

CITY OF LONGMONT
SECTION 400 - WASTEWATER COLLECTION
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400.00 MINIMUM DESIGN CRITERIA

400.01 GENERAL

1. All Wastewater collection systems will comply with the requirements of the Standards and Specifications for sanitary sewer and service line construction and may include criteria established by the Engineer for the overall hydraulics of the wastewater utility system. Other criteria may be outlined in Plans as determined by the City.
2. Design and planning criteria shall be in conformance with the City's Wastewater Master Plan (W.W.M.P.), as amended.
3. These standards and specifications apply to pipe sizes up to and including 15 inches in diameter. Sizes larger than 15 inches shall be as determined by the City on a case by case basis.
4. Groundwater barriers or other precautions may be required by the City Engineer in trenches located below the groundwater table.
5. Sewer interceptors (pipes larger than 12 inch diameter) will have flows no greater than a ratio of one (1.0) of flow depth to pipe diameter (d/D).

400.02 SANITARY SYSTEM PLANNING AND DESIGN

1. REQUIRED DESIGN STUDIES AND DESIGN REPORT
 - a. Sanitary Sewer Study: A sanitary sewer study detailing the impacts of the proposed development on the City's sanitary sewer system will be required for major developments. Such study shall include design parameters and flows.
 - b. Design Report: A design report may be required to be submitted to the City prior to Plan submittal/ during the preliminary stages of any design.
2. DESIGN/ PLANNING PERIOD
 - a. Improvements to the City's sanitary sewer system shall be designed for a service life of 50 years.

400.03 SANITARY SEWER FLOW DESIGN CRITERIA

1. AVERAGE DAILY FLOWS: Design average daily flow rates shall be based on 70% of the "Unit Rate of Consumption" values tabulated in Table 1 below. For design purposes, a 20% Infiltration Inflow (I & I) component should be included in the daily flow rates for each land use classification as shown in Table 1:

Table 4-1 Waste Water Design Flow Per Land Classification

| Land Use Classifications | Land Categories | Unit Rate of Consumption (gpdpa)* | Average Daily Flow (gpdpa)* (70% of consumption rate) | Average Design Flow (gpdpa)* + 20% I&I Qavg |
|---------------------------------------|-----------------|-----------------------------------|---|---|
| Residential Land Uses | | Dwelling Units per Acre | | |
| Rural Neighborhood | 1 | 800 | 560 | 672 |
| Single-Family Neighborhood | 1-8 | 1610 | 1127 | 1352 |
| Mixed Neighborhood | 6-18 | 1820 | 1274 | 1529 |
| Multi-family Neighborhood | 18-35 | 2700 | 1890 | 2268 |
| Commercial Land Uses | | | | |
| Downtown Central Business District | CBD | 2050 | 1435 | 1722 |
| Mixed Used Corridor | MUC | 2370 | 1659 | 1991 |
| Neighborhood Center | NC | 2000 | 1400 | 1680 |
| Regional Center | RC | 1200 | 840 | 1008 |
| Employment Land Uses | | | | |
| Industrial/ Economic Development | IED | 1420 | 994 | 1193 |
| Public Institutional Land Uses | | | | |
| Treated Water Irrigation | | | | |
| Parks, Greenways, and Open Space | PGOS | 650 | 455 | 546 |
| Public/ Quasi-Public | PQP | 990 | 693 | 832 |
| Raw Water Irrigation | | | | |
| Parks, Greenways, and Open Space | PGOS | 410 | 287 | 344 |
| Public/ Quasi-Public | PQP | 120 | 84 | 101 |

* Where gpdpa = Gallons per day per acre

2. REQUIRED SEWER HYDRAULIC CAPACITY

The required hydraulic capacity of sewer pipes shall be designed such that the sewer is flowing at no more than 80% of the full depth at the calculated future peak flow rate, unless otherwise approved by the City.

The partial flow rate at 80% (d/D) of the depth is approximately 87% of the sewer’s full-flow capacity (q/Q). See Table 2.

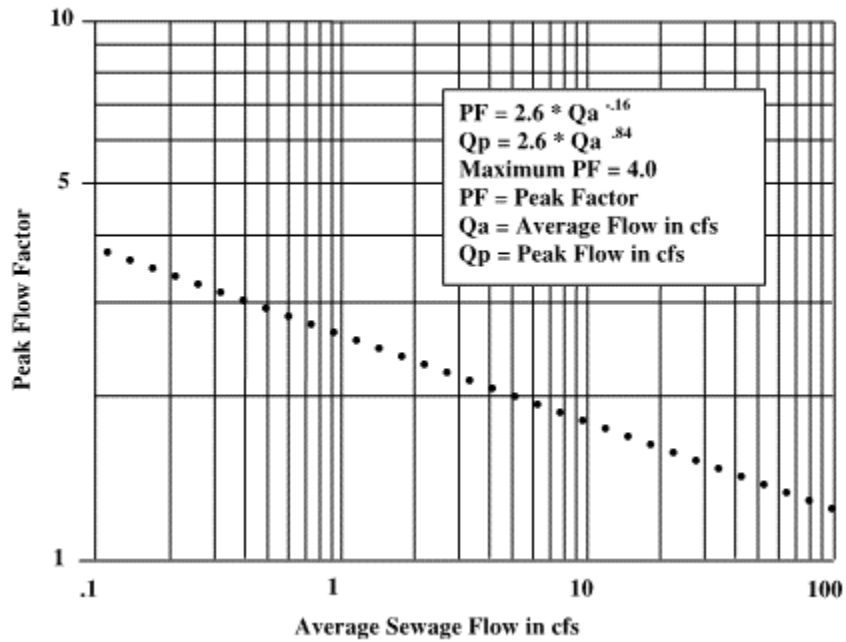
The Average Design Flow, Q_{avg} , is derived from column 4, Table 1 above.

