

ANNEX A – DESIGN OF SEWERS

1. APPROVAL PROCESS

- 1.1 The Applicant shall submit a sufficient number of copies of all Master Plans for Subdivisions to the City of Cranston Planning Department for review as per Section V.F.2. of the Subdivision Regulations. The Planning Department shall submit one (1) copy to the City of Cranston Engineering Division and one (1) copy to USFOS-Cranston WPCF (USFOS) for general review under a transmittal letter. USFOS shall respond to the Engineering Division within fourteen (14) calendar days with comments. The Engineering Division shall respond to the Planning Department within twenty one (21) calendar days of original receipt with comments.
- 1.2 Six (6) copies of all Preliminary Plans for Subdivisions shall be initially submitted to the City of Cranston Planning Department for review. The Planning Department shall submit three (3) copies to the City of Cranston Engineering Division.
- 1.3 Five (5) copies of all Preliminary Plans for New Streets, where no subdivision is pending, shall be initially submitted to the Director of the Department of Public Works (Director) for review. The Director shall submit three (3) copies to the City of Cranston Engineering Division.
- 1.4 Preliminary Plans for Subdivisions and New Streets submitted to the City shall include a \$500 check for the minimum Review Fee made out to USFOS-Cranston WPCF, which shall be forwarded to USFOS with the transmittal.
- 1.5 The Engineering Division shall submit two (2) copies of the Preliminary Plan to USFOS-Cranston WPCF for review under a transmittal letter.
- 1.6 USFOS shall respond to the Engineering Division within ten (10) calendar days, and:
 - Submit a preliminary determination of the manhours and “not to exceed” costs anticipated to review, inspect, and flow test the New Plat.
 - Return one (1) marked up copy including pertinent comments, and
 - Approve, amend, or reject them and request a new submittal,
- 1.7 The Director, within ten (10) calendar days will review the proposal and either approve it or negotiate its cost with UFSOS.
- 1.8 The Engineering Division shall respond to the Preliminary Plans for Subdivisions to the Planning Department and to the Preliminary Plans

for Streets to the Director within twenty one (21) calendar days of original receipt with comments. The Engineering Department may require modifications to the Preliminary and resubmittal.

- 1.9 When requested by the Director or upon the recommendation of USFOS which the City shall not unreasonably reject, USFOS will review the impact of any additional flow through the system at the applicant's cost to ensure that the sewers and Pump Stations have sufficient safe capacity. All calculations and hydraulic evaluations shall be certified by a professional engineer in the state of Rhode Island based on the GIS data provided and shall be submitted to the City for record keeping purposes, unless other data gathering methods are agreed to by the parties. Reasonable efforts will be made by USFOS to verify and correct GIS data as concerns become apparent.
- 1.10 Preliminary and Final Plan submissions for all sewer construction shall include a separate set of plans (vertical and horizontal plans) showing all ties of sewer connections, stationing of all manholes, elevations of all manholes inverts, stationing of all wyes, and a calculation of the additional flow, as well as any other information required.
- 1.11 Six (6) copies of all Final Plans for Subdivisions shall be initially submitted to the City of Cranston Planning Department for review. The Planning Department shall submit three (3) copies to the City of Cranston Engineering Division.
- 1.12 Five (5) copies of all Final Plans for New Streets shall be initially submitted to the City of Cranston Department of Public Works for review. The Department of Public Works shall submit three (3) copies to the City of Cranston Engineering Division.
- 1.13 The Engineering Division shall submit two (2) copies of the Final Plans to USFOS-Cranston WPCF for review under a transmittal letter.
- 1.14 USFOS will review the Final Plans and either approve them, amend them, or reject them and request a new submittal. USFOS shall respond to the Engineering Division within fourteen (14) calendar days with one (1) marked up copy including pertinent comments.
- 1.15 When approved, USFOS will include the following:
 - A revised determination of the manhours and "not to exceed" costs anticipated to review, inspect, and flow test the New Plat.
 - A letter agreeing to accept the subdivisions sewer flow into the system.
- 1.16 The Engineering Division shall respond to the Final Plans for Subdivisions to the Planning Department and to the Final Plans for

Streets to the Director of Public Works within twenty one (21) calendar days with comments. The Engineering Department may require modifications to the Final design and resubmittal.

