



**Appendix C**  
**Alaska Department of Environmental Conservation**  
**Division of Water Program Guide**

**Graywater Treatment and Disposal Systems**  
**For Temporary & Remote Camps**

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**Introduction**

This step by step guide provides information to assist temporary (24 persons or less) remote camp operators and others install the appropriate size and type of graywater treatment and disposal system. With this information you will be able to install a system that meets all the requirements for proper graywater handling at your temporary camp. This guide will:

- Assist you in assessing your graywater treatment and disposal design needs.
- Help you choose the appropriate location for your graywater system.
- Describe the design specifications for proper installation.

This guide discusses the treatment and disposal of graywater only and is only applicable to temporary and remote camps. Graywater is wastewater from a sink, shower, bath, laundry, kitchen or other domestic source and is intended to be used at temporary camps where human waste (excrement and urine) is handled using a using a pit privy, composting toilet or incinerating toilet. See the Department's Pit Privy Guide for information on designing, maintaining and closing a pit privy.

The amount of graywater your operation will produce determines what graywater treatment and disposal system you should consider.

Graywater must be treated to remove unsuitable materials prior to disposal to the environment. This guide provides several graywater treatment options that may be used in conjunction with two types of disposal; land surface disposal and subsurface land disposal. Surface (land) disposal may be allowed provided that a facility meets certain minimum requirements that are intended to protect sensitive receiving environments. Subsurface disposal may also be used when appropriate.

**STEP ONE: Estimate the quantity of graywater that will be produced each day.**

Use the chart below to make this estimate. The number of people per day is the maximum number of individuals who will be at your camp, including owners, operators, staff and guests. Multiply the per-person quantities by the maximum number of people (24 maximum) to estimate the amount of graywater produced each day.

<b>Water System</b>	<b>Amount of Graywater</b>
Non pressurized water system with one tap and water is used only for cooking and dishwashing	3 gallons per person per day
Pressurized water system where water is used for bathing, general cleaning, cooking and dishwashing (by hand)	20 gallons per person per day
Pressurized water system where water is used for bathing, general cleaning, cooking, dishwashing (by machine or by hand) and laundry	35 gallons per person per day

**STEP TWO: Determine type of graywater treatment system you will need.**

Use the chart below to determine what type of system(s) you will need.

0 - 50 gallons per day	Small volume graywater barrel treatment system may be used (1 for each 25 gallons per day of graywater produced)
0 to 500 gallons per day and no more than 90 days per year of use	Graywater treatment system with ground surface discharge <u>or</u> with soil absorption system
More than 500 gallons per day and/or more than 90 days per year of use	Graywater treatment system <u>and</u> soil absorption system

**STEP THREE: Decide where to locate your graywater treatment and disposal system.**

The graywater treatment and disposal systems must meet the minimum separation distances in the chart below. These minimum separation distances apply to the barrel treatment system and to the treatment basin and ground surface or soil absorption disposal systems.

<b>MINIMUM REQUIRED SEPARATION DISTANCE Measured Horizontally or Vertically</b>	
100 feet	Between a graywater treatment system/disposal system (disposing to surface or subsurface) and surface water, river, lake, stream, marine waters, wetlands, sloughs, and swamps.
150 feet	Between a disposal system (surface or subsurface) and a non-public drinking water source, such as that supplying a small temporary camp.
200 feet	Between graywater treatment system and/or disposal system (surface or subsurface) and any water source used to supply a public water system serving at least 25 people for more than 60 days.
25 feet	Between a graywater treatment or disposal system and any property line or right-of-way (ROW)
20 feet	Between a graywater treatment or disposal system and any structure, whether permanent or not, at your facility
4 feet	Between the bottom of the soil absorption system or the drain rock under the barrel treatment system and groundwater, measured vertically.
6 feet	Between the bottom of the soil absorption system or drain rock under the barrel treatment system and bedrock or other impermeable layer such as permafrost.

If you cannot meet these setback requirements, contact the DEC Temporary Camp Coordinator at the location on the cover sheet of this packet for further assistance. You may be required to provide to DEC site-specific information that documents your facility's particular circumstances, or you may not be eligible for coverage under this application.

#### **STEP FOUR: Choose how you will treat the graywater to achieve a primary treatment level.**

Primary treatment means that particles 0.04 inch (about the size of a grain of sand) or larger are filtered out before the graywater is discharged. This can be accomplished by purchasing a commercially manufactured system that is rated to treat graywater to primary treatment levels or by building a graywater treatment system on-site.

