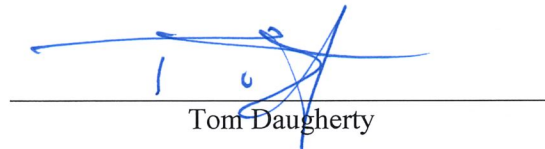


TOWN OF SILVERTHORNE

SANITARY SEWER SYSTEM STANDARDS

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Signed



Tom Daugherty

Public Works Director  
Town of Silverthorne

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TOWN OF SILVERTHORNE  
SANITARY SEWER SYSTEM STANDARDS

I. GENERAL

These Standards are provided as general guidelines, but their use does not relieve design engineers from their responsibilities to provide safe, functional, system designs that meet the standard of care expected of a registered professional engineer in the State of Colorado.

The construction of required collection and service lines for individual residences, subdivisions of residential development, and commercial or other development is the responsibility of the individual developer. Once constructed, the collection main lines and associated facilities shall be deeded to the Town for ownership, operation, and maintenance. Extension of the existing sewer system to and around the developing property shall be governed by the provisions of the code of the Town of Silverthorne, Chapter 3, Article III, Sewers. Main line sewage lift stations to be dedicated to the Town, and which are strongly discouraged and cannot be constructed within easements. The required land tracts must be deeded to the Town.

The Developer shall be responsible for the system costs of collecting sewage from its development and transporting it to an appropriately sized primary collector or trunk sewer line, or JSA interceptor, in accordance with the requirements of this document.

II. BASIC DESIGN PARAMETERS

Unit Sewage Quantities/Characteristics: Estimates of average annual sewage quantities for proposed developments shall be estimated using the Use Classification Schedule as a basis (see Town Code, Chapter 3, Article II), and best engineering practices. Sewage quantities used for design shall be estimated at not less than an annual average daily rate of 280 gallons per day per EQR. The wastewater loading parameters are expected to be that associated with domestic sewage. No industrial wastewater discharge is permitted.

Friction factors: Friction factor values (Manning's n) for sewer system analysis and design shall be at least 0.013 for all types and sizes of material.

Peaking Factors: The peaking factor associated with a particular development shall be calculated based on the use and population being served by a particular collector sewer line.

III. DETAILED DESIGN PARAMETERS

A. Sewer Lines:

1. Trunk Sewers

Trunk sewers to serve Silverthorne are already in place. Should it become apparent during development review that a proposed sewer line placement is advantageous for service to future developments, the Town may require upsizing of the collector for this purpose. Design parameters shall be consistent with those described under Collector System Sewers below. Population estimates for off-site developments for this design will be provided by the Town upon request.

2. Collector System Sewers:

- a. Shall be designed to be either a minimum of eight inches or twelve inches in diameter.
- b. Shall be designed with a depth of flow of 50% ( $d/D \leq 0.5$ )
- c. All gravity sewers shall be designed with a slope sufficient to provide a minimum velocity of 2.0 feet per second at the daily maximum-hour depth of flow design condition. The design minimum velocity shall be listed in the developer's engineering report and shown on the construction documents. Table 5 lists minimum grades for various sizes of pipe - **note that this is addition to the above minimum velocity requirement:**

TABLE 5  
MINIMUM GRADES FOR SEWERS IN ADDITION TO MINIMUM  
VELOCITY REQUIREMENT

<u>Pipe Size</u>	<u>Slope in Percent</u>
4-inch (service)	2.00
6-inch (service)	1.00
8-inch	0.40
12-inch	0.22

- d. All gravity sewers shall be designed with a peak maximum velocity of less than 15 feet per second. Special design and construction considerations and energy dissipation devices shall be employed so that this velocity is not exceeded.

