

## Section 10 – Design Criteria: Components

### 1. Tanks and Vaults

#### a. Watertightness

- i. Septic tanks, vaults, dosing tanks, other treatment components, risers and lids must not allow infiltration of ground water or surface water and must not allow the release of wastewater or liquids through other than designed openings.
- ii. When the final compartment of a tank is being proposed for use as a pump or siphon chamber, the wall between this chamber and the previous chamber must be watertight except for the intended hydraulic opening.
- iii. Acceptable watertightness testing methods performed at a manufacturer's site or in the field include water filling the tank or vacuum testing.

#### b. Tank Anchoring

- i. In locations where ground water or floodwaters may cause instability problems to the septic tank, vault, or other treatment unit in the OWTS due to flotation, the tank, vault or unit must be anchored in a manner sufficient to provide stability when the tank is empty.
- ii. Buoyancy calculations must be provided. Risers must be included in buoyance calculations.
- iii. If a manufacturer provides recommendations for anchoring designs, they may be used if they meet the conditions present at the site.
- iv. If a manufacturer does not provide recommendations for provisions to compensate for buoyancy, or if the professional engineer chooses to provide his/her own designs, the anchoring system design must be prepared by the professional engineer.

#### c. Identification and Data Marking

- i. All tanks and treatment units must be permanently and legibly marked in a location for the purpose of inspection that is readily visible when inspected before backfilling. The marking inscription must include the following:
  1. Name of manufacturer;
  2. Model or serial number, if available;
  3. Effective volume and unit of measure;
  4. Maximum depth of earth cover and external loads the tanks is designed to resist; and
  5. Inlet and outlet identifications, if relevant.

## 2. Septic Tanks

- a. The manufacturer must provide sufficient information to demonstrate that the tank will meet the design specification.
  - i. Sizing for residential capacity for new installations must be based upon the number of bedrooms according to Table 10-1:

**Table 10-1 Tank Sizing Chart**

<b>Number of Bedrooms</b>	<b>Tank Capacity (gallons)</b>
3 or less	1,000
4	1,250
Each Additional	250

- ii. For multi-family and non-residential applications, a septic tank must be sized to permit detention of incoming wastewater design flows for a minimum of 48 hours.
  - iii. For systems that remove toilet waste for separate treatment, tank capacity may be less than 1,000 gallons, if it provides a minimum of 48 hours detention time.
  - iv. Minimum tank size for new installations other than for a single-family residence is 400 gallons.
- b. Inspection and Testing of Septic Tank Watertightness
  - i. Testing of septic tanks must be performed and evaluated as specified in section 9 of ASTM C1227-13 (Standard Specification for Precast Septic Tanks) for concrete tanks or in Standard IAPMO/ANSI Z1000-2013 (American Standards for Prefabricated Septic Tanks) for other prefabricated septic tanks.
  - ii. Each unit must be inspected in the field for conditions that may compromise its watertightness.
  - iii. The inspection in the field must be conducted by The Clear Creek Environmental Health Department and be performed after the tank installation but before backfilling.
  - iv. If the inspection in the field indicates that the tank may be damaged or is not watertight, the inspector may require that the tank be tested for watertightness by the tank manufacturer or the system contractor.
- c. Septic Tank Design and Dimension Criteria
  - i. A septic tank must have two or more compartments or more than one tank may be used in series. The first compartment of a two-compartment tank or the first tank in a series must hold no less than one-half of the required effective volume.

