

## SECTION 4- SANITARY

4.1.	PURPOSE.....	4-1
4.2.	DESIGN REQUIREMENTS.....	4-1
4.3.	PROTECTION OF PUBLIC WATER SUPPLIES.....	4-2
4.4.	STORM WATER PROHIBITED.....	4-2
4.5.	SANITARY SEWER MAIN PIPE MATERIAL.....	4-3
4.6.	SEWER LINES (COLLECTORS, MAINS AND TRUNK LINES).....	4-4
4.7.	SANITARY SEWER SERVICE LINES (LATERALS).....	4-6
4.8.	SANITARY GRINDER/LIFT PUMPS.....	4-8
4.9.	TRENCH EXCAVATION.....	4-8
4.10.	PIPE BEDDING.....	4-10
4.11.	LAYING PIPE.....	4-10
4.12.	BACKFILLING PIPELINE TRENCHES.....	4-11
4.13.	SETTLEMENT OF TRENCHES.....	4-11
4.14.	MANHOLES.....	4-11
4.15.	TESTING OF SEWER MAINS AND MANHOLES.....	4-12
4.16.	VIDEO INSPECTION.....	4-14
4.17.	CONNECTIONS TO EXISTING LINES.....	4-14
4.18.	CONCRETE CRADLE, ANCHORS OR ENCASEMENT.....	4-14
4.19.	HIGHWAY AND RAILROAD CROSSINGS.....	4-14
4.20.	SANITARY SEWER PUMP STATIONS.....	4-15
4.21.	FORCE MAINS.....	4-17
4.22.	CONNECTING FORCE MAIN TO MANHOLE.....	4-19
4.23.	CONCRETE THRUST BLOCKS.....	4-19
4.24.	MISCELLANEOUS REQUIREMENTS.....	4-20
4.25.	RESPONSIBILITY FOR MAINTENANCE.....	4-20

### 4.1. PURPOSE

- 4.1.1. The purpose of this section is to outline requirements for design, construction, inspection, and final acceptance of sanitary sewer mains, house service connections, manholes, and appurtenances.

### 4.2. DESIGN REQUIREMENTS

- 4.2.1. When an existing sanitary sewer main needs to be extended to the Owner/Developer’s property, the same size line shall be extended by the Owner/Developer unless a larger size line is needed. In all cases the sanitary sewer line shall be extended to the furthest of each boundary of the property to allow future extensions. Sanitary sewer extensions shall be located in areas as determined by the City Engineer.
- 4.2.2. In cases where the expected flow from a proposed development will require a larger size line than already exists, the Owner/Developer shall be responsible, at his sole expense, for upgrading the existing system to an increased size that will handle the additional flow. Any cost sharing for these improvements between the Owner/Developer and the City of Lebanon will be determined on a case by case basis through a written request to the City Manager from the Owner/Developer.
- 4.2.3. It shall be the Owner/Developer’s responsibility to determine the downstream critical section of the existing sanitary sewer system. Should this section not be able to handle the additional flow, it shall be upgraded at the sole expense of the Owner/Developer. Copies of all calculations shall be provided to the office of the City Engineer for review and approval. A sample set of calculations is included in the Appendix. All calculations shall be signed and stamped by a

Professional Engineer registered in the State of Ohio. Flow rates shall be determined using the wastewater generation guidelines found in the Appendix.

- 4.2.4. In cases where sanitary sewer is not available to a site, it shall be the Owner/Developer's sole responsibility and cost to extend the sanitary sewer to the site.
  - 4.2.4.1. Sewer lines shall be sized to carry upstream future flows and in accordance with the most current City of Lebanon Sanitary Sewer Master Plan. Copies of all calculations shall be provided to the office of the City Engineer for review and approval. All calculations shall be signed and stamped by a Professional Engineer registered in the State of Ohio. Flow rates shall be determined using the guidelines found in the Appendix.
- 4.2.5. Septic tanks and leaching beds for single- family residences may be permitted, provided both the City Planning Commission and the Warren County Department of Health specifically authorize their use for a particular subdivision and provided further that all requirements of such health agency are complied with. If a septic tank system is used, it shall be approved by the Warren County Department of Health.
- 4.2.6. Pipe and joint materials shall conform in all respects to the material requirements outlined in this section.
- 4.2.7. When, in the opinion of the City of Lebanon, the proposed sewer pipe material is or will be incompatible with the wastewater to be transported, the City of Lebanon reserves the right to specify sewer pipe material which is compatible with the wastewater.

#### **4.3. PROTECTION OF PUBLIC WATER SUPPLIES**

- 4.3.1. There shall be no physical connection between a public or private potable water system and a sanitary sewer or its appurtenances, which would permit passage of any sewage into the potable water supply system.
- 4.3.2. Sanitary sewers and manholes shall be laid at least ten feet (10') horizontally from any existing or proposed water main. When local conditions prevent a separation of ten feet (10'), a sewer main may be laid closer than ten feet (10') to a water main if it is laid in a separate trench; if it is laid in the same trench, the water main must be located at one side on a bench of undisturbed earth. In either case, the elevation of the crown of the sewer must be at least eighteen inches (18") below the invert of the water main.
  - 4.3.2.1. When it is not possible to obtain proper horizontal and vertical separation as stipulated above, the sanitary sewer shall be constructed of Class 53 ductile iron pipe. The sewer main shall be pressure tested and shall withstand a 50 psi pressure test for a distance of ten feet (10') on each side of the water main. One full length of sewer main shall be centered over the water main so that both joints will be as far from the water main as possible.

#### **4.4. STORM WATER PROHIBITED**

- 4.4.1. Storm drainage and subsurface drainage, including foundation drains, shall not be permitted to empty into any sanitary sewer.
- 4.4.2. The following two notes shall appear on all sanitary sewer plans submitted for review and approval:
  - 4.4.2.1. Roof drains, foundation drains, sump pump drains, and all other clean water connections to the sanitary sewer system are prohibited.
  - 4.4.2.2. No buildings shall be connected to a sanitary sewer lateral until the building is under roof or as directed by the City Engineer.