Two types of graywater treatment systems can be constructed on-site, depending on the amount of graywater produced per day. (See steps One and Two above to estimate the amount of graywater.)

1. The graywater barrel treatment system for a camp or facility treating 50 gallons or less of graywater or less, per day;
2. A graywater treatment basin connected to a surface disposal system or a soil absorption system serving a camp or facility treating 0 and 500 or more gallons per day;

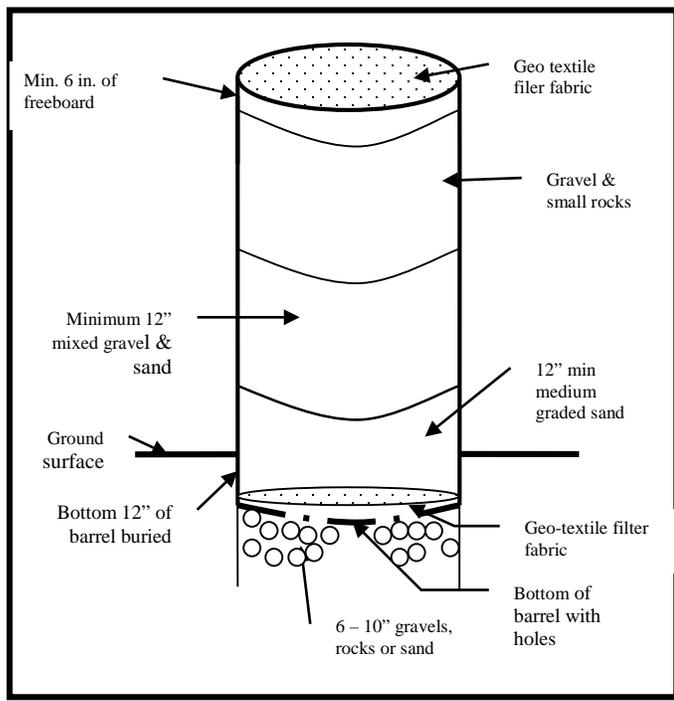
#### **SMALL VOLUME GRAYWATER BARREL TREATMENT SYSTEM**

Materials you will need for this project:

- A 55-gallon container (i.e., drum, garbage can or barrel; called "barrel" hereafter) that is tough enough to withstand some impacts, is water tight and has a snug fitting lid. A plastic container is most suitable because it can be cut into more easily transportable pieces when it is removed.
- A shovel or other digging tool.
- A drill (with 1" drill bit) to make holes in the bottom of the barrel.
- Soil filter material: 12" of mixed gravel and sand, 12" of medium graded sand.
- Non-woven geo textile filter fabric to catch 0.04 inch sized or larger particles.

Construction:

- Choose a location that meets the minimum separation distances in the chart found in Step Three.
- Drill or cut a minimum of four 1-inch holes in the bottom of the barrel. The holes must allow a maximum of 25 gallons of graywater to drain through in one day into the coarse gravel and rocks below the barrel.
- Dig a hole in the ground where the barrel will be placed, slightly larger than the barrel diameter and 18 to 24 inches deep into the soil. Fill the bottom 6 to 12 inches of the hole with coarse gravel and rocks. Make sure the bottom 12 inches of the barrel is buried below the ground and that the barrel is stable and plumb.
- Place a piece of non-woven geo textile filter fabric (sized to catch 0.04 inch particles) inside the barrel and over the holes to prevent the sand layer from escaping the container.



**Diagram 1: Barrel Treatment System**

- Add 12 inch layer of graded sand (similar to ashtray sand) into the bottom of the barrel on top of the filter fabric.
- Next add a 12 inch layer of mixed gravel and sand.
- Finally add a layer of gravel and small rocks to the barrel. Allow at least 6 inches of free-space at the top. This space is necessary so graywater doesn't overflow the treatment barrel when poured in.
- Place a filter cover made from a non-woven geo textile filter fabric (sized to catch particles 0.04 inches and larger) across the top of the barrel. Leave a slight bow to the fabric so the graywater will not spill out or run off when added.
- Cover the top of the barrel with a snug fitting lid that will shed rain and keep animals, birds and insects away from food scraps that may accumulate on top.

