



# County of San Diego

## Department of Environmental Health

### Land and Water Quality Division

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## **GRAYWATER SYSTEMS FOR OUTDOOR IRRIGATION DESIGN AND PROCEDURES MANUAL**

### **Introduction**

Graywater is untreated wastewater from bathroom sinks, bathtubs, showers and clothes washers but does not include wastewater from toilets, kitchen sinks or dishwashers. A graywater system is a type of onsite wastewater treatment system that utilizes trenches, subsurface drip irrigation systems, and mulch basins for wastewater disposal but can have the added benefit of using the wastewater as an irrigation source. Regulations for the use of graywater can be found in Chapter 16 of the California Plumbing Code (CPC).

The County of San Diego Department of Environmental Health (DEH) is the Administrative Authority for the oversight and permitting of graywater systems in the unincorporated areas of San Diego County. Similarly, each incorporated city in San Diego County administers graywater regulations within their city limits. If you reside in an incorporated city, please contact your city's Building Department for design and permitting requirements.

### **Objectives of This Guideline**

1. To assist the public with the design, installation, operation and maintenance of graywater systems.
2. To ensure subsurface irrigation systems discharging graywater will not contaminate surface water or groundwater or create public health hazards.
3. To explain the permitting procedures and inspection of graywater systems installed within the unincorporated areas of San Diego County.

This guideline has been developed to supplement Chapter 16 of the CPC and to provide information on how graywater systems are designed, reviewed, permitted and inspected by DEH in the unincorporated areas of the County. Persons seeking permits to install graywater systems in the unincorporated areas of San Diego County should first review Chapter 16 of the CPC, which can be found on the DEH website at [Graywater Systems](#). In addition, they may wish to review the County of San Diego Onsite Wastewater Treatment System Ordinance as well as DEH's "Local Agency Management Program" (LAMP) and "Onsite Wastewater Treatment System Groundwater Separation Policy". These documents can be found on the DEH website at [Septic Systems](#) along with our current fee schedule for graywater system design reviews and installation permits.

## **Types of Graywater Systems**

There are three types of graywater systems recognized in the California Plumbing Code, 1) the clothes washer system, 2) the simple system, and 3) the complex system.

### **Clothes Washer System**

A clothes washer system is a graywater system that obtains its flow from one domestic clothes washer in a one- or two-family dwelling. These systems are exempt from a construction permit as long as no modifications to the existing plumbing piping are made and the system is in compliance with all requirements of CPC 1602.1.1.

Although a construction permit is not required for a clothes washer system, the dispersal field must be sized using the same methodology as other graywater systems. Please refer to the DEH handout '*Graywater System Requirements for a Single Clothes Washer*' for specific information for this type of graywater system. Additional information on clothes washer system sizing is available in the *Design Requirements* section of this guideline.

### **Simple System**

A simple system exceeds a clothes washer system and has a discharge capacity less than 250 gallons per day (gpd). Simple systems shall comply with the following:

1. A construction permit is required for the installation of a simple system. No construction permit shall be issued until a plot plan with appropriate data to allow for a design review is submitted and approved by DEH.
2. The discharge capacity of a graywater system shall be determined as described in the "Discharge Volume" section on page 4 of this guideline.
3. A simple system shall meet the design criteria found in Chapter 16 of the CPC.

### **Complex System**

Any graywater system that discharges  $\geq 250$  gpd is considered a complex system, and shall comply with the following:

1. A construction permit is required for the installation of a complex system. No construction permit shall be issued until a plot plan with appropriate data to allow for a design review is submitted and approved by DEH.
2. The discharge capacity of a graywater system shall be determined by using the "Discharge Volume" section on page 4 of this document.
3. A complex system shall meet the design criteria found in Chapter 16 of the CPC *and* be designed by a person who can demonstrate competence to the satisfaction of the Enforcing Agency.