#### 4.5. SANITARY SEWER MAIN PIPE MATERIAL

- 4.5.1. Pipe must be delivered to the job site by means that will adequately support it and not subject it to undue stresses. In particular, the load shall be so supported that the bottom rows of pipe are not damaged by crushing. Pipe shall be unloaded carefully and strung or stored as close to the final point of placement as is practical. Pipe shall be stored on the job site in accordance with the manufacturer's recommendations. Any pipe that has been left uncovered and has subsequently been allowed to discolor, (this discoloration represents an indication of a possible reduction in pipe impact strength) may be subject to rejection by the City of Lebanon.
- 4.5.2. The depth of cover shall determine the required type of pipe to be installed. The City of Lebanon shall determine the type of pipe to be installed based on the depth of cover and the manufacturer's recommendation.
- 4.5.3. Sewer mains larger than eighteen inches (18") in diameter require special design considerations and shall be given special design criteria. An Owner/Developer anticipating construction of sewer mains larger than eighteen inches (18") in diameter shall meet with the City of Lebanon to establish design criteria.
- 4.5.4. The following pipe materials shall be used at the following depths:
  - 4.5.4.1. 14 feet or less – SDR-35 Polyvinyl Chloride (PVC) Pipe, Fittings and Joints
  - 4.5.4.2. Greater than 14 feet through 25 feet – SDR-26 Polyvinyl Chloride (PVC) Pipe, Fittings and Joints
  - 4.5.4.3. Greater than 25 feet – Class 53 Ductile Iron Pipe, Fittings and Joints
  - 4.5.4.4. Gasketed ABS or PVC Composite Pipe (8"-15") ODOT Item 707.47, Fitting and Joints may be permitted on a case-by-case basis with written permission by the City Engineer.
- 4.5.5. PVC Pipe
  - 4.5.5.1. PVC pipe shall meet the requirements for Poly Vinyl Chloride (PVC) gravity sewer pipes with integral bell and spigot gasketed joints. Nominal sized 4", 6", 8", 10", 12" and 15" are manufactured to meet requirements of American Society for Testing and Materials standard ASTM D-3034, *Standard Specification for Type PSM Poly (Vinyl Chloride)(PVC) Sewer Pipe*. Nominal sized 18", 21", 24", 27" and 30" comply with ASTM F-679, *Standard Specification for PVC Large Diameter Plastic Gravity Sewer Pipe*.
  - 4.5.5.2. All pipes used shall be manufactured for use in gravity flow applications, such as sanitary sewer lines. These pipes shall be produced with wall thickness corresponding to dimension ratio SDR-35 for pipes with 14 feet or less of cover and SDR-26 for pipes with 25 feet or less of cover. The pipe shall possess a pipe stiffness value of 46 psi for SDR-35 and 115 psi for SDR-26 when tested in accord with ASTM D-2412, *Standard Test Methods for Determination of External Loading of Plastic Pipe by Parallel Plate Loading*. Standard laying length is 13 feet; however, twenty-foot (20') lengths will be acceptable.
  - 4.5.5.3. All pipe shall utilize a "locked in" integral gasket joint design meeting the requirements of ASTM D-3212 *Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals*. The gaskets shall be reinforced with a steel band and conform to the requirements of ASTM F-477, *Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipes*.
  - 4.5.5.4. The pipe shall be manufactured from PVC compound meeting the requirements of cell class 12454-B as defined by ASTM D-1784, *Standard Specification for Rigid Poly (Vinyl Chloride)(PVC) Compounds*. These materials are classified as type T-I in ASTM F-679.
  - 4.5.5.5. Pipe markings shall be as specified in ASTM D-3034 and ASTM F-679.
  - 4.5.5.6. Quality assurance testing shall be as required by ASTM D-3034 and ASTM F-679.

4.5.6. Gasketed ABS or PVC Composite Pipe (8"-15") ODOT Item 707.47, Fitting and Joints

4.5.6.1. Gasketed ABS or PVC composite pipe shall conform to the requirements of ASTM Designation D2680-90 (or latest revision). Pipe and fitting shall be homogeneous throughout and free from visible cracks, holes, foreign inclusions, or other injurious defects. Minimum pipe stiffness, when measured in accordance with ASTM Test Method D2412, shall be 200 psi. The thermoplastic material shall be a rigid ABS or PVC plastic and shall meet or exceed the requirements of ASTM Specification D1784 for a minimum cell classification of 12454B or 12454C. The other component for semi-rigid pipe shall be Portland cement, Mearlcrete concrete or other inert filler material that essentially fills the truss annulus to form a composite pipe.

4.5.6.2. All fittings for PVC composite pipe shall conform to ASTM D2680-90 Section 7.1 and Tables 5 and 6. To insure compatibility, the pipe manufacturer shall furnish all fittings.

4.5.6.3. All joints shall be made with gasketed bell coupling connections. The manufacturer shall provide documentation showing no leakage when gasketed pipe joints are tested in accordance with ASTM D2680 Section 10.4.2 and ASTM Test Method D3212. Elastomeric seals (gaskets) shall meet the requirements of ASTM Designation F477.

4.5.7. Ductile Iron Pipe, Fittings and Joints

4.5.7.1. Ductile iron pipe shall be Class 53 unless otherwise approved in writing by the City Engineer. Ductile iron pipe shall conform to ANSI A21.51 and AWWA C151. All ductile iron pipe thickness shall be designed according to ANSI A21.50 and AWWA C 151 requirements.

4.5.7.2. Ductile iron pipe and fittings shall receive the standard cement mortar lining with bituminous seal coat on the inside in accordance with ANSI 21.4 requirements. Pipe and fittings shall have a standard coal tar or asphalt based bituminous outside coating a minimum of 1 mil thick.

4.5.7.3. All ductile iron pipe shall be protected by an eight-mil thick polyethylene encasement meeting the requirements of ANSI A21.5.

4.5.7.4. Each piece of pipe shall bear the manufacturer's name or trademark, the year in which it was produced and the letters "DI" or word "DUCTILE". Shop inspection and testing shall be in accordance with the AWWA Specifications cited above and shall be certified by an independent laboratory.

4.5.7.5. Fittings for ductile iron pipe shall be flanged Class 50 gray iron conforming to ANSI A21.10 and AWWA C110 for short body cast iron fittings or as approved by the City Engineer. Fittings shall have bituminous seal coat on the inside as specified herein.

4.5.8. Steel Encasement Pipe

4.5.8.1. Encasement pipe shall be steel, plain end, uncoated and unwrapped, have minimum yield point strength of 35,000 psi and conform to ASTM A252 Grade 2 of ASTM A130 Grade B without hydrostatic tests. The steel pipe shall have welded joints and be in at least 18-foot (18') lengths.

4.5.8.2. The diameter and wall thickness of the pipe shall conform to the requirements of the American Railway Engineering Association for railroad crossings, and the requirements of ODOT for highway crossings.

**4.6. SEWER LINES (COLLECTORS, MAINS AND TRUNK LINES)**

4.6.1. Sizing

4.6.1.1. All public sanitary sewers conveying raw sewage shall be at least eight inches (8") in diameter. New sewer systems shall be designed on the basis of an average daily per capita flow of sewage of not less than 100 gallons per day (gpd). This figure is assumed to cover

normal infiltration, but an additional allowance shall be made when conditions are unfavorable or as directed by the City Engineer.

- 4.6.1.2. Sanitary sewers shall be designed on a peak flow basis using a peak factor of four (4) times the total calculated average daily wastewater flow for sewer mains, and a peak factor of 2.5 for trunk sewers. The peak flow for areas which do not have a 24 hour run-off period shall be calculated as follows:

**Equation 1 - Peak Factor Determination**

$$\text{Peak Factor} * (\text{Calculated Wastewater Flow} * 24 \text{ Hrs.}) / (\text{Run - Off Period (In Hours)}) = \text{GPD}$$

Peak Factors are found in Table 2.  
Run-Off Periods are found in Table 3.

