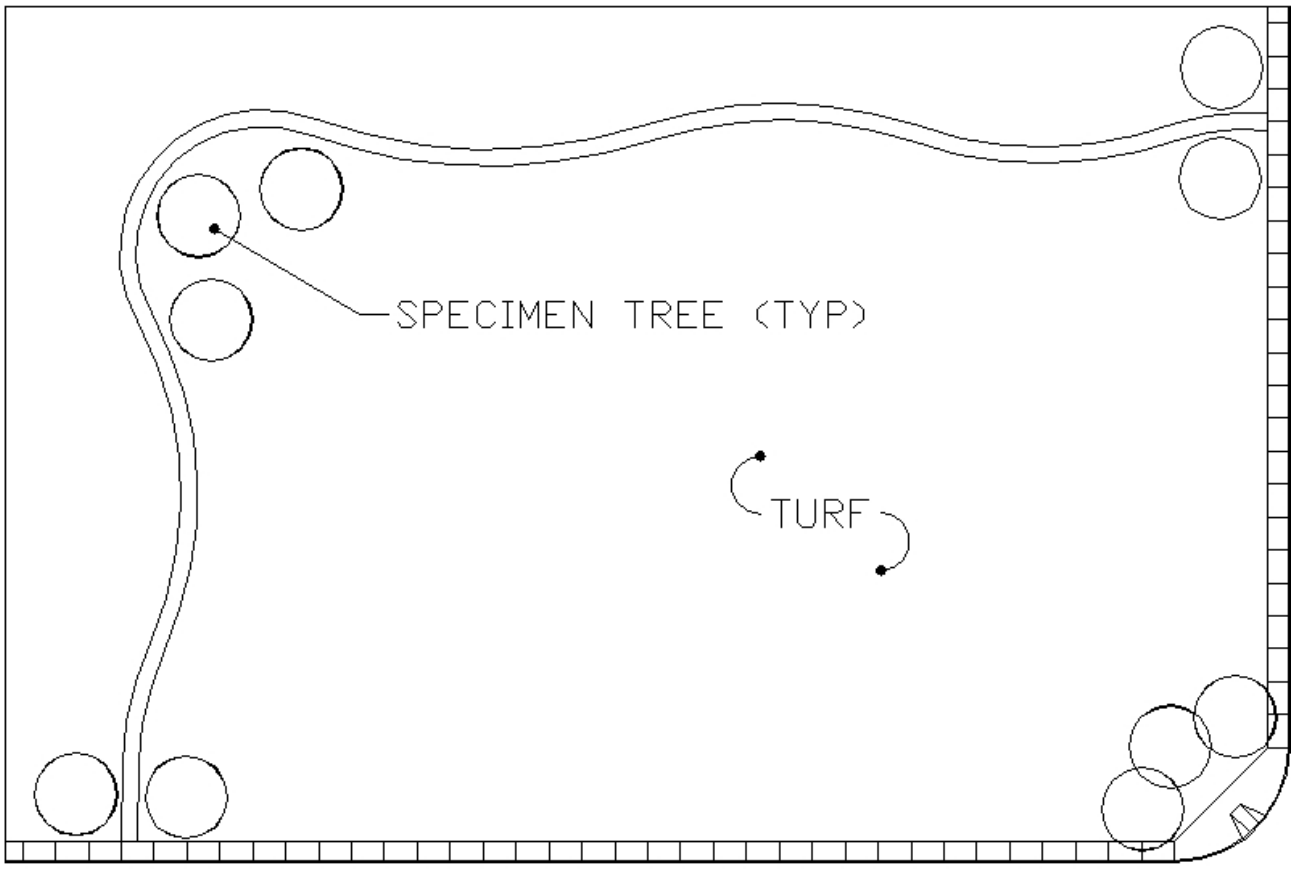
If your project does not have a separate valve for trees, you can specify a "Manual Soil Moisture Reading Station." Simply by using Detail #8 and having the Moisture Sensor Wires placed in a six inch round valve box will allow the Contractor, Arborist or End User to monitor and adjust the irrigation.

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

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

The Turfgrass areas should be on their own zone.

DESIGN THREE
LANDSCAPE PLAN



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WaterSwitch WS-AC

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:

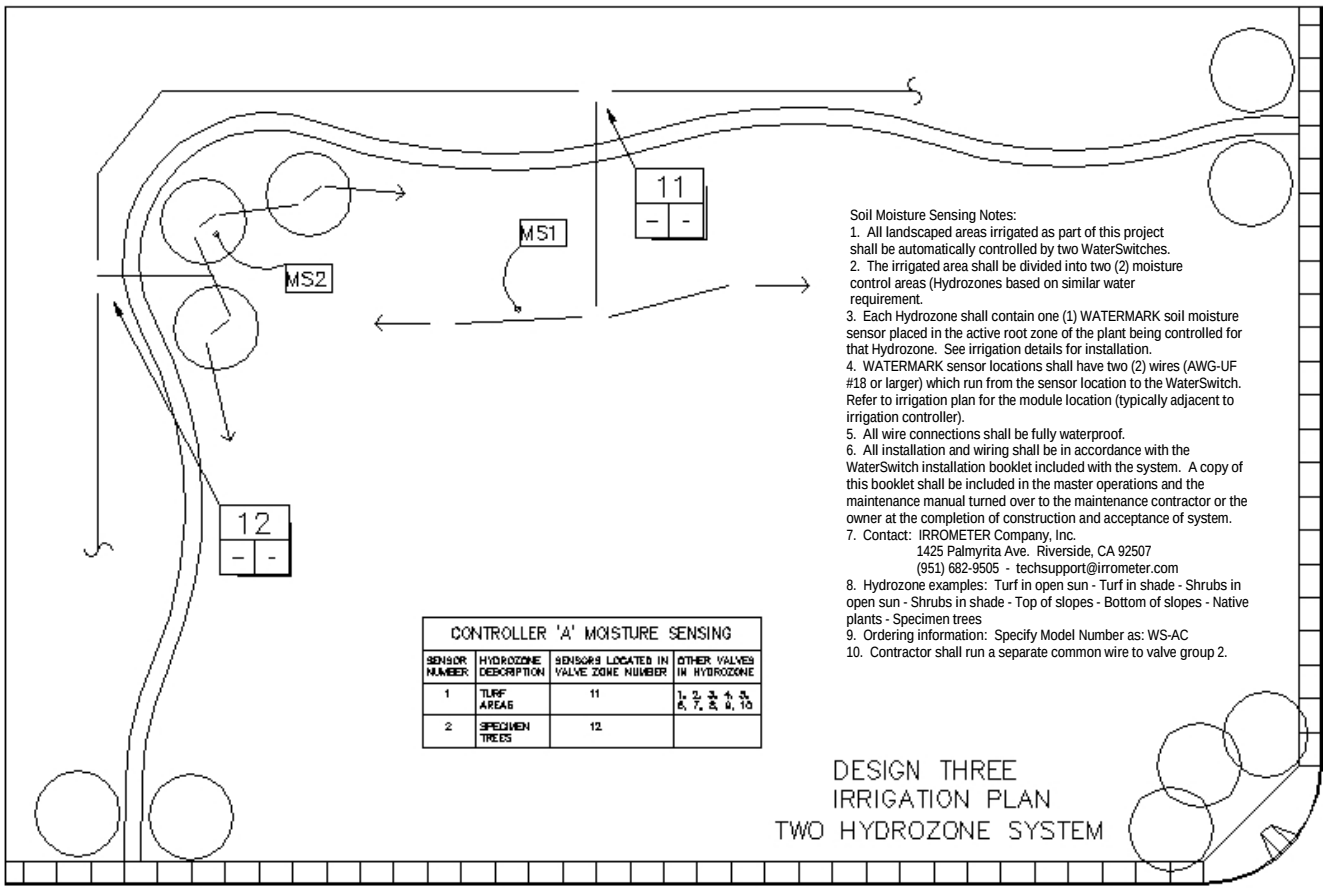
Symbol	Manufacturer	Description	Model
MS	Irrometer	WaterSwitch	WS-AC

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.

The WS-AC Instruction Manual can be downloaded from www.irrometer.com.



Multiple Hydrozone System Part Number Specification Details

The Watermark Multiple Hydrozone System (MHS) is supplied as a complete assembly, mounted in a control enclosure.

The system is designed 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 on a wall, typically under or beside the controller.

To specify, select a part number, such as:

MHS-4-18
MHS-6-32
MKS-8-48

The first number, (4, 6, 8), denotes the number of Hydrozones.
The second number, (18, 32, 48), denotes the number of irrigation zones or valves total.

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

Irrometer offers a product submittal form to the contractor for use when submitting the equipment that they intend to install on a project. 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 Irrometer Co., Inc. or any of their authorized distributors.

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, dry contact switch closures and a rain gauge. 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:

- Watermark Monitors shall be used to automatically record the soil moisture status of representative areas of this landscaping project.
- Eight (8) sensors shall be installed per Watermark Monitor as per the details in the legend.
- 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.
- All wiring connections shall be fully waterproof.
- 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.

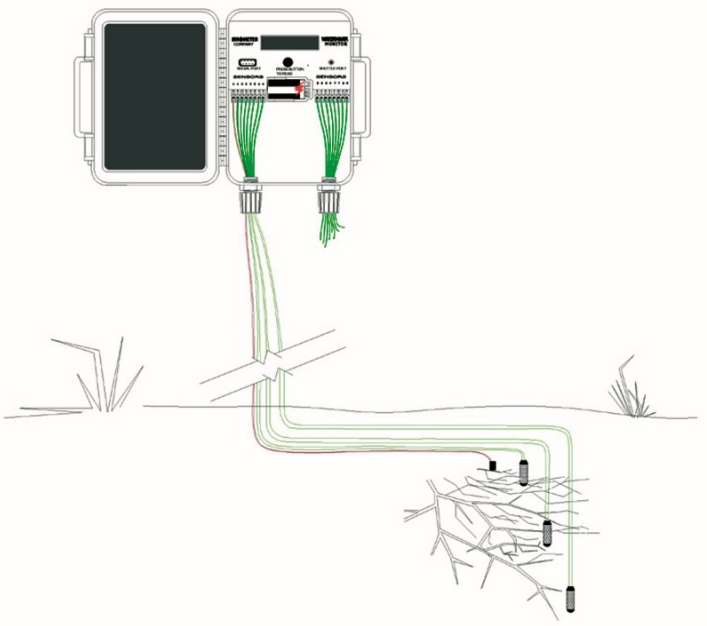
Sensor placement examples (shallow and deep sensors at):