## **Design Requirements**

Prior to completing any work or submitting fees, it is recommended that the contractor or property owner contact DEH to determine what relevant information is available for the subject property. At that time a determination will be made based on county requirements, lot size and characteristics, depth to groundwater and percolation rates (if known) on the feasibility of installing a graywater system on the property and what additional information will be required. Property owners are encouraged to call or meet with DEH staff to discuss

any concerns and ask questions to prevent any unnecessary delays or costs when designing or installing a graywater system.

### **Determination of Groundwater Depth**

There must be at least 3 vertical feet of separation between the deepest graywater dispersal point and the anticipated seasonal high groundwater level. Digging a test hole at least three vertical feet beyond the deepest dispersal point is sufficient for making this determination. In areas of known high groundwater, a deep boring to 10' depth may be required to compensate for seasonal fluctuations in groundwater depth.

If the required groundwater separation cannot be met, the graywater system cannot be installed. If the system is already installed, and groundwater separation is not met at a later date, the graywater system must be removed.

### **Graywater System Sizing**

Proper system sizing is necessary to prevent the surfacing or ponding of graywater. System size is a function of the volume of graywater discharged from the dwelling and the permeability of the soil on the site. The permeability of the soil will be determined from a soils evaluation or percolation test by a qualified professional and/or conditions of approval from a recorded subdivision map, parcel map, boundary adjustment, or certificate of compliance.

The following guidelines will assist in properly locating and constructing a graywater system.

#### Determining Discharge Volume

The graywater discharge for a single or multi-family dwelling is calculated using estimates of graywater use. These estimates can be based on water use records, calculations of local daily per person interior water use, or by using the following procedure:

1. The number of occupants of each dwelling unit shall be calculated as follows:
  - First Bedroom 2 occupants
  - Each additional bedroom 1 occupant
2. The estimated graywater flow of each occupant shall be calculated as follows where GPD = gallons per day and LPD = liters per day:
  - Showers, bathtubs, and wash basins 25 GPD (95 LPD)/occupant
  - Laundry 15 GPD (57 LPD)/occupant
3. The total number of occupants shall be multiplied by the applicable estimated graywater discharges as provided

#### Soil Types and Determination of Absorption Area

The type and permeability of the soil in which the graywater system is to be installed is critical for the proper sizing and functioning of the system. For example, sandy soil accepts water more readily than clay soil, so a system on a lot with sandy soil would be smaller than a system on the same size lot with clay soil. A qualified professional may be required to perform a soils evaluation in the proposed location of the dispersal area of the graywater system. The following table shows the square footage of absorption area

necessary for each soil type and may be used by a qualified professional to perform a soils evaluation for sizing purposes.

**TABLE 1**  
**Design Criteria of Six Typical Soils**

Soil Type	Minimum square feet of irrigation/leaching area per 100 gallons of graywater discharge per day	Maximum absorption capacity in gallons per square foot of irrigation/leaching area for a 24-hour period
Coarse sand or gravel	20	5.0
Fine sand	25	4.0
Sandy loam	40	2.5
Sandy clay	60	1.7
Clay with considerable sand or gravel	90	1.1
Clay with small amounts of sand or gravel	120	0.8

*An example of determining the required square footage of absorption area:*

*A two-bedroom house with three occupants generates 25 gallons of graywater per person per day = 75 gallons per day (GPD). Graywater from showers and wash basins only will be connected (no laundry). From **Table 1**; Sandy clay will absorb 1.7 gallons per square foot per day.*

*Therefore; 75 GPD / 1.7 gallons/ foot<sup>2</sup>/ day = 44 feet<sup>2</sup> of absorption area is required*

If the property has questionable or poor soil and DEH has no percolation test on file, or if the graywater system is to be placed in fill soil, a licensed professional must complete a percolation test. The licensed professional must be a California registered civil engineer, registered geologist or registered environmental health specialist certified to perform percolation testing in San Diego County. Testing must meet the standards set forth in the County of San Diego's "LAMP" which can be found on our website at [Septic Systems](#).

The percolation test depth must coincide with the proposed depth of the graywater system disposal field unless adequate information is known about the soil conditions in the disposal area. The number of test holes should be based on the soil conditions in the disposal area. Graywater systems are limited to soils with a percolation rate of 60 minutes per inch (mpi) or less.