**Table 2 - Peak Factors**

Type of Sewer	Peak Factor
Main	4.0
Trunk	2.5

**Table 3 - Run-Off Periods**

Entity	Run - Off Period
Municipality	24 Hours
Factories	Length of Shift
Subdivisions (over 250 homes)	24 Hours
Subdivisions (under 250 homes)	16 Hours
Hospitals	12 - 24 Hours
Schools	8 Hours
Restaurants	4 Hours
Mobile Home Parks	12 Hours
Apartments	12 Hours
Motels	4 Hours
Other	Use of other run - off periods must be justified

- 4.6.1.3. A complete set of computations that indicate expected flow for sizing of sewers, depth of flow and velocities at minimum, average, and maximum daily waste flows for the different sizes of sewers proposed shall be provided to the City of Lebanon. All calculations shall be signed and stamped by a Professional Engineer registered in the State of Ohio.

**4.6.2. Depth**

- 4.6.2.1. In general, sewers shall be deep enough to prevent freezing and to receive sewage from basements and cellars. In no case shall mains be less than sixty inches (60") deep. Unless otherwise approved, all homes within a new development shall be serviced by gravity flow to the sanitary sewer main.

**4.6.3. Location**

- 4.6.3.1. Unless otherwise approved by the City Engineer, public sanitary sewer mains shall be installed in the centerline of the street or, upon approval, in a public utility easement granted to the City of Lebanon. A sanitary sewer maintenance area shall be provided. This sanitary sewer maintenance area width shall be no less than twenty feet (20') and shall be totally within the public right-of-way or public utility easement. It shall be centered on the sanitary sewer main.

4.6.3.1.1. In situations in which a sanitary sewer is deeper than ten feet, the City Engineer reserves the right to require an easement greater than 20 feet in width.

4.6.3.2. No sewer main shall run between residential or commercial structures unless authorized by the City Engineer.

4.6.3.3. The Contractor shall install a four-inch by four-inch (4"x 4") wood location post at all sanitary sewer plugs, including sanitary sewer main termination points. The location post shall be painted green and marked so as to identify the sanitary sewer line.

4.6.4. Alignment

4.6.4.1. The sanitary sewer mains shall be laid at uniform grade and in straight alignment. Proper grade and alignment shall be verified for each section of pipeline using appropriate instrumentation and methodology.

4.6.5. Flow Velocity

4.6.5.1. All sanitary sewers shall be designed to give a mean velocity of at least two feet per second (2 FPS) when flowing full. This is based on Manning's formula using an "n" factor of 0.013 for design. When velocities greater than twelve feet per second (12 FPS) are expected, provisions shall be made to protect against displacement and erosion of the pipe.

4.6.6. Slope

4.6.6.1. All sewers shall be laid with uniform slope and straight alignment between manholes. Table 4 lists the minimum slopes which shall be provided, however, slopes greater than these are desirable.

**Table 4 - Minimum Sanitary Sewer Pipe Slopes**

Sewer Size (In.)	Minimum Slope
8	0.50
10	0.28
12	0.22
14	0.17
15	0.15
16	0.14
18	0.12
21	0.10
24	0.08
27	0.067
30	0.058
36	0.046
39	0.041
42	0.037
48	0.030

4.6.7. Changes in Pipe Size and Grade

4.6.7.1. All changes in pipeline size and grade shall occur in a manhole. Inverts of pipes shall be matched in manholes.

**4.7. SANITARY SEWER SERVICE LINES (LATERALS)**

4.7.1. The City of Lebanon shall approve the location of the sanitary sewer service laterals on the sewer main. The Contractor shall lay the sanitary sewer service lateral from the sanitary sewer main to a point along the Right-of-Way line, installing a cleanout with a screw out cap and a Ford metallic lid assembly marked "sewer".

- 
- 4.7.1.1. In general, locating a sanitary sewer service lateral under a walkways or driveways should be avoided.
  - 4.7.1.2. Cleanouts shall be the responsibility of the Developer. The developer may install the cleanouts at the time of utility installation, or the Developer may elect to have the cleanouts installed at the time of home construction. In either case bonds will not be released until properly installed cleanouts are in place.
  - 4.7.2. All sanitary sewer service laterals shall be gasketed SDR-35, SDR-26 PVC, or Class 53 Ductile Iron as specified herein unless otherwise specified by the City of Lebanon. Glued joints are not acceptable. Trenching, pipe laying, joints and backfilling shall conform to the requirements set out herein. All open ends shall be sealed with standard plugs to the satisfaction of the City of Lebanon.
    - 4.7.2.1. Laterals installed on mains with cover less than 14 feet shall be gasketed SDR-35 PVC.
    - 4.7.2.2. Laterals installed on mains with cover between 14 and 25 feet shall be gasketed SDR-26 PVC.
    - 4.7.2.3. Laterals installed on mains with cover 25 feet or more shall be Class 53 Ductile Iron.
  - 4.7.3. All sewer laterals shall be bedded with a minimum of six inches (6") of compacted #9's (grits), or washed round stone and shall be backfilled to a minimum of twelve inches (12") above the top of the sanitary sewer lateral with compacted #9's (grits).
  - 4.7.4. The installation of sewer laterals shall follow immediately or be concurrent with the construction of the sanitary sewer main.
  - 4.7.5. Size
    - 4.7.5.1. The size of sanitary sewer laterals shall be subject to the approval of the City of Lebanon, but in no case shall the diameter be less than six inches (6") from the sanitary sewer main to the required cleanout assembly.
    - 4.7.5.2. The sewer cleanout shall be covered at grade level by an approved Ford Type A cover marked "SEWER". Sewer laterals shall tie directly to the building sewer.
    - 4.7.5.3. The transition coupling from the building sewer to the cleanout will be accomplished by the use of a rigid coupling (PVC, rubber/stainless steel) or a flexible rubber boot (Fernco or approved).
  - 4.7.6. Slope
    - 4.7.6.1. The general requirements for the slope of sanitary sewer laterals shall be one quarter (1/4) inch per linear foot (2% slope).
  - 4.7.7. Location
    - 4.7.7.1. No sanitary sewer lateral shall be laid parallel to or within five feet (5') of any load-bearing wall that might thereby be weakened.
    - 4.7.7.2. Whenever a sanitary sewer service line crosses a concrete street curb, the Contractor shall clearly mark the location of the sewer service line with an "S" cut or imprinted into the concrete curb near the top.
  - 4.7.8. Depth
    - 4.7.8.1. Sanitary sewer laterals shall be deep enough to receive sewage from basements and cellars.
    - 4.7.8.2. The minimum sewer lateral depth shall be twenty-four inches (24").
  - 4.7.9. Alignment
-

4.7.9.1. The sanitary sewer lateral shall be laid in a uniform grade and in alignment from the main to meet the probable building sewer grade at the cleanout assembly so that no bends will be required.

4.7.9.2. Sanitary laterals are to run perpendicular to the sanitary sewer main from the utility standard cleanout assembly. Any deviation from this standard must have the written approval of the City Engineer.

#### 4.7.10. Cleanouts

4.7.10.1. Cleanouts for sanitary sewer laterals shall be built at all horizontal or vertical changes of direction and shall consist of a six-inch (6") directional tee and wye. Along straight segments of pipe outside the right-of-way, cleanouts shall be installed as required by the Ohio Plumbing Code. A copy of the City of Lebanon standard cleanout detail is contained in the Appendix.

