* Install multiple-outlet emitters to serve one or more plants, with each outlet providing for one emitter.
** Install two emitters per shrub to provide even watering and to provide a backup if one emitter clogs or malfunctions. If shrubs are closely-spaced, install one emitter per plant.
*** Install the lower number of emitters with higher flow rates for deeply-rooted plantings. Zone these plants on a separate irrigation circuit and increase their run-time per day.

As you design your drip system, consider your plant needs. Are you establishing a brand new landscape, or are you renovating an old, established one that's already in place? New plantings consist of younger, smaller and shallower-rooted plants which will eventually mature into the landscape you visualize. Existing landscapes will have older, possibly mature and deeper-rooted plants. The watering schedule, flow rate and number of emitters needed will vary a great deal between the new and the old landscape. However, drip systems have the flexibility of expansion to fit the grown plants in an established landscape.

In the new landscape, group plants by water requirements (zoning) so that similar plants are watered on the same circuit. All plants will require regular watering in the establishment process. Generally speaking, in the new landscape, plants will require fewer emitters but more frequent watering. Generally speaking, in the new landscape, plants will require fewer emitters but more frequent watering.

In the established landscape, plants are already in place, and trying to zone plants to similar water schedules may present additional challenges. Remember that the mature landscape will require additional water capacity by emitters with greater flow rate or run times. Flood plant root zones with periodic additional watering to leach salts which collect and will damages plants.

Tubing and emitters will need adjustment to maintain the proper drip line location as trees and shrubs grow. Generally speaking, in the established landscape, mature plants will require additional emitters with deeper, but less frequent, watering.

Information Sources

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For more information:
Master Gardener desk
702-257-5555 or
Website: www.unce.unr.edu/southern/ or
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Designing A Landscape Drip Irrigation System for Southern Nevada

Dr. David M. Cox, formerly Extension Educator

Background

By definition, drip irrigation is the frequent, slow, application of water to the specific root zone of the plant material. The concept of a drip system is fairly simple, water is delivered to individual plants in the landscape at a low pressure and delivery rate to specific areas or zones in the landscape. Because a well-designed system only applies water where the plants are located, these systems are promoted as water conserving. Drip irrigation is also referred to as micro, low-flow, low-volume and trickle irrigation.

There are many advantages, and several disadvantages, of drip irrigation. For additional background information, a description of system components and optional equipment, and a listing of the advantages and disadvantages of drip systems, request fact sheet *FS-91-53 Drip Irrigation Systems*. While it provides general information about drip irrigation, the purpose of this publication is to help individuals design a specific drip system to fit their landscape needs.

Design Considerations

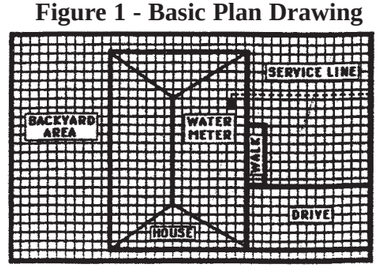
The design, installation and management of an efficient system requires planning and attention to detail. There are five areas of design consideration in the step-by-step approach:

- Make a plan
- Measure the flow rate
- Determine the soil type
- Select appropriate plant material
- Design drip irrigation system

Make a Plan

The place to start is on paper. Use graph paper with 1/8" or 1/10" squares and make your drawing to scale. For most residential landscape designs, using a scale of 1/10" = 1' is appropriate. On your drawing, note the important landscape features which may include the water source and location, planting areas, hardscape (paved areas, decks, walls, etc.), slopes and their direction, and plant material. Include the actual dimensions of the drip lines you plan to install. Take measurements from your architectural home plants is you have them, or use a 100' tape and measure them for yourself.

Figure 1 - Basic Plan Drawing



Measure the Flow Rate

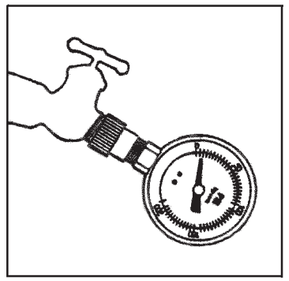
At the water source where you will attach the valve and control assemblies for the system, measure the pressure and flow rate using one of the following methods.