- e. All gravity sewers shall be constructed of SDR 26 polyvinyl chloride (PVC) pipe or polyethylene lined ductile iron pipe, where additional strength is required (such as river crossings). The pipe shall meet the requirements of Details S1, S2, S3, and S11.
- f. Shall be installed at a depth capable of serving the development by gravity. Normally the depths should not be less than eight feet. The absolute minimum depth of cover allowed shall be 4 feet 6-inches. If less than eight feet, shall have special provisions for freezing protection as well as engineered measures to protect the pipe and insulation from crushing or deforming due to surface loads. The sewer shall also be installed at a depth reasonable for connection from above to allow for service to developments upstream as necessary. The maximum allowable depth of cover over the pipe shall be 12 feet. (See Detail S3)
- g. Shall be installed with a minimum 10-foot clear separation from any treated water main (See Detail S10).
- h. Shall be installed with a tracer wire to facilitate future locates.

3. Trench Systems

Pipes shall be bedded so as to not provide hydraulic permeability in excess of that of the natural surrounding soils. At no time shall the bedding be allowed to transport water within the trench or interconnect water, sewer, or service line trenches and bedding. Designing for the prevention of the transport of water within the trench is the responsibility of the design engineer. The following methods have been shown to be effective: Properly compacted impervious bedding material (i.e., road base or flow fill), properly spaced clay dams; PVC anti-seep collars. Other methods may be approved by the Town.

If non-impervious pipe bedding material is used, a system for preventing movement of water is to be installed with spacing determined by the slope of the pipe. A new trench blocking feature is to be installed at a point where the horizontal level of the top of the bedding material at the downstream dam reaches the bottom of the trench at the upstream dam, or at 100-foot intervals, whichever is less.

4. Service system lines:

- a) Shall be a minimum of 4-inches in diameter for single family residential and a minimum of 6-inches for commercial. All lines shall be sized to handle required peak instantaneous flows from the building.
- b) All building sewers shall be run in the shortest practical alignment and at a uniform slope of not less than one-fourth (1/4) of an inch per foot (2%) toward the point of discharge.
- c) Shall be constructed of SDR 26 polyvinyl chloride pipe (PVC), including all fittings and risers including the gasketed transition to the building plumbing.
- d) Shall be connected to main collector lines with a Genco™ Type F (Flanged) tapping saddle connection, or Town approved equal, or with a push on type wye connection at 30 to 45 degrees from vertical. For all new construction, push on type wye connections may be provided for each platted lot. See Detail S1.
- e) Shall be insulated with 100 psi foam under all driveways, roadways, parking areas where any portion of the service line has a depth of cover of less than 8 feet from final ground surface See Detail S3.
- f) Shall be installed with clean-outs within five feet of the building, and then at a maximum spacing of 100 feet, and for each aggregate change in direction exceeding one hundred and eighty (180) degrees – and in conformance with Uniform Plumbing Code. Clean-out piping material shall be the same as the service line piping and shall meet the requirements of Detail S2.
- g) Shall be installed with oil and/or sand interceptors or grease traps on all lines servicing restaurants, car washes and businesses or commercial garages and other locations, and as required by the Town. These traps or interceptors shall be sized and installed in accordance with the Uniform Plumbing Code.
- h) Shall be installed individually to each building, that is, a single separate, service line shall be provided to each sewer account and to each unit of a town house, up to three units. Where a detached accessory apartment has been approved, the service line from the accessory apartment may join the main service line underground, with adequate cleanouts provided.

- i) Shall be installed in accordance with the Currently adopted Plumbing Code unless sections a. thru h. above are more restrictive, then sections a. thru h. shall apply.