4.7.10.2. The cleanout cap/plug shall have a protruding operating nut.

4.7.10.3. When within the Right-of-Way, cleanouts shall be covered by a Ford Type A twenty inch (20") single lid cover lettered "SEWER" with an 11 1/2" locking lid to be flush with final ground level. Installation of cleanouts in traffic areas shall be covered by an "extra heavy cover" Ford Type A twenty-inch (20") single lid cover lettered "SEWER" with an 11-1/2" locking lid; flush to the grade of the pavement.

#### 4.7.11. Lateral Connections

4.7.11.1. Lateral connections to the sanitary sewer main shall only be located at an existing "wye" connection on the main. When none exist on the main, an approved manufactured saddle wye shall be installed at the sanitary sewer main cut in a neat, even manner. The connection shall be rendered watertight by means of commercial fittings and/or a rubber gasket seal. (Examples are Fernco, Indiana Seal, Mission, or manufactured products of equal standards approved by the City of Lebanon). Concrete encasement shall only be permitted by special written authorization by the City of Lebanon.

4.7.11.2. All connections between the sanitary sewer main and sanitary sewer lateral, as well as the connection between the sanitary sewer lateral and the building connection, shall be inspected by the City of Lebanon prior to backfilling.

4.7.11.3. Under no circumstances shall the lateral be connected to the sewer main at the top of the pipe.

#### 4.7.12. Maintenance

4.7.12.1. The owner of a premises served by a sanitary lateral shall be responsible for the operation, maintenance, repair and reconstruction of the sanitary lateral from the building to the point of connection with the public sanitary sewer main. (§1311.17)

### 4.8. SANITARY GRINDER/LIFT PUMPS

4.8.1. Sufficient depth of sewer mains shall be provided to allow gravity flow for all sanitary sewer lateral connections. The use of grinder/lift pumps for sanitary sewer laterals is not permitted within new developments unless approval is granted, in writing, by the City Engineer.

### 4.9. TRENCH EXCAVATION

4.9.1. Unless specifically directed otherwise by the City Engineer, not more than 500 feet of trench shall be opened ahead of the pipe laying work of any one crew and not more than 500 feet of open ditch shall be left behind the pipe laying work of any one crew.

4.9.2. All backfilled ditches shall be maintained in such a manner that they will offer no hazard to the passage of traffic. The convenience of the traveling public and property owners abutting shall be taken into consideration. All public or private drives shall be taken into consideration and shall

- be promptly backfilled or bridged. Excavated materials shall be disposed of so as to cause the least interference.
- 4.9.3. Trenches in which pipes are to be laid shall be excavated via open cut to the depths shown on the approved plans. The minimum allowable trench width shall not be less than the outside diameter of the pipe plus eight inches (8"). Where rock is encountered, it shall be removed to a minimum depth of four inches below the pipe bells.
- 4.9.4. Unless specifically authorized by the City Engineer, trenches shall in no case be excavated or permitted to become wider than two feet six inches (2' - 6"), plus the nominal diameter of the pipe at the level of or below the top of the pipe.
- 4.9.5. All excavation materials shall be placed a minimum of two feet (2') back from the edge of the trench.
- 4.9.6. Where conditions exist that may be conducive to slides or cave ins, proper and adequate sheeting, shoring and bracing shall be installed to provide safe working conditions and to prevent damage of work.
- 4.9.7. It is the Contractor's sole responsibility to maintain safe working conditions on the job site and to conform to "Specific Safety Requirements Relating to Construction of the Industrial Commission of Ohio", "Construction Safety and Health Regulations, Part 1926, Subpart P "Occupational Safety and Health Administration, U. S. Department of Labor, and all local laws, ordinances, and regulations.
- 4.9.8. Trenches shall be kept free of water during the laying of pipe until the pipeline has been backfilled.
- 4.9.9. Obstructions
- 4.9.9.1. In cases where storm sewers, sanitary sewers, gas lines, water lines, telephone lines, and other utilities, or other underground structures are encountered, they shall not be displaced or disturbed unless necessary, in which case they shall be replaced in as good condition as found as quickly as possible.
- 4.9.10. Shoring, Sheeting, and Bracing
- 4.9.10.1. The shoring, sheeting and bracing of excavations shall be performed by the Contractor in compliance with applicable safety codes and OSHA requirements.
- 4.9.10.2. Where unstable material is encountered or where the depth of excavation in earth exceeds five feet (5'), the sides of the trench or excavation shall be supported by substantial sheeting, bracing and shoring, or the sides shall be sloped to the angle of repose. Sloping the sides of the ditch to the angle of repose will not be permitted in streets, roads, narrow rights-of-way or other constricted areas unless otherwise specified. The design and installation of all sheeting, sheet piling, bracing and shoring shall be based on computations of pressure exerted by the materials to be retained under construction conditions. Adequate and proper shoring of all excavations shall be the entire responsibility of the Contractor; however, the City Engineer may require the submission of shoring plans (accompanied by supporting computations) for review prior to the Contractor undertaking any portion of the work. Submitted plans shall be signed and stamped by a Professional Engineer registered in the State of Ohio.
- 4.9.10.3. Excavations to be made below the depth of an existing foundation, shall be supported by shoring, bracing or underpinning as long as the excavation shall remain open, or thereafter if required to insure the stability of the structure supported by the foundation. The Contractor shall be held strictly responsible for any damage to said foundation.
- 4.9.10.4. Solid sheeting will be required for wet or unstable material.

- 4.9.10.5. Care shall be taken to avoid excessive backfill loads on the completed pipelines. The requirements that the width of the ditch at the level of the crown of the pipe be no more than two feet six inches (2'-6") plus the nominal diameter of the pipe shall be strictly observed.
- 4.9.10.6. Trench sheeting shall not be removed until sufficient backfill has been placed to protect the pipe.
- 4.9.10.7. All sheeting, planking, timbering, bracing and bridging shall be placed, renewed and maintained as long as necessary.

#### **4.10. PIPE BEDDING**

- 4.10.1. All sanitary sewer pipe shall be bedded in accordance with the standard detail contained in the Appendix.
- 4.10.2. In all cases, the foundation for sanitary sewer mains shall be prepared so that the entire load of the backfill on top of the sewer pipe will be carried on the barrel of the pipe so that none of the load will be carried on the bells.
- 4.10.3. The depth at the bottom of the bells of the pipe will be at least four inches (4") above the bottom of the trench as excavated. Supporting of sewer pipe shall be as set out herein, and in no case shall the sewer pipe be supported on blocks.