- ii. Inlet invert must be at least two inches higher than the outlet invert.
  - iii. Inlet tee or baffle must extend above the surface of the liquid at least five inches and must extend a minimum of eight inches below the liquid surface. However the inlet tee or baffle must not extend to a depth of more than 40 percent of the liquid depth measured from the liquid surface.
  - iv. Outlet tee or baffle must extend at least 5 inches above and 14 inches below the outlet invert, however it must not extend to more than 40 percent of the liquid depth measured from the liquid surface. The outlet tee or baffle that accommodates an effluent screen must be located so that the effluent screen has sufficient clearance to be removed through the access opening with a riser in place.
  - v. The distance from the outlet invert to the underside of the tank top must be at least ten inches.
  - vi. Liquid depth must be a minimum of 30 inches and the maximum depth must not exceed the tank length.
  - vii. The transfer of liquid from the first compartment to the second or successive compartment must be made at a liquid depth of between 35 and 40 percent of the liquid depth measured from the liquid surface.
  - viii. At least one access opening no less than 20 inches across must be provided in each compartment of a septic tank.
  - ix. A septic tank must have a minimum of 25 square feet of liquid surface area and have at least a six-foot separation between inlets and outlets. Septic tanks in series, combined, must have a minimum of 25 square feet of liquid surface area and the sum of the distances between inlets and outlets of all tanks must be at least six feet. The requirements for liquid surface area and separation between inlet and outlet may be waived for tanks with less than 750 gallon effective volume.
- d. Concrete Septic Tank Structural Design
- i. Concrete septic tanks must comply with the structural design criteria of ASTM C1227-13 (Standard Specification for Precast Septic Tanks).
  - ii. The design for each tank model and size by each manufacturer must be certified by a professional engineer as complying with these design and structural requirements and the watertightness standard of this regulation.
  - iii. Certification by a professional engineer must be submitted to the Division for acceptance.
  - iv. Tank slab lids, mid-seam tanks, and the connections between the tank and risers must be designed to provide for a watertight seal.
- e. Fiberglass, Fiberglass-Reinforced Polyester, and Plastic Tanks

- i. All fiberglass, fiberglass-reinforced polyester, and plastic tanks must meet the minimum design and structural criteria of IAPMO/ANSI Z1000-2013 (American Standards for Prefabricated Septic Tanks) and be certified by a professional engineer as meeting these standards. The professional engineer certifying the criteria must be registered or licensed in the United States, but need not be registered in Colorado.
- ii. All tanks must be sold and delivered by the manufacturer or manufacturer's designated representative, preferably completely assembled. On-site tank assembly will be allowed on an as-needed basis.
- iii. Tanks must be structurally sound and support external forces as specified in the standard referenced above when empty and internal forces when full. Tanks must not deform or creep resulting in deflection of more than five percent in shape as a result of loads imposed.
- iv. All tanks must be constructed of sound, durable materials and not be subject to excessive corrosion, decay, frost damage, or cracking.
- v. All seams or connections including to risers must be sealed to be watertight.
- f. Metal tanks are prohibited.

### **3. Abandonment of Tank**

- a. A tank may be completely removed and the parts disposed of safely
  - i. If the tank will remain in place:
  - ii. The tank must be pumped to remove as much waste as possible;
  - iii. The bottom of the tank must be broken so the tank neither floats nor fills with water;
  - iv. The top must be collapsed and the sides may be broken into the void;
  - v. The remaining void must be filled with gravel, sand or compacted soil; and
  - vi. The filled excavation will be graded to surroundings, allowing for settling.
- b. The Department may require abandonment of a tank that is deemed to be a hazard.

### **4. Pipe Standards and Bedding Requirements**

- a. Pipe Standards
  - i. All wastewater pipes used in portions of an OWTS that are pressurized must be constructed of compatible pipe, primer, bonding agent, and fittings. Flexible couplings to connect pipes may only be used in portions of an OWTS that are intended for gravity flow of the wastewater.