**Graywater Dispersal Requirements**

The dispersal field for a gray water system can be a mulch basin, an irrigation field, or a disposal field utilizing mini-trenches. All graywater dispersal fields shall be sized in accordance with **Table 1** and be of sufficient depth, length and width to prevent ponding and/or runoff. In addition, the dispersal field shall not extend within three (3) vertical feet (91.5 cm) of the highest known seasonal groundwater, or be installed in a manner that contaminates groundwater or surface water. Dispersal system setback requirements are included in Table 3 below.

Mulch Basin

A mulch basin generally consists of a shallow basin within which vegetation is planted or dug around trees and must be installed on relatively level ground. Mulch basins will require periodic maintenance, reshaping or removal of dirt to maintain surge capacity, to

accommodate plant growth, and to prevent ponding or runoff. Mulch must be replenished as necessary to allow for the ongoing decomposition of organic matter. A minimum mulch thickness of two inches is required, but four inches is recommended.

#### Irrigation Field

Irrigation fields generally are constructed using a subsurface drip irrigation system and therefore need some type of filtering and backwash system to prevent clogging of the drip emitters. The following design and installation requirements apply to graywater irrigation fields:

1. The backwash line shall be connected to the sewer or septic system.
2. A pressure reducer shall be installed where pressure at the discharge side of the pump exceeds 20 psi to maintain pressure no greater than 20 psi.
3. The filter shall be a minimum 140 mesh (115 micron) filter with a capacity of 25 gallons per minute.
4. The location, type, length or number and spacing of drip emitters for the drip field shall be specified in the design.
5. All drip irrigation supply lines shall be of PVC class 200, with schedule 40 fittings. Drip feeder lines will be Poly or flexible PVC.
6. All joints must be properly solvent-cemented, and before burial demonstrated to be drip tight during a five minute pressure test.
7. When multiple irrigation zones are used, the system design will employ user controls, such as valves, switches, timers and other controllers to rotate the distribution of graywater between the zones.
8. Each irrigation zone shall include the required number of emitters to accommodate the entire wastewater flow per day.
9. An automatic flush valve/vacuum breaker shall be installed in each irrigation zone to prevent back siphonage of water and soil.
10. All supply piping and drip feeder lines shall be covered to a minimum depth of two (2) inches (51 mm) with mulch or soil.

#### Disposal Field

Disposal fields generally consist of mini-trenches similar to leach line trenches and can be used for irrigating deeper root zones of trees or large shrubs. The following design and installation requirements apply to graywater disposal fields:

1. Disposal field lines shall be installed according to the specification ranges summarized in **Table 2**, below.
2. Clean stone, gravel or similar filter material graded  $\frac{3}{4}$  inch to 2.5 inch shall be used and shall be covered with straw, untreated building paper or other approved material to prevent closure of voids with earth backfill.
3. Leach pipe shall be a minimum of 3" perforated pipe HDPE, PE, ABS or PVC.
4. If manufactured leaching chambers are used instead of pipe and filter material, the chambers must be installed in compliance with the manufacturer's installation instructions.
5. When graywater disposal lines are installed on sloping ground they must be installed on contour.
6. The tight lines connecting each horizontal leaching section must employ approved water-tight joints and be installed in natural (unfilled) soil.
7. Multiple disposal zones may be used. Each zone shall have the required length of trench to accommodate the entire wastewater flow per day with valves as needed to rotate the distribution of graywater between zones.

8. As with the irrigation field dispersal, when multiple disposal zones are used, the system design shall employ user controls, such as valves, switches, timers and other controllers to rotate the distribution of graywater between the zones, and each zone will include a flush valve/ antisiphon valve to prevent back siphonage of water and soil.