#### **4.11. LAYING PIPE**

- 4.11.1. All pipe shall be laid with ends abutting true to line and grade as shown on the plans. Supporting of pipe shall be as specified under 4.10. specified herein and in no case shall be supported on blocks.
- 4.11.2. Fittings for the sewer mains shall be provided and placed as shown on the plans. All open ends of pipes and branches shall be sealed or plugged.
- 4.11.3. Before each piece of pipe is lowered into the trench, it shall be thoroughly cleaned and inspected for defects. Any piece of pipe or fitting which is known to be defective shall not be laid or placed. Any defective pipe or fitting discovered after the pipe is laid shall be removed and replaced with a satisfactory pipe or fitting. In case a length of pipe is cut to fit in a line, it shall be so cut as to leave a smooth edge at right angles to the longitudinal axis of the pipe.
- 4.11.4. Granular bedding material as specified herein, shall be used to correct irregularities in the earth trench subgrade.
- 4.11.5. The interior of the pipe shall be maintained clean. When laying pipe is stopped for any reason, the exposed end of such pipe shall be closed with a plug fitted into the pipe bell, so as to exclude earth or other material.
- 4.11.6. No backfilling (except for securing pipe in place) over pipe will be allowed until the City of Lebanon has made an inspection of the joints, alignment and grade in the section laid.
  - 4.11.6.1. Inspections shall not relieve the Contractor of further liability in case of defective joints, misalignment caused by backfilling and other such deficiencies that are identified later.
- 4.11.7. Upon the completion of a section of sanitary sewer, inverts and slopes shall be checked and the results shall be provided in writing to the City of Lebanon. The information, at minimum, shall include:
  - 4.11.7.1. Upstream junction information (manhole number, etc.)
  - 4.11.7.2. Upstream plan invert
  - 4.11.7.3. Upstream installed invert
  - 4.11.7.4. Downstream junction information (manhole number, etc.)

- 4.11.7.5. Downstream plan invert
- 4.11.7.6. Downstream installed invert
- 4.11.7.7. Plan Slope
- 4.11.7.8. Installed Slope
- 4.11.7.9. Pipe Material
- 4.11.7.10. Bedding Material
- 4.11.7.11. Backfill Material
- 4.11.7.12. Contractor certification indicating that the information shown is true and correct.

#### **4.12. BACKFILLING PIPELINE TRENCHES**

- 4.12.1. All backfilling shall be accomplished in accordance with the details shown on the Standard Drawings and the requirements of this Section. Any variances must be approved in writing by the City Engineer.
- 4.12.2. When directed by the City of Lebanon, the Contractor shall add water to the backfill material or dry out the material when needed to attain a condition near optimum moisture content for a maximum density of the material when it is compacted. The Contractor shall obtain a compaction of the backfill of at least 95 percent of standard Proctor density (ASTM D698) where mechanical compacting of backfill is required. Copies of all testing reports shall be provided to the City Engineer.
- 4.12.3. In all cases, walking or working on the completed pipelines except as may be necessary in compacting or backfilling will not be permitted until the trench has been backfilled to a point one foot (1') above the top of the pipe. The filling of the trench and the tamping of the backfill shall be carried on simultaneously on both sides of the pipe in such a manner that the completed pipeline will not be disturbed and injurious side pressures do not occur.

#### **4.13. SETTLEMENT OF TRENCHES**

- 4.13.1. The Contractor shall be responsible for any trench settlement that occurs within two years from the time of final acceptance of the work. If paving shall require replacement because of trench settlement within this time, it shall be replaced by the Contractor. Repair of settlement damage shall meet the approval of the City of Lebanon.

#### **4.14. MANHOLES**

- 4.14.1. Manholes shall be of the pre-cast concrete type. Manhole lift holes and grade adjustment rings shall be sealed with non-shrinking grout or other material approved by the City of Lebanon. Inlet and outlet pipes shall be joined to the manhole with a gasketed, flexible, watertight connection or any watertight connection arrangement that allows differential settlement of the pipe and manhole wall to take place. Watertight manhole covers are to be used wherever the manhole tops may be flooded by street runoff or high water. Vented lids shall be provided when the manhole is located within four feet of the street centerline. Locked manhole covers may be desirable in isolated easement locations or where vandalism may be a problem.
- 4.14.2. Manholes shall be installed: at the end of each line; at all changes in grade, size or alignment; at all intersections; and at distances not greater than 350 feet for sewers 30 inches or less, or as approved by the City Engineer. Greater spacing may be permitted in larger sewers. Cleanouts may be used only for special conditions and shall not be substituted for manholes.
- 4.14.3. The minimum diameter of manholes shall be 48 inches (48"). Larger diameter manholes are preferable for large diameter sewers. A minimum access diameter of 24 inches (24") shall be provided.

- 4.14.4. The flow channel straight through a manhole shall be made to conform as closely as possible in shape and slope to that of the connecting sewers. The channel walls shall be formed or shaped to the full height of the crown of the outlet sewer in such a manner to not obstruct maintenance, inspection or flow in the sewers.
  - 4.14.5. A bench shall be provided on each side of any manhole channel when the pipe diameter(s) are less than the manhole diameter. The bench shall be sloped no less than 1/2 inch per foot (4 percent). No lateral sewer, service connection, or drop manhole pipe shall discharge onto the surface of the bench.
  - 4.14.6. A drop pipe shall be provided for a sewer entering a manhole at an elevation of 24 inches (24") or more above the manhole invert. Where the difference in elevation between the incoming sewer and the manhole invert is less than 24 inches (24"), the invert shall be filleted to prevent solids deposition. Drop manholes shall be constructed with an outside drop connection. Due to the unequal earth pressures that would result from the backfilling operation in the vicinity of the manhole, the entire outside drop connection shall be encased in concrete. Drop manholes shall be constructed in accordance with the standard drawing contained in the Appendix.
  - 4.14.7. Where corrosive conditions due to septicity or other causes are anticipated, consideration shall be given to providing corrosion protection on the interior of the manholes.
  - 4.14.8. Manhole steps shall be constructed and installed as shown in the Standard Drawings.
  - 4.14.9. Only concrete grade rings shall be used. Plastic grade rings are not permitted.
  - 4.14.10. Adjustable riser rings shall not be used on new manholes. Adjustable riser rings shall only be used on existing manholes with written permission from the City Engineer.
- 4.15. TESTING OF SEWER MAINS AND MANHOLES**
- 4.15.1. The City of Lebanon will require a prior notice of not more than 48 hours and not less than 24 hours to schedule an inspection of all applicable sanitary sewer appurtenances.
  - 4.15.2. Sanitary sewer pipe joints shall be watertight and all leakage shall be repaired in a manner approved by the City of Lebanon.
  - 4.15.3. All sanitary sewer mains, constructed as part of the Improvements, shall be tested for leakage and pipe deflection.
  - 4.15.4. The City of Lebanon may require the Contractor to perform additional infiltration and/or exfiltration tests to demonstrate the quality of the sewer main Improvements.
  - 4.15.5. After the Improvements have been completed but prior to performing any test herein specified, the Contractor shall clean the sewer line constructed in the Improvements by high-pressure flushing or other approved method. The Contractor shall ensure that gravel and debris is not flushed into the existing sanitary sewer system.
  - 4.15.6. Prior to the first layer of blacktop the Contractor shall be responsible for having an inspection of the sewer main and laterals with the use of a video camera performed by a professional inspection firm. Copies of all videos and written reports shall be provided to the office of the City Engineer for review and approval. All defects will be corrected by the Contractor as directed by the City Engineer.
  - 4.15.7. All lines or section of lines that are found to be laid improperly with respect to line or grade, that are found to contain broken or leaking sections of pipe, or are obstructed in such a manner that they cannot be satisfactorily corrected otherwise, shall be removed and replaced.
  - 4.15.8. Pipe Deflection Test