Turf areas
Shrub areas
Tree areas
Top slope
Bottom slope

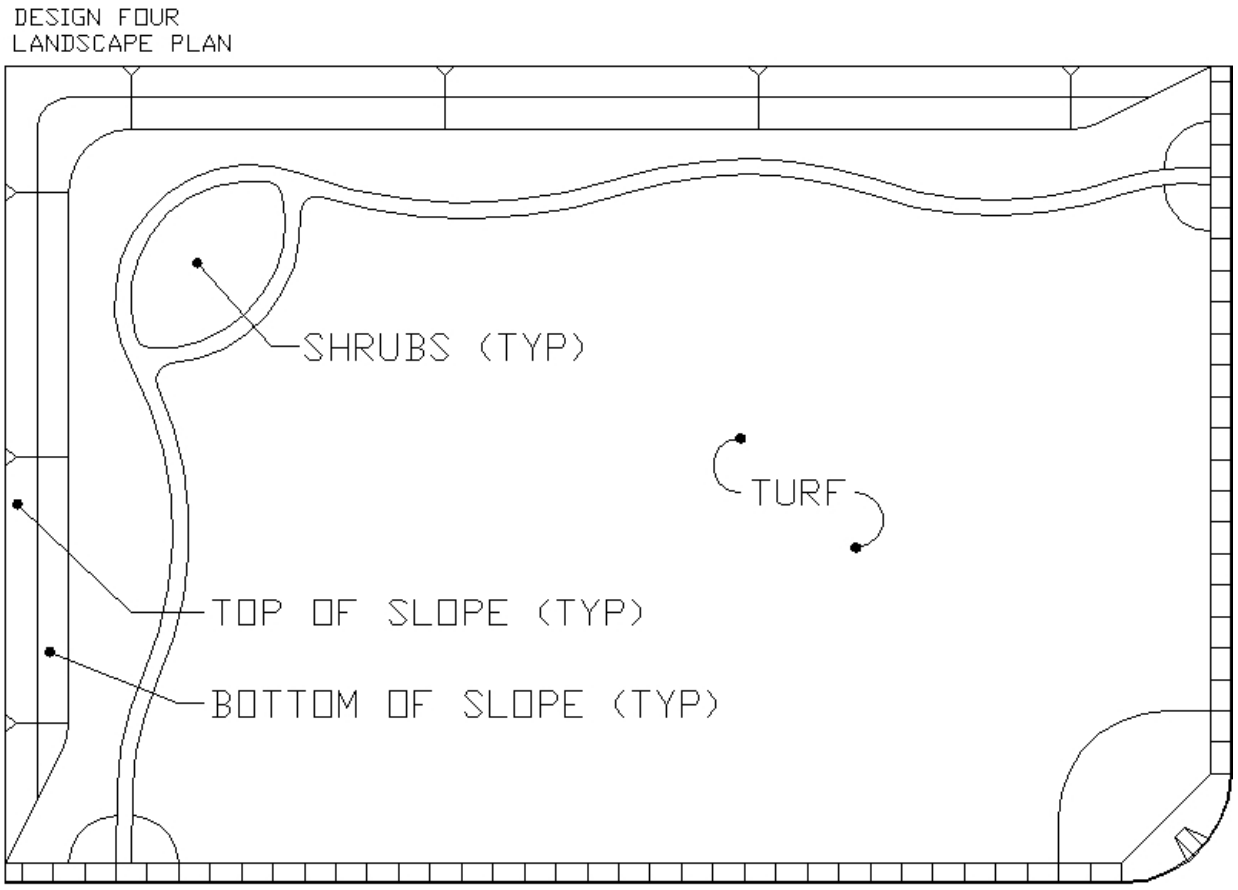
Drip Zones
Sprinkler Zones Full Sun
Shaded Areas
Specimen tree

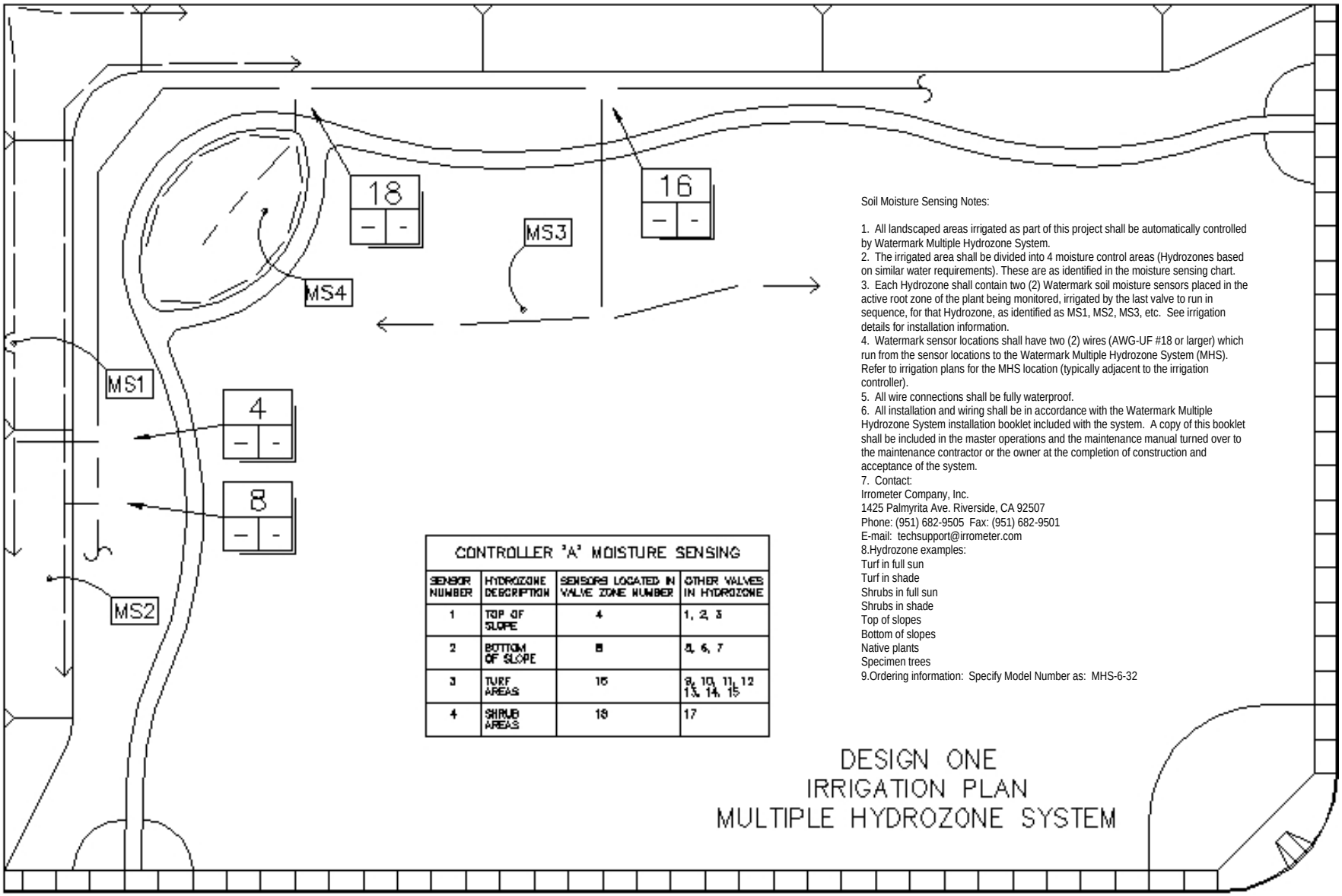
Design Sample 4

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



Automated collection of soil moisture readings can be downloaded to a user's personal computer to provide a visual representation of the changes in the trends of soil moisture within the root zones being managed by the irrigation system.



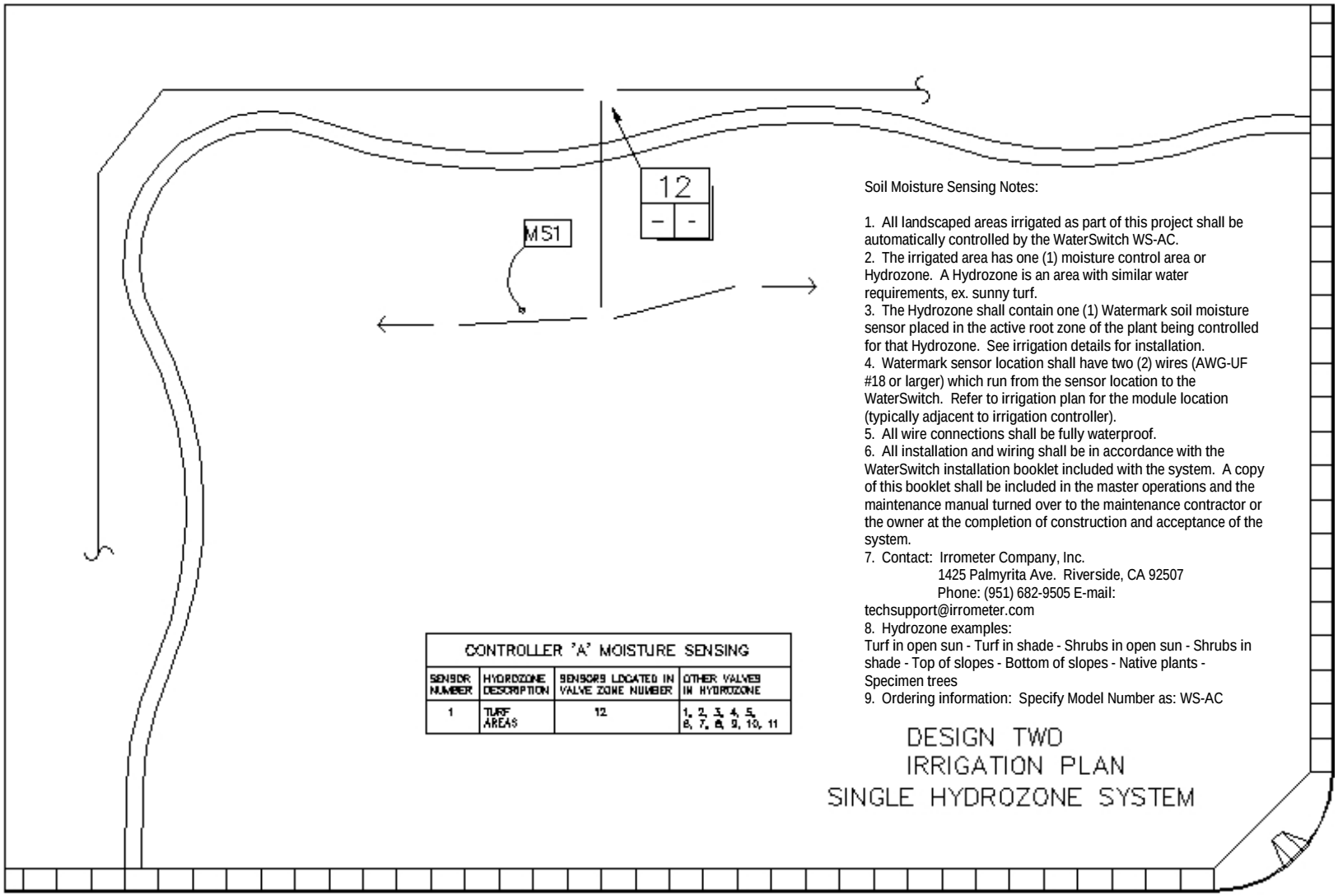


CONTROLLER 'A' MOISTURE SENSING			
SENSOR NUMBER	HYDROZONE DESCRIPTION	SENSORS LOCATED IN VALVE ZONE NUMBER	OTHER VALVES IN HYDROZONE
1	TOP OF SLOPE	4	1, 2, 3
2	BOTTOM OF SLOPE	8	5, 6, 7
3	TURF AREAS	16	9, 10, 11, 12 13, 14, 15
4	SHRUB AREAS	18	17

Soil Moisture Sensing Notes:

1. All landscaped areas irrigated as part of this project shall be automatically controlled by Watermark Multiple Hydrozone System.
2. The irrigated area shall be divided into 4 moisture control areas (Hydrozones based on similar water requirements). These are as identified in the moisture sensing chart.
3. Each Hydrozone shall contain two (2) Watermark soil moisture sensors placed in the active root zone of the plant being monitored, irrigated by the last valve to run in sequence, for that Hydrozone, as identified as MS1, MS2, MS3, etc. See irrigation details for installation information.
4. Watermark sensor locations shall have two (2) wires (AWG-UF #18 or larger) which run from the sensor locations to the Watermark Multiple Hydrozone System (MHS). Refer to irrigation plans for the MHS location (typically adjacent to the irrigation controller).
5. All wire connections shall be fully waterproof.
6. All installation and wiring shall be in accordance with the Watermark Multiple Hydrozone System installation booklet included with the system. A copy of this booklet shall be included in 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.
7. Contact:
Irrometer Company, Inc.
1425 Palmyrita Ave. Riverside, CA 92507
Phone: (951) 682-9505 Fax: (951) 682-9501
E-mail: techsupport@irrometer.com
8.Hydrozone examples:
Turf in full sun
Turf in shade
Shrubs in full sun
Shrubs in shade
Top of slopes
Bottom of slopes
Native plants
Specimen trees
9.Ordering information: Specify Model Number as: MHS-6-32

DESIGN ONE
IRRIGATION PLAN
MULTIPLE HYDROZONE SYSTEM

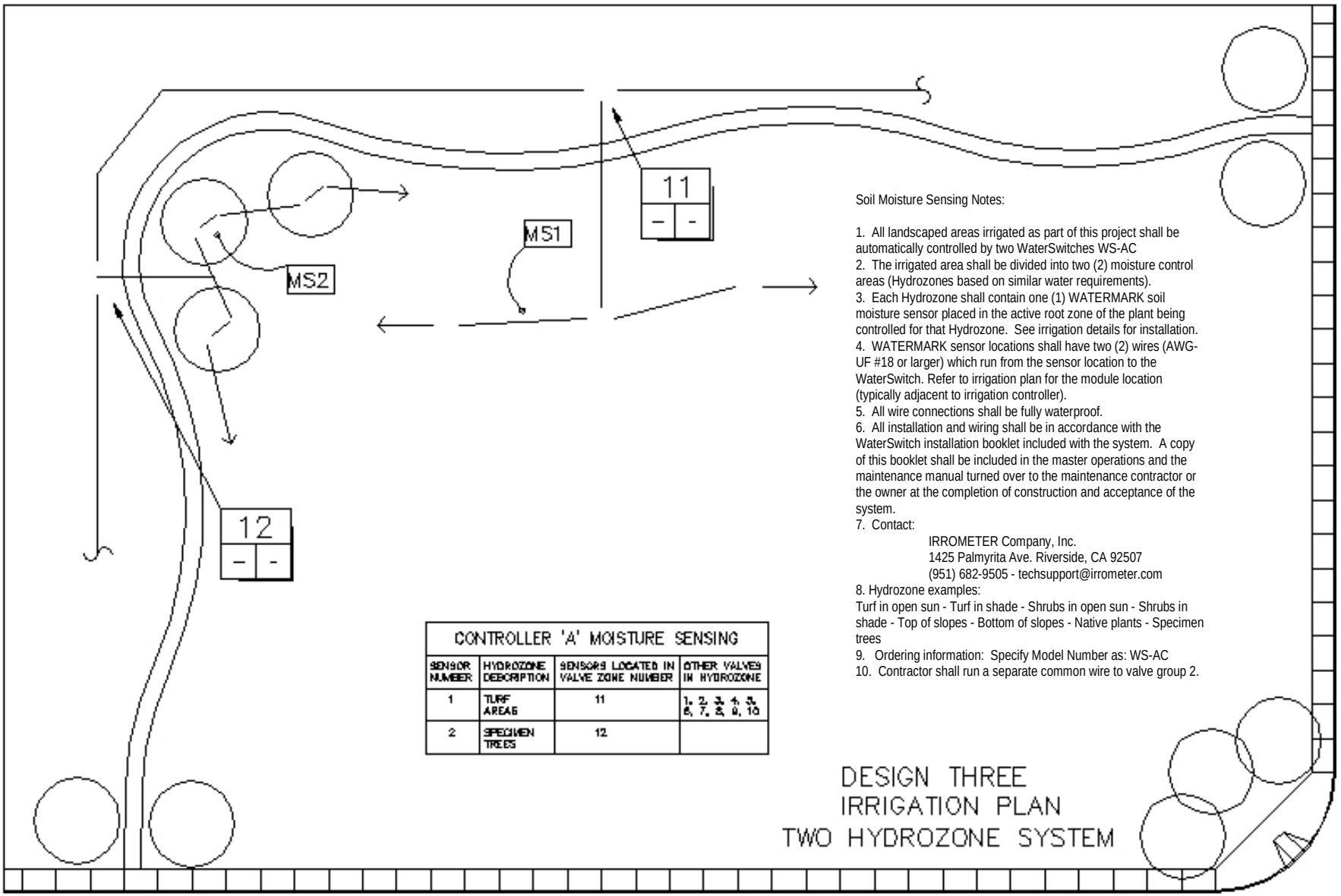


CONTROLLER 'A' MOISTURE SENSING			
SENSOR NUMBER	HYDROZONE DESCRIPTION	SENSORS LOCATED IN VALVE ZONE NUMBER	OTHER VALVES IN HYDROZONE
1	TURF AREAS	12	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11

Soil Moisture Sensing Notes:

1. All landscaped areas irrigated as part of this project shall be automatically controlled by the WaterSwitch WS-AC.
2. The irrigated area has one (1) moisture control area or Hydrozone. A Hydrozone is an area with similar water requirements, ex. sunny turf.
3. The Hydrozone shall contain one (1) Watermark soil moisture sensor placed in the active root zone of the plant being controlled for that Hydrozone. See irrigation details for installation.
4. Watermark sensor location shall have two (2) wires (AWG-UF #18 or larger) which run from the sensor location to the WaterSwitch. Refer to irrigation plan for the module location (typically adjacent to irrigation controller).
5. All wire connections shall be fully waterproof.
6. All installation and wiring shall be in accordance with the WaterSwitch installation booklet included with the system. A copy of this booklet shall be included in 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.
7. Contact: Irrometer Company, Inc.
   1425 Palmyrita Ave. Riverside, CA 92507
   Phone: (951) 682-9505 E-mail:
techsupport@irrometer.com
8. Hydrozone examples:
Turf in open sun - Turf in shade - Shrubs in open sun - Shrubs in shade - Top of slopes - Bottom of slopes - Native plants - Specimen trees
9. Ordering information: Specify Model Number as: WS-AC

DESIGN TWO
IRRIGATION PLAN
SINGLE HYDROZONE SYSTEM



Soil Moisture Sensing Notes:

1. All landscaped areas irrigated as part of this project shall be automatically controlled by two WaterSwitches WS-AC
2. The irrigated area shall be divided into two (2) moisture control areas (Hydrozones based on similar water requirements).
3. Each Hydrozone shall contain one (1) WATERMARK soil moisture sensor placed in the active root zone of the plant being controlled for that Hydrozone. See irrigation details for installation.
4. WATERMARK sensor locations shall have two (2) wires (AWG-UF #18 or larger) which run from the sensor location to the WaterSwitch. Refer to irrigation plan for the module location (typically adjacent to irrigation controller).
5. All wire connections shall be fully waterproof.
6. All installation and wiring shall be in accordance with the WaterSwitch installation booklet included with the system. A copy of this booklet shall be included in 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.
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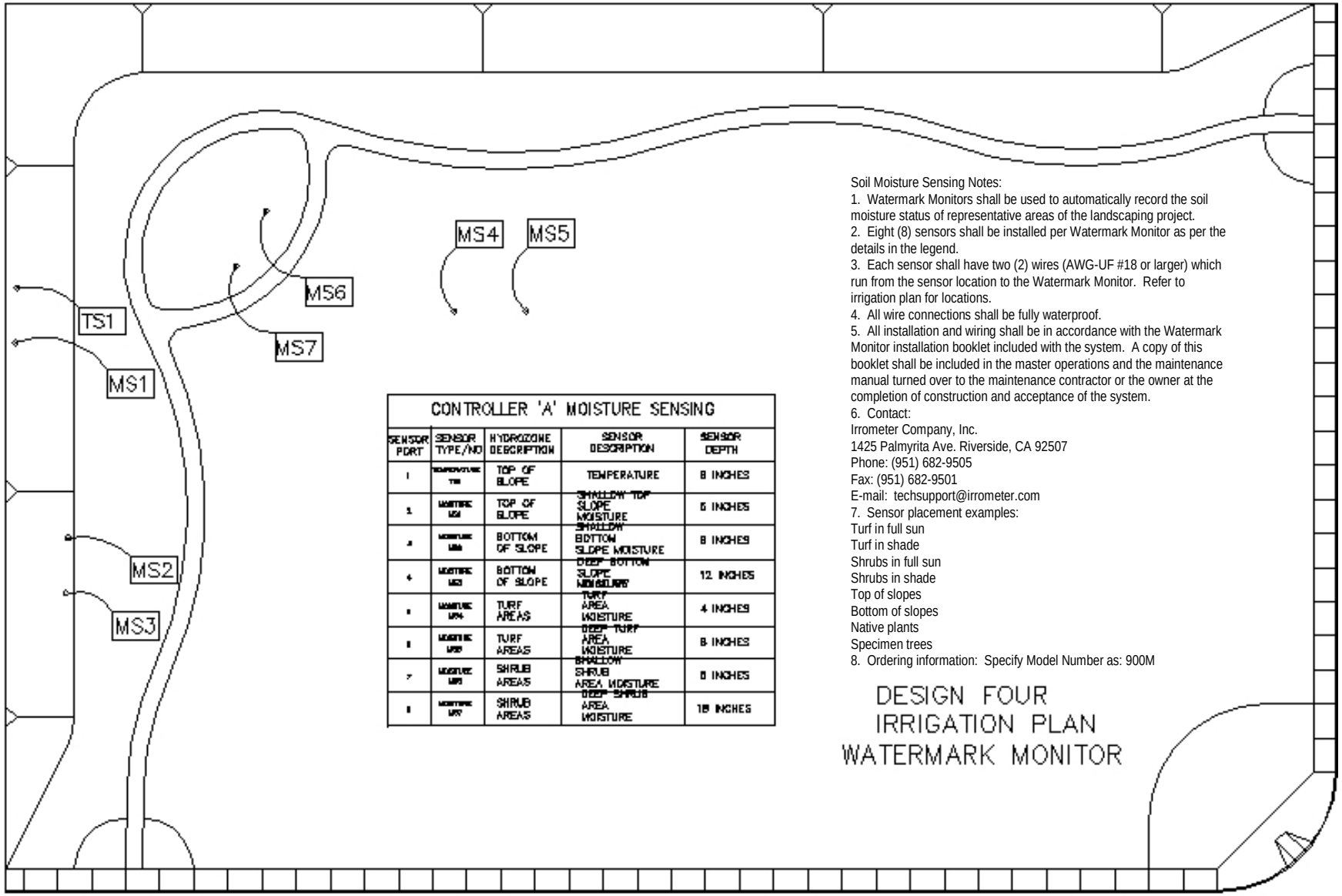
8. Hydrozone examples:
Turf in open sun - Turf in shade - Shrubs in open sun - Shrubs in shade - Top of slopes - Bottom of slopes - Native plants - Specimen trees
9. Ordering information: Specify Model Number as: WS-AC
10. Contractor shall run a separate common wire to valve group 2.