The Peaking Factor (PF) is to be determined using the Peak Flow Factor Graph (Figure 1) or the equation below:

$$PF = 2.6 \times Q_{avg} \text{ (cfs)}^{-0.16}$$

In no cases shall the Peaking Factor be less than 2.0 or greater than 4.0.

Figure 4- 1 Peak Flow Factor Graph



Source: Sanitary Sewer Design Technical Criteria Manual, 2008 Rev, City and County of Denver Department of Public Works

The Required Sewer Hydraulic Capacity, Q , is calculated as follows:

$$Q = \frac{\text{Peak Factor} \times \text{Average Daily Sewer Flow}}{0.87}$$

Example:

Consider a proposed Multi-family Neighborhood development of 29 acres.

Step 1 - Determine Average Design Flow:

Average Design Flow, Q_{avg} , from Table 1: 2,268 gpdpa

Convert to gallons per day: 2,268 gpdpa x 29 acres = 65,772 gpd

Average Design Flow, Q_{avg} (cfs): 65,772 gpd x 1.55 x 10⁻⁶ (cfs)/ (gal/day) = 0.1019 cfs

Step 2 – Determine the Peak Factor:

$$PF = 2.6 \times Q_{avg} \text{ (cfs)} ^{-0.16}$$

$$PF = 2.6 \times (0.1019) ^{-0.16} = 3.75$$

Step 3 – Determine the Required Sewer Hydraulic Capacity:

$$\text{Required Sewer Hydraulic Capacity} = (PF \times Q_{avg})/0.87 \text{ (for pipes flowing at 80\% full)}$$

$$\text{Required Sewer Hydraulic Capacity} = (3.75 \times .1019)/ 0.87 = 0.44 \text{ cfs.}$$

3. SEWER SIZING

The sizing of sewers shall be based on the Manning’s Equation with the following *n* factors:

| Type of Pipe | <i>n</i> factor |
|--------------------------------|-----------------|
| Reinforced Concrete Pipe (RCP) | 0.013 |
| Plastic (PVC etc.) | 0.013 |

Manning's Equation for pipes flowing full, where Q = Flow in cfs

$$Q = VA = \left(\frac{1.49}{n} \right) AR^{\frac{2}{3}} \sqrt{S} \quad [\text{U.S.}]$$

Where:

Q = Flow Rate, (ft³/s)

v = Velocity, (ft/s)

A = Flow Area, (ft²)

n = Manning’s Roughness Coefficient

R = Hydraulic Radius, (ft)

S = Channel Slope, (ft/ft)

Table 4-2 Hydraulic Elements Chart

Source: Sanitary Sewer Design Technical Criteria Manual, 2008 Rev, City and County of Denver Department of Public Works

*** PARTIAL FLOW (q/Q) ***

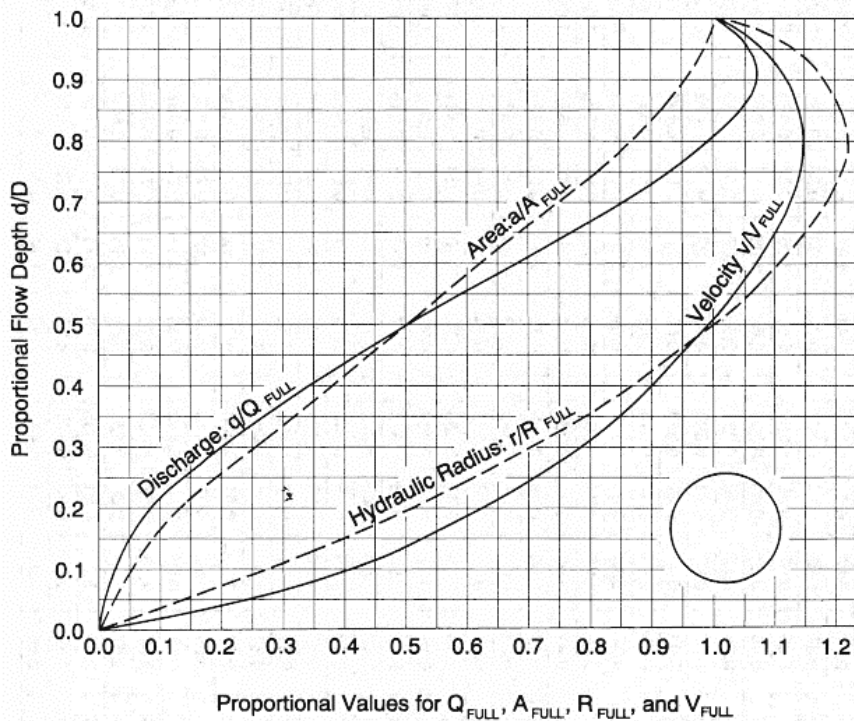
| Depth over Diameter d/D | 0.0x | 0.1x | 0.2x | 0.3x | 0.4x | 0.5x | 0.6x | 0.7x | 0.8x | 0.9x |
|-------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 0.x0 | 0.000 | 0.017 | 0.070 | 0.154 | 0.266 | 0.401 | 0.554 | 0.715 | 0.872 | 1.002 |
| 0.x1 | 0.000 | 0.021 | 0.077 | 0.164 | 0.278 | 0.416 | 0.570 | 0.731 | 0.887 | 1.012 |
| 0.x2 | 0.001 | 0.025 | 0.084 | 0.174 | 0.291 | 0.430 | 0.586 | 0.747 | 0.902 | 1.021 |
| 0.x3 | 0.001 | 0.029 | 0.092 | 0.185 | 0.304 | 0.445 | 0.602 | 0.763 | 0.916 | 1.029 |
| 0.x4 | 0.003 | 0.034 | 0.100 | 0.195 | 0.317 | 0.460 | 0.618 | 0.779 | 0.930 | 1.036 |
| 0.x5 | 0.004 | 0.039 | 0.108 | 0.206 | 0.331 | 0.476 | 0.634 | 0.795 | 0.943 | 1.041 |
| 0.x6 | 0.006 | 0.045 | 0.116 | 0.218 | 0.345 | 0.491 | 0.650 | 0.811 | 0.956 | 1.044 |
| 0.x7 | 0.008 | 0.050 | 0.125 | 0.229 | 0.358 | 0.507 | 0.666 | 0.827 | 0.969 | 1.045 |
| 0.x8 | 0.011 | 0.056 | 0.134 | 0.241 | 0.372 | 0.522 | 0.683 | 0.842 | 0.981 | 1.043 |
| 0.x9 | 0.014 | 0.063 | 0.144 | 0.253 | 0.387 | 0.538 | 0.699 | 0.857 | 0.992 | 1.035 |