**TABLE 2**  
**Disposal Field Construction**

Minimum	Maximum
Number of drain lines per valved zone	1
Length of each perforated line	—
Bottom width of trench	100 ft. (30,840 mm)
Spacing of lines, center to center	12 in. (305 mm)
Depth of earth cover of lines	24 in. (610 mm)
Depth of filter material cover of lines	4 ft. (1219 mm)
Depth of filter material beneath lines	2 in. (51 mm)
Grade of perforated lines	3 in. (76 mm)
	level
	3 in./100 ft. (2 mm/m)

**Tanks, Valves and Piping**

If a holding tank is included in the graywater system design, the following is required:

1. The tank shall be constructed of durable material. All seams and joints to the tank are to be watertight.
2. The tank is to be vented to at least eight feet height, and the vent is to be affixed to the structure. The tank and vent are to be sealed against vermin and mosquitoes.
3. The tank is to be labeled “GRAYWATER IRRIGATION SYSTEM, CAUTION, UNSAFE WATER”.
4. The tank is to have an overflow drain that is connected to the building’s sewer or septic system. If connected to the septic system, the connection must be up gradient of the septic tank. The overflow drain must not be less in size than the inlet pipe, and must gravity flow to the sewer pipe. A backflow device is to be installed on the overflow pipe so sewage does not back into the holding tank.
5. Piping is to meet specifications as set forth in the California Uniform Plumbing Code, sections 604 through 606.
6. Piping is to be labeled at least every five feet with the following:”CAUTION, NON-POTABLE WATER, DO NOT DRINK.
7. The three way valve that diverts graywater to either the graywater system or sewer shall be readily accessible and clearly labeled as to direction of flow.

**Filters**

For single fixture systems where a filter is used in the design, the filter needs to be cleaned periodically and must be done in a sink that disposes to the graywater system, building sewer system or septic tank. A potable water line for the purposes of back flushing the graywater system cannot be connected to a clothes washer system.

Filters used in a graywater irrigation system shall be as specified by the manufacturer’s installation instructions for the design flow rate and intended use. Filter backwash water

and flush water shall not be used for any purpose. Sanitary procedures shall be followed when handling filter backwash and flush discharge or graywater.

**Properly Locating the Graywater System**

The graywater system must maintain certain setbacks to structures, existing septic systems, water lines, water wells and surface waters. These setbacks are summarized in **Table 3**.

**TABLE 3  
Graywater System Setbacks**

Minimum Horizontal Distance Required From:	<u>Tank (ft)</u>	<u>Irrigation Field (ft)</u>	<u>Disposal Field (ft)</u>
Building structures <sup>1</sup>	5 <sup>2</sup>	2	5
Property line adjoining private property	5	1.5 feet	5
Water supply wells <sup>3</sup>	50	100	100
Streams and lakes <sup>3</sup>	50	100 <sup>4,5</sup>	100 <sup>4</sup>
Sewage pits or cesspools	5	5	5
Sewage disposal field	5	4 <sup>6</sup>	4 <sup>6</sup>
Septic tank	0	5	5
Onsite domestic water service line	5	0	0
Pressurized public water main	10	10 <sup>7</sup>	10 <sup>7</sup>

<sup>1</sup> Building structures does not include porches and steps, whether covered or uncovered, breezeways, roofed porte-cocheres, roofed patios, carports, covered walks, covered driveways, and similar structures or appurtenances.

<sup>2</sup> Underground tanks shall not be located within a 45 degree angle from the bottom of the foundation, or they shall be designed to address the surcharge imposed by the structure. The distance may be reduced to six (6) inches for aboveground tanks when first approved by the Enforcing Agency.

<sup>3</sup>Where special hazards are involved, the distance required shall be increased as directed by the Enforcing Agency.

<sup>4</sup>These minimum clear horizontal distances shall also apply between the irrigation or disposal field and the ocean mean higher high tide line.

<sup>5</sup>The minimum horizontal distance may be reduced to 50 feet for irrigation fields utilizing graywater which has been filtered prior to entering the distribution piping

<sup>6</sup> Plus two feet for each additional foot of depth in excess of one foot below the bottom of the drain line.

<sup>7</sup> For parallel construction or crossings, approval by the Enforcing Agency shall be required.

**Special Provision for Future Graywater Stub-out**

Graywater stub-out plumbing may be allowed for future connection prior to the installation of irrigation lines and landscaping. The stub-out shall be permanently marked "GRAYWATER STUB-OUT, CAUTION, UNSAFE WATER".