- 1.17 The CITY shall complete review of the Final Design plans and either approve them, amend them, or reject them and request a new submittal. One marked-up copy will be returned to the submitter.
- 1.18 The CITY must submit two (2) copies of the Approved Final Design to USFOS after approval by the City, no later than ten (10) working days prior to when any work shall commence. The City reserves the right to review the evaluation process at any time during the course of this procedure.
- 1.19 After the Director approves the Final Plans and specifications, the developer shall submit the name of a qualified sewer contractor whom he proposes to do the work, together with a breakdown of items, quantities and unit prices for the project. After reviewing the breakdown submitted and investigating the qualifications of the proposed contractor, the Director shall make the final determination whether to allow the developer to use his proposed contractor or, if this contractor is unacceptable to the City, to submit another contractor for approval.
- 1.20 No work can commence of any sewer installation without the Director's approval of the plan and the contractor.
- 1.21 The Director, or the Applicant at the Director's request, shall notify USFOS five (5) work days prior to the commencement of any approved New Plat related excavation, advising of the name, phone number, and address of the developer and the contractor, along with the name and phone number of the contractor's foreman.
- 1.22 USFOS will inspect the New Plat construction consisting of excavation, laying of sewer mains and street laterals, installation of manholes, backfilling to the elevation of the existing ground, camera inspection, and pressure testing; and shall perform the flow test. The Applicant, at his choice and expense, has the option of using a private contractor or hiring USFOS to camera inspect and pressure test the system. If USFOS is hired for this additional work by the Applicant, the cost for this work shall be reimbursed directly from the Applicant.
- 1.23 The City shall require that Applicant's contractor follow the USFOS inspector's instructions pertaining to sewer work. On certain projects, USFOS may recommend more vigorous and frequent inspections at the work site, including full time inspection. The Director will review this recommendation and compare it to USFOS's proposal for review and inspection services, and will approve of the additional work if acceptable.

- 1.24 The construction and laying out of all sewer lines other than Building Drains and Building Laterals pursuant to this section shall be subject to the inspection of USFOS. If at any time USFOS determines that the construction of such sewer lines is not being performed in accordance with the plans and specifications as approved, he shall forthwith notify the Applicant and the Director to this effect in writing. The Director may then order the suspension of all further work by and of payments to the contractor until such corrections are made as will produce complete compliance with the plans and specifications.
- 1.25 The City of Cranston City Code, Chapter 26, Sewers, Specifications for Highways Covering Residential and Industrial Plat Developments, and other City of Cranston Department of Public Works guidelines, rules, regulations and other applicable laws, including specifically the TR-16 Guides for the design of Wastewater Treatment Works (by the New England Interstate Water Pollution Control Commission), provide the general specifications for construction of sanitary sewers and represent the minimum acceptable standards and design for construction. These guidelines shall be the basis for all design plan reviews and construction inspections. Where there is a conflict between these documents, the precedence shall be in the order identified above.
- 1.26 The construction of any new wastewater pumping station shall be in accordance with general specifications shown in Chapter 3 "Wastewater Pumping Stations" in the TR-16 Guides for the design of Wastewater Treatment Works (by the New England Interstate Water Pollution Control Commission, the most recent edition). The pumping station shall be constructed with instrumentation and telemetry system compatible with the Facility's current Supervisory Control And Data Acquisition (SCADA) program.
- 1.27 As a condition of final acceptance of the sewer system, the developer, his engineer, or his contractor shall request, only through the Engineering Division, a final inspection by USFOS. A written acceptance of the system shall be filed with the Engineering Division as a condition of Bond release.
- 1.28 Before final approval of any sewer system, the contractor shall submit to USFOS two (2) sewer as-built plans with GIS coordinates for each manhole noted. The as-built plans shall be on copy-tuff and in a computer .dxf format and meet the following requirements:
 - a. All record plans are required to be in a uniform size of 20" by 40".
 - b. Scale for plans: Horizontal 1 inch = 40 feet, Vertical 1 inch = 10 feet.
 - c. Station figures to be shown on all manhole structures.
 - d. Distance of laterals are to be shown with depths of end of pipe at

the property line.