*** PARTIAL VELOCITY (v/V) ***

| Depth over Diameter d/D | 0.0x | 0.1x | 0.2x | 0.3x | 0.4x | 0.5x | 0.6x | 0.7x | 0.8x | 0.9x |
|----------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 0.x0 | 0.000 | 0.332 | 0.488 | 0.609 | 0.711 | 0.803 | 0.884 | 0.957 | 1.017 | 1.058 |
| 0.x1 | 0.083 | 0.350 | 0.502 | 0.620 | 0.721 | 0.811 | 0.892 | 0.963 | 1.023 | 1.060 |
| 0.x2 | 0.128 | 0.367 | 0.514 | 0.631 | 0.731 | 0.819 | 0.899 | 0.970 | 1.028 | 1.061 |
| 0.x3 | 0.164 | 0.385 | 0.527 | 0.642 | 0.740 | 0.828 | 0.907 | 0.976 | 1.032 | 1.062 |
| 0.x4 | 0.194 | 0.401 | 0.540 | 0.652 | 0.749 | 0.836 | 0.914 | 0.982 | 1.037 | 1.062 |
| 0.x5 | 0.222 | 0.416 | 0.552 | 0.662 | 0.758 | 0.844 | 0.922 | 0.989 | 1.041 | 1.061 |
| 0.x6 | 0.247 | 0.432 | 0.564 | 0.672 | 0.767 | 0.852 | 0.929 | 0.995 | 1.045 | 1.058 |
| 0.x7 | 0.270 | 0.446 | 0.575 | 0.682 | 0.776 | 0.861 | 0.936 | 1.001 | 1.049 | 1.055 |
| 0.x8 | 0.292 | 0.461 | 0.587 | 0.692 | 0.785 | 0.869 | 0.943 | 1.006 | 1.052 | 1.048 |
| 0.x9 | 0.312 | 0.475 | 0.598 | 0.702 | 0.794 | 0.876 | 0.950 | 1.012 | 1.055 | 1.037 |

Add the value in the top-most row to the value in the left-most column to get d/D. Read the value of the partial element (q/Q or v/V) at the intersection. For example, the partial flow (q/Q) when d/D 0.80 (i.e., 0.8x + 0.x0) is 0.87

Figure 4-2 Hydraulic Elements Chart for Circular Pipes



$$\frac{Q}{Q_{full}} = \frac{V}{V_{full}} = \frac{A}{A_{full}} = \frac{R}{R_{full}}$$

400.04 DESIGN VELOCITIES AND GRADES - MAIN LINES

1. All sanitary sewers shall be designed to ensure that the peak day flows velocities within the pipe will be two (2) feet per second as a minimum and ten (10) feet per second as a maximum. The minimum and the maximum grades of the sewer lines shall be as follows:

Table 4-3 Minimum and Maximum Sewer Pipe Slope

| Pipe Diameter (inches) | Minimum Slope (%) | Maximum Slope (%) |
|------------------------|-------------------|-------------------|
| 8 | 0.40 | 7.5 |
| 10 | 0.25 | 5.5 |
| 12 | 0.20 | 4.5 |
| 15 | 0.15 | 3.5 |

2. Sanitary Sewer mains constructed under these Standards and Specifications shall be designed so as to adequately serve the entire area when fully developed. The minimum allowable size for a sewer main is eight (8) inch diameter. The City reserves the right to resize any sewer main that is inadequate for the proposed use, based on standard engineering practices.

400.05 SERVICE LINE SIZES AND GRADES

1. Service lines shall be designed with a minimum fall of one quarter (1/4) inch per foot (2%) and a maximum velocity of ten (10) feet per second. In the event that site conditions do not allow a 2% slope, the City may grant a variance to the minimum slope requirements. The minimum allowable service line size is four (4) inches. Any building requiring larger than a four inch service shall be sized by the Design Engineer based on standard engineering practices. All service line sizes will be subject to review and approval of the City Engineer.