B. Manholes:

1. Shall be constructed of materials described in Details S4, S5, S6, S7, and S8.
2. Shall be spaced not more than 500 feet apart
3. When located in pavement or other roadway, the rim shall be depressed 1/4 to 1/2-inch below finished grade and at least one, one-inch precast concrete grade ring must be used. When installed in open ground, the rim shall be installed 6-inches above finished grade with a concrete collar. When manholes are installed in an unpaved road they shall be placed so as to allow for upward adjustment without exceeding the maximum 12-inch grade ring requirement.
4. Shall be designed with a minimum drop of 0.10 foot across the manhole for pipes entering with slopes of 2.5% and less, and with a minimum drop of 0.20 feet for pipes entering the manhole at an angle of 90° to 120° to the outlet pipe. Manhole inverts shall conform to the slope of the inlet pipe if that slope is greater than 2.5%.
5. Shall be constructed as an interior drop manhole if the invert of the inlet pipe is greater than 12-inches higher than the outlet pipe invert. The drop manhole and piping shall be installed as shown in Detail S8.
6. Shall be identified using labels provided upon request by the Town. Generally, a manhole upstream of an existing manhole shall carry an identifying number identical to the manhole being connected to followed by a decimal point and a number sequentially from one and increasing as they are installed upstream (i.e., SA 5.1, SA 5.2, SA. 5.3....). A new manhole installed between two existing manholes shall carry an identifying number identical to the downstream manhole followed by the next appropriate letter of the alphabet. (i.e., SA 5.1, SA 5.1A, SA 5.2...)
7. Shall have the exterior coated with two coats of Town approved epoxy and/or wrapped with a bituthene waterproofing membrane in accordance with manufacturer recommendations for a watertight installation.

C. Miscellaneous Provisions:

1. Sewer Mains must be 8” (eight inches) or larger.



2. The Developer is responsible for the design, construction, and inspection of sewers needed to provide for the collection of wastewater, and servicing of these lines, for the subject property. If the future needs of the Town require a sewer of a size larger than that needed to provide the needs of the development, the Town may pay for the additional cost of material required to have the necessary sized collector or interceptor installed.
3. Lift stations: The Town of Silverthorne will not permit public sewage lift stations to service individual subdivisions or commercial/office development unless a feasibility study has exhausted all possibilities for gravity service. If it is absolutely necessary to utilize a lift station, at a minimum it must have the following characteristics:
  - a. Entrance and main service level shall be at least one foot above the 100-year flood plain and the elevation of the lowest flood or floodproofing of the structure, to be at least two feet above the Base Flood Elevation.
  - c. Stand-by power will be provided for the peak design pump capacity and all building loads.
  - d. The lift station shall be subject to the site approval of the Colorado Department of Public Health and Environment.
4. Easements. Where a sewer line which will become the property of the Town and crosses or is located on private property, an exclusive easement for the vehicular access, maintenance, operation, repair, upsizing, or replacement of the item or system must be dedicated to the Town and labeled as an Exclusive Sewer Easement on all project documentation. The easement shall meet the following requirements:
  - a. The exclusive easement shall be 25 feet in width, usually 12-1/2 feet on both sides of the center line of the pipe for the full length of the pipe on the subject property. If both water and sewer lines are to be within the easement then it shall be an exclusive easement 35 feet in width, with at least a 10-foot clear distance between the pipes.
  - b. An appropriate deed or dedication will be required to be conveyed to the Town at or prior to final acceptance request of the lines and/or facilities.
  - c. The easement shall stipulate that the Town is not responsible for and has the right to limit surface improvements installed within the easement and over the line. Generally other buried utilities, either parallel or crossing at less than 45 degrees, may not be installed in

the Easement. Any buried utilities within the easement, when permitted, require written permission from the Town.

