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The ReWater[®] System
Owner's Operation Manual
2017 Edition



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GENERAL INFORMATION

Please read this entire manual prior to installation or operation. It describes the proprietary ReWater® irrigation system, how to install it, its operation, subsurface irrigation, greywater and its effect on soil and plants, and some requirements of Chapter 16 of the California Plumbing Code. Chapter 16 and other state codes are at <http://rewater.com/support/codes-and-forms/>.

California's and most other state's code defines greywater as used water from shower, tubs, clothes washers, bath room and laundry room sinks that have not come in contact with kitchen and toilet water. Other sources of water, such as Jacuzzi discharge, RO and non-salt generating water conditioning tail water, and AC condensate, can be allowed by an inspector. Some other sources of water can be used but must be approved in writing by ReWater Systems before warranty coverage becomes effective.

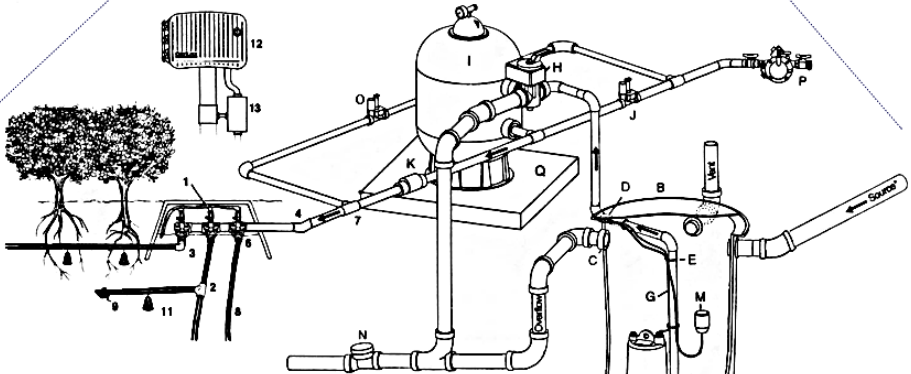
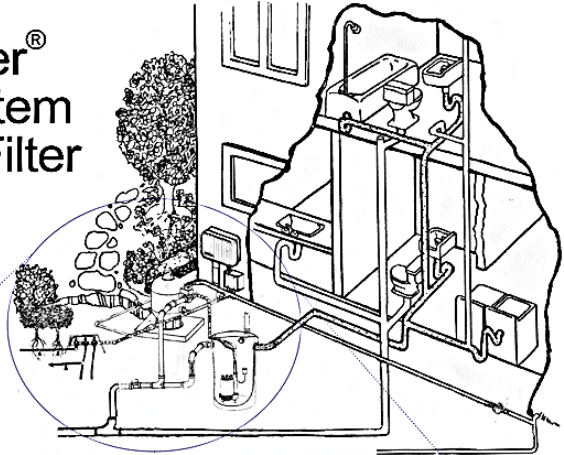
To use this system, arrange your home's plumbing so that selected greywater sources flow via gravity to the surge tank. In new construction, it's easy. Size your tank for the peak hourly surge of greywater flowing from your home or building. In the tank, a float switch turns on the unique ReWater controller, which starts the pump if irrigation is scheduled that day. The pump is sized according to your landscape's needs, and sends that water through a filter vessel and out to irrigation as required. Our bag filter model removes debris as it enters the tank.

After a predetermined amount of irrigation run-time, our controller signals a backwash cycle to begin at the end of the day. During that cycle, the 3-way inlet valve on top of the vessel will rotate 180 degrees, a fresh water valve will open on the bottom of the vessel, allowing water to rapidly fill the vessel from the bottom, lifting the trapped debris inside to flow out the vessel into the sewer system. When the cycle ends, those valves return to their irrigation mode. This backwashing interval and its duration can be changed via a drop-down menu.

The controller orchestrates 1-4 irrigation programs simultaneously. Up to twenty one 24 VAC electric solenoid valves direct water to ReWater's proprietary emitters placed subsurface in the landscape as required for your landscaping. Any number of those 21 valves can be set to use greywater with optional fresh water supplementation, or fresh water only. For fresh water-only valves, they must be plumbed to a fresh water-only source.

Design your greywater irrigation network based on your landscape's irrigation needs as you would with any ideal irrigation system. The more greywater you have to irrigate with, the more greywater you can reuse. However, the ReWater system can automatically supplement any balance of a day's irrigation program with potable water after midnight (this feature can be turned off), and that water will be used extremely efficiently too, so the size of your irrigation system is not constrained by the volume of greywater.

The ReWater® Irrigation System & Automatic Filter



Irrigation Components

1. 1" 24 VAC solenoid valves
2. Tees
3. 90° elbows
4. 45° elbows
5. 1" Threaded male adapters
6. Slip reducers
7. Reducing Tees
8. Polyethylene tubing (16mm, 19mm)
9. Figure 8 ends for poly tubing
10. Compression rings
11. ReWater® emitters
12. ReWater® controller
13. 24 VAC/ 120 VAC relay junction box

Filtration Components

- A. Surge tank (70 gal 24" x 36"; 110 gal 30" x 36")
- B. Lid w/SS screws and gasket material
- C. Bulkhead adapters (4/2"; or 2/2" and 2/3")
- D. Electrical tension grommets
- E. Nylon tie straps
- F. 2" Threaded male adapters
- G. 2" Discharge pipe
- H. 3-way Tee valve w/24 VAC Actuator
- I. Fiberglass filter vessel
- J. Solenoid valve for backwash
- K. 1 1/2" swing check valve
- L. 1/2hp submersible pump w/20' cable
- M. 24 VAC float switch w/20' cable
- N. Backflow valve w/viewing port (2"; or 3")
- O. Solenoid valve for Irrigation (1"; or 1 1/2")
- P. Reduced Pressure Principle device (1"; or 1 1/2")
- Q. Platform (optional)



INSTALLATION

Economics

The most economic way to install the ReWater® system is by plumbing only the regularly-used showers, baths, and clothes washer into the tank; about 95% of the reusable water comes from these few sources. Our Model RW2F and RW2AF systems come with 2" pipe and connections, which are rated for up to 8 fixtures units, or about 4 greywater fixtures. Our Model RW3AF system handles up to 35 fixture units, about 17 fixtures. Include more fixtures only when they do not greatly add to the overall plumbing cost, or when your water is pricey, or when reducing wastewater discharges is important, or to maximize your green footprint or optimize LEED or Build It Green points.

Never connect kitchen sinks or dishwashers due to animal fats, which solidify as grease, and food particles, which clog up the filter quickly and eventually ruin the downstream irrigation network, and because it's illegal.