400.06 DEPTH

1. Unless otherwise approved by the City Engineer due to site specific conditions, sanitary sewer mains should be designed deep enough to accommodate service line installations and a maximum cover of 15 feet. Without exceeding maximum flow velocities, service lines shall be a maximum of ten (10) feet deep at the back of sidewalk. Minimum pipe cover shall be three (3) feet unless otherwise approved by the City Engineer. Refer to Section 100 for minimum allowable vertical clearance to other utilities.

400.07 ALIGNMENT

1. Unless otherwise approved by the City Engineer, sewer mains shall be laid whenever possible at the center line of the street. Sewer mains shall be located a minimum of ten (10) feet horizontally from existing or proposed water mains and storm sewer mains (edge to edge distance) and shall be located a minimum of five (5) feet horizontally from lip of gutter and manholes. Curved sewer pipe may not be used.
2. Sewer mains shall not be installed within 15 feet of any existing building, retaining wall, or structure unless approved by the City Engineer. No structure or retaining wall shall be constructed within a minimum of 15 feet from any sewer main unless approved by the City Engineer.

400.08 FUTURE EXTENSION OF MAINS

1. When a sewer line under construction is anticipated to be extended at a future date, the end of the line shall have a manhole and a plugged stub-out installed in the direction(s) of future extension. Sanitary sewers must be extended to the far edge of the property to be serviced, or to the edge of the platted subdivision, or as directed by the City. All extension lengths shall be subject to the approval of the City.
2. Dead – end main lines with no plans for future extension, shall extend a minimum of ten (10) feet into the last property to be served and a manhole shall be installed at the end of the line.

400.09 MANHOLE GUIDELINES

1. Manholes should be located at all changes in grade, size and alignment. At all instances, the crown of the pipes shall be at the same elevation, or the drop across the manhole between the incoming and outgoing invert flow shall be a minimum of 0.2 feet. Drops less than 0.2 feet will require the City Engineer's approval. When a TEE invert is constructed, the invert coming into the straight through channel must be at least two tenths (0.2) of a foot higher than the out invert. A one tenth (0.1) foot drop between the inverts may be used when the sewer flows straight through the manhole without any bends or branches.
2. Manholes shall be located at street intersections whenever possible.
3. Manholes are to be four (4) foot in diameter for pipes up to and including 15 inches, larger pipes or multiple large pipes shall require manholes with a five (5) foot diameter or larger. See Detail 400-01.
4. Inside drop manholes must be a minimum five (5) ft. in diameter. See Detail 400-05.
5. Manholes must be spaced no farther than 400 feet apart, unless approved by the City Engineer.
6. Manholes should be located in areas which are not subject to flooding from surface runoff.
7. Manholes may not be located in areas where ponding or storm detention basins are to be used.
8. If the manhole invert is deeper than 15 feet below finished grade or rim elevation, a structural design of the manhole base needs to be submitted to the City Engineer for review.
9. Maintenance access: Direct, all weather vehicular access shall be provided to manholes and valve boxes installed in areas outside of the public roadway. This shall consist of a minimum ten (10) foot wide gravel, asphalt, or concrete path or roadway constructed to the thicknesses indicated in these Standards with a minimum 55 foot center line radius on curves.
10. Manholes shall be located a minimum distance of four (4) feet from the edge of the curb and gutter or maintenance access path. If the manhole is located at a greater distance, provide a bulb-out or concrete pad area in order to allow maintenance vehicles to turn-around.
11. If the possibility of surface runoff cannot be avoided, a solid manhole cover, having an integral O-ring type gasket and a waterproof insert that can be bolted closed, must be used. See note for bolt pattern in Detail 400-07.
12. All manholes located outside dedicated street rights-of-way and/or within the one-100 year flood plain shall be designed and constructed with a watertight, bolted type cover and the manhole ring shall be bolted to the manhole cone.

400.10 ABANDONMENT OF EXISTING SEWER LINES OR "STUBS"

1. All sewer service lines that were installed and will not be used shall be abandoned at the main. This shall include excavating the PVC line and installing a PVC plug in the line, pavement removal and restoration. In new construction, abandonment of an existing sewer service line must occur prior to final lift of paving. Removing a tap or wye in a non-PVC tap will require a repair clamp. All other abandonments will require further direction from the City.
2. All sewer lines that tie directly into a manhole, either main lines or service lines, shall be abandoned at the manhole by plugging the inside wall of the manhole with concrete.
3. All abandonments of service lines will need to be approved and inspected by the City.

400.11 GREASE INTERCEPTORS, OIL SEPARATORS, AND SAND INTERCEPTORS

1. If required, grease interceptors, oil separators, and sand interceptors shall conform to the provisions outlined in the corresponding section in the City of Longmont Municipal Code.

401.00 MATERIALS

1. For a specific list of materials accepted by the Public Works and Natural Resources Department see the APPROVED MATERIALS LIST. A copy of the APPROVED MATERIALS LIST can be obtained from the Public Works Department or online from the City’s website.

401.01 POLYVINYL CHLORIDE PIPE (PVC)

401.01.01 DESCRIPTION OF PIPE

1. All PVC pipe sizes four (4) inch through 15 inch shall meet the requirements of ASTM D3034 "Type PSM Polyvinyl Chloride (PVC) Sewer Pipe and Fittings", sizes 18 inch through 27 inch shall meet the requirements of ASTM F-679.
2. All PVC pipe used for sanitary sewer mains shall be “green” in color.