- d. The easement shall be labeled in accordance to its use i.e., EXCLUSIVE 25FT WATER for water facilities, EXCLUSIVE 25FT SEWER for sewer facilities (EXCLUSIVE 35FT WATER AND SEWER EASEMENT), **Water and Sewer easements shall not be labeled as utility easements.**
5. Whenever any water main lines are crossed, the water main and sewer main or service line shall have full length, not less than 20', single sticks of pipe centered on the crossing (See Detail S11).
6. Landscaping, revegetation, surface restoration, and erosion control:
  - a. Whenever a sewer line is installed in an open area (area other than a surfaced path or roadway), the surface shall be restored to its natural condition. Any area requiring revegetation shall be watered regularly to promote growth of healthy grass. Trees are not permitted within the exclusive easements.
  - b. Areas that are at high risk for erosion, as determined by the design engineer and/or the Town, require additional measures such as riprap, planting of low shrubs, and the use of erosion control netting to promote slope stability.
7. Placement of utilities within right-of-way or easements – Detail S10  
The Town has a typical cross-section of utility placements within a street right-of-way. The layout shall be used and included in the plans and specifications for all projects. Placement within an easement shall meet the provisions of Section III.C.3 of this document. If permitted, any other crossing utilities must cross water and sewer lines at a minimum 45-degree angle.

#### IV. SPECIFICATIONS

- A. Material: All material shall be new and the best available. It shall be specified according to the latest revision of the standards of the American National Standards Institute (ANSI) and the American Society of Testing and Materials (ATSM). The following are the minimum requirements.
  1. Pipe.
    - a. Polyvinyl chloride pipe shall be suitable for gravity sewer service and shall meet or exceed the requirements of ASTM Specification SDR-26 (PS115). All fittings and cleanouts shall be made of the

same class and by the same pipe manufacturer with bells at each joint or a bell and spigot connection.

- b. Ductile iron pipe shall be at least Class 52 in accordance with ANSI Specification A.21. with push on joints and shall have a polyethylene lining at least forty mils thick conforming to the requirement of ASTM D1248.
2. Manholes shall be constructed of cast-in-place concrete bases, or precast bases if approved by the Town, and precast barrel sections similar to Detail S6 and S7.
- a. Precast concrete sections shall conform to ASTM Specification C478.
  - b. Poured in place bases shall be constructed of concrete with a 28-day compressive strength of 3,000 psi and shall be reinforced with standard deformed reinforcement conforming to the requirements of ASTM Specification A615, Grade 60.
  - c. The rim, frame and cover shall be constructed of highway rated (H-20) cast iron conforming to the requirements of ASTM A48-76 Class 35 or ductile iron conforming to ASTM A536-80 grade 65-45-12 where required. This item shall be "J-Mark" 1161 or "Neenah" R-1706, (or Town approved equal) with "Sewer" stamped on top.
  - d. In the floodplain or any other areas as determined by the Town, waterproof bolt down lids shall be provided. These shall be bolt down frame and cover similar to "Neenah" R-1916F1.
  - e. Steps shall be made of Steel Reinforced Plastic.
  - f. Manhole cover elevations shall be adjusted with precast concrete grade rings. These rings shall not be less than six inches wide and shall be furnished to allow for one-inch adjustments. No more than twelve inches adjustment rings will be allowed.
  - g. Seals similar to Ram-Nek or Rubber-Nek shall be provided at mating joints of all manhole sections. Any excess material protruding from the joint shall be removed so that no material can fall into the manhole.
3. Couplings. Pipes of dissimilar materials shall be connected with stainless steel reinforced flexible couplings such as Fernco Proflex, fitting tightly

and providing for proper connection of pipes of different materials and/or diameters.

4. Grout. A non-shrink grout shall be used to seal interior pipe connections to seal manholes watertight. Grouting must be completed prior to application of any waterproofing.
4. Insulation – Detail S3  
Where approved and required, insulation shall be rigid, extruded polystyrene foam boards measuring at least 2 feet wide by 8 feet in length by 2-inches thick with a high-density skin. The boards shall be placed a minimum of 3-inches (6-inches preferred) above the pipe on a compacted back-fill bed. They shall be placed per Detail S3, to form a minimum width of 48-inches or full trench width, whichever is less, and jointed with adhesive tape. Insulation shall be 100 psi rated under driven surfaces and at least 60 psi rated for any other installation.