- e. Ties to the “Y”’s and end of laterals are to be shown from permanent structures.
 - f. Ledge and selected materials are to be shown in the profile.
 - g. Slope, size and type of pipe to be shown in profile.
 - h. All utilities encountered during construction to be shown on profile.
 - i. Sewer record plan and storm drain plans are to be drawn separately.
 - j. The record plan shall be drawn so as the north designation shall be pointing in the upper quadrant.
- 1.29 After the New Plat work is completed to its satisfaction, USFOS shall review the-built plans and GIS data submitted by the Applicant and shall accept this information only if the as-built plans and GIS data comply with CITY codes and requirements. After this data is approved by USFOS, USFOS shall approve the sewer plan for the New Plat and submit to the Director a Final Inspection report consisting of, but not limited to, the field data, inspection reports, test results, video tapes, one (1) set of as-built plans, and all documentation relating to the project, for the City’s records. The Director shall forward copies of the pertinent information to Engineering and the IT Division. USFOS shall submit an O&M cost estimate with the final report which shall be used to modify USFOS’s Service Fee after review and approval by the DPW, effective thirty (30) days from its submission or on a date agreeable to both USFOS and the DPW. This information shall be submitted to the Director prior to submission of the final bill for this work unless the Applicant fails to furnish all the information required within thirty (30) days of the completion of the field work.
- 1.30 USFOS shall bill the City for the New Plat inspections per the Final Plan revised determination of the manhours and “not to exceed” costs anticipated to review, inspect, and flow test the New Plat on a monthly basis, including any additional work incurred during the course of the project approved by the City, unless otherwise noted. The bill will summarize and detail the work performed for review and inspecting the sewer work, with work descriptions and manhours spent. If no additional work has been agreed to, the total cost of the work must not exceed the cost shown in the Final Plan revised determination. A copy shall be provided to the developer. The City shall review the bills and compensate USFOS in accordance with Section 9(1)(K) of the Service Agreement. The City shall not release the Applicant’s bond nor provide an occupancy permit until USFOS has approved the New Plat and been paid for its approved inspection efforts by the City.

- 1.31 All sewer lines on public property constructed pursuant to the provisions of the preceding section shall become the property of the City when said installation is successfully tested and accepted by the Director of Public Works. After such sewer lines have been connected with the public sewer, all the normal costs of operating and maintaining the Sewer Mains shall be borne by the City. However, the City may backcharge the contractor for any abnormal conditions for a period of six (6) months after acceptance.
- 1.32 Private sewers and sewers extending into adjacent communities which connect to the City sewer, shall be installed in conformance with the City Sewer Use Ordinance and these regulations unless otherwise approved by the Director.
- 1.33 No person shall make connection of roof downspouts, floor drains, sump pumps, exterior foundation drains, areaway drains, or other sources of surface runoff or groundwater to a building sewer, Building Drain, Building Lateral, or Street Lateral which in turn is connected directly to a public sewer or septage system.

2. SEWER MAIN STANDARDS

2.1 Minimum Size

No gravity sewer main shall be less than eight (8) inches (20.3 cm) diameter.

2.2 Depth

The minimum cover shall be four (4) feet over the crown of the pipe, except that insulation may be provided for sewers that cannot be placed at a depth sufficient to prevent freezing upon the approval of the Director.

2.3 Buoyancy

Buoyancy of sewers shall be considered and flotation of the pipe shall be prevented with appropriate construction where high groundwater conditions are anticipated.

2.4 Slope

The minimum slope for a sewer main shall be as follows:

<u>Sewer Size</u>	<u>Per Cent (Feet per 100 foot)</u>
8 inches (203 mm)	0.60
10 inches (254 mm)	0.42
12 inches (305 mm)	0.33

14 inches (356 mm)	0.26
15 inches (381 mm)	0.23
16 inches (406 mm)	0.21
18 inches (457 mm)	0.18
21 inches (533 mm)	0.15
24 inches (610 mm)	0.12
27 inches (686 mm)	0.10
30 inches (762 mm)	0.087
36 inches (914mm)	0.069
42 inches (1067 mm)	0.056

All sewers shall be designed and constructed to give mean velocities, when flowing full, of not less than 2.0 feet per second (0.6 m/s), based on Manning's formula using an "n" value of 0.013.