CONTROLLER 'A' MOISTURE SENSING

SENSOR NUMBER	HYDROZONE DESCRIPTION	SENSORS LOCATED IN VALVE ZONE NUMBER	OTHER VALVES IN HYDROZONE
1	TURF AREAS	11	1, 2, 3, 4, 5, 6, 7, 8, 9, 10
2	SPECIMEN TREES	12	

DESIGN THREE
IRRIGATION PLAN
TWO HYDROZONE SYSTEM



CONTROLLER 'A' MOISTURE SENSING				
SENSOR PORT	SENSOR TYPE/NO	HYDROZONE DESCRIPTION	SENSOR DESCRIPTION	SENSOR DEPTH
1		TOP OF SLOPE	TEMPERATURE	8 INCHES
2		TOP OF SLOPE	SHALLOW TOP SLOPE MOISTURE	6 INCHES
3		BOTTOM OF SLOPE	SHALLOW BOTTOM SLOPE MOISTURE	8 INCHES
4		BOTTOM OF SLOPE	DEEP BOTTOM SLOPE MOISTURE	12 INCHES
5		TURF AREAS	TURF AREA MOISTURE	4 INCHES
6		TURF AREAS	DEEP TURF AREA MOISTURE	8 INCHES
7		SHRUB AREAS	SHALLOW SHRUB AREA MOISTURE	8 INCHES
8		SHRUB AREAS	DEEP SHRUB AREA MOISTURE	18 INCHES

Soil Moisture Sensing Notes:
1. Watermark Monitors shall be used to automatically record the soil moisture status of representative areas of the landscaping project.
2. Eight (8) sensors shall be installed per Watermark Monitor as per the details in the legend.
3. Each sensor 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 wire connections shall be fully waterproof.
5. All installation and wiring shall be in accordance with the Watermark Monitor installation booklet included with the system. A copy of this booklet shall be included in 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:
Irrometer Company, Inc.
1425 Palmyrita Ave. Riverside, CA 92507
Phone: (951) 682-9505
Fax: (951) 682-9501
E-mail: techsupport@irrometer.com
7. Sensor placement examples:
Turf in full sun
Turf in shade
Shrubs in full sun
Shrubs in shade
Top of slopes
Bottom of slopes
Native plants
Specimen trees
8. Ordering information: Specify Model Number as: 900M

DESIGN FOUR
IRRIGATION PLAN
WATERMARK MONITOR

IRROMETER®

Irrometer Gauges

Membrane Vented Pressure Gauge

These durable, specially constructed gauges have a stainless-steel case and shatter proof plastic face designed to greatly lengthen gauge life and automatically vent to atmosphere.

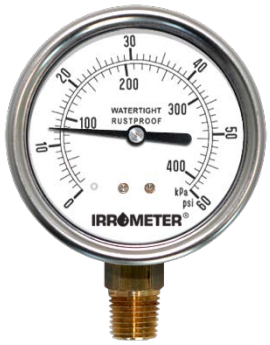
The Irrometer Company has manufactured pressure and vacuum gauges for over fifty years. These gauges are warranted to be water tight, dust proof and rust proof. They give years of continuous service under conditions in which ordinary gauges would last only months.

Irrometer'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.

Irrometer Membrane Vented Pressure Gauges have a have 2 ½" (63mm) face, are ASME B40.1 Grade B commercial gauge accuracy (±3-2-3% of span), with ¼" 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 in a stainless-steel case with a breathable membrane vent to automatically adjust for temperature and elevation changes. Operating range of -40° to 150° F (-40° to 65° C) ambient.

Part Numbering for Series 7 Membrane Vented Gauges:

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



Liquid Filled Pressure Gauge

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

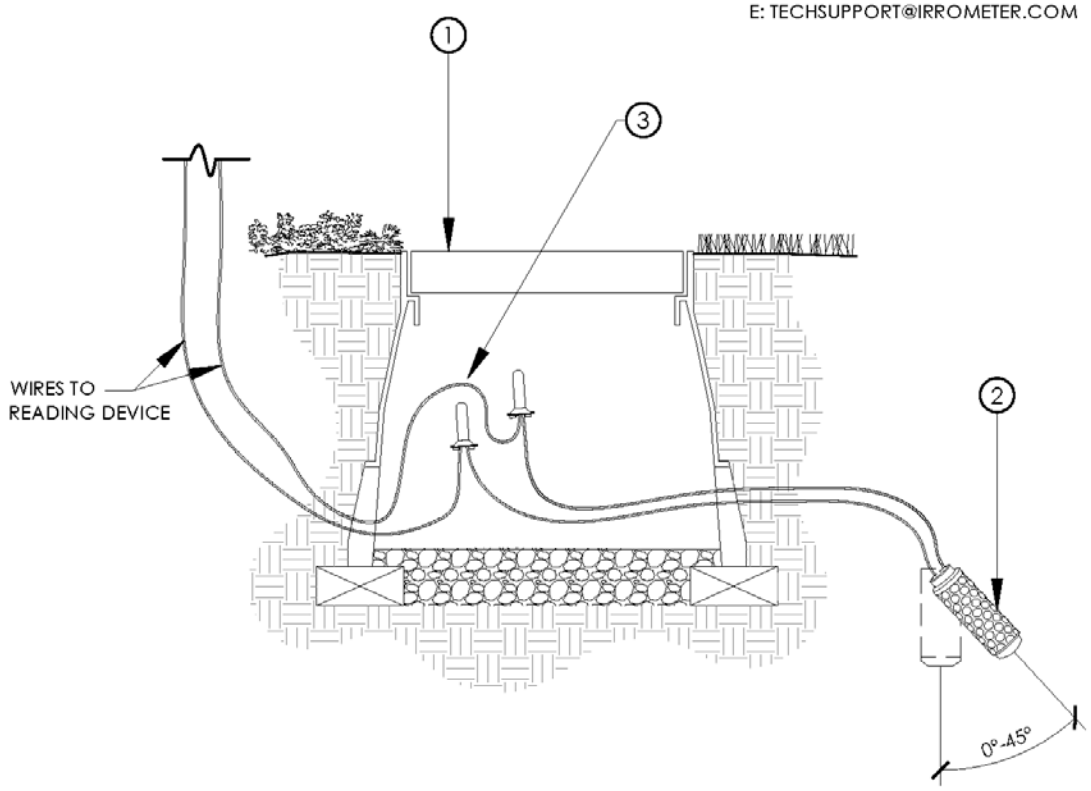
Irrometer Liquid Filled Pressure Gauges have 2 ½" (63mm) face, are ASME B40.1 Grade B commercial gauge accuracy (±3-2-3% of span), with ¼" NPT brass bottom connection and a bronze Bourdon tube mechanism. Available in four pressure ranges from 0-60 PSI to 0-400 PSI with dual scale of PSI and kPa in 304 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:

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

CAD DRAWINGS

IRROMETER®
1425 PALMYRITA AVE
RIVERSIDE, CA 92507
P: 951.682.9505
E: TECHSUPPORT@IRROMETER.COM



1. VALVE BOX PER PLAN
2. WATERMARK MOISTURE SENSOR. INSTALL PER MANUFACTURER SPECIFICATIONS
3. WATERPROOF WIRE CONNECTORS

NOTES:

- LOCATE SENSORS AT APPROPRIATE DEPTH FOR PLANT MATERIAL.

N.T.S.

WATERMARK MOISTURE SENSOR (TURF INSTALLATION)

CAD-201

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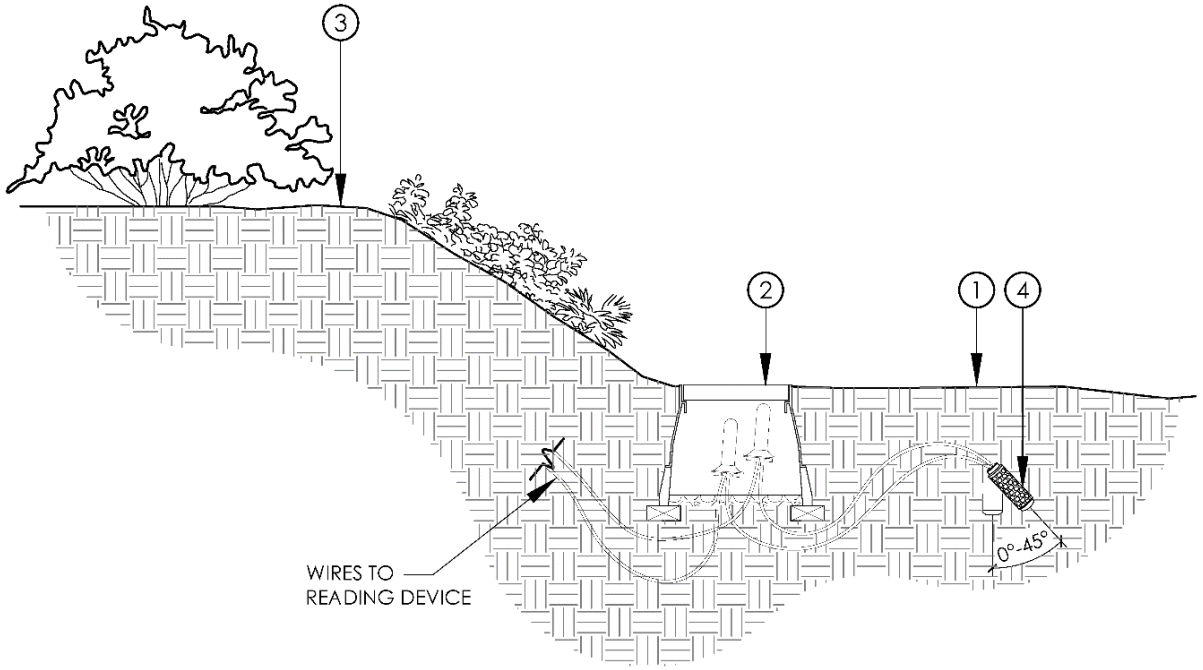
1425 PALMYRITA AVE
RIVERSIDE, CA 92507
P: 951.682.9505
E: TECHSUPPORT@IRROMETER.COM