Plumbing Code

In California, the greywater irrigation code is Chapter 16 of the California Plumbing Code (CPC), and it governs all aspects of legal greywater systems and installations. It refers to the Uniform Plumbing Code (UPC) for basic plumbing criteria, but unlike the UPC, the CPC does not need adoption by a local authority, i.e., city or county or their appointed agency or department. The city in which you live has complete jurisdiction over your system unless there is a formal, written delegation of authority by the city council to another jurisdiction. If you live in the unincorporated county, the county has jurisdiction.

A permit is required for installation in California unless exempted by your City Council or county Board of Supervisors. Per California Water Code Section 14877.3, any local code effecting the state code can only be passed by a legislative body for certain stated reasons, and then only by ordinance after a public hearing. Any change to the code that wasn't approved in this manner is illegal.

If your state uses the International Plumbing Code, the information in this manual will be relevant to your installation.

Building Permits

In General: A permit is required to install a pressurized greywater irrigation system in California unless exempted by your local authority. ReWater does not offer unpressurized systems because they do not work like the majority of people want irrigation to work.

Existing Permits: You may amend an existing permit to include "a greywater irrigation system per Chapter 16 of the California Plumbing Code". With that amendment, submit a ReWater

System Code Compliance Form included in the purchase price of a system. Compliance Forms include a plot plan of your home, a soil report, and a landscaping drawing, and all the calculations therefrom, so the plan checker/inspector will know all about the system and your property to issue a permit without having to ask lots of questions. Amending an existing permit may save you fees.

New Permits: If there is no existing permit to amend, apply at your local building inspection department for a plumbing permit for "a greywater irrigation system per Chapter 16 of the California Plumbing Code". ReWater Code Compliance Forms are included in the purchase price of a system.

Future Systems: You may isolate greywater from other wastewater sources without special permission as long as you do not attach the greywater system to that plumbing and that plumbing flows by gravity to the sewer. This is usually accomplished by creating a greywater supply line inside the building, exiting the foundation once past the last greywater connection, then looping back through the foundation to the sewer, with a vent above that loop. That loop is where the surge tank will sit. If that loop is within 10' of an openable window or door, the vent needs to terminate above the roof; it may be connected to an existing vent stack. Also, greywater stub-outs are allowed if they are properly marked.

Partial Systems: If you install the surge tank and/or filter vessel, the irrigation network does not have to be installed to receive an "occupancy" on your home. By design, greywater will simply overflow to the sewer until the irrigation system is hooked up. There can be a separate inspection of the greywater irrigation network, which can be scheduled any time, usually after the landscaping is installed.

A permit department may or may not require a detailed map of the whole proposed project. A map is a good idea for future reference though, as it will enable you to extend, modify, or maintain your irrigation network later on when you can't recall where everything was buried. A map can also be a good selling point should you decide to sell your home.

Plumbing

ONLY SHOWER, TUB, JACUZZI, CLOTHES WASHER, BATHROOM SINK, LAUNDRY ROOM SINK, AND OTHER LEGAL SOURCES OF GREY WATER CAN BE USED IN THIS SYSTEM. ANY WATER SOURCE NOT APPROVED BY REWATER IN WRITING MAY CLOG THE FILTER AND/OR IRRIGATION NETWORK AND VOID YOUR WARRANTY.

Most of this section is standard plumbing code information. Every licensed plumber should already know these basics. Don't hire one who doesn't.

Sources of greywater: There are two types of plumbing pipe - cast iron and ABS plastic. ABS is the easiest and least expensive to work with. Cast iron is quieter in the vertical position, and is required for three story or taller buildings. All piping must be trapped and vented with the same 1/4" per foot fall as with other wastewater pipes. Their collective "fixture unit" value dictates the size of pipe used; usually 4 or less fixtures results in a 2" supply pipe. All components in our RW2F and RW2AF systems are 2". 2" grommets require a 3" hole saw. Models RW3F and RW3AF have 3" grommets and require a 4 1/8" hole saw.

AS YOU BUILD THE GREYWATER SOURCE PIPE, KEEP THAT PIPE HIGH IN ORDER TO KEEP THE SURGE TANK LID CLOSE TO GRADE AND THE TANK ABLE TO OVERFLOW TO THE SEWER VIA GRAVITY. IF THE TANK WILL SIT BELOW GRADE, A RISER IS HIGHLY RECOMMENDED.

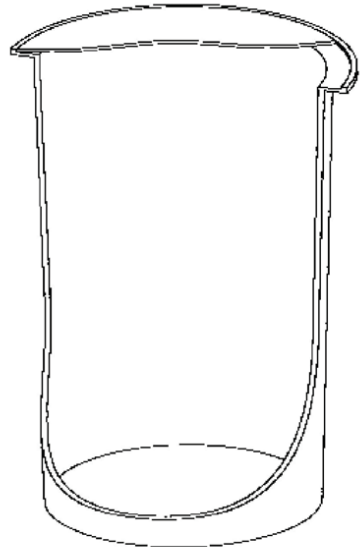
TANKS

70 gallon

- 36" tall x 30" wide at top rim OD x 23" wide at bottom OD
- Weight, 37 lbs with 12 lbs lid
- 7/32" polyethylene sidewalls, ANSI wastewater standard
- 3" holes for 2" rubber bulkhead grommets
- 3/4" holes for 1/2" wire tensioners
- Stainless Steel bolts & washers

110 gallon

- 36" tall x 36" wide at top rim OD x 29" wide at bottom OD
- Weight, 54 lbs with 32 lbs lid
- 7/32" polyethylene sidewalls, ANSI wastewater standard
- 4 1/8" holes for 3" rubber bulkhead grommets
- 3" holes for 2" rubber grommets
- 3/4" holes for 1/2" wire tensioners
- Stainless Steel bolts & washers



Tank installation: Connect the greywater supply pipe to the tank by cutting a hole for the grommet in the tank wall as close to the lid as possible and still be able to insert a rubber grommet. Insert grommet. Apply liquid soap to the supply pipe, then wiggle it through the rubber bulkhead so that 2" of pipe protrudes inside the tank. You may need to slightly bevel the leading edge of the pipe to force it through the grommet.

Overflow: At the same elevation as the inlet, cut the same size hole as for the inlet. Insert grommet. Apply liquid soap to the overflow pipe then wiggle it through the grommet, leaving about 2" on the inside of the tank. On that pipe, in an accessible location, install the swing-check valve horizontally, flowing in the proper direction. Connect this pipe to the sewer line.