Sewers shall be laid with a uniform slope between manholes.

2.5 Maximum Flow Depths

Sewers of a diameter from eight (8) inches (20.3 cm) through twenty-one (21) inches (53.3 cm) shall be designed so that they are flowing at a depth no greater than 0.6 times the diameter of the sewer at peak flow rates.

Sewers of a diameter larger than twenty-one (21) inches (53.3 cm) shall be designed so that they are flowing at a depth no greater than 0.7 times the diameter of the sewer at peak flow rates.

2.6 Maximum and Minimum Velocities

Velocities greater than twelve (12) fps (3.7 mps), or less than two (2) fps (0.61 mps) when flowing full, will be unacceptable.

2.7 Alignment

All new sewer lines shall be installed with straight alignment between manholes, using a laser system for alignment and degree of slope. Each manhole floor and invert shall be within 0.01 feet of that on the approved plan.

2.8 Changes in Pipe Size

Installing a smaller sewer downstream from a larger sewer in general will be considered unacceptable.

At the juncture between a sewer and one of larger diameter, the inverts of the sewers shall be designed so that the peak flow lines

match.

2.9 Materials

Gravity sewer pipe shall be ASTM Rigid Schedule 40 or heavier PVC Pipe for sewer use conforming to ASTM Specifications D-3034; or cement lined ductile iron manufactured in accordance with ANSI/AWWA C151/A21.51, C111/A21.11, and C150/A21.50, or as approved by the Director. All pipe shall have compression joints with an elastomeric gasket type conforming to ASTM D-3212; or as approved by the Director.

3. SIPHONS

3.1 Sizing

Siphons shall have no less than two barrels with a minimum pipe size of 6 inches and should be provided with necessary appurtenances for convenient flushing and maintenance.

The design shall provide for sufficient heads and pipe sizes to secure velocities of at least 3.0 feet per second (0.92 m/s) for average flows under initial conditions.

3.2 Manholes

Manholes shall have adequate clearances for cleaning equipment and for inspection and flushing.

The inlet and outlet details shall be arranged so that the normal flow is diverted to one barrel and so that either barrel may be taken out of service for maintenance. Provide a hose connection to the siphon for flushing purposes.

4. AERIAL CROSSINGS

4.1 Support

Provide appropriate support for all joints and pipes used for aerial crossing. The supports shall withstand frost heaves as well as overturning, settlement, flooding, thermal expansion, vibrations, and other loads that may act against the piping.

4.2 Freeze Protection

Provide precautions against freezing by insulation and increased slope. Provide expansion joints between above-ground and below-ground sewers. Where buried sewers change to aerial sewers, use

special construction techniques to minimize damage from frost heaves.

4.3 Physical Protection

For aerial stream crossings, consider the impact of flood waters and debris. The bottom of the pipe shall be now lower than the 100-year flood elevation. Ductile iron pipe with restrained mechanical joints.

5. PROTECTION OF WATER RESOURCES

5.1 Location of Sewers in Streams

The top of all sewers entering or crossing streams shall be sufficiently below the natural bottom of the stream bed to protect the sewer line. The following minimum cover requirements must be met:

- a. 1 foot (30.5 cm) of cover where the sewer is located in rock.
- b. 3 feet (91.4 cm) of cover in other material, except that more than 3 feet may be required in major streams.
- c. In paved stream channels, place the top of the sewer line at least 1 foot (30.5 cm) below the channel pavement.

Position sewers located along streams sufficiently outside of the stream bed to allow for stream widening in the future and for the prevention of siltation during construction.

5.2 Structures

Locate sewer manholes or other structures outside of streams whenever possible. Where structures must be located in a stream, they shall not interfere with the free discharge of flood flows.

5.3 Alignment

Sewers shall cross streams perpendicular to the flow without a change in grade.

5.4 Materials

Sewers entering or crossing streams shall be watertight and free from changes in alignment or grade. Joints shall be restrained in order to prevent movement from stream forces. In major streams, provide ball-and-socket or restrained joints designed for hard service applications. Provide mechanical joints with retainer glands for smaller streams.