- 4.15.8.1. Deflection tests shall be performed by the Contractor on all flexible pipe. The test shall be conducted after the final backfill has been in place at least 30 days to permit stabilization of the soil-pipe system.
- 4.15.8.2. No pipe shall exceed a deflection of 5 percent (5%). If deflection exceeds 5 percent (5%), replacement or corrections shall be as directed by the City of Lebanon.
- 4.15.8.3. The rigid ball or mandrel used for the deflection test shall have a diameter not less than 95 percent (95%) of the base inside diameter or average inside diameter of the pipe depending on which is specified in the ASTM Specification, including the appendix of said ASTM Specification, to which the pipe is manufactured. The test shall be performed without mechanical pulling devices.
- 4.15.9. Air test
  - 4.15.9.1. The air test shall, as a minimum, conform to the test procedure described in ASTM F-1417 for plastic pipe, and for other material test procedures approved by the City of Lebanon.
  - 4.15.9.2. All air tests shall be done prior to Final Inspection by the Contractor in the presence of the City of Lebanon who will determine if the tested pipe span is acceptable. The air test is conducted between two consecutive manholes. All pipe outlets must be plugged in the section being tested using suitable test plugs. One of these plugs must be tapped and used for filling the test section with compressed air.
  - 4.15.9.3. At the time of the test, each manhole shall be inspected by the City of Lebanon to determine possible leaks. Questionable manholes shall be vacuum tested.
- 4.15.10. Vacuum Test
  - 4.15.10.1. Each manhole shall be tested immediately after assembly and prior to backfilling.
  - 4.15.10.2. All lift holes shall be plugged with an approved non-shrink grout.
  - 4.15.10.3. No grout will be placed in the horizontal joints before testing, unless prior approval is granted by the City of Lebanon.
  - 4.15.10.4. All pipes entering the manhole shall be plugged, taking care to securely brace the plugs from being drawn into the manhole.
  - 4.15.10.5. The test head shall be placed at the inside of the top of the cone section and the seal inflated in accordance with the manufacturer's recommendation.
  - 4.15.10.6. A vacuum of ten inches (10") of mercury shall be drawn and the vacuum pump shut off. With the valves closed, the time shall be measured for the vacuum to not drop below nine inches (9") of mercury. The manholes shall pass if the time meets or exceeds the following table.

**Table 5 - Minimum Test Time for Various Manholes**

<b>Depth of Manhole</b>	<b>48" Diameter</b>	<b>60" Diameter</b>	<b>72" Diameter</b>
<b>0-10 feet</b>	40 seconds	90 seconds	120 seconds
<b>11-20 feet</b>	80 seconds	120 seconds	150 seconds
<b>21-30 feet</b>	120 seconds	150 seconds	180 seconds

- 4.15.10.7. If the manhole fails the initial test, necessary repairs shall be made with a non-shrink grout. Retesting shall proceed until a satisfactory test is obtained.
- 4.15.11. Air Test

- 4.15.11.1. The air test shall, as a minimum, conform to the test procedure described in ASTM C-828-76T.
- 4.15.11.2. The air test will be made after backfilling has been completed and compacted.
- 4.15.11.3. All tees and ends of sewer services shall be plugged with flexible joint plugs or caps securely fastened to withstand the internal test pressures. Such plugs or caps shall be readily removable, and shall provide a socket suitable for making a flexible jointed lateral connection or extension.

#### **4.16. VIDEO INSPECTION**

- 4.16.1. A video inspection of the all sanitary and storm sewer mains shall be conducted in accordance with the requirements set forth in Section 2.13. Copies of the video and written reports shall be provided to the City Engineer prior to the acceptance of the improvements or the release of bonds.

#### **4.17. CONNECTIONS TO EXISTING LINES**

- 4.17.1. The CONTRACTOR shall provide all labor and material required in connecting the newly constructed sanitary sewer main to an existing sanitary sewer main or manhole as shown on the approved drawings. A representative of the City of Lebanon must be present while the connection is being made. The City of Lebanon will require a prior notice of not more than 48 hours and not less than 24 hours advance notice before the connection is made.

#### **4.18. CONCRETE CRADLE, ANCHORS OR ENCASEMENT**

- 4.18.1. Concrete cradles, anchors or encasement of sanitary sewer mains and/or fittings shall be placed as shown on the plans. In areas requiring concrete encasement, Class 53 ductile iron shall be used unless waived by the City Engineer. Concrete shall be ODOT Class C and shall be mixed sufficiently wet to permit it to flow under the pipe to form a continuous bed. While placing the concrete, care shall be taken not to disturb the grade or line of the pipe or injure the joints.
- 4.18.2. Concrete encasement shall completely surround the pipe and shall have a minimum thickness at any point of one fourth (1/4) of the outside diameter of the pipe or four inches (4"), whichever is greater. In addition, four (4) reinforcing bars of a size shown on the approved plans shall be evenly spaced around the pipe and have length equal to the length of the encasement. Wherever the strength of the pipe is not sufficient to support the external loads, the encasement shall be designed to provide the necessary additional strength.

#### **4.19. HIGHWAY AND RAILROAD CROSSINGS**

- 4.19.1. Steel encasement pipe for road and railroad crossings shall be bored and/or jacked into place to the elevations shown on the plans. All joints between lengths shall be solidly welded with a smooth, non-obstructing joint inside. The sanitary sewer pipe shall be installed after the encasement pipe is in place. Installation of the sanitary sewer main in the encasement pipe shall be as per the manufacturer's recommendations. After the sanitary sewer main has been installed, inspected, and tested as specified, both ends of the cover pipe shall be closed with a rubber gasketed donut, brick, or concrete block masonry in a manner acceptable to the City of Lebanon and the encasement pipe shall be filled with sand.
- 4.19.2. Encasement pipe shall be steel, plain end, uncoated and unwrapped, have minimum yield point strength of 35,000 psi, and conform to ASTM A252 Grade 2 of ASTM A130 Grade B without hydrostatic tests. The steel pipe shall have welded joints and be in at least 18-foot (18') lengths. The diameter and wall thickness of the pipe shall conform to the requirements of the American Railway Engineering Association for railroad crossings and the requirements of ODOT for highway crossings.

---

## 4.20. SANITARY SEWER PUMP STATIONS

### 4.20.1. General

#### 4.20.1.1. Design Requirements

- 4.20.1.1.1. All sanitary sewer pump stations shall be subject to the approval of the Director of Water and Wastewater and the City Engineer.
- 4.20.1.1.2. Sanitary sewer pump stations shall be designed in accordance with the latest edition of the *Recommended Standards for Wastewater Facilities* (Ten States Standards). Unless waived by the City of Lebanon, pump stations are to be of the suction lift or submersible type, designed for meeting the peak hourly flow with the largest pump out of service, and shall meet the guidelines presented herein.
- 4.20.1.1.3. All pump stations shall be provided with a portable generator and transfer switch and all related appurtenances. The portable generator and appurtenances shall be subject to the approval of the Director of Water and Wastewater, the Director of Electric and the City Engineer.