401.01.02 CLASS AND TYPE

1. Unless otherwise approved by the City, all sizes of PVC pipe shall be SDR 35, and shall have the A.S.T.M. Specification, nominal diameter, and name or trade mark of the manufacturer imprinted on the outside of the pipe.

401.01.03 PIPE LENGTHS

1. Pipe shall be furnished in maximum lengths of 14.5 feet except service tees and closure pieces.

401.01.04 JOINT TYPE

1. Unless approved by the City, pipe joint assemblies shall be bell and spigot push-on joints using elastomeric gaskets with an O-ring rubber gasket conforming to ASTM F477. Joints shall conform to ASTM D 3212.
2. Solvent cement joints are strictly prohibited.

401.01.05 PIPE BARREL DIAMETER DEFLECTION

1. The diameter indicated on the Plans shall mean the inside diameter of the pipe.
2. Test each sewer pipe section between manholes for vertical ring deflection after completing backfill.
3. Pipe shall be constructed so that the maximum initial vertical diameter does not decrease by more than 5% of the base internal diameter.
4. The maximum allowable deflection of the line shall be 5% of the base internal diameter.
5. Mandrel outside diameters in inches are as follows:

Table 4-4 Mandrel Outside Diameters and Deflections

| PIPE SIZE, inches | BASE I.D., inches | 5% DEFLECTION |
|--------------------------|--------------------------|----------------------|
| 6 | 5.742 | 5.455 |
| 8 | 7.665 | 7.282 |
| 10 | 9.563 | 9.085 |
| 12 | 11.361 | 10.793 |
| 15 | 13.898 | 13.203 |

7. The contractor shall uncover all pipe sections exceeding the above maximum allowable deflections and replace the bedding and backfill to prevent excessive deflection. Retest repaired sections.

401.01.06 PIPE QUALITY

1. PVC having any of the following visual defects will not be accepted:
 - a. Straight pipe, measured from the concave side, shall not deviate from straight greater than 1/16 inch per foot of length.
 - b. Pipe which is sufficiently out-of-round to prohibit proper jointing.
 - c. Improperly formed bell and spigot ends.
 - d. Fractured, cracked, chipped, or otherwise sufficiently damaged pipe.
 - e. Pipe that has been damaged during shipment or handling. Acceptance of the pipe at point of delivery will not relieve the Contractor of full responsibility for any defects in material of the completed pipeline.

401.02 DUCTILE IRON PIPE

401.02.01 DESCRIPTION

1. Pipe shall be ductile iron, Class 50, or poly-lined, designed in accordance with AWWA C-151, C-150. Fittings shall be cast iron. When allowed, the ductile iron pipe shall be lined with an epoxy lining type. Cement mortar lining will not be allowed.

401.02.02 JOINT TYPE

1. Joints shall be mechanical joint or push-on joint unless otherwise authorized by the City.

401.02.03 CORROSION PROTECTION

1. Refer to Section 500 – Water Distribution of these Standards for corrosion protection requirements.

401.03 VITRIFIED CLAY PIPE

401.03.01 DESCRIPTION

1. The installation of vitrified clay pipe is not permitted.

401.04 ASBESTOS CEMENT PIPE (ACP)

401.04.01 DESCRIPTION

1. The installation of Asbestos Cement Pipe is not permitted.

401.05 FITTINGS FOR SEWER PIPE

401.05.01 DESCRIPTION

1. Fittings used in new sewer construction, unless authorized by the City Engineer, shall be of the same material and class as the pipe to which it is attached.
2. Connections between dissimilar pipe materials are subject to the City Engineer's approval.

401.06 CLEAN-OUTS IN SERVICE LINES

401.06.01 DESCRIPTION

1. All clean-outs will be PVC or cast iron pipe. Clean-outs shall be placed two (2) feet outside of the structure and at a maximum of one hundred feet apart and at each change in direction of one hundred and thirty five degrees or greater as per the I.P.C. If the clean-out conflicts with structures it can be placed in alternate locations conforming to specific site conditions. Clean-outs in traffic areas shall be cast iron and be designed to carry the appropriate weight loads without damage to the pipe or clean-out.

401.07 UNDERDRAINS

401.07.01 GENERAL

1. Refer to Section 300 for underdrain requirements.
2. Underdrains are not a part of the sanitary sewer system and they shall not connect to the system at any time.

401.08 MANHOLES

401.08.01 DESCRIPTION

1. All manholes shall be constructed using precast concrete sections fabricated from Type II cement and otherwise conforming to ASTM C-478. Manhole steps shall be polypropylene meeting the following requirements. They shall be Grade 60 steel-reinforced, corrosion-resistant polypropylene plastic conforming to ASTM C478. They shall be fabricated with positive-friction lock system for being hand driven by hammer into preformed holes.
2. Manhole cones shall be of the eccentric type. See Detail 400-01.

401.08.02 MISCELLANEOUS MATERIALS

1. Mortar; non-shrink, non-metallic grout; and preformed plastic gaskets shall be in accordance with the approved material list.