Backfill materials shall be stone, coarse aggregate, washed gravel, or other material that will not readily erode, cause siltation, damage pipe during backfill, or corrode the pipe. On large stream crossings, place

riprap over the sewer pipe to prevent erosion.

6 MANHOLE STANDARDS

6.1 Location

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 three hundred (300) feet (91.4 m) or as approved by the Director.

6.2 Manhole Materials

Manholes shall be constructed of precast reinforced concrete, ASTM Designation: C-478, latest edition; or as approved by the Director, and shall have O-ring or bituminous based gasketed joints. A twelve (12) inch bedding of compacted stone shall be placed underneath any manhole. The minimum internal diameter shall be 48 inches (1.2 m).

All new manhole joints and pinholes shall be parged from the outside and inside to prevent infiltration. Following which, a bituminous coating shall be installed on the exterior.

Inlet and outlet pipes shall be joined to the manhole with a gasketed, flexible watertight connection or with another watertight connection arrangement that allows for differential settlement of the pipe and the manhole.

All inverts and tables shall be constructed with red sewer bricks. At least one row of red sewer bricks shall be installed between the manhole frame and structure to meet the finished grade. The bricks shall be well cemented below, on top, and between each other. However the inside and outside faces of the bricks shall not be covered with cement or mortar.

Ladder bars furnished for manholes and concrete chambers shall be designed in accordance with the latest requirements of ASTM C-478 of gray iron construction (minimum tensile strength of 40,000 psi) or fabricated of a minimum 3/8 inch round steel step encapsulated with copolymer polypropylene plastic. The manhole top and ladder bars shall be installed aligned for ease of entry.

6.3 Manhole Frame Materials

Cast iron manhole frames and covers with thirty (30) inch diameter openings shall be used, Cat. No. L7-193 and LT-103 as manufactured by E.L. LeBaron Foundry Co. or approved equal. Materials used in the manufacture of the castings shall conform to ASTM A48 of latest revision, Class 30 or better. All frames and covers shall have

machined bearing surfaces to prevent rocking and rattling. All frames and covers shall receive a factory painting of a manufacturer recommended black asphaltum or bitumastic coating which shall be smooth and durable with no tendency to scale or chip off.

On each manhole two (2) complete rings of a 1/2 inch diameter approved flexible butyl rubber joint sealant shall be installed between the bottom of the frame and the top of the concrete of the manhole. At least two stainless steel 3/4 inch anchor bolts shall be installed to secure the frame to the manhole, aligned with the center line of the road to minimize rocking.

All covers shall have clearly embossed the year of construction and the word "SEWER".

Standard manhole covers shall have two (2) 5/8 inch vent holes.

In areas prone to flooding, watertight covers shall be installed in paved areas and locking covers equal to Type 2 as manufactured by E.L. LeBaron Foundry Co. with three keys per cover in non-paved areas under the direction of the Director.

6.4 Flow Drop

Provide a minimum 0.1 foot drop through the manhole.

Wherever sewers enter manholes such that the inlet invert of the sewer is above, but less than 2 feet above, the manhole bottom, a channeled, steel troweled concrete fillet shall be constructed to prevent the flow from splashing into the manhole.

Manhole uncontrolled internal drops shall not exceed 2.0 feet.

Manhole drops in excess of 2.0 feet must be built with a vented external-drop manhole. The outside drop connection shall be encased in concrete.

6.5 Bench

Provide a bench on each side of every manhole channel. The bench should have a slope no less than 0.5 inch per foot and no greater than 1.0 inch per foot. No street lateral, sewer main, or drop manhole pipe shall discharge onto the surface of the bench.

7. BUILDING DRAINS

7.1 Conformance

The connection of the building sewer into the public sewer shall conform to the requirements of the building and plumbing code to other applicable rules and regulations of the City, or the procedures set forth in appropriate specifications of the ASTM and Water

Environment Federation Manual of Practice No. 9, latest edition. All such connections shall be made gastight. Any deviation from the prescribed procedures and materials must be approved by the Director before installation.