Vent: At the same elevation as the inlet and outlet, cut a 3" hole for a 2" grommet. Insert grommet. Apply liquid soap to the vent pipe, and wiggle it through the grommet. Vents can be

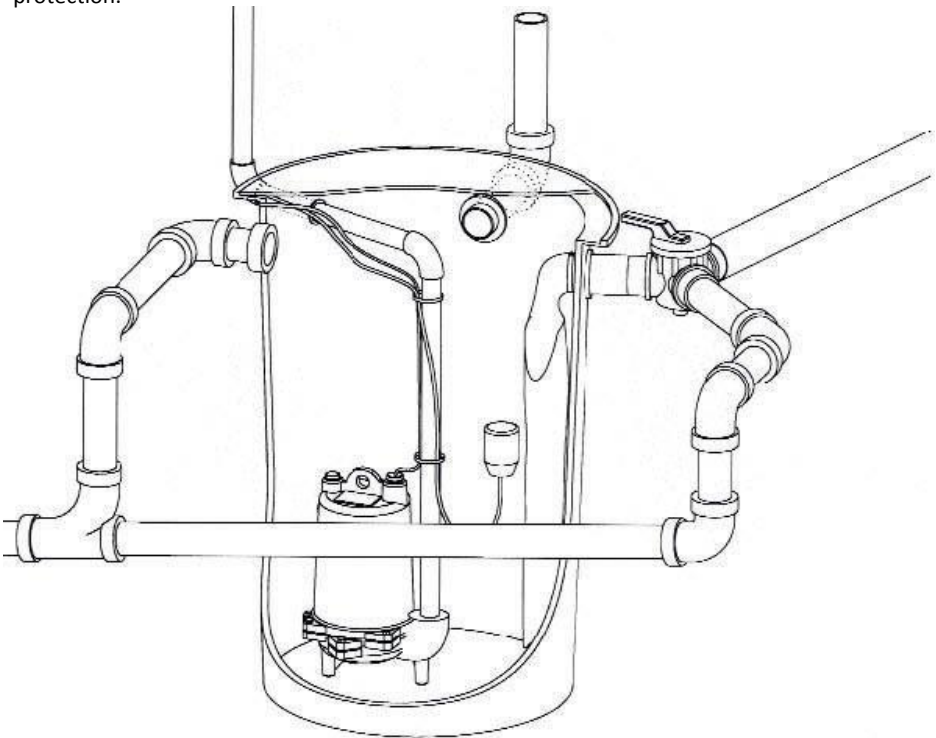
connected to a vent stack, run up through the roof alone, or if the tank sits outside the house and not within 10' of a door or openable window, a "candy cane" vent is allowed.

STANDARD PUMP

½ hp, 73 lbs, Cast Iron, submersible 120 VAC electricity, 12/3 20' cord, w/ tie straps 11.5 amps starting draw, UL Listed for effluent use. Thermally protected (oil and bearings) Shaft 416 SST Impeller Wear Ring 304 SST 24 psi, 90 gpm discharge, 55' TDH (cut-off) Not for pumping uphill.

The pump is installed inside the surge tank, with its discharge pipe passing through a rubber bulkhead grommet installed in a hole cut in the top side wall extending out of the tank towards the filter vessel.

Note: Undersized pumps reduce discharge rates, shorten irrigation runs, and can allow incoming greywater to overflow to the sewer. 208 and 230 VAC pumps are available for your landscape and topography needs. These pumps require the ReWater RWJB Junction Box for NEMA 4 protection.



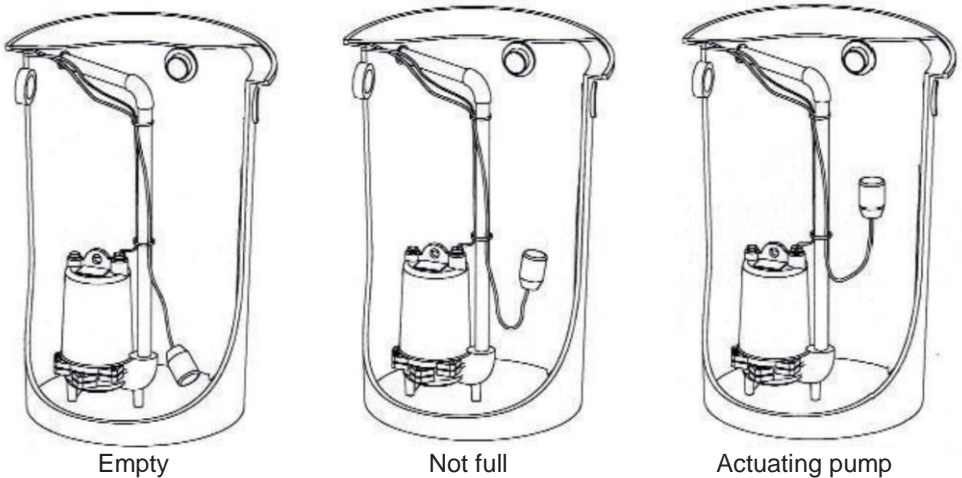
INCREASED UPHILL LOAD MAY CAUSE THE PUMP TO LABOR CONTINUOUSLY AND TO PREMATURELY FAIL, WHICH IS NOT COVERED UNDER WARRANTY.

FLOAT SENSOR SWITCH: Cut two $\frac{3}{4}$ " holes in the top side wall of the tank for the wire tension grommets. The float sensor must be secured 13" up the pump discharge pipe, as measured from the tank bottom. When secured to the pump discharge pipe, the sensor cord should only allow the float to barely touch the floor of the tank. If the remainder of this cord is not long enough to reach the controller, extend it in a waterproof junction box outside the tank.

NOTE: If you extend the float sensor wire to reach the controller, and you run it parallel to the power wires for more than 75', you must use double shielded wire for that sensor extension or the parallel power can energize the sensor wire and make it able to receive garage door and other errant signals. Leave one end of the drain wire in that shielded bundle unconnected.

As water enters the tank, the float switch rises to approximately 26" from the tank floor. This causes the internal electrical circuit within the float to be complete, allowing the controller to start the pump. Note that there is a 30 second delay in the pump shut-off.

ReWater's Complete Control User's Guide has wiring instructions <http://rewater.com/wp-content/uploads/2016/04/ReWater-User-Guide-English.pdf>.