## **Indoor Use of Graywater**

Graywater shall not be allowed for indoor use, such as flushing toilets and urinals, unless it is treated to meet the requirements of NSF 350 or the California Department of Public Health statewide uniform criteria for tertiary disinfected recycled water as provided in California Code of Regulations, Title 22 as specified in Section 1601.7.2 of the CPC. In addition, the system must meet the requirements of Section 1604.0 of the CPC, "On-Site Treated Nonpotable Graywater Systems".

## **The Permit Process**

### **Application Submittal**

A graywater system plot plan and applicable review fees must be submitted to DEH to initiate the permitting process. The plot plan will be drawn per the specifications set forth in Section 1602.7 of the CPC for the review of the proposed graywater system. A field review fee is generally required although an over the counter plan review may be possible under certain conditions. This drawing should be prepared using a standard engineer's scale on 8.5"x11" or 11"x17" size paper.

The **plot plan** shall contain the following information:

- Site address
- Tax assessor's parcel number
- Owner's name, mailing address, and phone number
- Contractor's name, mailing address, and phone number, if applicable
- Vicinity map, scale, north arrow, Thomas Bros. Map coordinates
- Property lines and lot dimensions
- All existing or proposed structures and paved areas
- Number of existing or proposed bedrooms and fixtures that will be connected to the graywater system and calculation of daily graywater flow
- Direction and approximate slope of ground surface through the use of topographic lines
- Location of the existing or proposed OWTS along with the expansion area or building sewer connecting the structure to public sewer
- Existing or proposed grading showing all cut and fills along with all existing or proposed retaining walls. Include energy dissipaters for pad drainage
- All known, recorded easements on or within 20 feet of lot boundaries (open-space, utility, road, waterline, etc.)
- Location of proposed graywater system, including all system components and subsurface dispersal lines
- Identify source of potable water
- Location of all public waterlines on or within 20 feet of property and signed water line statement
- Location of all wells on or within 100 feet of property
- The location of all deep borings or percolation test holes, if required
- Details of construction including a description of the proposed installation methods and materials.

In addition to the plot plan, it is required to submit details of construction necessary to assure compliance with the regulations set forth in Chapter 16 of the CPC, together with a full description of the complete installation, including installation methods, construction

and materials. A log of soil formations and groundwater levels may be required with a statement of the water absorption characteristics of the soil in the proposed irrigation area as determined by the soils evaluation, percolation test or other data as available.

### **Office Review and Over-the-Counter Approval**

The DEH area specialist or duty specialist will complete an office review of the graywater system plan at the time of the design submittal. During the office review, all relevant information will be reviewed to ensure the system can be installed in compliance with all state and local guidelines. The submittal shall include a plot plan as described above, percolation data and/or other soil information, and groundwater data relevant to the location of the proposed graywater system.

A field review will be required by DEH any time a graywater system is proposed for a property where no OWTS design information is on file for that site. If acceptable OWTS information is on file, the application submittal information meets the regulatory requirements, and the graywater system is proposed to be installed in similar soils as the existing OWTS, then an over-the-counter approval can be issued and the field review waived.

### **Field Review**

The purpose of a field review is to determine if there are any soil, groundwater or setback concerns which could result in the improper discharge of graywater. The field review will ensure that the proposed graywater system can be installed as proposed on the plot plan. The following items specific to graywater systems will be verified:

1. The graywater tank location will allow for draining or overflow by gravity to the sewer or septic system.
2. The irrigation/disposal field can be installed in an area that is suitable and will meet the minimum size and setback requirements per the CPC.
3. If a pump system is used, the elevations between the pump and highest point of discharge must be verified to ensure the proposed pump will be adequate to lift the graywater to the point of discharge.

Upon completion of the review, the applicant will be notified in writing of any necessary corrections to the graywater system design or requirements for additional information such as percolation testing or groundwater evaluation. Approved graywater system designs are valid for one year from the date of the approval.