7.2 Minimum Size

The pipes for Building Drains, the lowest horizontal piping of a drainage system which receives the discharge from wastewater pipes inside the walls of the building and conveys it to the Building Lateral, shall be not less than four (4) inches in diameter, but larger sizes may be required by the Director.

7.3 Depth

Whenever possible, the Building Drain shall be brought to the building at an elevation below the basement floor.

No plumbing fixtures shall be installed where the overflow rim of the lowest plumbing fixtures are below the next upstream manhole in the public sewer, except where:

- a) A sewage grinder pump is utilized to pump sewage to the Building Drain, upon approval of the Director, or
- b) A backwater valve is installed only for plumbing fixtures installed where the overflow rim of the lowest plumbing fixtures are below the next upstream manhole in the public sewer, upon approval of the Director.

In either of the above cases, the City shall have no responsibility for the installation, operation, and maintenance of said equipment.

7.4 Materials

The Building Drain, shall begin a minimum of six (6) inches (15.2 cm) inside the foundation wall, through the foundation wall, and to five (5) feet (1.5 meters) outside the inner face of the building wall shall be four (4) inch (10.2 cm) diameter PVC, cast iron, or ductile iron pipe.

8. SEWER LATERALS

8.1 Minimum Size

The pipes for Building Laterals and Street Laterals from the public sewer main, but never nearer to the connected building than the end of the Building Drain, shall be not less than six (6) inches (15.2 cm) in diameter, but larger sizes may be required by the Director.

8.2 Depth

Sewer service connections, Street and Building Laterals, from the public sewer to the Building Drain shall be laid at such depth and gradient and in such location as the Director may determine.

8.3 Slope

Building Lateral and Street Lateral pipes shall be laid with a minimum gradient of at least one-quarter inch per foot (2.1 cm/m).

8.4 Alignment

All pipe shall have compression joints. The following design standards for laterals are considered acceptable.

8.5 Materials

Gravity sewer pipe shall be ASTM Rigid Schedule 40 or heavier PVC Pipe for sewer use conforming to ASTM Specifications D-3034, or as approved by the Director. All pipe shall have compression joints with an elastomeric gasket type conforming to ASTM D-3212; or as approved by the Director.

8.6 Installation

Street and Sewer Laterals shall be laid accurately to straight lines and gradients, except that:

- a) If angles in the alignment of building sewers are unavoidable, the changes in direction or gradient shall be provided with special means for flushing and cleaning in accordance with the particular requirements of the Director. When completed, the inside of a sewer service connection shall be left smooth and clean.
- b) Building Laterals, from the property line to the Building Drain, shall end with a cleanout, a six (6) inch (15.2 cm) by six (6) inch (15.2 cm) by four (4) inch (10.2 cm) PVC Schedule 40 wye with a four (4) inch (10.2 cm) PVC Schedule 40 standpipe and brass threaded cover located at ground level. The outlet of the wye shall be located at the property line and shall connect to the Street Lateral.
- c) Where practical, the Street Lateral, from the Sewer Main to the Building Lateral at the Property Line, shall tie into a manhole, the hole shall be bored and patched around the Street Lateral inside and outside of the manhole to prevent infiltration and movement of pipe. The Street Laterals shall empty into inverts going with the flow of wastewater. No service connection pipe will be installed below the invert grade of the sewer structure. If the Street Lateral enters the manhole equal to the invert or equal

to the table, the table shall be rebuild to make an invert for the new service to provide a smooth flow line for the connection.

- d) Street Laterals shall otherwise enter the sewer main above the spring line, angled so that the lateral sewage enters flowing with the sewage in the sewer main. The Street Lateral shall be attached to the sewer main with a Fernco type coupling. The Street Lateral may include a 6" PVC Schedule 40 angle, not greater than 45°, to provide the proper flow alignment.

No service pipes for other utilities, such as water, gas and the like, whether City owned or privately owned, shall be laid in the same trench with a building sewer, except by written approval of the Director.

If during inspection a Building Lateral clean out trap can not be penetrated for lateral inspection or cleaning, the property owner shall replace it with a PVC wye at their expense.

If the Building Lateral to be connected with a Street Lateral is found to extend within the limits of the City street, the Owner or his Contractor will be required to take out a street opening permit form the City.