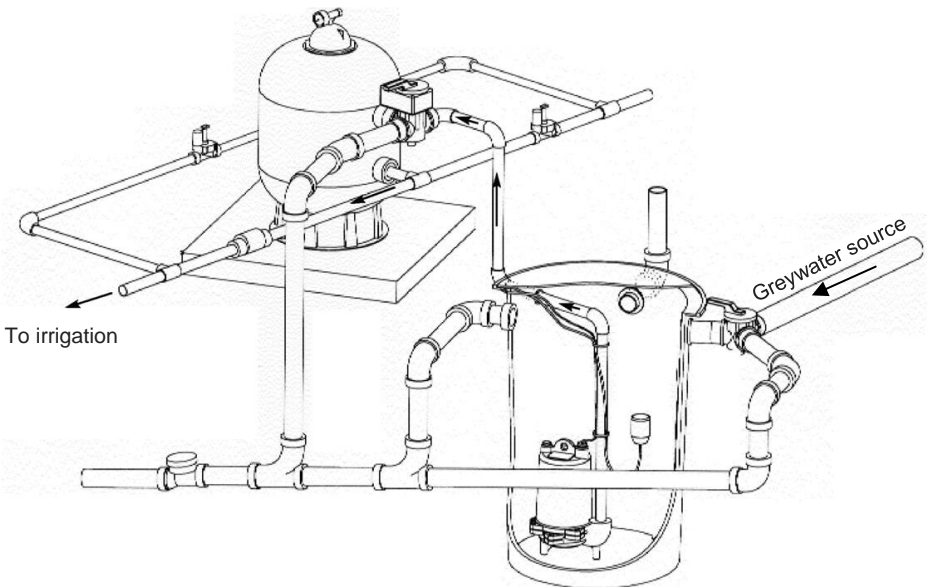


FILTER VESSEL: When filled with 150 pounds of 20 grit washed silica sand, this filter vessel removes solids in the greywater to the preferred size. The vessel is UV and rain proof, so it may be mounted indoors or outdoors. Greywater entering and leaving it is pressurized, so it may be mounted above or below the surge tank and pump. On initial start up, bleed the vessel of air to fill it with water.

The potable backwash supply pipe entering the bottom of the vessel must deliver 50 PSI but no more than 70 PSI. When using a potable water supply with more than 50 PSI, install a pressure regulator before the filter vessel to reduce the possibility of an upstream potable pressure surge blowing up the vessel during backwash.

Irrigation Mode

When the pump turns on, it sends greywater to the 24 VAC actuator and 2-position valve on the top port of the vessel and forces it down through the sand, where hair, lint, and other debris is trapped in tiny spaces between the sand particles. By the time this water exits the vessel, it is properly filtered, and it flows out the bottom port on the vessel through the swing-check valve to the irrigation valves. There must be at least 15 PSI at the irrigation valves for them to operate correctly. Check a flow chart for pressure losses in PVC pipe.

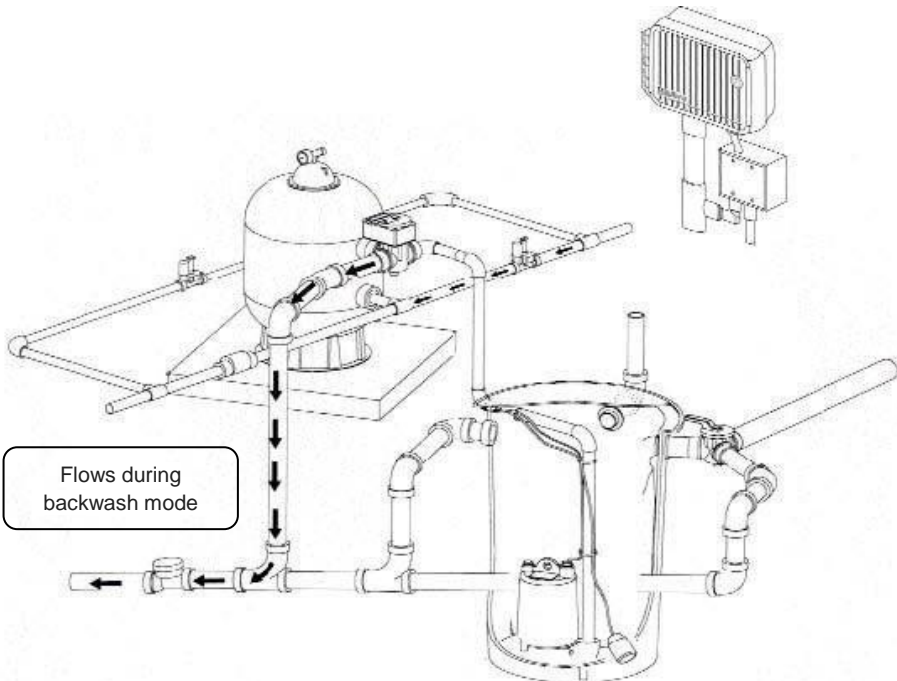


Shows greywater being pumped through filter and out to irrigation area.

Backwash Mode

The controller initiates a backwash cycle based on accumulated run time, factory set to trigger at 14 hours of accumulated irrigation run-time and it backwashes for 4 minutes. This insures continuous filtration and proper irrigation pressure at a single-family home. The interval and duration of the backwash cycle can be reprogrammed on the controller's drop-down menu in the Recycling Features position. After the cycle is triggered, at 12:00 midnight, the controller begins backwashing by simultaneously opening the normally closed fresh water backwash valve, and by rotating the 2-position valve on the filter vessel. Potable water is then rapidly forced up into the sand, causing sand particles to rise and separate from each other, releasing the trapped debris. Lighter than the sand, the debris rises to the top and flows out to the waste line through the 2-position valve. When the backwash cycle is working properly, the sand's surface is free of debris. If matted debris appears on the surface over time, scrap it off and decrease the interval between backwashings and/or increase the length of backwash, as needed. Replace the sand annually to insure proper filtration and sufficient irrigation pressure.

All low voltage wires go into the controller through the 1½" conduit on the bottom on that controller. Refer to the ReWater Controller User's Guide for wiring details.



NOTE: Filter sand does not come with a filter system, and will have to be purchased locally due to its weight. Most DIY big box stores and sand blasting supply houses stock 20-grit sand.

ELECTRICAL CONTROLLER

Please see ReWater's Controller User's Guide at <http://rewater.com/wp-content/uploads/2016/04/ReWater-User-Guide-English.pdf>.

Filter Vessel 2-position Actuator

The 20' red/white/black 3-wire lead connects the 24VAC valve actuator mounted on the top port of the filter vessel to the ReWater controller. If you extend these waterproof wires, you must provide waterproof connections. Run these wires up through the 1½" conduit provided on the ReWater controller to inside that controller where shown on page 4, item 16 of the ReWater Controller User's Guide <http://rewater.com/wp-content/uploads/2016/04/ReWater-User-Guide-English.pdf>. Protect these wires from foot traffic and other potential damage by securing them to a wall or placing them inside conduit.

With the controller powered up, you may manually start the backwash cycle by rotating the controller dial to "manual" and pressing "next" repeatedly until you read "backwash", then press "+". The very first time you start up the system, before the backwash cycle begins, the embossed word "OFF" on the actuator's handle should be over the pipe leading to the sewer line. When the backwash cycle starts, the handle should slowly turn until it faces the other direction, landing over the pump's discharge pipe. If it does not turn, flip the toggle switch on the back to change the actuator's polarity. When properly set, and you actuated a backwash cycle, you should be able to hear and feel water running through the pipe to the sewer line.



Pump

Adjacent on the lower right and attached to the controller is a junction box where the 120 VAC power, controller, and pump wires are connected (see page 26 of the User's Guide). Carefully read the ReWater Controller User's Guide before connecting any wires in that junction box.