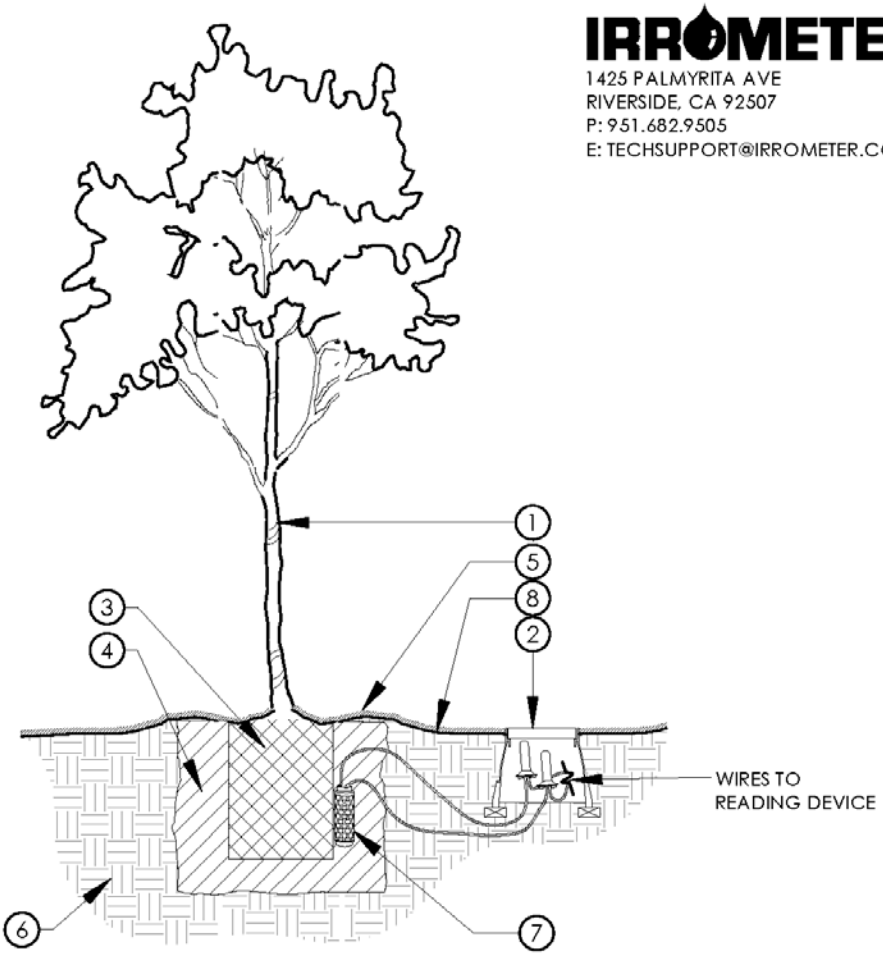
1. BOTTOM OF BASIN
2. SPLICE BOX
3. FINISH GRADE
4. WATERMARK MODEL 200SS SOIL MOISTURE SENSOR. INSTALL SENSOR AT THE LOW POINT OF THE BASIN IN NATIVE GRADE. WIRES SHALL RUN TO GRADE AND BE PLACED IN A 6" ROUND VALVE BOX AND SPLICED TO CONNECTED EQUIPMENT. INSTALL PER MANUFACTURER SPECIFICATIONS.

NO SCALE

WATERMARK BASIN INSTALLATION

CAD-209

IRROMETER®
1425 PALMYRITA AVE
RIVERSIDE, CA 92507
P: 951.682.9505
E: TECHSUPPORT@IRROMETER.COM



1. TREE PER PLANTING PLAN.
2. SPLICE BOX
3. ROOTBALL OF TREE.
4. BACKFILL MIX PER PLAN.
5. EARTH WATERING BASIN.
6. NATIVE SOIL.
7. WATERMARK MODEL 200SS SOIL MOISTURE SENSOR. INSTALL SENSOR ADJACENT TO ROOTS AT A DEPTH NEAR THE MIDDLE OF THE ROOTBALL. WIRES SHALL RUN TO GRADE AND BE PLACED IN A 6" ROUND VALVE BOX AND SPLICED TO CONNECTED EQUIPMENT. INSTALL PER MANUFACTURER SPECIFICATIONS.
8. FINISH GRADE

NOTES:

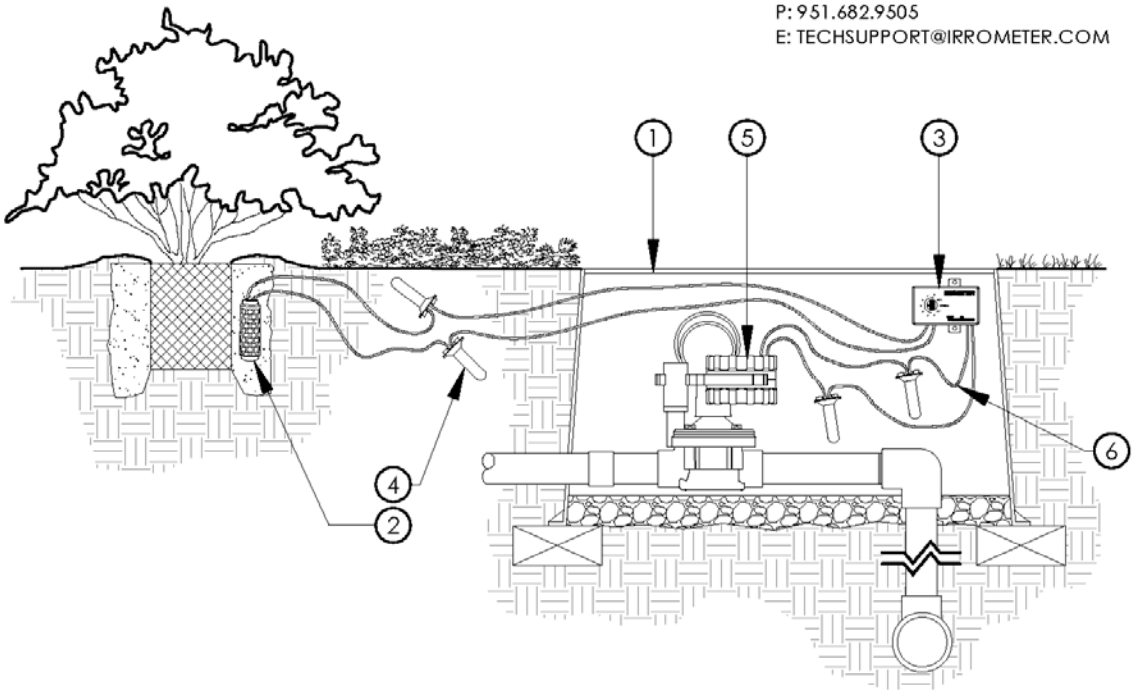
- LOCATE SENSORS AT APPROPRIATE DEPTH FOR PLANT MATERIAL.

NO SCALE

WATERMARK TREE/SHRUB INSTALLATION

CAD-204

IRROMETER®
1425 PALMYRITA AVE
RIVERSIDE, CA 92507
P: 951.682.9505
E: TECHSUPPORT@IRROMETER.COM



1. VALVE BOX PER PLAN.
2. WATERMARK MOISTURE SENSOR. INSTALL PER MANUFACTURER SPECIFICATIONS.
3. WATERSWITCH DC (WS-DC)
4. WATERPROOF WIRE CONNECTORS
5. BATTERY OPERATED CONTROLLER PER PLAN
6. SENSOR CONNECTOR

NOTES:

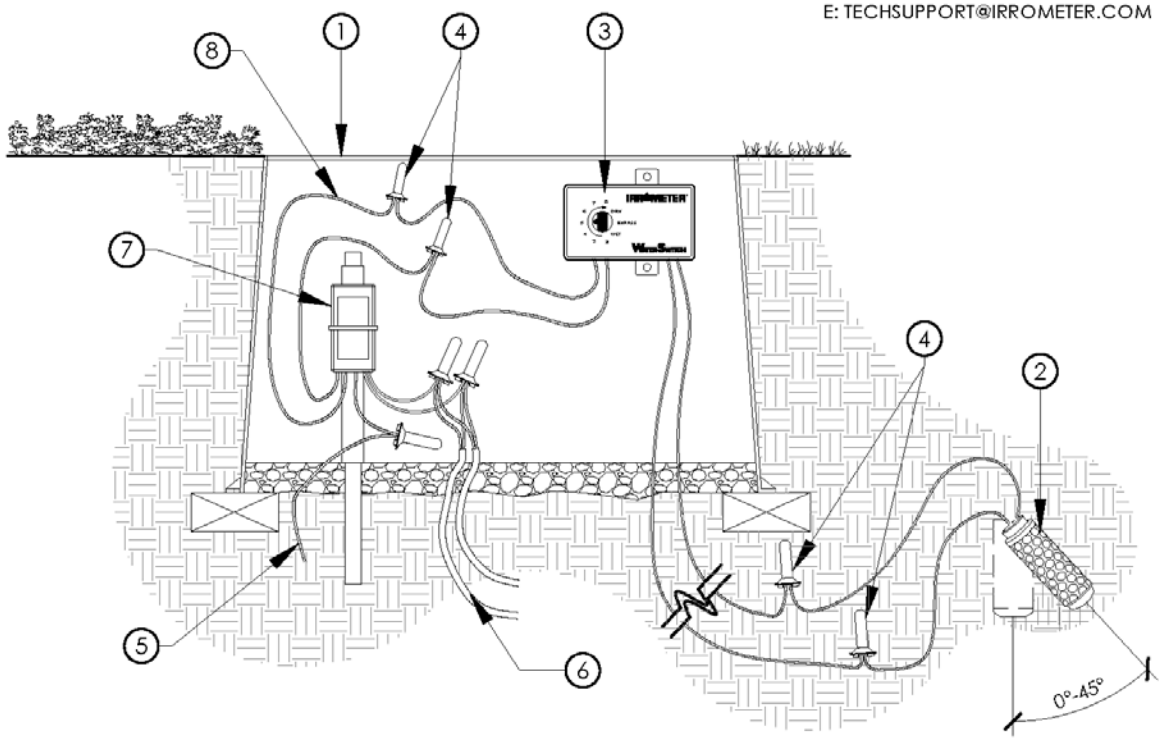
- LOCATE SENSOR AT APPROPRIATE DEPTH FOR PLANT MATERIAL.
- MAKE ALL WIRING CONNECTIONS USING WATERPROOF CONNECTORS.
- REPLACE 9 VOLT ALKALINE BATTERY ANNUALLY.
- SET TO BYPASS POSITION FOR MANUAL OPERATION FOR MAINTENANCE.

NO SCALE

WATERSWITCH DC (WS-DC) WITH BATTERY OPERATED CONTROLLER

CAD-202

IRROMETER®
1425 PALMYRITA AVE
RIVERSIDE, CA 92507
P: 951.682.9505
E: TECHSUPPORT@IRROMETER.COM



1. VALVE BOX PER PLAN.
2. WATERMARK MOISTURE SENSOR. INSTALL PER MANUFACTURER SPECIFICATIONS.
3. WATERSWITCH DC (WS-DC)
4. WATERPROOF WIRE CONNECTORS.
5. GROUND WIRE.
6. 2 WIRE PATH PER PLAN.
7. SENSOR DECODER PER PLAN.
8. SENSOR CONNECTOR - WIRE PER MANUFACTURER'S SPECIFICATIONS