8.7 Inspection

The contractor installing the Building Lateral and Street Lateral shall make a submittal as per Section 1 above, including details of the cleanout and sewer main connection.

The applicant for the building sewer connection permit shall notify USFOS when the Street Lateral is to be installed. The installation of the Street Lateral shall be made under the supervision of USFOS.

The applicant for the building sewer connection permit shall notify the Plumbing Inspector when the Building Drain and Building Lateral are ready for inspection, and connection to the Street Lateral. The installation of the Building Drain and Building Lateral shall be made under the supervision of the Plumbing Inspector.

The contractor installing the Building Lateral and Street Lateral shall provide two (2) copies of as-built drawings of the installation acceptable to USFOS to both USFOS and the Building Inspector with dimensions to locate the cleanout.

8.8 Separate and Independent Building Sewers/Laterals

No sewer service connection shall serve more than one building, except by permission of the Director. A separate and independent Building Lateral shall be provided for every building; except where one building stands at the rear of another on an interior lot and no private sewer is available or can be constructed to the rear building

through an adjoining alley, court, yard or driveway, the Building Lateral from the front building may be extended to the rear building and the whole considered as one Building Lateral, but the City does not and will not assume any obligation or responsibility for damage caused by or resulting from any such single connection aforementioned. The rights appurtenant to such single connection or extension from a front building to a rear building shall be recorded with each of the respective deeds.

9. PRESSURE SEWER SYSTEMS

9.1 Pressure Lateral

When a building can not be serviced by a gravity lateral to the main sewer, a pumped lateral may be installed directly to the closed manhole on the sewer main with the approval of the Director. In such instances, the minimum pipe size allowable for a pumped lateral shall be 1 ¼ inches and the system shall be designed for a minimum flow rate 2 feet per second. Such a system shall have minimum 60 working gallon receiving tank and an audible failure alarm in the living area. However, the City shall have no responsibility for the operation and maintenance of said equipment, including the pressure lateral to the manhole or pressure main. Pressure laterals shall discharge to a pressure sewer main via a wye or to a manhole, but not to a gravity sewer main.

9.2 Septic Tank Effluent Pumping (STEP)

A property owner may install a sewage grinder pump to discharge the treated discharge from their septic tank to the Street Lateral or main sewer with the approval of the Director. In such instances, the minimum pipe size allowable for a pumped lateral shall be 1 1/4 inch and the pump shall be designed such that the minimum flow rate is 2.0 feet per second. Such a system shall have an audible alarm in the living area. However, the City shall have no responsibility for the operation and maintenance of said equipment.

9.3 Grinder Pumps

Sewage grinder pumps shall have an oil filled hermetically sealed motor, hardened stainless steel cutter rotor and disc, automatic alternate direction, stainless steel fasteners, and a seal leak alarm, unless otherwise approved by the Director. The pump and discharge piping shall be designed for a minimum flow rate of 2 feet per second in the discharge piping.

9.4 Cleanout Connections

A cleanout connection manhole or structure shall be placed on each lateral at the property line with an inlet valve, wye, and cleanout valve so that the line from the property to the sewer main can be isolated and pressurized from the cleanout or rodded.

9.5 Pressure Sewer Main

A pressure sewer main shall be designed to provide a velocity of 2 feet per second at the average daily flow of the installed system. All pressure laterals shall enter via a wye. All bends shall be long radius sweeps. The pipe material shall be Class 200, SDR 21 PVC or greater.

9.6 Air Release Valves

To release air trapped in the pressure lines, site automatic air release valves at high points in the system. Air release valves shall be located in a manhole or structure to allow access for repair and maintenance. Also, place air release manholes at least 14 pipe diameters downstream of the location where hydraulic jumps occur. Hydraulic "jumps" form in sections where the pipeline intersects with the hydraulic grade line. Air bubbles formed by hydraulic jump conditions are carried downstream with the wastewater flow.

10. INSTALLATION

10.1 Trenching

All excavation for sewer installation shall be adequately guarded with barricades and lights so as to protect the public from hazard. Streets, sidewalks, parkways and other public property disturbed in the course of the work shall be restored in a manner satisfactory to the City.