401.08.03 CASTINGS

1. All castings for manhole, covers and frames and for other purposes must be of rough gray iron, and have a workman like finish free from blow-holes. Manhole frames and covers shall be as indicated on the Approved Materials List.
2. Manhole covers shall have the words "Sanitary Sewer, Confined Space, Entry Permit Required" cast on the cover. Manhole covers will be sized for 24 inch diameter openings, one (1) inch thick, designed for traffic loading. Manhole covers will be located above the pipelines so the City's jetting equipment can access the pipelines. The manhole frames and risers should be designed for H-20 minimum traffic loading.

401.09 CONCRETE AND REINFORCING STEEL

401.09.01 DESCRIPTION

1. All concrete, unless otherwise specified on the approved plans, shall use Type II cement and have a minimum compressive strength of 4,000 p.s.i. at twenty-eight (28) days. The concrete design mix will be subject to the City Engineer's approval. An air entraining agent must be used in all concrete. Metal reinforcement shall be deformed steel bars sized according to their application by the Design Engineer, subject to the approval of the City Engineer. All steel reinforcement shall conform to ASTM A615, Grade 60.

402.00 INSTALLATION OF SEWER MAINS AND APPURTANCES

402.01 PLUGS OR STOPPERS

402.01.01 DESCRIPTION

1. Water-tight P.V.C. mechanical plugs or stoppers shall be furnished for all temporary or permanent stub-outs and all unused branch pipes. The size of the stopper shall be determined by the size of the pipe in which it is installed.

402.02 CONNECTION TO THE EXISTING SYSTEM

402.02.01 DESCRIPTION

1. The physical connection to the existing sewer system shall be plugged until Construction Acceptance has been issued for the project. If improper construction methods or materials are used, or excess infiltration occurs, the City may require the sewer be plugged until satisfactory corrections are made. 48 hours notice must be given to the Inspector prior to any connection to the existing system.

402.03 TAPPING

1. No one is permitted to tap the existing sewer system, except Operations and Maintenance Department personnel. Where tapping is necessary, the Contractor shall apply for the tap and pay the associated material tapping fee. The only size tap directly allowed on a sanitary sewer pipe in accordance with the City of Longmont Municipal Code is four (4) inch. Any larger size line must be brought into the City System through a manhole. Any other service size direct connections to the sewer system must be approved by the City.
2. Six (6) inch WYE connections are not allowed.
3. Taps will be scheduled when the Operations and Maintenance Division is contacted by the Contractor. No tap will be scheduled less than 48 hours, or two working days, from the time the Operations and Maintenance Division is contacted for the tap. No tap will be scheduled until all fees have been paid.
4. When the tapping crew arrives at the site, they will inspect the preparation of the trench for safety, as defined by current O.S.H.A. Standards.
5. The pipe must be sufficiently exposed to accommodate the tapping equipment.
6. When all conditions are deemed safe as described in paragraphs three and four (3 & 4), Operations and Maintenance Division will physically make the tap(s).
7. If the conditions of paragraphs three and four (3 & 4) are not satisfied, the Operations and Maintenance Division personnel will not perform the tap and a new time will have to be scheduled.
8. If rescheduling is necessary due to the fault of the Contractor, all costs for time lost on the originally scheduled tap may be billed to the Contractor.
9. Taps are only made Monday through Thursday. Taps will not be performed on Fridays except for emergency taps.

402.04 GENERAL PIPE INSTALLATION

402.04.01 LOWERING OF PIPE AND ACCESSORIES INTO TRENCH

1. All pipe, fittings, and accessories shall be carefully lowered into the trench with suitable equipment in a manner that will prevent damage to pipe and fittings. Under no circumstances shall pipe or accessories be dropped or dumped into the trench. Pipe and accessories shall be inspected for defects prior to their being lowered into the trench. All foreign matter or dirt shall be removed from the interior and machined ends of pipe and accessories before it is lowered into position in the trench. Pipe shall be kept clean by means approved by the City Engineer during and after installation.

402.04.02 INSTALLATION OF PIPE

1. Every precaution shall be taken to prevent foreign material from entering the pipe while it is being placed in line. The end of the pipe will be plugged or capped with approved materials when work stops. Pipe shall be installed working downstream to upstream with the bell end facing upgrade. All pipe installed must be to the required line and grade and checked to insure there is no variation from that line and grade. No pipe shall be laid when, in the opinion of the City Engineer, trench conditions are unsuitable, such as unstable bedding, pipe subgrade, or trench walls or the presence of contaminated soil or liquids.

402.04.03 CUTTING OF PIPE

1. The cutting of pipe for inserting into fittings, shall be done in a neat and workmanlike manner without damage to the pipe or lining and so as to leave a smooth end with beveled edges recut to match the original pipe. Flame cutting of ductile pipe shall not be allowed. Asbestos cement pipe shall not be cut. An entire section of pipe shall be removed and replaced with a non-asbestos type pipe.

402.04.04 JOINING OF PIPE

1. Push on and mechanical joints shall be installed in accordance with the manufacturer's recommendations.

402.04.05 JOINT DEFLECTION

1. Sewer pipes shall not have any deflections. All pipes shall be laid and maintained to the required lines and grades. No deviation shall be made from the required line or grade except with the written consent of the City. Manholes and other necessary appurtenances shall be installed at the required locations. All pipes shall be laid to the depth shown on the Plans or as directed by the City Engineer in writing.

402.05 SERVICE LINES

402.05.01 GENERAL

1. Each structure and each subdivided lot shall be served by a separate service line. Compound taps are not allowed in the City as per City Ordinance Section 14.08.230.
2. It is the responsibility of the owner of the premises to service and maintain the sanitary sewer service line from the structure to the connection in the main.