BEFORE CONNECTING ANY OTHER WIRE, CONNECT ALL GROUNDING WIRES TO EITHER A METAL PLUMBING NETWORK OR TO A COPPER STAKE DRIVEN INTO SOIL. FAILURE TO PROPERLY GROUND THIS CONTROLLER MAY RESULT IN SERIOUS DAMAGE TO THE CIRCUIT BOARD. SUCH DAMAGE IS NOT COVERED BY WARRANTY.

Irrigation

BEFORE DIGGING IN THE YARD, CHECK WITH YOUR UTILITY COMPANIES FOR THE EXACT PLACEMENT OF BURIED UTILITY LINES.

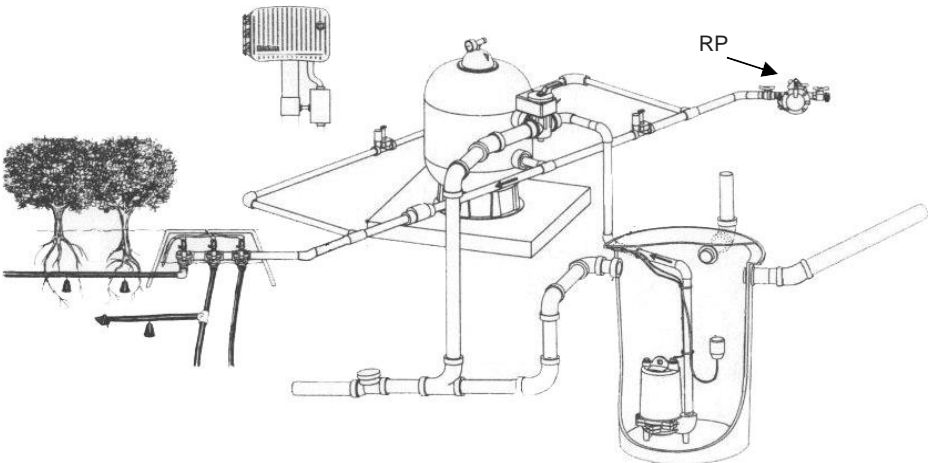
The Main Line

Just downstream of the filter vessel, mount the 2" PVC swingcheck valve upright with the arrow pointing in the direction of flow on the Schedule 40 2" pipe extending from the lower port of the filter vessel. On that pipe, connect a tee for the 1" (model RW2AF) or 1.5" (model RW3AF) potable water supplement valve to inject water through. This 2" pipe is now the irrigation main and irrigation can begin downstream of the injection point.

Take the irrigation main at least 8" underground to each irrigation valve to be served with greywater.

You will need additional 2" Schedule 40 PVC pipe and fittings to connect the vessel to your irrigation valves. Do not reduce this 2" pipe size prior to the irrigation valves or you will needlessly lose pressure. Keep turns on that mainline to a minimum, as they also reduce pressure. Paint exposed PVC pipe with latex paint, or bury it, to keep it from becoming brittle and susceptible to cracking due to UV light. Maintain the largest pipe size as long as possible to maintain water pressure.

The potable pipe supplying any irrigation system must have a Reduced Pressure Principle Device (RP) at its beginning to prevent possible contamination of the potable water supply in the rare event of reversed flow in the potable water lines.



CONNECTING THE VALVES

The 24 VAC greywater irrigation valves are ideally connected at "valve manifolds" serving a certain area of the landscape, all fed by the 2" irrigation main. Keep the irrigation main 2" all the way to the valves to keep from losing pressure before irrigation can occur. See figure # 11.

Wiring for these valves is to be direct burial type, and connected to the ReWater controller through the 1.5" conduit at the bottom of the controller. Use water-proof connectors where wires are spliced.

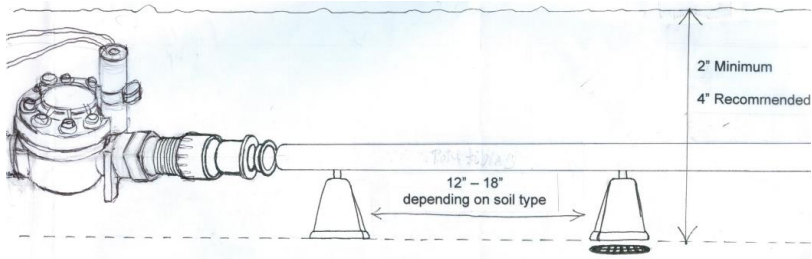
Each valve control wire shall be connected to a single terminal inside the controller. The irrigation terminals are labeled 1-21. There are 4 valve common (VC) terminals on the controller and any valve's common wire can be connected to any "VC" terminal.

NOTE: You can use a ReWater controller to operate potable water valves controlling sprinklers, rotors, bubblers, etc. See <http://rewater.com/wp-content/uploads/2016/04/ReWater-User-Guide-English.pdf> at page 8.

EMITTERS

ReWater's emitters are designed for subsurface use with greywater and other organic water sources approved by ReWater. They release water into soil at 12 GPH at 15 psi, in 2-minute doses (programmable) when the ReWater controller is irrigating automatically. Emitters can be buried as shallow as 2" and as close together as it takes to keep water from ponding or running off. We recommend emitter spacing of 12" – 18" apart and water release at 4" deep, as measured from the soil surface to the emitter's base.

Emitters are assembled by snapping the circular screen into the cone-shaped body. Using a 16p nail, poke a hole in the tubing where you need an emitter, then insert the emitter's barb into the hole. Emitters can be attached directly to 26mm, 20mm, or 16mm poly tubing if you're careful not to snap off the barb. Use turn fittings to keep tubing from kinking, or pressure loss or stoppage will occur.



IRRIGATION DESIGN

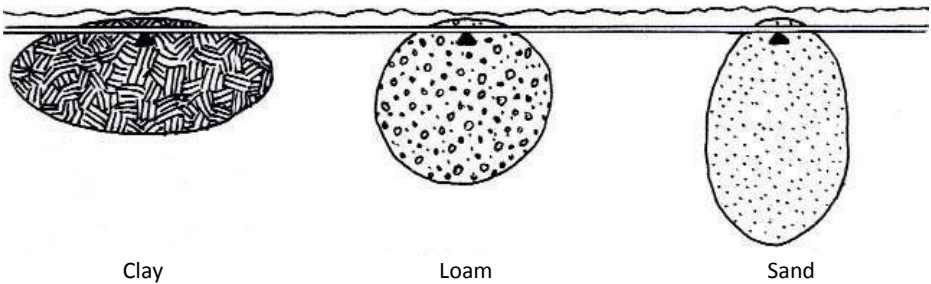
THE IRRIGATION INDUSTRY HAS ACCEPTED THAT CERTAIN DESIGN CONSIDERATIONS MUST BE MET FOR AN IDEAL IRRIGATION SYSTEM. WE HAVE SPENT YEARS NARROWING THEM DOWN TO THE FOLLOWING FIVE SHORT STEPS.