Ledge rock, boulders, and large stones shall be removed, providing a minimum of 4 inches (10.2 cm) below and on each side of all pipe(s). Minimum bedding requirements for sewer pipe construction shall be Class B as described in the American Society of Testing Materials standard ASTM C 12.

10.2 Backfilling

No backfill shall be placed against newly constructed masonry or concrete structures unless authorized by USFOS. Only after the manhole structures have been inspected can the area around the manhole structure be backfilled.

All backfill shall be of suitable selected bank run or plant processed sand and gravel with a maximum sieve size of ¾ inch material, approved by the City.

Debris, frozen material, large clods, stones, organic mater, or other unsuitable materials for backfill shall not be used.

For additional bedding and backfill details, see City Standards CR-10/S-1, that are available in the Division of Engineering.

10.3 Compaction

The backfill under and beside the pipe shall be compacted for pipe support evenly on both sides of the pipe in layers so that the pipe remains aligned. These layers shall be compacted to not less than 95% of maximum density according to AASHTO T180 and shall be no more than 8-inches thick after compaction.

After successful pressure tests, all sewer lines and manholes structures shall be cleaned and flushed by the contractor.

10.4 Flow Test

After the contractor has cleaned and flushed the system, USFOS shall perform a flow test which consists of running water into the upstream manhole and inspecting the system after the water is turned off for any standing water in the manholes or pipes.

10.5 Street Repairs

All repairs to City streets shall be in accordance with the most recent revision of the City of Cranston Specifications for Utility Company Repairs to City Streets.

11. INTERNAL INSPECTION

11.01 Sewer Main Camera Inspection

After the sewer manhole structures and sewer pipes are installed, but before the manhole inverts are installed, the contractor will camera inspect and video tape the sewer main lines to the satisfaction of USFOS who shall be present for the entire period to verify that there are no discrepancies in the pipes.

11.02 Sewer Main Leakage Testing

After the camera inspection is completed, the contractor shall air pressure test the sewer mains and laterals with the USFOS inspector present to approve the test. The test will consist of seven-(7) psi for

fifteen (15) minutes or a longer amount of time if the inspector deems necessary. The pressure shall not drop more than 0.1 psi. The contractor must explicitly identify what repairs or modifications he makes, at his expense, to the inspector.

11.03 Manhole Camera Inspection

All manhole structures shall be inspected by USFOS and video taped after the inverts are installed for proper installation of brickwork and proper angles of inverts.

11.04 Manhole Pressure Test

Once the manhole structures are completed, the contractor shall conduct a manhole air pressure test, with USFOS present to approve the test. The test will consist of seven-(7) psi for fifteen (15) minutes or a longer amount of time if the inspector deems necessary. The pressure shall not drop more than 0.1 psi. The contractor must explicitly identify what repairs or modifications he makes, at his expense, to the Inspector.

12. PROTECTION OF WATER SUPPLIES

12.1 Relation to Water Structures

Sewers shall be located far away from public water supply wells or other potable water supply sources and structures. Engineer plans shall show all existing waterworks units, such as basins, wells, or other treatment units that are within 200 feet of the proposed sewer.

12.2 Relation to Water Mains

Whenever possible, lay out sewers at least 10 feet from any existing or proposed water main. A sewer may be installed closer than 10 feet to a water main provide that it is laid out in a separate trench with the crown of the sewer at least 18 inches (46 cm) below the invert of the water main. Exceptions require the approval of the Director.

Whenever sewers must cross water mains, lay out the sewer so that the top of the sewer is at least 18 inches (46 cm) below the bottom of the water main. The sewer joints shall be equidistant and located as far away as possible from the water main joints. When the sewer can not meet the above requirements, relocate the water main to provide for this separation or reconstruct it with mechanical-joint pipe for a distance of 10 feet on each side of the sewer. One full-length water main should be centered over the sewer so that both joints will be as far from the sewer as possible. Where a water main crosses under a sewer, adequate structural support should be provided for the sewer to

maintain line and grade.

When it is impossible to achieve horizontal and/or vertical separation as stipulate above, both the water main and the sewer shall be constructed of mechanical-joint cement-lined ductile iron pipe or another equivalent that is watertight and structurally sound. Both pipes shall be pressure tested to 150 psi to ensure they are watertight.