### 4.20.2. Equipment

- 4.20.2.1. In order to unify responsibility for proper operation of the complete pumping station, all system components be furnished by a single supplier (unitary source). The pumping station must be of standard catalog design, totally warranted by the manufacturer. Under no circumstances will a system consisting of parts compiled and assembled by a manufacturer's representative or distributor be accepted.

#### 4.20.2.2. Manufacturer

- 4.20.2.2.1. Equipment and materials shall be manufactured by The Gorman-Rupp Company or an approved equal.

### 4.20.3. Accessories

- 4.20.3.1. Each Pump Station shall be provided with the following Accessories:

#### 4.20.3.1.1. Station Heater:

- 4.20.3.1.1.1. Pump station shall be provided with a 1300/1500 watt, 115 volt electric heater with cord and grounding plug. The heater shall be provided with an adjustable thermostat. Ungrounded heaters shall not be acceptable.

#### 4.20.3.1.2. Drain Kit:

- 4.20.3.1.2.1. Pumps to be supplied with a drain kit for ease of maintenance. The kit to contain 10' length of reinforced plastic hose with a female quick connect fitting at one end, and factory installed drain fittings in each pump. Fittings include a stainless steel pipe nipple, stainless steel bushing, stainless steel ball valve and aluminum male quick connect fitting.

#### 4.20.3.1.3. Spare Parts Kit:

- 4.20.3.1.3.1. The following minimum spare parts shall be furnished with the pump station:

- 4.20.3.1.3.1.1. One spare pump mechanical seal (complete with shaft sleeve).
- 4.20.3.1.3.1.2. One cover plate O-Ring.
- 4.20.3.1.3.1.3. One rotating assembly O-Ring.
- 4.20.3.1.3.1.4. One set of impeller clearance adjustment shims.

#### 4.20.3.1.4. Volute Casing Heater:

- 4.20.3.1.4.1. Pump shall be provided with a thermostat mounted to the exterior of the volute casing, and a 115 volt electric heater inserted into the interior of the volute by means of a dedicated port. The heater shall be energized at 43+/-3 degrees F to provide heat to the casing and eliminate the possibility of freezing. Heater probes that must be installed through a pump drain port shall not be acceptable. Heater probes that must be installed through a pump drain port shall not be acceptable.
- 4.20.3.1.5. Gauge Kit
  - 4.20.3.1.5.1. A gauge kit shall be supplied for each pump. Suction pressure must be monitored by a glycerin-filled compound gauge, and discharge pressure by a glycerin-filled pressure gauge. Gauges to be at least 4 inches in diameter, graduated in feet water column. Rated accuracy shall be 1% of full scale reading. Compound gauge shall be graduated -34 to +34 feet water column minimum. Pressure gauge to be graduated 0 to 140 feet water column minimum.
  - 4.20.3.1.5.2. Gauges to be factory mounted on a resilient panel with frame assembly secured to pumps or piping. Gauge installations shall be complete with all hoses and stainless steel fittings, including a shutoff valve for each gauge line at the point of connection to suction and discharge pipes.
- 4.20.3.1.6. UL Label Requirement:
  - 4.20.3.1.6.1. Pump station components and controls shall conform to third party safety certification. The station shall bear a UL label listed for "Packaged Pumping System". The panel shall bear a serialized UL label listed for "Enclosed Industrial Control Panels". The pump station components, panel enclosure, and all components mounted on the sub-panel or control cover shall conform to UL descriptions and procedures.
- 4.20.3.1.7. Transient Voltage Surge Suppressor:
  - 4.20.3.1.7.1. A transient voltage surge suppressor shall be furnished to minimize damage to pump motors and control as result of transient voltage surges. The suppressor shall utilize metal-oxide varistors encapsulated in a non-conductive housing. The arrester shall be rated 480 volts RMS nominal with a discharge capability of 2000 amps.
  - 4.20.3.1.7.2. The control panel shall be equipped with a panel heater to minimize the effects of humidity and condensation. The heater shall include a thermostat.
- 4.20.3.1.8. Phase Monitor:
  - 4.20.3.1.8.1. The control panel shall be equipped to monitor the incoming power and shut down the pump motors when required to protect the motor(s) from damage caused by phase reversal, phase loss, high voltage, low voltage, and voltage unbalance. An adjustable time delay shall be provided to minimize nuisance trips. The motor(s) shall automatically restart, following an adjustable time delay, when power conditions return to normal.
- 4.20.3.1.9. Stepdown Transformer:
  - 4.20.3.1.9.1. The lift station shall be equipped with a 3 KVA stepdown transformer to supply 115 volt, AC, single phase for the control and auxiliary equipment. The primary and secondary side of the transformer shall be protected by a thermal magnetic circuit breakers, sized to meet the power requirements of the transformer. An operating mechanism shall penetrate the control panel door and a padlockable operator handle shall be secured on the exterior surface. Interlocks must prevent opening the door until primary circuit breaker is in "OFF" position.
- 4.20.3.1.10. Alarm Light (External):

4.20.3.1.10.1. Station manufacturer will supply one 115 VAC alarm light fixture with vapor-tight red globe, guard, conduit box, and mounting base. The design must prevent rain water from collecting in the gasketed area of the fixture, between the base and globe

#### 4.20.3.1.11. Emergency Bypass Pumping Connections

4.20.3.1.11.1. Provisions shall be made within the header piping and wet well of the pump station for connection of a 4" portable engine driven emergency bypass pump.

4.20.3.1.11.2. Piping modifications to accommodate the portable bypass pump shall include isolation plug valves and aluminum quick-disconnect fittings to match the existing hose sections of the City of Lebanon Wastewater Department. Connection fittings shall be 4" camlock fittings, type A or F, by Allen Machine Company, or equal.

#### 4.20.4. Standby Power System

##### 4.20.4.1. General

4.20.4.1.1. Each pump station shall be provided with an electrical power system that has been tested during design verification, production and at the final job site. All finished equipment shall be of the latest commercial design and will be complete with all of the necessary accessories for complete installation. The equipment supplied and installed shall meet the requirements of the National Electrical Code, along with all applicable local codes and regulations. All equipment shall be new and of current production of a national firm that manufactures generator sets and controls, transfer switches, switchgear, and assembles the generator sets as a complete and coordinated system. There will be one source responsibility for warranty, parts, and service through a local representative with factory-trained servicemen.

4.20.4.1.2. The power system shall be finished by a single manufacturer who shall be responsible for the design, coordination, and testing of the complete system. The entire system shall be installed as shown on the plans, drawings, and specifications herein.

4.20.4.1.3. The equipment shall be produced by a manufacturer who has produced this type of equipment for a period of at least 10 years and who maintains a service organization available twenty-four hours a day throughout the year.

4.20.4.1.4. The equipment shall be produced by a manufacturer who is ISO 9001 certified for the design, development, production, installation, and service of their complete product line.

4.20.4.1.5. All equipment shall be approved by the City Engineer, The Director of Water and Wastewater, and the Director of Electric of the City of Lebanon.

4.20.4.1.6. Each standby power system shall consist of the following minimum items:

4.20.4.1.6.1. Generator set

4.20.4.1.6.2. Transfer switch

4.20.4.1.6.3. Monitoring and communication equipment.

4.20.4.2. Specific requirements for the standby power system will be determined on a project-by-project basis.

#### 4.21. FORCE MAINS

##### 4.21.1. General

4.21.1.1. Sanitary sewer force mains shall be designed so that the minimum velocity of two feet (2') per second (fps) is maintained when the sewage pumps are operating their design pumping rate.