- ii. Where unperforated plastic pipe and fittings are used for gravity flow, the minimum wall thickness of the pipe must conform to ASTM Standard D 3034-16 (2016 version) or equivalent or greater strength. Schedule 40 pipe is preferred.
  - iii. Perforated distribution pipe surrounded by rock within a soil treatment area must have a minimum wall thickness and perforations conforming to ASTM Standard D 2729-17 (2017 version) or equivalent or greater strength. Corrugated polyethylene pipe with smooth interior that meets ASTM F405-13 (2013 version) or AASHTO M252-09 (2009 version) specifications or equivalent may be used.
  - iv. Schedule 40 [ASTM Standard D 3034-16 (2016 version)] or pipe of equivalent or greater strength must be used for the placement of piping under driveways or roadways and in instances where sewer line setback distances are granted a variance for any reason.
  - v. Tile pipe, open-joint pipe, and cast iron pipe must not be used in an OWTS.
  - vi. Pressure pipe must be rated for the intended use to accommodate pump discharge pressure.
- b. Bedding
- i. All system piping, except for distribution laterals within the soil treatment area, must be bedded with select material before final inspection by the Department.
  - ii. Select bedding material must consist of loose, granular material, free from stones, clods, frozen soil, or other deleterious material. Select material may consist of on-site job-excavated or imported material.
  - iii. Bedding material must be mechanically compacted to support piping.
- c. Cleanouts required between the building and the septic tank:
- i. Cleanouts must have a secure cap and a riser extending to or easily accessible from grade. The installation of a straight tee or sanitary tee is acceptable.
  - ii. Cleanouts must be provided within five (5) feet of the outside of the building.
  - iii. Where a sewer has a change of horizontal direction greater than 45 degrees, a cleanout must be installed at the change of direction unless a cleanout already exists within 40 feet upstream of this fitting. Where more than one change of direction greater than 45 degrees occurs within 40 feet of a developed length of piping, the cleanout for the first change of direction may serve as the cleanout for all changes within that 40 feet of developed length of pipe.
  - iv. Cleanouts must be provided at intervals within the building sewer from the structure to the tank of not more than 100 feet. The effluent pipe between the septic tank and soil treatment area is exempt from this requirement

## **5. Distribution Box**

- a. A distribution box, if used, must be of sufficient size to distribute effluent equally to the laterals of a trench or absorption bed system. The box must be constructed with the inlet invert at least one inch above the level of the outlet inverts. Flow equalizers or similar devices must be used to adjust the flow between laterals. Access to the box must be provided with a manhole riser with access lid at or above grade if the top of the box does not reach final grade.

## **6. Drop Box**

- a. In sequential or serial distribution, a watertight box may be used to transfer the effluent to the following trench when the effluent in a trench has received the designed level for overflow to the next trench. A drop box shall have a riser at or above final grade, if the top of the drop box does not reach final grade. Outlet pipes in sequential distribution must be designed and installed so that they may be capped off for resting periods.

## **7. Stepdown/Relief Pipe**

- a. In sequential or serial distribution, an unperforated pipe may be used to transfer the effluent to the following trench when the effluent in a trench has received the designed level for overflow from that trench.

## **8. Wastewater Pumping and Dosing Siphon Systems**

- a. Pumps
  - i. Non-clog pump opening must have at least two-inch diameter solids handling capacity where raw wastewater is pumped. A pump opening must not have more than 3/4-inch diameter solids handling capacity if previously settled effluent is pumped.
  - ii. Pumps must be certified to the UL778 (Edition 6 or earlier version) electrical safety standard, bear the seal of approval of CSA, UL or an equivalent testing program and be constructed of corrosion resistant materials.
  - iii. Grinder pumps must also be certified to NSF/ANSI Standard 46 (2017 or earlier version) and bear the seal of approval of the NSF or equivalent testing and certification program.
- b. Floats and Switches
  - i. Automatic liquid level controls must be provided to start and shut off pumps at a frequency or level specified in the design.
  - ii. Floats must be mounted on a stem separate from the pump discharge piping to allow for removal, adjustment, and replacement of the float from grade without removing the pump.
  - iii. Float switches must be certified to the UL60947-4-1 (Edition 3 or earlier version), or CSA C22.23 No 205-17 (2017 or earlier version) electrical safety standard,

bear the seal of approval of CSA, UL or an equivalent certification program and be constructed of corrosion resistant materials.

- iv. Dosing siphons for pressure dosing and higher level treatment systems must provide for a means of determining the number of dosing events.

c. Location of Pump or Siphon

- i. A pump or a siphon may be installed in a separate tank following the septic tank. The tank must be of sufficient volume to allow pump or siphon cycling commensurate with the design capacity.
- ii. The second compartment of a two-compartment septic tank may only be used as the pump tank when the tank is specifically designed for this purpose and it can be demonstrated to the satisfaction of the local public health agency that the minimum 48-hour detention time will not be decreased. The pump must be screened or provided with an approved filtering device to assure that only liquid effluent will be discharged. The transfer of liquid from the first to the second compartment must be at an elevation that is between the inlet and outlet invert elevations, and through a standard tee designed and located as per the requirements of Section 10.4.c.iv.
- iii. Siphons must not be installed in the second compartment of a two compartment tank.
- iv. The use of a three-compartment septic tank, sized to provide the required effective volume in the first two compartments with the pump or siphon in the third compartment is acceptable for tanks specifically designed for this purpose. The transfer of liquid from the second to the third compartment must be at an elevation that is between the inlet and outlet invert elevation, and through a standard tee designed and located as per the requirements of Section 10.2.c.iv.