3. Sewer service lines shall not be installed in trenches containing conduits which carry potable water without written permission of the City Engineer. Service lines shall be separated laterally from conduits which contain potable water by a minimum of ten (10) feet edge to edge.
4. Exception: For water and sanitary sewer services, where it is not possible to achieve a ten (10) foot separation of the water and sewer services due to the size, location or other physical restraints of the lot, the City Engineer may allow deviation on a case-by-case basis if supported by data from the Design Engineer. Such deviation may allow installation of the water service closer to the sanitary sewer provided the water service is laid in a separate trench or on an undisturbed earth bench located on one side of the trench at such an elevation that the bottom of the water service is at least (eighteen) 18 inches above the top of the sewer.
5. All service lines shall be extended 15 feet into the lot.
6. Location of all service lines shall be marked with an "S" stamped in curb head or sidewalk.
7. All service lines must be inspected by the Inspector. It is the responsibility of the Contractor or Developer to provide to the City Engineer as-built drawings indicating actual locations of all service stubs prior to the issuance of Construction Acceptance.
8. Sanitary sewer service line rehabilitation work will require that a forty eight (48) hour notification be given to the City prior to commencing. All rehabilitation work on sanitary sewer services must be inspected by the City.
9. All six (6) inch or larger sewer service connections into manholes shall channel their influent to flow with the main stream at no greater angle than 45 degrees with a minimum drop of 0.2 feet and a maximum drop of eighteen (18) inches without a drop manhole.
10. Service line bedding, trench backfill, and compaction shall be the same as for the mainline sewer.
11. All services smaller than six (6) inches must connect into a sewer main unless otherwise approved by the City Engineer.

402.06 SETTING OF MANHOLES AND FITTINGS

402.06.01 GENERAL

1. Manholes shall be constructed of concrete in accordance with the Standard Detail 400-01. The materials, operations, excavation, and backfilling shall conform to the applicable sections of these Specifications.

402.06.02 MANHOLE BASES

1. Contractor may provide cast in place manhole inverts or precast manhole inverts at Contractor's option. In case of any change in alignment or elevation of manholes, Contractor is responsible for making all changes with the approval of the City Engineer.
2. All cast-in-place concrete bases for manholes shall be constructed such that they are level conforming to the dimensions as shown on the standard details. Invert channels shall be smooth and semi-circular in shape conforming to the inside of the adjacent sewer section. These must be formed directly in the concrete of the base. For a straight-through manhole with no other inlets, the channel may be constructed by laying a full section of sewer pipe through the manhole and by cutting out the top half of the pipe after the surrounding concrete has hardened. Changes in

direction of flow shall be made with a smooth curve having as large a radius as the manhole will permit. Manhole bases shall be thoroughly bonded to the barrel of the pipe. Provide a rubber water-stop on pipe barrel for PVC pipe. All connections with pipes shall be made without projections or voids. The pipe shall not penetrate more than two inches (2) beyond the interior wall. Flowlines need to extend through the length of the base. See Standard Detail 400-01. Inverts must meet the requirements of the City.

3. All precast concrete bases for manholes shall be constructed level with the precast base and first barrel section monolithic, conformance ASTM C478, Type II cement. The pipe penetration gaskets shall be as specified in the Approved Material List. No modification of precast sections will be permitted on the job site. All such fabrication must be accomplished at the point of manufacture. The manufacturer shall cut openings of sufficient size to receive entering pipes providing three quarter (3/4) inch annular space around the pipe or as required by the manufacturer of penetration gaskets. Inverts within the precast base shall have the same requirements as the inverts for the cast-in-place manhole bases.
4. Pipe size changes shall be accomplished by matching pipe crowns and forming the channel to accommodate the pipe size differential. The floor of the manhole outside of the channels shall be smooth and shall slope toward the channels at not less than one (1) inch per foot.

402.06.03 PIPE CONNECTIONS

1. Manholes shall be thoroughly bonded to the barrel of the pipe. Provide a rubber gasket on pipe barrel for PVC pipe. All connections with pipes shall be made without projections or voids. Where shown on the Plans, a piece of pipe of the proper size shall be built into the manhole where future laterals may be connected. This pipe shall be sealed with a plug at its outer end and an invert shall be built into each manhole for such lateral connections.

402.06.04 DROP MANHOLES

1. Outside drop manholes are not allowed. Inside drop manholes, if necessary, shall be constructed in accordance with Detail 400-05. A minimum five foot diameter manhole is required for inside drops.

402.06.05 MANHOLE STEPS

1. Manholes shall be provided with polypropylene coated reinforced steps not less than fifteen (15) inches in width, built into or thoroughly anchored in the walls at the time of fabrication or installation. No steps shall be installed in the grade rings. These steps shall be positioned, as shown on the standard details 400-01. Steps or rungs shall not be required unless the depth of manhole from ring to invert exceeds three (3) feet. Steps shall be vertically plumb.

402.06.06 PRECAST MANHOLES

1. All precast cones shall be of the eccentric type. Precast sections shall be placed on the manhole base after it has reached sufficient compressive strength per Section 409.01. No modification of precast sections will be permitted on the job site, all such fabrication must be accomplished at the point of manufacture. The manhole base shall be thoroughly cleaned, to prepare for the placing of the precast sections. Preformed plastic gaskets or approved equal, are to be applied to the precast section bearing seat. The first precast section shall be carefully lowered onto the base so that the preformed plastic gaskets or mortar is evenly seated on all sides. The interior side of the first, and if

deemed necessary by the Inspector, other joints shall be grouted with a non-shrink grout. Each succeeding precast section shall be jointed in a similar manner. See Detail 400-01.