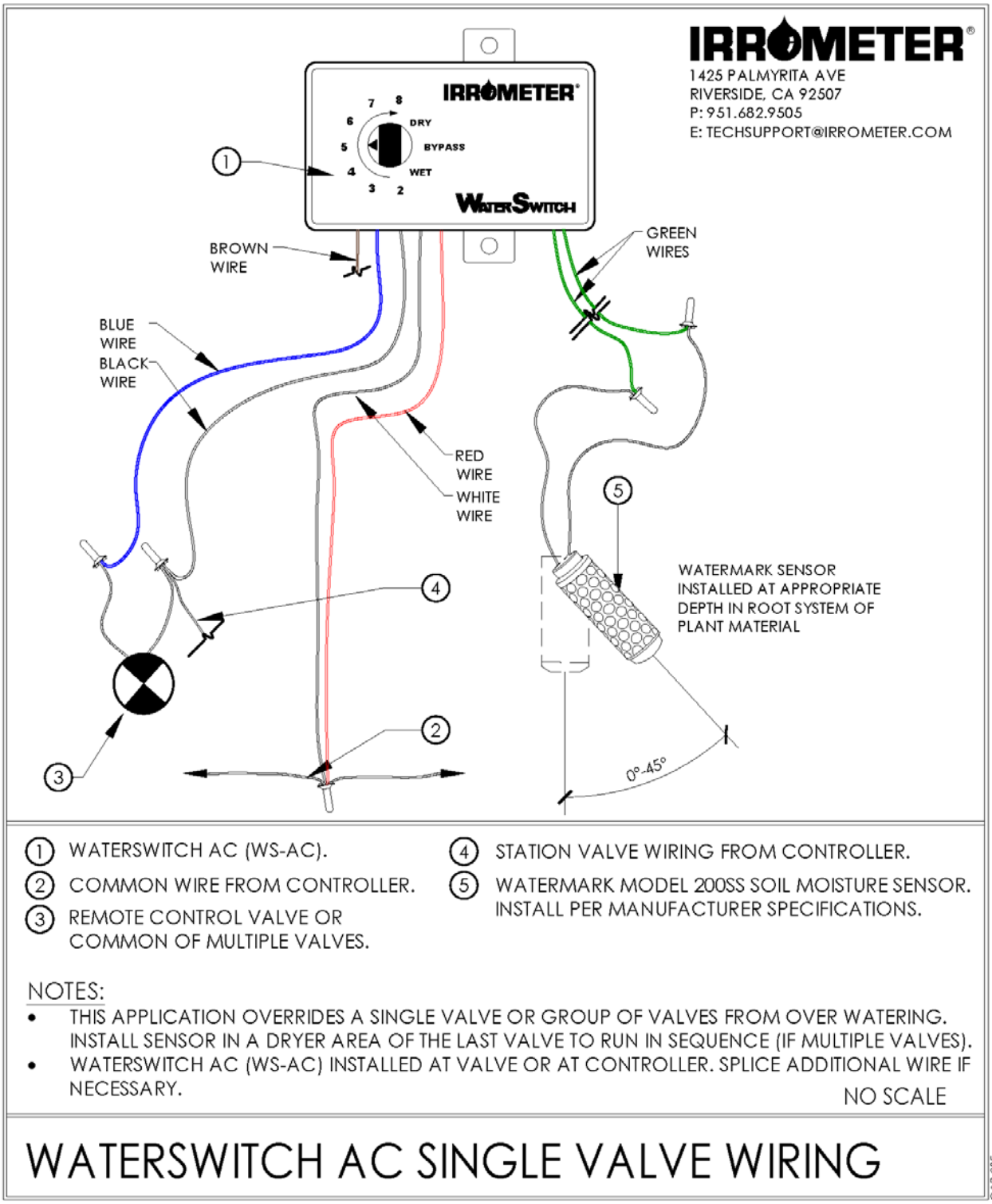
NOTES:

- LOCATE SENSOR AT APPROPRIATE DEPTH FOR PLANT MATERIAL.
- MAKE ALL WIRING CONNECTIONS USING WATERPROOF CONNECTORS.
- REPLACE 9 VOLT ALKALINE BATTERY ANNUALLY.
- SET TO BYPASS POSITION FOR MANUAL OPERATION FOR MAINTENANCE.

NO SCALE

WATERSWITCH DC (WS-DC) WITH DECODER

CAD-203


IRROMETER
1425 PALMYRITA AVE
RIVERSIDE, CA 92507
P: 951.682.9505
E: TECHSUPPORT@IRROMETER.COM
IRROMETER
DRY
BYPASS
WET
WaterSwitch
BROWN WIRE
GREEN WIRES
BLUE WIRE
BLACK WIRE
RED WIRE
WHITE WIRE
WATERMARK SENSOR INSTALLED AT APPROPRIATE DEPTH IN ROOT SYSTEM OF PLANT MATERIAL
0°-45°
1 WATERSWITCH AC (WS-AC).
2 COMMON WIRE FROM CONTROLLER.
3 REMOTE CONTROL VALVE OR COMMON OF MULTIPLE VALVES.
4 STATION VALVE WIRING FROM CONTROLLER.
5 WATERMARK MODEL 200SS SOIL MOISTURE SENSOR. INSTALL PER MANUFACTURER SPECIFICATIONS.
NOTES:
• THIS APPLICATION OVERRIDES A SINGLE VALVE OR GROUP OF VALVES FROM OVER WATERING. INSTALL SENSOR IN A DRYER AREA OF THE LAST VALVE TO RUN IN SEQUENCE (IF MULTIPLE VALVES).
• WATERSWITCH AC (WS-AC) INSTALLED AT VALVE OR AT CONTROLLER. SPLICE ADDITIONAL WIRE IF NECESSARY.
NO SCALE
WATERSWITCH AC SINGLE VALVE WIRING
CAD-205

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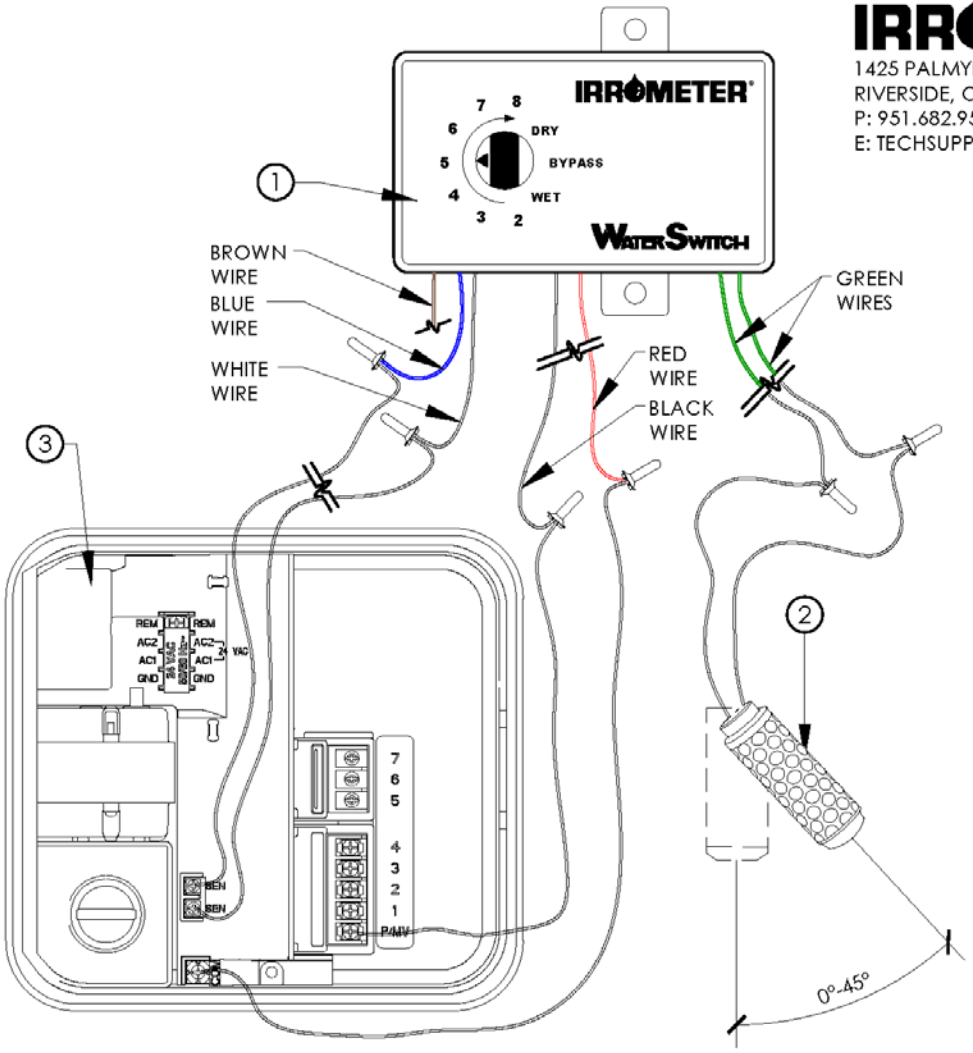


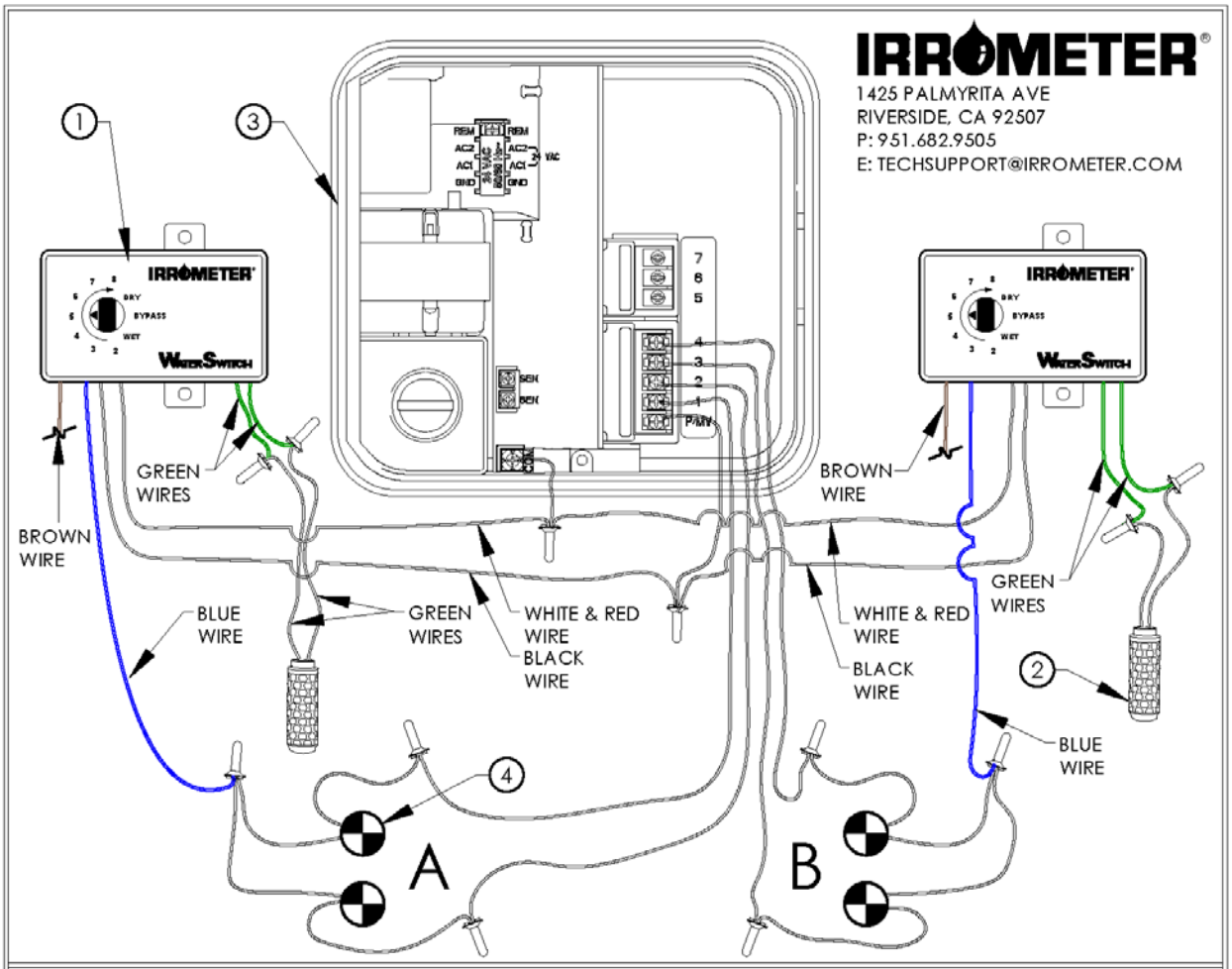
1. WATERSWITCH AC (WS-AC).
2. WATERMARK MODEL 200SS SOIL MOISTURE SENSOR. INSTALL PER MANUFACTURER SPECIFICATIONS.
3. IRRIGATION CONTROLLER.