Step #1. Determine your soil type, to find out whether you should amend your soil. Adding amendments is the single best thing you can do to improve any landscape's health.

Soil is made up of organic materials and mineral fragments. Organic materials help keep the soil open and full of oxygen, they decompose into plant food, and they hold the millions of tiny microbes which break down the post-filter solids in greywater. These solids replenish the nutrients that plants take from the soil. Mineral fragments, ranging in size from clay, silt, to sand, determine how fast water will move through soil. The larger the fragments, as in sand, the larger the spaces between them, thus the faster water will move through those spaces. As with any garden, plants do better in organically rich, open, soil. It is standard good gardening practice to amend poor soil with compost, peat, mulch, manure, or other organic matter prior to planting.

NOTE: ALWAYS AMEND CLAYEY SOILS

Types of Soil



Step #2. Collect information about the plants to be irrigated, to determine how many emitters it will take to support them on a regular basis.

The type and potential water demand of the plants you will irrigate determines the number of emitters you will need to install now. Install emitters based on the plants' size when mature. If a plant is drought tolerant, it might need slightly less emitters than a plant right next to it that is the same size. It is much easier to include the correct amount of emitters now rather than have to add more after the poly tubing lines are buried.

Step #3. Collect information about the microclimates at the site, to determine where you need to compensate for non-uniform watering requirements by adding more emitters.

Numbers of Emitters	Normal Plant Types
1 (each @12" apart)	Fescue Lawns, deep rooted ground covers
2+	Small Shrubs (under 4' when mature)
4+	Large Shrubs (over 4' when mature)
6+	Small Trees (under 10' when mature)
10+	Large Trees (over 10' when mature)

The landscape site has an overall climate, but it probably has several microclimates too. For example, the sunny side of a house is hot compared to the shady side of that house. You need to determine what the microclimate is for each valve in order to determine how much water each valved area will need. Some valves may even have different microclimates along their own length; for example, a spot shaded by a tree along the sunny side of a house may be 15 degrees cooler on a hot day. Study the planting plan to see if you need to add emitters to hot spots.

Step #4. Calculate the amount of gallons per day that is needed by the plant with the lowest thirst on each valve, to establish a base line irrigation run time.

To establish each valve's base line run time, determine which plants on each valve need the least amount of water. Assuming 12 gph, calculate how many minutes it takes to fulfill those plants water needs. This is your base-line run time for that particular valve.

Step #5. Calculate the amount of gallons per day that is needed by the thirstiest plants on each valve, to establish how many more emitters you need to add for their higher water requirement.

With a base line irrigation run time established, you need to place more emitters around thirstier plants to get more water to them via the same valve. This is easy to do during installation, but difficult after the irrigation network is buried.

Tubing ID Size	Tubing OD Size	Spacing	Max # of Emitters	Max Length of Tubing
.600	.700 / 16mm	1.2(14) (1)	35 (3)	41'(4)
		2'	30	60'
		3'	27	81'
		4'	25	100'
		5'	23	115'
.830	.940 / 20mm	1.2(14)	62	73'
		2'	54	108'
		3'	47	141'
		4'	43	172'
		5'	40	200'

Tubing ID Size	Tubing OD Size	Spacing	Max # of Emitters	Max Length of Tubing
1.06	1.20	1.2(14")	95	112'
		2'	82	164'
		3'	72	216'
		4'	66	164'
		5'	62	310'

“These design parameters were established by CIT based on the hydraulic performance of the ReWater irrigation system.” - Center for Irrigation Technology, California State University, Fresno.

Note #1: Minimum suggested spacing

Note #2: As fixed by code uniformity requirements. Note that emitters may be skipped, and placed in groupings, as long as the total number of emitters is not exceeded.

Note #3: As limited by code uniformity requirements (no ponding or run-off).

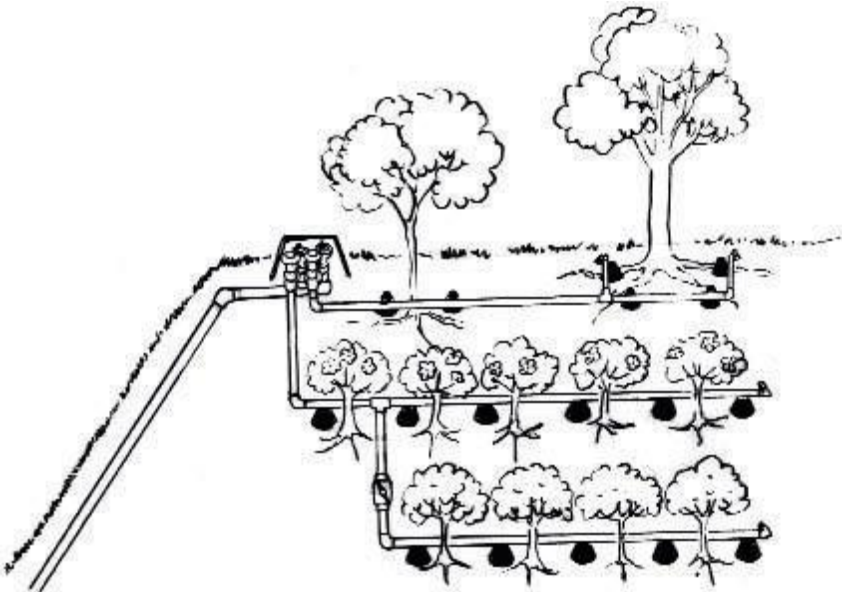
DO NOT INSTALL MORE THAN THE RECOMMENDED TOTAL EMITTERS ON ANY VALVE, OR MORE THAN THE RECOMMENDED NUMBER OF EMITTERS ON ANY SIZE TUBING, OR USE MORE THAN THE RECOMMENDED TUBING LENGTH ON ANY ONE VALVE, AS UNEQUAL IRRIGATION PRESSURE WILL OCCUR AND DRY AREAS MAY RESULT.

To facilitate easy location and possible tube flushing someday, place the ends of irrigation main lines in buried valve boxes or just above the surface.

Recommendations

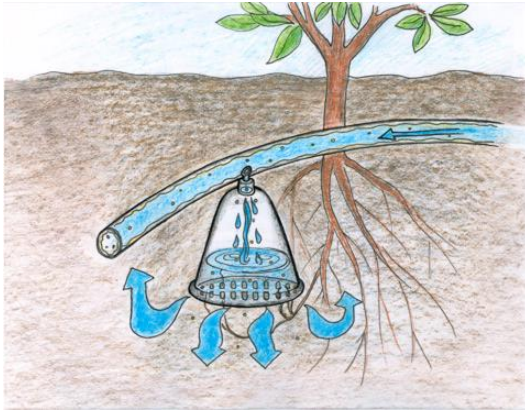
Recommendation 1. Establish new plants with fresh water before using greywater. Over-saturate the soil to insure their initial survival. Establish turf and ground cover with surface irrigation.