The small volume graywater barrel treatment system **operational requirements** are:

- Twenty-five gallons or less of graywater per day can be treated in a single small volume graywater barrel treatment system.
- A facility can only have one or two small volume graywater barrel treatment systems operating simultaneously at the camp.
- The graywater barrel treatment system needs to be protected from rain and snow.
- Spills, leaks or surfacing of graywater must be prevented from all small volume graywater barrel treatment systems. This protects people at your camp, public health and Alaska's water quality.
- Replace or repair a system immediately if there are leaks or surfacing of graywater.
- If filtration is slow, replace the soil filter material. Use care when handling used filter soil – it may contain harmful bacteria. Disinfect with hydrated lime as required.

## BAGFILTER GRAYWATER TREATMENT BASIN

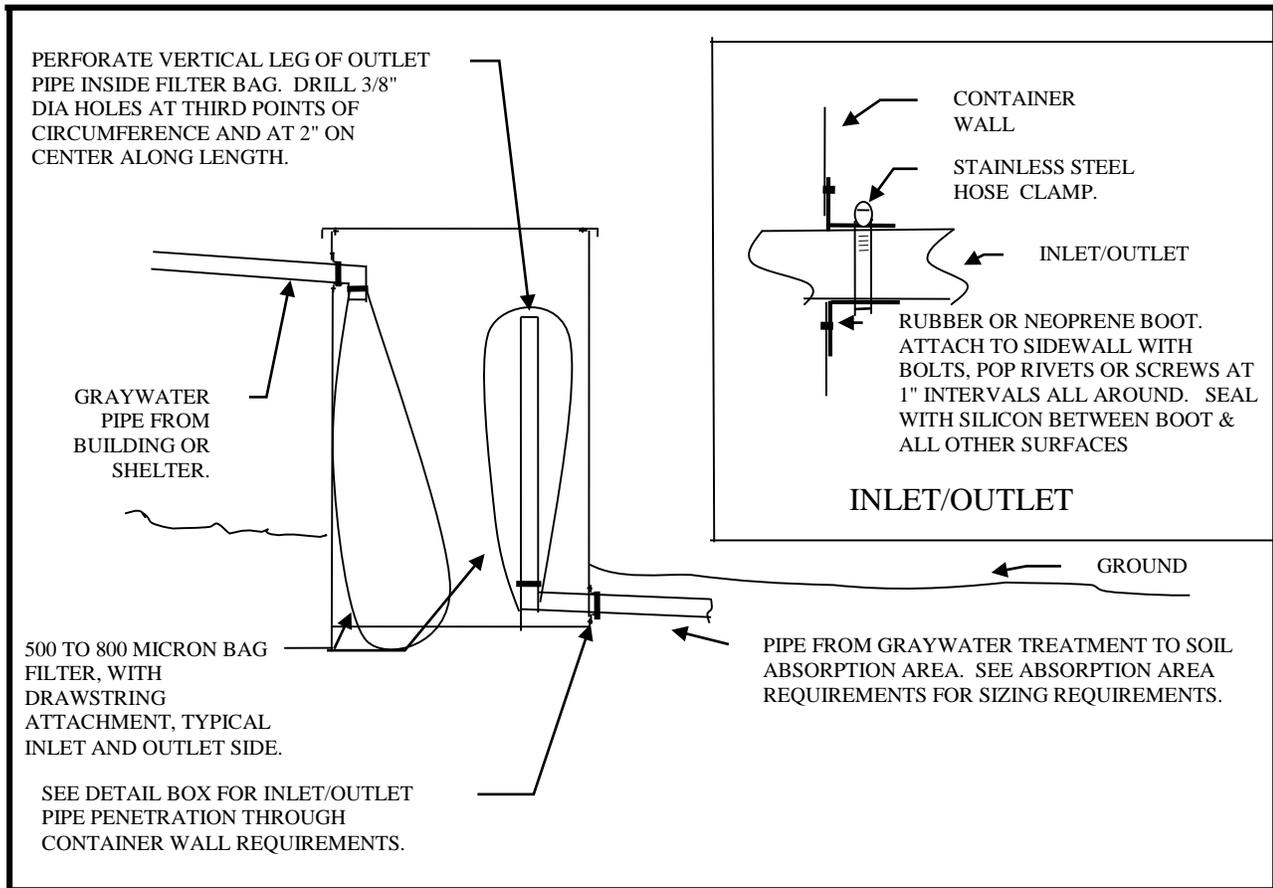
This system is used to treat and dispose of larger quantities of graywater (i.e., greater than 50 gallons per day). Unlike the barrel treatment method, this system has a separate treatment “basin” that filters out the particles larger than 0.04 inches. Following treatment in the “basin”, the leftover graywater receives final disposal, according to the daily volume generated (Step Two). Graywater is discharged to either the ground surface (for daily volumes up to 500 gpd and when site is used no more than 90 days per year) or to a soil absorption system (for daily volumes of up to 840 gpd or when a site is used more than 90 days per year).