NOTES:

- WATERSWITCH AC (WS-AC) LOCATED AT CONTROLLER. THIS IS APPLICABLE WHERE ONE SENSOR LOCATION IS USED TO OVERRIDE AN ENTIRE CONTROLLER. SENSOR LOCATION SHALL BE IN THE VALVE ZONE MOST REPRESENTATIVE OF THE ENTIRE CONTROLLER. THE VALVE ZONE WITH THE SENSOR SHALL BE THE LAST VALVE TO RUN IN THE CYCLE.

SINGLE HYDROZONE WIRING DIAGRAM NO SCALE

CAD-206



1. WATERMARK ELECTRIC MODULE (WEM)
2. WATERMARK MODEL 200SS SOIL MOISTURE SENSOR. INSTALL PER MANUFACTURER SPECIFICATIONS
3. IRRIGATION CONTROLLER
4. REMOTE CONTROL VALVE

NOTES:

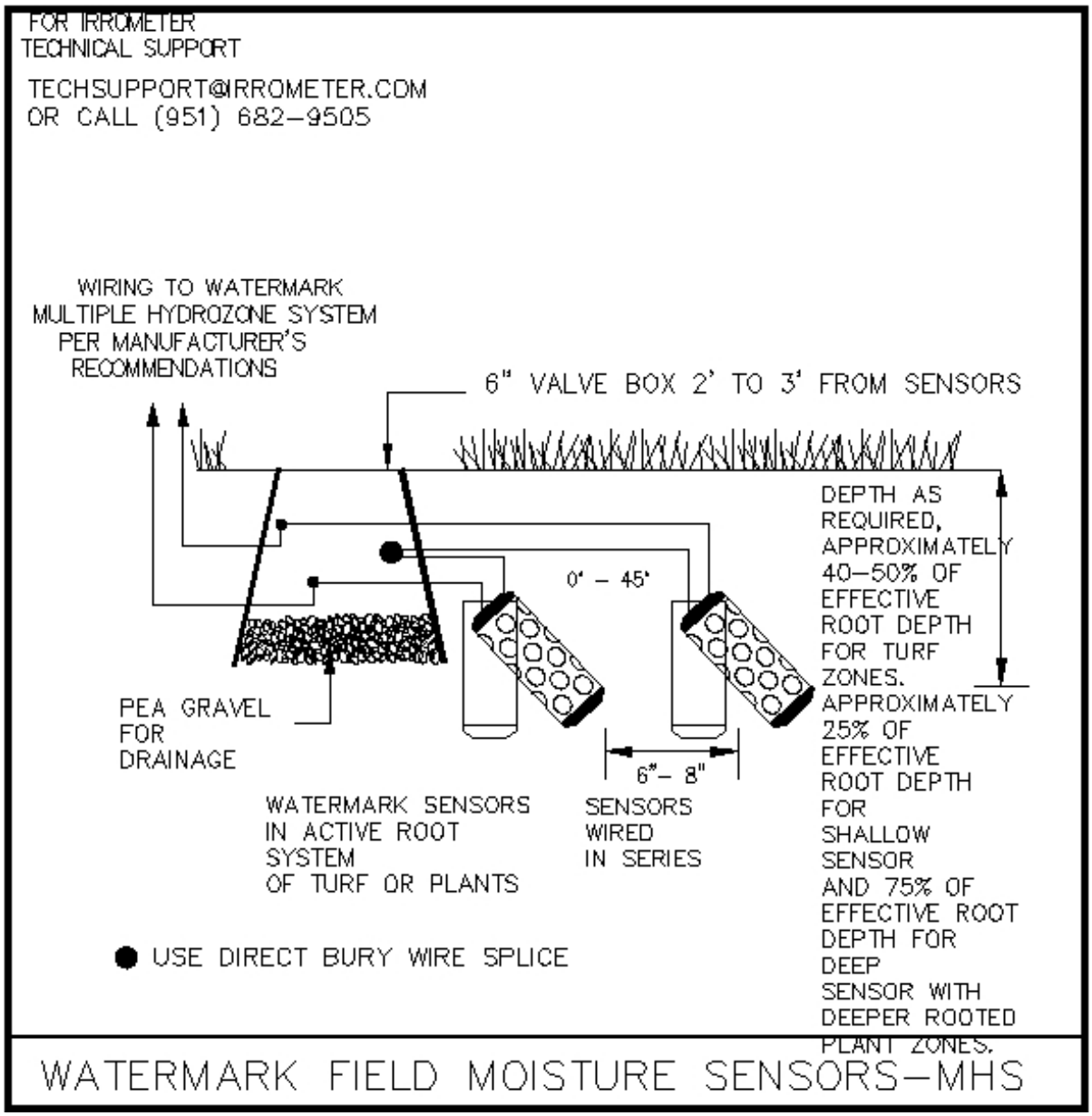
- A SIMPLE "TWO HYDROZONE" SOIL MOISTURE CONTROL SYSTEM WHICH UTILIZES AND STANDARD 24 VAC TIME CLOCK HAVING A MASTER VALVE (MV) OR PUMP START (PS) CIRCUIT. IN THE ABOVE EXAMPLE, VALVES 1&2 IRRIGATE TURF GRASS (HYDROZONE #1). VALVES 3&4 IRRIGATE SHRUB & GROUNDCOVER AREAS (HYDROZONE #2). EACH HYDROZONE HAS IT'S OWN MOISTURE SENSOR LOCATION AND AN INDEPENDENT FULLY ADJUSTABLE WS-AC MOUNTED AT THE CONTROLLER. DO NOT CONNECT WS-AC UNTIL PLANTS ARE ESTABLISHED.

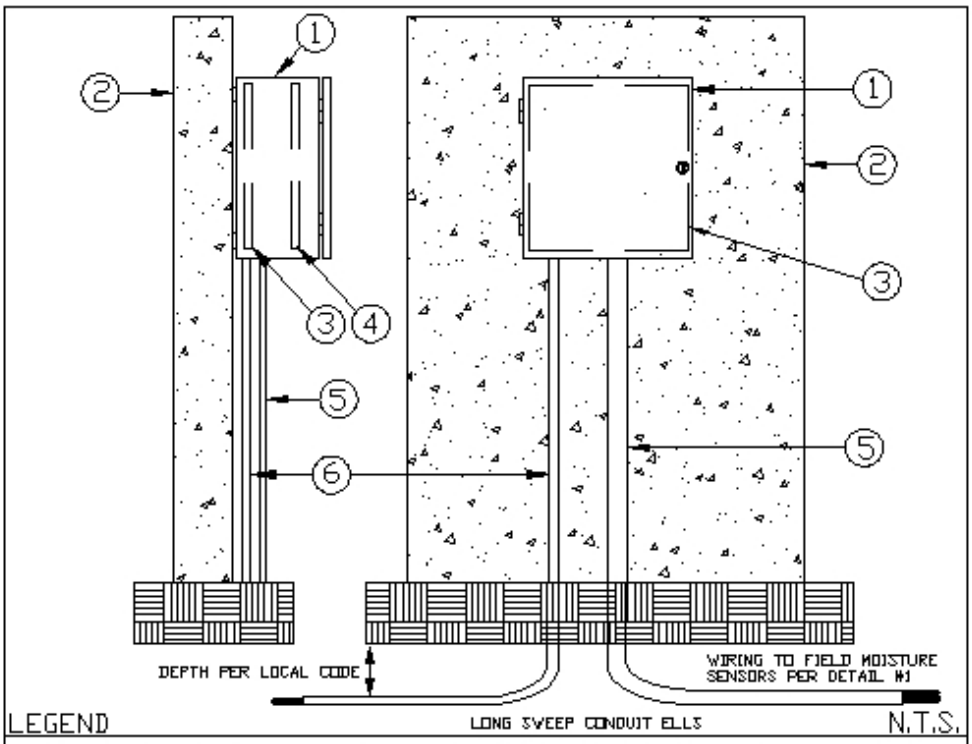
MV MUST HAVE "OFF" TIME BETWEEN STATIONS

NO SCALE

TWO HYDROZONE WIRING DIAGRAM

CAD-207


FOR IRROMETER
TECHNICAL SUPPORT
TECHSUPPORT@IRROMETER.COM
OR CALL (951) 682-9505
WIRING TO WATERMARK
MULTIPLE HYDROZONE SYSTEM
PER MANUFACTURER'S
RECOMMENDATIONS
6" VALVE BOX 2' TO 3' FROM SENSORS
DEPTH AS
REQUIRED,
APPROXIMATELY
40-50% OF
EFFECTIVE
ROOT DEPTH
FOR TURF
ZONES.
APPROXIMATELY
25% OF
EFFECTIVE
ROOT DEPTH
FOR
SHALLOW
SENSOR
AND 75% OF
EFFECTIVE ROOT
DEPTH FOR
DEEP
SENSOR WITH
DEEPER ROOTED
PLANT ZONES.
0" - 45"
PEA GRAVEL
FOR
DRAINAGE
6"- 8"
WATERMARK SENSORS
IN ACTIVE ROOT
SYSTEM
OF TURF OR PLANTS
SENSORS
WIRED
IN SERIES
● USE DIRECT BURY WIRE SPLICE
WATERMARK FIELD MOISTURE SENSORS-MHS



LEGEND

1. MOISTURE CONTROL PANEL ENCLOSURE MOUNTED PER MANUFACTURER'S INSTRUCTIONS
2. WALL
3. MOISTURE CONTROL PANEL REAR PANEL
4. MOISTURE CONTROL PANEL FRONT PANEL
5. CONDUIT PER LOCAL CODE
6. CONDUIT PER LOCAL CODE