Water Pressure

Phone your local water company who can provide you with this information.*

Attach a pressure gauge to the source and take a reading.*

Figure 2 - Water Pressure Gauge



Water Flow Rate

Measure this yourself by making your connection to the water source you are going to use.* Install a shutoff valve after your connection and devise a system where you can fill a one-gallon container. Once you can fill the one-gallon container, open the shutoff valve completely and time the seconds it takes to fill the container. With this information, use the chart below to determine the maximum flow rates. It is recommended that you use only 80% of the water you have available.

Figure 3 - Calculating Maximum Flow Rates

Seconds	GPM	GPH
12	5.0	300
14	4.3	257
16	3.75	225
18	3.3	200
20	3.0	180

Seconds = seconds to fill a 1 gallon container

GPM = gallons per minute (Note: Limit home landscape systems to 5.0 or less GPM as pipe and tubing available to home landscapers is not sized for more than 5 GPM).

GPH = gallons per hour

When planning the design for your drip system, the flow rate will determine the number of emitters the system will supply. In most cases, reduce the water pressure to between 10 and 30 psi, depending on the type of emitters used. Installation of a pressure-reducing valve at the control section of the system will permit emitters to operate under the range of pressure recommended by the manufacturer.

Some multiple-outlet emitters are designed for high pressure operation. Systems built with these components do not require a pressure reducing valve.

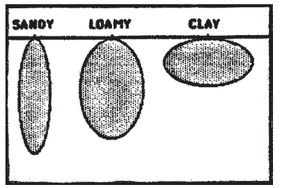
Determine Soil Type

For a drip system to apply water efficiently and in the proper amounts, it is fundamentally important to identify the soil type and understand how water moves through different types of soil. The soil type will determine the number and placement of emitters for the individual plants. In a simple classification, soils are described in three categories - sandy, loamy and clay.

If you are unsure of your soil type, use the following hand-ball method as a test. Squeeze a handful of damp soil in your hand and slowly release your grip. Sandy soil will crumble on release. Loamy soil will retain its shape, but will break apart readily when disturbed. Clay soils are much more gummy in texture and will mold to different shapes without breaking or crumbling. Clay soils also dry very hard and lumpy and will return to dust when crushed.

The following illustration shows how water is distributed in the three different soil types. Because of large pore spaces, sandy soils allow water to penetrate very deep with only a narrow, lateral distribution. Loamy soil shows the most desirable pattern and characteristics with a fairly deep and wide distribution. Clay soils have small pore spaces and provide a wide, lateral pattern.

Figure 4 - Water Distribution Pattern in Different Soils



Select Appropriate Plant Material

With the competition for water supplies in the desert Southwest, consider plant materials that are drought tolerant and/or low-water-users. For the purpose of zoning your landscape, note on your drawing and plan which plants are low, medium and high water users. University of Nevada Cooperative Extension has several fact sheets that will help with the plant selection and identification process.

At this point, having successfully drawn your plan, measured the water sorce flow rate, determined the soil type and selected the appropriate plant material, you are ready to proceed. The next step in creating your drip sstem is to select the irrigation components and design the system layout.

Design Drip Irrigation System

The following emitter guide gives the recommended number of emitters and flow rates for different sized plants based on the soil type. This chart was developed for the Las Vegas Valley area in southern Nevada.

Emitter Selection Guide

Plant Material	Soil Type	No. of Emitters*	Flow Rate (gph)
Small Shrubs**	Sandy	1	1
(To 2’ High)		2	1/2
	Loamy	1	1/2
	Clay	1	½
Medium Shrubs***	Sandy	2	2
(2-4’ High)		4	1
	Loamy	2-3	1
	Clay	2	1
Small Trees and	Sandy	6-8	2
Larger Shrubs***	Loamy	3-6	2
(6-8’ Canopy)		6-8	2
	Clay	3-4	2
Larger Trees and	Sandy	8-16	2
Shrubs***	Loamy	8-16	2
(10’-15’ Canopy)	Clay	6-12	2
		8-16	1