### **Permit to Construct**

An approved graywater system design is required prior to issuance of a Graywater System Installation Permit. When the graywater system will serve a new dwelling or a new portion of an existing dwelling, DEH may need to conduct a field grading inspection and/ or review the building construction plans stamped by the County Planning and Development Services prior to issuing the installation permit. These additional requirements will be indicated on the design approval as necessary. If the graywater system will serve an existing dwelling that is not being modified other than to install the system, the grading check and building plan review are not necessary.

The appropriate Graywater System Installation Inspection fee is required for permit issuance. This permit will be valid for one year from the date of issuance.

### **System Inspection**

DEH will inspect the graywater system installation to ensure the approved design was followed with respect to materials, sizing and location. The graywater system, which includes tanks, piping, valves and all appurtenances along with the subsurface dispersal field, must be left open and visible for inspection and approval by DEH. No portion of the graywater system can be backfilled without authorization from DEH.

The graywater system inspection will be similar to an OWTS inspection with the main focus being the diversion valve, surge tank, if used, and mulch basin, mini leach line or subsurface drip locations to ensure compliance with the regulations and to determine if there are any conditions which could result in an improper discharge of graywater. All specifications per Chapter 16 of the CPC shall be required which include the following;

1. All system components shall be per the approved plan with respect to size, number and locations.
2. The three-way valve shall be installed in a location that is readily accessible to allow diversion of the graywater to the building sewer or septic tank.
3. The surge tank, piping and other materials are to meet a nationally recognized testing standard, such as IAPMO, NSF, AWWA or ASTM.
4. The surge tank shall be installed on dry, level, well-compacted soil if in a drywell or on a level, 3-inch concrete slab or equivalent, if above ground.
5. The surge tank shall be anchored against overturning.
6. The surge tank shall have the rated capacity permanently marked on the unit along with "GRAYWATER IRRIGATION SYSTEM, DANGER - UNSAFE WATER".
7. The surge tank lid shall be gasketed and locking.
8. The surge tank shall be filled with water for water-tightness testing.
9. The tank shall be properly vented as per Chapter 5 of the CPC which requires venting through roof or 10 foot above grade with a screened opening.
10. The surge tank shall have an overflow pipe and emergency drain pipe that drains to and is permanently connected to the building sewer or septic tank. The diameter shall not be less than the diameter of the inlet pipe.
11. A backwater valve shall be installed on the sewer line to prevent backflow of sewage into the surge tank.
12. All graywater piping shall be marked or have a continuous tape stating "DANGER - UNSAFE WATER".
13. The supply lines shall be water tight and glued, ABS or PVC with schedule 40 fittings.
14. Pump systems shall be pressure tested at 40 psi from the tank to the point of irrigation, emitter or trench to ensure water tightness.
15. A maintenance manual shall be provided by the contractor or installer of the graywater system.
16. Any connection to a potable water system for make up water requires an air gap or the installation of an approved backflow prevention device. In addition, an approved backflow prevention device shall be installed at the public water meter if required by the local water purveyor.

Additional design requirements as specified in the Irrigation Field and Disposal Field sections of this Guideline will also be evaluated during the system inspection.

Upon completion of the inspection, a written report will be provided to the property owner. If approved, the report will provide the details on the installation and give approval for the graywater system to be backfilled. If the inspection is disapproved, the required corrections will be listed along with any requirements to obtain a reinspection permit. DEH will notify the local building department when the DEH permit inspection has been completed.

### **Authority**

California Plumbing Code, Title 24, Part 5, California Code of Regulations, Chapter 16, "Alternate Water Sources for Nonpotable Applications" (CPC) which addresses the permitting, construction, inspection and specifications for graywater systems for subsurface landscape irrigation.

San Diego County Code of Regulatory Ordinances Title 6, Division 8, Chapter 3, Section 68.301 et al, known as the Onsite Wastewater Treatment System Ordinance which addresses the permitting, construction, inspection and specifications for onsite wastewater treatment systems.

San Diego County Code of Regulatory Ordinances Title 9, Division 4, Chapter 1 which adopts the California Plumbing Code as the San Diego County Plumbing Code.