d. Pump or Siphon Discharge Piping

- i. The discharge pipe from the pumping or siphon chamber must be protected from freezing by burying the pipe below frost level or sloping the pipe to allow it to be self-draining. Drainage must be provided through the bottom of the pump or through a weep hole located in the discharge pipe prior to exiting the tank.
- ii. The pump discharge piping must have a quick disconnect that is accessible from grade to allow for easy pump access and removal.
- iii. The pipe must be sized to maintain a velocity of two or more feet per second.
- iv. Pressure pipes must be designed to prevent air or vacuum locking and allow self-draining of the pipes.

e. Access

- i. The pump or dosing system tank, chamber, or compartment must have a minimum 24-inch diameter access riser, made of corrosion-resistant material, extending to or above ground level. A smaller diameter riser may only be

installed if it is accepted by the Division as an integral component of a specific product during the product review process.

- ii. The access riser must have a watertight connection to the pump or dosing chamber/compartment to prevent infiltration or exfiltration.
  - iii. All other intrusions to the riser for electrical or other component access must also be watertight.
- f. Splice Box
- i. Splice boxes must be located outside the pump system access riser and be accessible from the ground surface.
  - ii. Wire splices are prohibited inside the tank, dosing chamber or riser. Wire splicing must be completed with corrosion-resistant, watertight connectors.
- g. Controls and Circuits
- i. Control panels or other electrical boxes used to control the functions of an OWTS must comply with the following, as appropriate:
    - 1. The pump system must have an audible and visual alarm notification in the event an excessively high water condition occurs.
    - 2. The pump must be connected to a control breaker separate from the alarm breaker and from any other control system circuits.
    - 3. An electrical disconnect must be provided within the line of sight of the pump chamber.
    - 4. The pump system must be provided with a means that will allow the pump to be manually operated; such as an H.O.A. switch (Hand/Off/Auto).
    - 5. The pump system for pressure dosing and higher level treatment systems must have a mechanism for tracking both the amount of time the pump runs and the number of cycles the pump operates.
    - 6. Must bear the seal of a Nationally Recognized Testing Laboratory (NRTL), such as UL or ETL.

## **9. Effluent Screens**

- a. An effluent screen is required on all new systems and repairs where the septic tank is replaced.
- b. If a pump or dosing siphon is used to remove septic tank effluent from the final compartment of the septic tank, the effluent must be filtered prior to dispersal into the soil treatment area. An effluent screen, pump vault equipped with a filter cartridge, or a filter on the discharge pipe, would all be considered acceptable.

- c. The effluent screen must be cleaned at manufacturer-recommended intervals, or more often, if use patterns indicate.
- d. Where an ejector pump, grinder pump or non-clog pump is proposed for use prior to the septic tank, an effluent screen must be installed on the outlet of the septic tank.
- e. The handle of the effluent screen must be installed within twelve inches below the top of the riser.

#### **10. Grease Interceptor Tanks**

- a. All commercial food service facilities and other facilities generating fats, oils and greases in their waste must install a grease interceptor tank.
- b. Grease interceptor tanks shall treat only those portions of the total wastewater flow in which grease and oils are generated.
- c. The grease interceptor must have a minimum of two compartments and must be sized proportionate to the amount of fats, oils and grease it receives, the peak flow rate through the tank, and the expected cleaning frequency.
- d. The inlet and outlet tees or baffles must extend into the bottom 1/3 of the liquid volume, but must be at least 12 inches off the inside floor of the interceptor.
- e. The inlet and outlet tees or baffles must extend at least 5 inches above the liquid level and must provide for a free vent area across the liquid surface.

#### **11. Floor Drains**

- a. Floors drains from any facility, workshop or garage shall not be connected to any OWTS unless that system consists solely of a sealed vault or holding tank.