Recommendation 2. Do not install irrigation on uphill runs. Rather, pump to the highest point, install as many valves as needed, then irrigate downhill. When irrigating slopes, irrigate horizontally with separate valves.

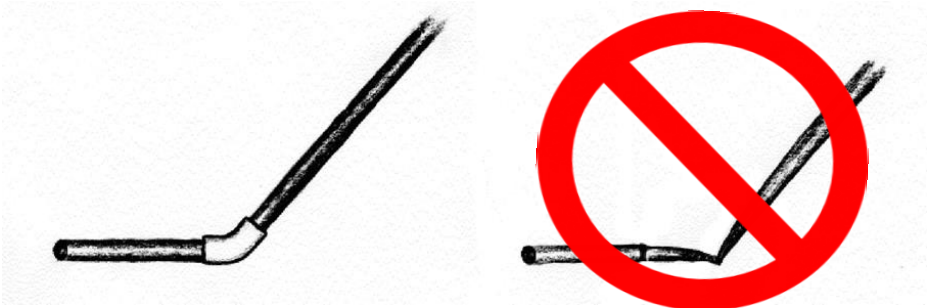


Recommendation 3. If you must irrigate more than one horizontal run from the same valve on a slope, place an inline ball valve at the beginning of the lower run to balance the gravity-caused pressure difference in that run. Test to insure that pressure is balanced between the rows before burying the emitters. See Section B of Figure 14.

Recommendation 4. When irrigating on a slope, install emitters uphill of the plants you intend to irrigate. The steeper the slope, the farther uphill the emitter should be placed. For example, on a 10 degree slope, place them 4" uphill; 20 degree/8", 30 degree/12" uphill, etc.



Recommendation 5. To keep tubing from collapsing, thus pinching off pressure, use 90 degree or 45 degree "elbows" wherever you intend to make sharp turns.



Recommendation 6. Below future sidewalks, driveways, and paths, bury tubing in a sleeve of larger PVC pipe to keep the tube from being cut during construction. It is a lot easier to install sleeves before the cement is poured or the bricks are laid, so do yourself a favor and install them wherever you even think you might need one.

Recommendation 7. After installation, but before covering the emitters with soil, run high pressure water through the tubing with the ends off to thoroughly blow out any debris that probably got inside. **Get it all out!** Before covering the emitters, replace the ends, and check to insure that each emitter has water flow.

OPERATION

IRRIGATION

The ReWater controller reuses greywater as it is produced in 2-minute doses to the irrigation valves in sequence, according to the irrigation programs you set on the controller, starting and stopping the pump as greywater fills the tank at various times throughout the day. At midnight, it supplements any balance on the irrigation program(s) with potable water from the potable water supply. After completing the irrigation program, it resets and waits for the next day's greywater.

If sufficient greywater is produced after midnight during the fresh water supplement mode, the controller closes the potable water valve and starts the pump, which sends greywater to the irrigation valves still requiring water that day. The controller returns to potable water if needed to complete the irrigation program.

In the rare event that greywater is produced after the controller has satisfied all the irrigation programs that day (programs A-D), any excess greywater will fill the tank. When full, it overflows to the sewer system.

Once the controller is properly wired to the power, float switch, 3-way valve actuator, backwash valve, and fresh water valve, and to its irrigation valves out in the landscape, you are ready to begin programming the irrigation functions.

GREYWATER & PLANTS

Greywater

Greywater is good for plants. The ReWater system provides highly oxygenated greywater due to its immediate transportation to the garden. Oxygen allows plants to absorb nutrients faster. Another good fact about greywater is it contains dead skin cells, body oils, soap scum, and other organic properties that easily break down into nutrients when exposed to microbes found in soil. One of the most common cleansing agents in shampoos, ammonium laureth sulfate, is also marketed as a soil conditioner. Greywater can also have slightly elevated levels of deleterious properties. Here is how to mitigate them:

- Chlorine ultimately breaks down into salt and water. If large amounts are present during hot spells, it can inhibit a plant's ability to quickly uptake water during time of need. Hydrogen peroxide bleach is an excellent substitute for chlorine, it's also color safe, and it increases the oxygen available to plants. Small amounts of chlorine found in scrubbing compounds like Comet and Ajax help retard growth inside the system.
- Boron is essential to healthy plant growth, but most soils contain enough to support healthy plant growth. Avoid all Boraxo products or any laundry product containing sodium perborate. Some of the worst offenders are Dash, Dreft Ultra, Oxydol Ultra, Tide with Bleach, White King, and Wisk Advanced Action. Many liquid fabric softeners also contain sodium perborate.
- Salt comes mostly from powdered laundry detergents. Use liquid detergents, which have substantially less salts than powders. All liquid detergents are better than all powders. Best liquid choices are Alfa Kleen, All Regular, Bold, Ecover, ERA Plus, Oasis, Shaklee, and Yes. Oasis has a "booster" available which works like a color-safe bleach.

You can counter salt's immediate effects by using fertilizers recommended for acid-loving plants, like azaleas and camellias, or with products made to counter salt. Two of the best products for this are sold under the names Exsodis and Plant's Choice. You can add them directly to your shower drain water. Another way to balance the pH of greywater is to periodically add phosphoric acid to greywater at the rate of 1 ounce per 50 gallons of water. Just dump some down the shower drain and it will mix with the greywater that day.

To counter long-term salt buildup in clayey soils, shovel gypsum into the soil where greywater is used. Long-term salt build-up is usually leached out by rain during the rainy season. During prolonged droughts, irrigate with enough water so that salts migrate past the root zone.

- Acid Cleaners actually help balance the pH level of greywater. They are usually diluted enough from washing them down the drain with rinse water. Taking one shower afterwards typically satisfies this requirement.

- Phosphorous was once the most common cleaning agent in laundry products, but it was mostly removed per federal law in the 1970s. Phosphorous is not welcome at a city-maintained wastewater system because it creates plant growth in their discharged water. In your garden though, that's good. There are three essential elements for plant life - nitrogen, phosphorous, and potassium.

Plants

Plants receiving greywater get a rich liquid diet that is slightly alkaline, usually about 7.0 pH. However, your source water is the biggest factor in your greywater's pH. Some plants, like azaleas, camellias, rhododendrons, and most ferns, prefer a more acidic soil. They are usually planted in the shade. When using greywater on acid-loving plants, either regularly balance the pH level in the water or soil, or do not use greywater in that area.

If you are not familiar with plant types and their needs, there are many reference books available. The Sunset Western Garden Book is extremely useful, with pictures and numerous categories for cross referencing by plant type, climate preference, soil requirements, and other helpful categories.