2. In areas where the manhole will be exposed to groundwater, damp-proofing shall be provided consisting of an approved waterproofing applied to the thicknesses and recommendations of the manufacturer. The waterproofing shall only be applied to clean surfaces free of oils, greases, and foreign matters and shall not be placed on surfaces when the ambient air temperature is less than 50 degrees Fahrenheit, unless approved by the manufacturer.

402.06.07 MANHOLE RISERS

1. Manhole frames shall be raised using precast reinforced concrete rings or cast in place concrete; No other material will be allowed. The first step will be no lower than 24 inches from the finished grade of the street. Drop-in type risers are not allowed for new construction. Drop-in type risers may be used on overlay projects, but only one riser may be used and it shall not exceed 4 inches in height. All risers must have a minimum of three (3) set screws per riser. No steps are allowed on the riser section. See Detail 400-02.

402.07 UTILITY MARKER SIGNS

402.07.01 GENERAL

1. Utility marker signs, shall be installed by the contractor next to manholes located in open fields or unpaved areas, See Detail 100-10.

402.08 LIFT STATIONS

402.08.01 GENERAL

1. Lift stations are not allowed unless approved through a Design Exception Request process per Section 100 in these City Standards.
2. All Design Exception Requests will be evaluated and approved on a case-by-case basis.

403.00 TESTING

403.01 INFILTRATION TESTING

1. After the compaction of fill material has been completed, tested, and approved, the Contractor will check for infiltration in the main. This check will begin at the furthest upgrade end of the system and proceed downgrade in the main from section to section. A section shall be defined as any portion of installed sewer line between two adjacent manholes.
2. Visible infiltration is not allowed.

403.02 AIR TESTING

1. The air test shall be made when the sewer is clean. The line shall be plugged at each manhole with pneumatic plugs. Low pressure air shall be introduced into the plugged line until the internal pressure reaches four (4.0) p.s.i.g. greater than the average back pressure of any ground water pressure that may submerge the pipe. At least two (2) minutes shall be allowed for the air temperature to stabilize before readings are taken and the time is started.
2. The portion being tested shall pass if it does not lose air at a rate to cause the pressure to drop from three point six (3.6) to three (3.0) p.s.i.g. (greater than the average back pressure of any ground water that may submerge the pipe) in less than the time listed below. If failure of the test occurs in any section, that section must be repaired and retested until satisfactory results are achieved.

Table 4-5 Air Testing

| Pipe Diameter in inches | Minimum Allowable Minutes 3.6 – 3.0 psig Pressure |
|-------------------------|---|
| 6 | 3.0 |
| 8 | 4.0 |
| 10 | 5.0 |
| 12 | 6.0 |
| 15 | 7.5 |

3. All service plugs shall be secured in place to prevent displacement during testing operations.

403.03 MANHOLE LEAKAGE TEST

1. Manholes shall be tested by vacuum testing. Vacuum test after assembly and backfilling, but prior to paving. Care shall be taken to effect a seal between the vacuum base and the manhole rim. Pipe plugs shall be secured to prevent movement while the vacuum is drawn. A vacuum of ten (10) inches of mercury shall be drawn. The time for the vacuum to drop one inch of mercury shall be recorded. If preformed plastic gaskets are pulled out during the vacuum test, the manhole shall be disassembled and the gaskets shall be replaced. Acceptance shall be defined as when the time to drop one inch meets or exceeds the following:

Table 4-6 Manhole Leakage Test

| Diameter | Time to Drop One Inch (1") Hg |
|----------|-------------------------------|
| 4 ft. | 60 seconds |
| 5 ft. | 75 seconds |

2. Manholes will not be accepted if there is any visible infiltration when empty.
3. All installed manholes will be tested. Any manhole with an unsatisfactory test shall be repaired and retested until satisfactory results are obtained.
4. Failure of any test is considered failure of the manhole involved. If the manhole fails the test after repair options have been exhausted, the manhole shall be replaced.

403.04 VISUAL INSPECTION

1. All new sewer lines shall be subject to inspection by lamping or other visual means. All new P.V.C pipe shall be subject to mandrel testing in accordance with section 401.05.05.
2. All newly constructed sanitary sewer lines shall be completely jetted to remove dirt and debris prior to Construction Acceptance. The contractor will be responsible for removing all of the dirt and debris from the lines during the jetting operation and not allow any debris into any active City sewer line. Jetting shall be done after first lift of asphalt is completed. If City inspectors feel a problem exists with the line or if unusual problems occur during construction, the City, at its sole discretion, may require the lines to be videotaped by City personnel or by private contractor, at the developer's expense, prior to Construction Acceptance.
3. Contractor/Developer may, at his expense, hire an independent firm to videotape the sewer line. A designated City employee will be assigned to observe the camera work and video tapes of the line will be supplied to the City for further review.
4. Prior to final lift of asphalt at Final Acceptance, all of the installed sanitary sewer lines shall be videotaped by City personnel. All defects found in the lines at the time of the camera operations shall be repaired prior to the City granting Final Acceptance.
5. Manholes and sewer lines must be clean prior to scheduling video inspection. If rescheduling is necessary due to the fault of the Contractor, all costs for time lost on the originally scheduled camera inspection may be billed to the Contractor.