Treatment basins may be built at the site in accordance with the drawing below, or they may be self-contained manufactured units that have been evaluated and approved by NSF/ANS. Standard 46 as devices used in wastewater treatment systems. A listing of acceptable treatment basins may be obtained at [Onsite Wastewater Treatment System Services](#)

Construction specifications for a graywater treatment basin required for land surface or subsurface absorption systems:

- Choose a location for both the treatment basin and the soil absorption system that meets the minimum separation distances described in the chart in Step Three.
- The graywater treatment basin:
  1. Must be made of durable materials such as plastic or painted plywood/metal that will not rust, corrode or breakdown when wet and must be constructed to prevent the entry of rodents, vermin, snow and rain.
  2. Must have walls thick enough to withstand external soil backfill pressures (if partially buried) and internal water pressures.
- Penetrations through the basin walls for the inlet and outlet pipes must be durable and water tight.
- Piping materials must be durable, suitable and properly sized for intended use.
- An internal filtration system must be constructed inside the basin with separate bag filters at the inlet and the outlet that:
  - Have openings that are between 500 and 800 microns in diameter
  - Are sized to filter no more than 50 gallons per day per square foot of filter area
  - Are securely attached to the inlet and outlet piping, inside the basin with a drawstring to allow for easy changing

## Diagram 2. Graywater Treatment Basin



### STEP FIVE: Determine what type of disposal system will be installed with the treatment basin.

There are two types of disposal systems that may be used: subsurface soil (Steps 5A and 5B) and land surface disposal system (Step 5C)

### Subsurface Land Disposal

There are three types of soil absorption systems to choose from:

1. Gravel-less pipe covered with a fabric membrane. These are available from a variety of plumbing sources and manufacturers.

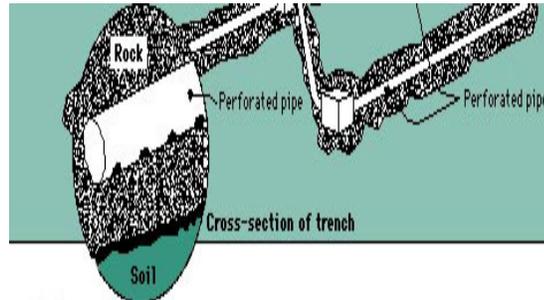


Gravelless single pipe (courtesy ADS)



2. Leaching chambers. These are available from a variety of plumbing sources and manufacturers.

3. A shallow trench type soil absorption system constructed with sewer pipe and 3/4 to 3 inch drain rock as described in the ADEC Installer's Manual for Conventional Onsite Domestic Wastewater Treatment and Disposal Systems. This can be found on the ADEC web site: [ADEC Installer Manual](#)



**STEP 5A: Determine the size of the soil absorption system that will be required.**

Length of soil absorption system =  $\frac{\text{number of people} \times \text{estimated graywater produced per person}^1}{\text{Application rate (from the chart below)}}$

Application Rate (gpd/foot)

Soil Type	8 inch Gravel – less Pipe <sup>4</sup>	10 inch Gravel- less Pipe <sup>4</sup>	Chambered System <sup>4,5</sup>	Drain Field Rock <sup>4</sup>
Granular soils <sup>2</sup>	6.0	8.0	12	4 X trench width
Fine soils <sup>3</sup>	3.0	4.0	6	2 X trench width

<sup>1</sup> In gallons per day per person, based on determination from Step One.

<sup>2</sup> Application rate is 4 gallons per day per square foot for gravels and coarse sand.