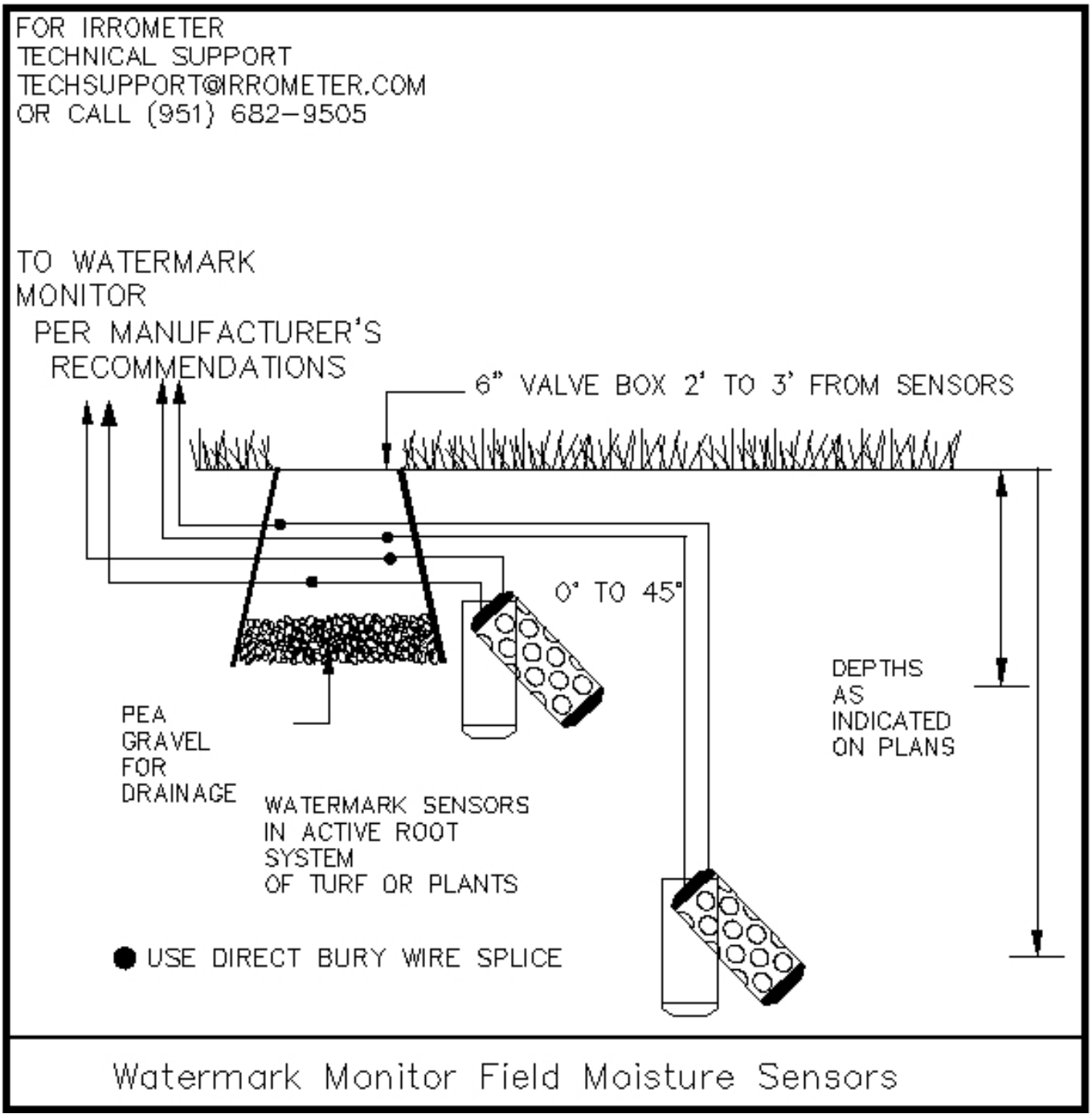
NOTE: CONDUIT MAY ONLY RUN FROM MOISTURE CONTROLLER ENCLOSURE TO IRRIGATION CONTROLLER ENCLOSURE

MHS-__-__

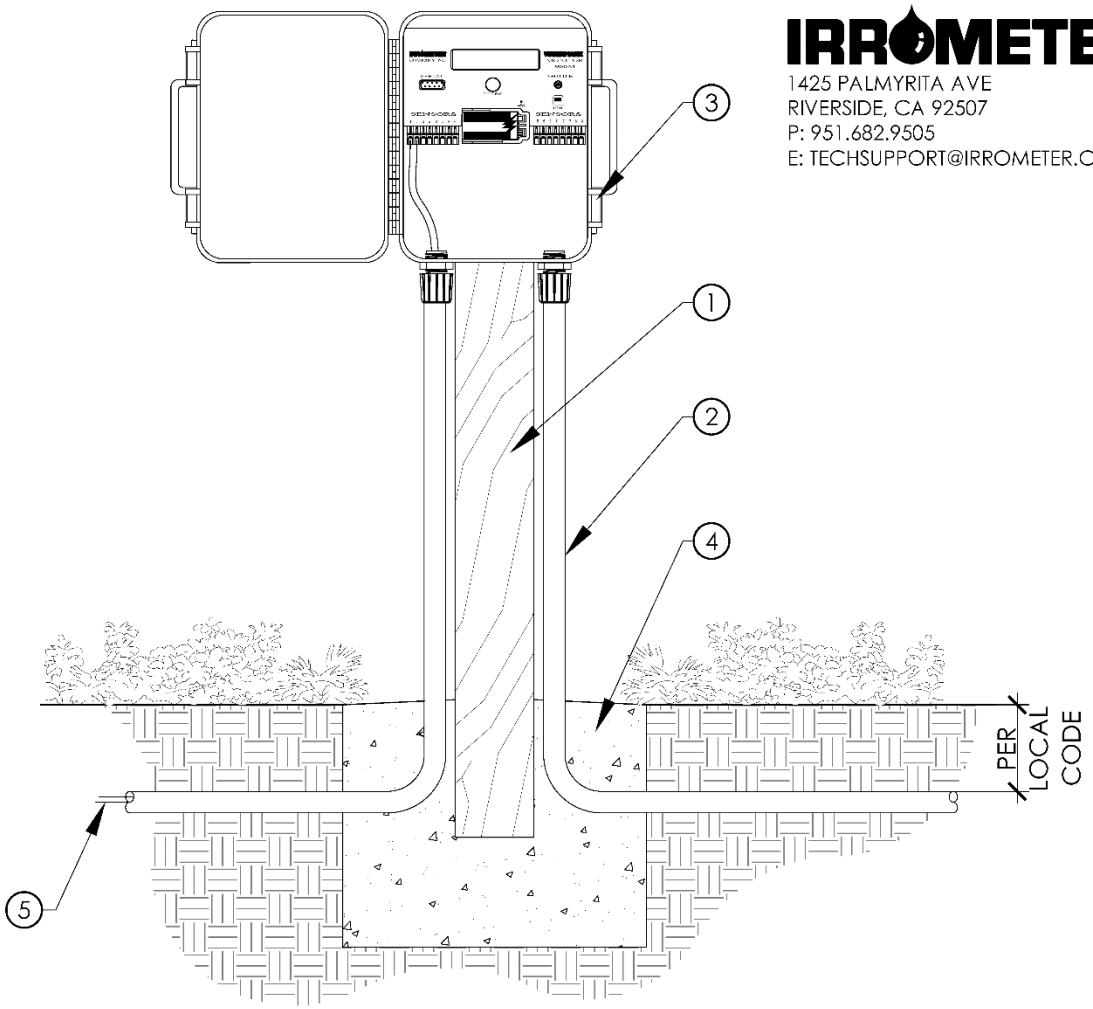
SPECIFICATIONS

The cabinet shall be of a weather resistant nature manufactured entirely of 304 grade stainless steel. The Watermark Multiple Hydrozone System wiring boards shall be provided on an aluminum backboard that will allow for removal. The Watermark Multiple Hydrozone System front panel shall be on a removeable hinged stainless steel deadfront panel. The cabinet door shall be mounted with removeable stainless steel hinges and compress a thermoplastic seal when closed. The above described product shall be a NEMA 3R Rainproof Enclosure.

7 MULTIPLE HYDROZONE SYSTEM ENCLOSURE


FOR IRROMETER
TECHNICAL SUPPORT
TECHSUPPORT@IRROMETER.COM
OR CALL (951) 682-9505
TO WATERMARK
MONITOR
PER MANUFACTURER'S
RECOMMENDATIONS
6" VALVE BOX 2' TO 3' FROM SENSORS
0° TO 45°
DEPTHS
AS
INDICATED
ON PLANS
PEA
GRAVEL
FOR
DRAINAGE
WATERMARK SENSORS
IN ACTIVE ROOT
SYSTEM
OF TURF OR PLANTS
● USE DIRECT BURY WIRE SPLICE
Watermark Monitor Field Moisture Sensors

IRROMETER®
1425 PALMYRITA AVE
RIVERSIDE, CA 92507
P: 951.682.9505
E: TECHSUPPORT@IRROMETER.COM



1. MOUNTING POST. MINIMUM 4" X 4" TREATED WOOD.
2. $\frac{3}{4}$" CONDUIT SWEEP ELL
3. WATERMARK FIELD MONITOR.
4. CONCRETE POST ANCHOR MINIMUM 12" x 12" x 12" WITH POST INSERTED OR INSTALLED WITH GALVANIZED POST BASE
5. WIRE LEADS TO SENSOR. REPEAT FOR EACH SENSOR. REFER TO WATERMARK MONITOR FIELD MOISTURE SENSOR DETAIL

NOTES:

- LOCATE IN FIELD NEAR SENSORS MOUNTED ON POST AS SHOWN OR IN CONTROLLER ENCLOSURE.

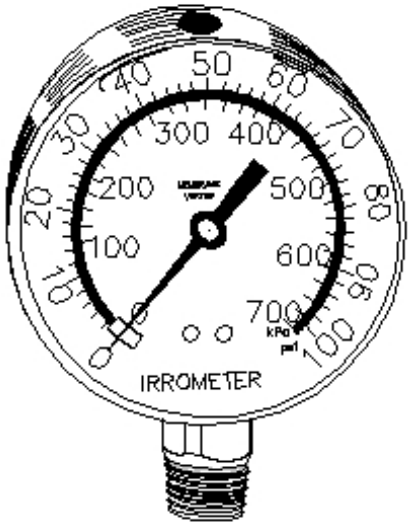
NO SCALE

WATERMARK MONITOR FIELD INSTALLATION

CAD-208

FOR IRROMETER
TECHNICAL SUPPORT
CALL (951) 682-9505

STAINLESS STEEL COVER
MEMBRANE VENTED



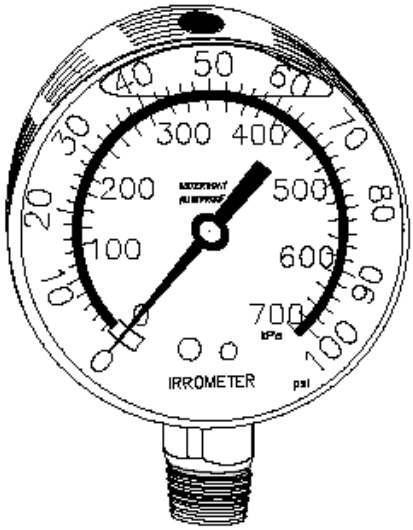
MEMBRANE VENTED
PRESSURE GAUGES PROVIDE
SUPERIOR TEMPERATURE AND
ELEVATION RELATED
COMPENSATION WHILE
MAINTAINING A DUST PROOF
AND WATER PROOF
ENVIRONMENT

MEMBRANE VENTED 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
ANSI B40.1 GRADE B COMMERCIAL SERIES
1/4" NPT BRASS BOTTOM CONNECTION
INTERNAL COMPONENTS:
BRASS WITH BRASS GEAR AND PHOSPHORUS BRONZE BOURDON TUBE
304 STAINLESS STEEL CASE WITH BUNA-N VENT PLUG
POLYCARBONATE FACE

13	Irrometer Membrane Vented Pressure Gauge

FOR IRROMETER
TECHNICAL SUPPORT
CALL (951) 682-9505

STAINLESS STEEL COVER
LIQUID FILLED



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

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
ANSI 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 (0-150° F AMBIENT)

13	Irrometer Liquid Filled Pressure Gauge

For more information:

The Irrometer Company Inc.
1425 Palmyrita Ave.
Riverside, CA 92507
Phone: (951) 682-9505
Fax: (951) 682-9501
www.irrometer.com
techsupport@irrometer.com