B. Installation:

1. Installation of sewer Mains and manholes, which will become the property of the Town or will connect to a Town system where service will be provided, shall be performed in a high-quality manner. The work shall be conducted with such forces of workers possessing the necessary knowledge, ability, skill and experience to complete the project in a first class and acceptable condition in a reasonable amount of time. The Town has the right to reject work that has not been completed in a high-quality manner.
2. Safety. In accordance with generally accepted construction practices and the requirements of State and Federal safety regulations, the Developer shall insure that the Contractor understands that they are solely and completely responsible for conditions on the job site, including safety of all persons and property during performance of work. This requirement will apply continuously and not be limited to normal working hours. The duty of the Inspector to conduct construction observation of the Contractor's performance is not intended to include review of the adequacy of the Contractor's and/or Sub-contractor's safety measures, in, on, or near the construction site.

The Developer's Contractor shall at all times whether or not so specifically directed by the Engineer, take necessary precautions to insure the protection of the public. The Contractor shall furnish, erect, and maintain, at his own expense, all necessary barricades, suitable and sufficient warning lights, construction signs, provide a sufficient number of personnel, and take all necessary precautions for the operation of the

work and safety of the public through or around his construction operations.

- 3 At least 48 hours prior to start of construction, final stamped construction drawings must be provided. Any supplied detail shall be subject to review and approval by the Town. A mandatory pre-construction meeting must be scheduled with the Town
5. Trenching and backfill. All trenching and backfill operations shall conform to the requirements set forth by OSHA and as detailed in the Town of Silverthorne, Excavation Permit Process and Standards, Section 2.
5. The Developer shall be responsible for the maintenance and satisfactory operation of the improvements until they receive a certificate of acceptance from the Town, at which time all work will become the property of the Town. Written acceptance will not be provided until finished grading and/or any paving is complete. The two-year warranty period shall start when the public improvement is put into use. The Developer is responsible for the satisfactory repair or replacement of any work, material or equipment which becomes defective during this period.

The developer shall request acceptance of the installed facility by the Town upon completion of the project and upon completion of all “punch list” items. The request shall be made in writing to the Silverthorne Community Development Department per the terms of the Project’s Subdivision Improvement Agreement.

6. Example details: Detail S1 through S11 provided in this text, which may be used if the design engineer determines they are appropriate, are intended to portray types of installation methods which may be compatible with Town systems, and to illustrate the basic standards of construction expected on Town facilities. These details do not relieve the Design Engineer from their responsibilities to provide safe, functional, system design that meets the standard of care expected of a registered professional engineer in the State of Colorado.
7. At the time of final acceptance request, the developer shall provide to Town: “Sewer Videos” of the final installed and cleaned sewer mains, and; as-built drawings meeting the requirements of the Town Engineer, in both plan and profile, of the constructed system indicating the locations, materials, and depths of all system components, and; a sealed letter report from the Design Engineer stating that the improvements were constructed per the approved plans and specifications, or with any pre-approved deviations detailed within this letter report.

C. Observation and Testing: All facilities being constructed by the Developer which will become the property of the Town or which will connect to a Town system shall be subject to observation and inspection.

1. Construction checking.

a. During installation, or as determined by the Public Works Director, the Developer shall provide full-time construction inspection by a qualified inspector who reports to the design engineer, and; the Town may make periodic observations. The purpose of the Town's observations is to generally determine the progress of the work and to see if the work is being performed generally in accordance with plans and specifications. The Town will in no way be responsible for how the work is performed; safety in, on or about the job site; methods of performance, or; timeliness in the performance of the work.

b. Inspection of Work.

(1) Inspectors shall inspect all materials used and observe the work done. Inspections may extend to all or any part of the work and to the preparation or manufacture of the materials to be used. The inspectors will not be authorized to alter the provisions of specifications without the approval of the Town and the Design Engineer, or to delay the fulfillment of the construction by failure to inspect materials and work with reasonable promptness. An Inspector cannot issue instructions contrary to the approved drawings and specifications or act as foreman for any Contractor or Sub-contractor. The Inspector will have authority to reject defective material, and to temporarily suspend any work that is being done improperly – pending a final decision of the design engineer and the Town.