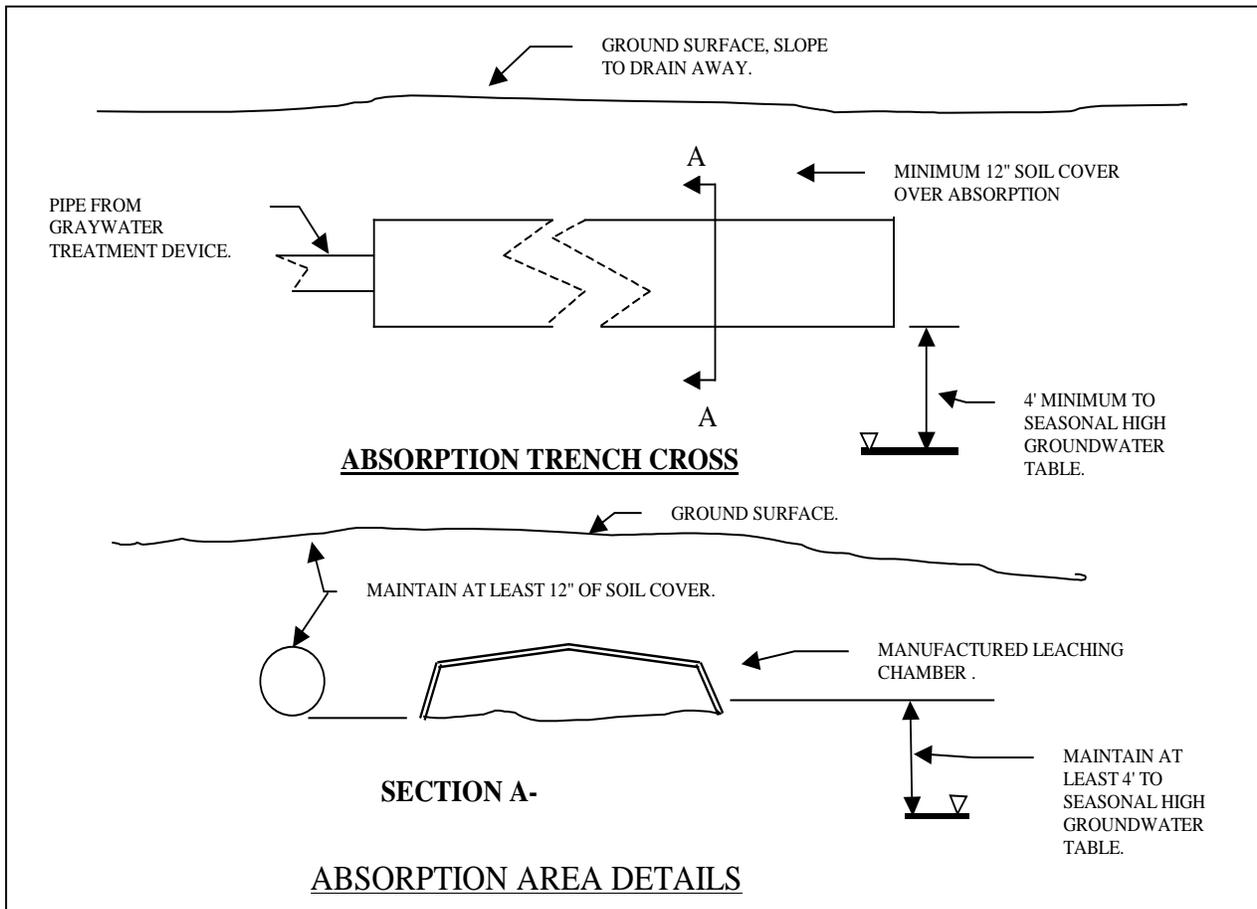
<sup>3</sup> Application rate is 2 gallons per day per square foot for fine grained soil such as silt, silty sand or silty gravel.

<sup>4</sup> In gallons per day per linear foot of pipe, chamber or trench.

<sup>5</sup> Based on a chambered unit width of 3 feet.

## STEP 5B: Install the soil absorption system using the following specifications

- The system must meet all separation distances in Step Three.
- The absorption system must be covered with a minimum of 12 inches of soil (more if operated during freezing conditions).
- Conventional trenches, gravel-less pipe and leaching chamber runs should be 100 feet in length or less.



### Graywater treatment basin and soil absorption system operational requirements:

- Graywater treatment basin and soil absorption system must be operated so that there are no spills, leaks or surfacing of wastewater and in such a manner as to not be a threat to public health or the environment.
- Systems must be repaired or replaced immediately if there are leaks or surfacing of graywater.
- Operating this system during periods of continuous freezing conditions is not permitted unless it is adequately insulated or otherwise protected against frost.

## **STEP 5C: To discharge via surface land disposal**

Surface land disposal must meet the separation distances listed in Step 3. The discharge pipe or hose must be terminated and positioned so that the treated water that is discharged does not directly migrate to surface water or cause erosion or damage to vegetation. The discharge area should be closely monitored to make sure that vegetation is not damaged and to prevent accumulation of slimes or other residual materials. The point of discharge (such as end of hose) should be periodically moved. The area must be clearly marked or fenced to prevent foot traffic.

For more information or if you have questions, contact:

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