- 4.21.1.2. There shall be at least a minimum of 48 inches cover over the top of the sanitary sewer force main pipe.
- 4.21.1.3. Installation shall be in accordance with Sections 4.9, 4.10, 4.11, 4.12, and 4.15 of this Manual.
- 4.21.2. Air release valves shall be required every 600 feet and at all high points along the force main. Pipe Materials
  - 4.21.2.1. Ductile Iron Pipe, Fittings and Joints
    - 4.21.2.1.1. Ductile iron pipe, fittings and joints used for the construction of sanitary sewer force mains shall comply with section 4.5.7 of this Manual.
  - 4.21.2.2. Steel Encasement Pipe
    - 4.21.2.2.1. Steel encasement pipe used for the construction of sanitary sewer force mains shall comply with section 4.5.8 of this Manual.
- 4.21.3. Testing Of Sanitary Sewer Force Mains
  - 4.21.3.1. As a minimum, all sewer force mains shall be tested in accordance with the Hydrostatic Testing Requirements of AWWA C600.
    - 4.21.3.1.1. All force mains shall be given a hydrostatic test of at least 1.5 times the shutoff head of the connected pumps or 150 psi, whichever is greater. Loss of water pressure during test shall not exceed 5 psi in a 2 hour period.
    - 4.21.3.1.2. Where practicable, pipelines shall be tested between line valves or plugs in lengths of not more than 1500 feet.
    - 4.21.3.1.3. The pump, pipe connection, and all necessary apparatus, including the gauges, shall be furnished by the Contractor. Copies of gauge accuracy reports shall be provided upon request.
    - 4.21.3.1.4. The pipe shall be slowly filled with water and the specified test pressure shall be applied by means of a pump connected to the pipe in a manner satisfactory to the City of Lebanon.
    - 4.21.3.1.5. Before applying the specified test pressure, all air shall be expelled from the pipe. If permanent air vents are not located at all high points, the Contractor shall install corporation cocks at such points so the air can be expelled as the line is filled with water. After all the air has been expelled, the corporation cocks shall be closed and the test pressure applied.
    - 4.21.3.1.6. Duration of test shall not be less than two hours.
    - 4.21.3.1.7. The test pressure shall not exceed the rated pressure of the valves in the pipeline.
    - 4.21.3.1.8. Where leaks are visible at exposed joints and/or evident on the surface where joints are covered, the Contractor shall repair the joints, retighten the bolts, relay the pipe, or replace the pipe until the leak is eliminated – regardless of total leakage as shown by the hydrostatic test. Polyethylene encasement damaged from repairs must also be properly repaired or replaced to the satisfaction of the City Engineer.
    - 4.21.3.1.9. All pipe, fittings and other materials found to be defective under test shall be removed and replaced at the Contractor’s expense.
    - 4.21.3.1.10. Lines that fail to meet test shall be repaired and retested as necessary until test requirements are complied with.
    - 4.21.3.1.11. The City of Lebanon may provide water for testing the force mains; however, the Contractor will be responsible for piping or hauling the water if necessary. If water is to be used from fire hydrants, the Contractor shall be familiar with and shall comply with the

City of Lebanon’s Fire Hydrant Meter Rental Rules and Regulations. The City of Lebanon may waive all fees except the security deposit for approved uses on City of Lebanon projects. The Contractor shall not operate any valves on existing water mains. All valves shall be operated by the City of Lebanon.

4.21.3.1.12. No pipe installation will be accepted if the leakage is greater than that determined by the formula:

**Equation 2 - Allowable Leakage**

$$L = \frac{SD*(P)^{1/2}}{133,200}$$

Where:

L is the allowable leakage, in gallons per hour

S is the length of pipeline tested, in feet

D is the nominal diameter of the pipe, in inches

P is the average test pressure during the leakage test, in pounds per square inch gauge.

4.21.3.1.13. Allowable leakage at various pressures and pipe sizes are shown in Table 6 (from AWWA C600 – Table 6A).

**Table 6 - Allowable Leakage Per 1000 Feet Of Pipeline**

Allowable Leakage Per 1000 Feet Of Pipeline* In Gallons Per Hour														
Avg. Test Pressure (psi)	3	4	6	8	10	12	14	16	18	20	24	30	36	42
250	0.36	0.47	0.71	0.95	1.19	1.42	1.66	1.90	2.14	2.37	2.85	3.56	4.27	4.99
225	0.34	0.45	0.68	0.90	1.13	1.35	1.58	1.80	2.03	2.25	2.70	3.38	4.05	4.73
200	0.32	0.43	0.64	0.85	1.06	1.28	1.48	1.70	1.91	2.12	2.55	3.19	3.82	4.46
175	0.30	0.40	0.59	0.80	0.99	1.19	1.39	1.59	1.79	1.98	2.38	2.98	3.58	4.17
150	0.28	0.37	0.55	0.74	0.92	1.10	1.29	1.47	1.66	1.84	2.21	2.76	3.31	3.86
125	0.25	0.34	0.50	0.67	0.84	1.01	1.18	1.34	1.51	1.68	2.01	2.52	3.02	3.53
100	0.23	0.30	0.45	0.60	0.75	0.90	1.05	1.20	1.35	1.50	1.80	2.25	2.70	3.15

\*If the pipeline under test contains sections of various diameters, the allowable leakage will be the sum of the computed leakage for each size.

**4.22. CONNECTING FORCE MAIN TO MANHOLE**

4.22.1. All sanitary sewer force mains must connect to manholes at the flow channel elevation. The Design Engineer shall show the method of connecting force mains to manholes in the plan’s details.

**4.23. CONCRETE THRUST BLOCKS**

4.23.1. Concrete thrust blocks shall be provided at all bends on the sanitary sewer force main. Concrete cradles, anchors, or encasement of force mains and fittings shall be placed where shown on the plans. Concrete shall be ODOT Class C and shall be mixed sufficiently wet to permit it to flow under the pipe to form a continuous bed. While placing concrete, care shall be taken not to disturb the grade or line of the pipe or injure the joints. In places where concrete will be poured at a mechanical joint or fitting, a polyethylene (plastic) sheet having a minimum thickness of 8 mil, shall be wrapped around the fitting to prevent the concrete from coming in contact with the fitting’s bolts and nuts.

- 4.23.2. Force mains constructed under creeks or drainage waterways shall be encased in concrete to a point at least ten feet (10') beyond the edge of the creek or drainage ways.

**4.24. MISCELLANEOUS REQUIREMENTS**

- 4.24.1. All sewer main repairs shall be made utilizing shear couplings with stainless steel bands.

**4.25. RESPONSIBILITY FOR MAINTENANCE**

- 4.25.1. Prior to formal acceptance of the Improvements by the City of Lebanon, the Contractor and/or Owner/Developer shall be responsible for the maintenance and repair of the Improvements in compliance with these specifications for a period of two years after construction completion and acceptance by the City of Lebanon.