(2) If sub-standard material, not conforming to the requirements of the approved drawings and specifications, have been delivered to the project, or have been incorporated in the work, or if inferior quality work has been performed, then such material or work shall be considered as unacceptable and shall be removed and replaced as directed by the Design Engineer and/or the Town, at the Developer's expense, and before any services may be provided by the Town. All materials shall be subject to examination and testing at any time during

manufacture. The Design Engineer and/or the Town has the right to reject defective materials during manufacture or, before or after they have been incorporated into the work.

- (3) Some of the specific items and work that are required to be tested or checked are listed below. The Developer or its Contractor shall give the inspector and the Town timely notice of the date and time of readiness for observation and inspection. If any work should be covered up without the consent of the Inspector, the Inspector may require that it be uncovered for examination at the Developer's expense.

A list of some specific items requiring complete, continuous, observation and written and photographic documentation follows:

- (a) Sewer line installation, assembly, bedding and back-fill.
- (b) Manhole installation, assembly, waterproofing, concrete collar, and frame installation.
- (c) All service line connections to main lines.
- (d) Main line flushing and videoing
- (e) Final vacuum and leakage tests.
- (f) Alignment and grade test/verification.
- (g) All connections to existing Town systems.
- (h) Clean-out installation.
- (i) Grease, oil, and sand interceptor installation.

2. Testing and tasks associated with sewer construction.

- a. Throughout the progress of the work, several tests are required to be performed to ensure system integrity, to demonstrate system operation, and to ensure system compatibility prior to connecting it to, and placing it into service with, the existing Town system. In general, 48 hours' notice of proposed testing is required to be given to the Inspector and the Town. The following is a description

of the tasks and tests to be performed along with some specific requirements:

- (1) Pipeline Flushing. The Contractor shall flush the pipelines as the work progresses in accordance with standard practice to ensure that sand, rocks, or other foreign material are not left in any of the pipelines. When flushing, care should be taken to prevent damage to property or roadways or erosion of surrounding soils. Flushed debris shall not be allowed to enter the existing sewer system. The design engineer is required to analyze the capacity of any receiving sanitary sewer to assure that a backup will not occur. The Inspector and Town must be present for any pipeline flushing.
- (2) Once the sewer pipelines have been flushed, the sewer pipelines shall be videoed. Properly labeled and identified documentation shall consist of color digital recordings, log sheets, and a written report detailing the condition and orientation of the pipeline and lateral and service line connections/openings. The report shall note the time and date of video inspection, street name, upstream and downstream manholes with correct labeling, direction of view, direction of flow, surface material, pipeline length, pipe section length, pipe size, pipe material, lateral and service connections, recording reference number, distance counter number, and a detailed logging of all defects encountered. Any rejected work shall be repaired, then re-videoed.
- (4) Manhole Visual Examination. The Inspector shall visually check each manhole, both exterior and interior, for flaws, cracks, holes, contamination, or other inadequacies which might affect the operation or watertight integrity of the manhole. Should any inadequacies be found, the Contractor, at his own expense, shall make any repairs deemed necessary by the Design Engineer.
- (5) Manhole and Sewer Line Vacuum Leakage Test. All manholes and sewer lines shall be tested for leakage and all tests shall be witnessed by the Town and the Design Engineer and/or Inspector. The leakage test shall be conducted prior to back-filling around the manhole and shall be carried out per National Pre-Cast Concrete Association guidelines, or as proposed by the Design Engineer and approved by the Town.



- (a) If the manhole fails the test, the Contractor shall make necessary repairs. Repairs and repair procedures must be acceptable to the Town, then retest.
- (b) If sealant has entered the interior of the manhole, it must be trimmed off flush with the manhole walls.