Trees

Hardwood trees such as oaks and walnuts are particularly susceptible to root fungus if their roots do not dry out between irrigation cycles. Such fungi can eventually kill even the oldest most established tree. To prevent this, irrigate hardwoods using separate zones. Emitters in those zones should be placed under the perimeter of the tree's canopy, where smaller roots capable of absorbing water are located. This valve should be turned off periodically to allow roots to dry out. Once well established, hardwoods can be weaned from frequent irrigation.

Underground Obstacles

Existing gardens contain obstacles such as sidewalks and driveways, but also buried roots, pipes from earlier irrigation systems, water mains, and other surprises. Remember, you can go under and around some obstacles with this irrigation network. Do not to kink or pinch the tubing.

MAINTENANCE & WARRANTY

NEVER OPERATE YOUR SYSTEM WITHOUT AN OPERATIONAL FILTER.

- **Filter vessel:** The filter vessel should be checked and the sand within replaced annually. Using the large hexagon wrench provided at the time of purchase, spin open the top of the filter vessel, roll the black water diffuser on it's side, and scoop out the old sand. Dispose of old sand in a garbage can. Refill with new 20-grit washed silica sand. Roll the diffuser back to horizontal. Wash off any sand from the threads in the neck of the vessel. Spin the top of the filter vessel firmly back into place. Tighten it securely or it will leak, causing pressure loss and dripping from the top.
- **Irrigation Network:** Should somebody cut your tubing and a portion of your downstream irrigation network become clogged with soil, you might be able to unclog it by removing the end cap from that section of tubing and blowing the tubing out with high pressure water. If that doesn't get all the emitters to drip again, close off the end, and stir eight ounces of phosphoric acid into a tank of greywater, pumping that solution to the clogged emitters. Allow to sit two hours, then pump several tanks of fresh water through that section. The only guaranteed way to clear clogged emitters is to dig up the clogged emitters and replace them.
- **Battery:** Replace your alkaline battery every two years.

WARRANTY & PROBLEM SOLVING

ReWater Systems warrants all parts of the ReWater® System to be free of manufacturing defects for a period of two years from the date of purchase. We will replace free of charge parts found by ReWater to be defective under normal use and service within the warranty period.

Within the warranty period, return the suspect component to ReWater Systems at PO Box 19364 Thousand Oaks CA 91319 postage prepaid and we will immediately assess and remedy the situation. You may call ReWater for expedited warranty instructions.

Plugging of the irrigation network is always a result of owner failure to properly maintain the filter system or of tubing being cut in the soil and is not covered by warranty. This warranty also does not cover plant loss or other such consequences due to the use of incompatible laundry products or other materials, animal waste, or improper installation or operation. ReWater will not be responsible for other incidental or consequential damages or for parts or systems with parts that have been altered, and our liability under this warranty is limited solely to replacing or repairing defective parts. No other express or implied warranty exists.

FREQUENTLY ASKED QUESTIONS & ANSWERS

Operations

Why isn't the pump working?

- A. There are several possibilities, listed here in the order of most likely.
 - You have no greywater irrigation time scheduled on the irrigation controller for that particular day. Put some run-time on some valves for that day. Every day should have some run-time scheduled or greywater will be lost to the overflow that day.
 - Even though you have the dial in the “Manual, single-station” position, and you depressed the “+” button to start manual irrigation, you have no greywater in the tank at that moment so the system is irrigating with potable water, not the pump.
 - The float switch has slipped and is now mounted incorrectly on the pump discharge pipe or it is just floating around loosely in the tank. Remount it securely on the pump discharge pipe right above the top of the pump.
 - The float switch is stuck in the “Off” (down) position, maybe trapped between the tank and the pump. Resecure it to the pump’s discharge pipe so it can’t get trapped.
 - The pump has stopped due to some rocks, a dropped lid bolt, or other foreign object falling in the tank and jamming the impellor. Turn off the power, remove the pump from the tank, remove the bottom cover plate on the pump, remove the object from the impeller, then put it all back together again.
 - The float switch is broken. Test the float by shaking it lightly while holding it upright while the controller is in the “manual, single station”, “+” (on) position. If you don’t hear the float switch click on and the pump stays off, and your multi-meter can’t read 120 VAC coming from the relay in the junction box (see page 26 in the ReWater controller User’s Guide), replace the float switch.
 - The circuit breaker supplying the controller has been tripped. Reset it.
 - An undersized pump has burned out prematurely due to continuously pumping uphill, causing it to labor virtually non-stop. Fix the design problem by replacing with a more appropriate pump.

Landscaping

How do I test operate my irrigation valves manually?

- A. If you have power at the controller (if you can read the LED, you do), rotate the dial to the “manual, single station” position and press “Next” repeatedly until you reach the desired valve # to check, then press “+” (on). If you don’t have power, manually turn on the fresh water supplement valve at the filter to pressurize the main line and manually open the solenoid on the desired valve on the desired irrigation valve.

Why are my brand new plants wilting?

- A. Brand new plants need an unusual amount of water before their root systems are mature enough to sustain the plant in its new environment. Increase the valve run-time durations enough to saturate the soil around new plantings until they become established. Then slowly cut the water back as they become established.

Why are some of my new plants thriving and some are not?

- A. Plant installation practices vary by landscaper. The single biggest factor in plant growth is good soil prep, whether using fresh water or greywater. Plus, there is always a small percentage of plants that just don't survive the initial planting.
- If the problem is with random plants on the same zone that appear wilted, you may not have enough emitters on the plants that are wilting. Add emitters for those plants.
- If the problem is with an entire irrigation zone, you may not have enough irrigation time on that particular zone/valve. Add more time.
- If all the affected plants are in one specific area of about 5'-10' in diameter, your site may have had a construction clean-out spot right where those plants are now located. That spot is now a mini-toxic waste site. Excavate that area and replace the soil. It is a pain, but it's the only way to grow nice plants in that particular area.

Why is there always a dry spot in my garden?

- A. There are several possibilities:
 1. There is a kinked or cut tube keeping water from the emitter(s) in that area. Locate the closest emitter and see if it receives water when the pump comes on and the valve opens. If no water arrives, trace the tubing back to the problem and either straighten it out or splice in a new section of tubing.
 2. There are not enough emitters for that location due to high evapo-transpiration or fast drainage. Add an emitter(s). If this becomes apparent soon after installation, there may be too many emitters on a valve or tube, leaving insufficient water for uniform irrigation. Trace the tube back to the larger tube/piece and replace the small tube with larger tubing from that portion onwards. Do not add more emitters to a valve or tube than allowed by this manual at .

Technical Support Assistance

Call ReWater Systems, Inc., at (805) 716-0104 or email support@rewater.com for other answers. With systems in operation since 1990, we can give you a fast and accurate response.



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