

## SECTION 21

### WASTEWATER FORCE MAINS

#### 21.1 GENERAL CONSIDERATIONS

##### 21.1.1 DESIGN PERIOD

Force main systems shall be designed for the estimated ultimate tributary population, as delineated in the approved City of Mascotte Wastewater Master Plan (latest edition) except in considering parts of the systems that can be readily increased in capacity.

##### 21.1.2 LOCATION

Force mains shall be located in dedicated rights-of-way or utility easements. When installed in rights-of-way, force mains shall maintain a consistent alignment with respect to the centerline of the road. All force mains located outside of dedicated rights-of-way shall require a minimum twenty (20) foot easement. Additional easement widths shall be provided when the pipe size or depth of cover so dictate. If a force main is located adjacent to a road right-of-way, a minimum ten (10) foot easement shall be provided. Additional easement widths shall be provided if the pipe size or depth of cover so dictate. Force mains shall not be placed under retention ponds, tennis courts, or under structures. In general, force mains shall not be located along side or rear lot lines. Placement of a force main along side or rear lot line may be allowed on a case by case basis if such a force main configuration results in efficient placement and utilization of the sewer system. This criteria shall also apply to force mains in retention pond berms.

#### 21.2 DESIGN BASIS

##### 21.2.1 AVERAGE DAILY FLOW

Provisions of Section 20.2.1 shall apply.

##### 21.2.2 PEAK DESIGN FLOW

Provisions of Section 22.2.1 shall apply.

##### 21.2.3 DESIGN CALCULATIONS

DEVELOPER's ENGINEER shall submit signed, sealed and dated design calculations with the PLANS for all force main projects. Calculations shall show that force mains will have sufficient hydraulic capacity to transport all design flows.

## **21.3 DETAILS OF DESIGN AND CONSTRUCTION**

### 21.3.1 VELOCITY AND DIAMETER

At design pumping rates, a cleansing velocity of at least two (2) feet per second should be maintained. Maximum velocity at design pumping rates should not exceed eight (8) feet per second for ductile iron pipe or five (5) feet per second for PVC pipe. The minimum force main diameter shall be four (4) inches. Only 4", 6", 8", 10", 12", 16", 20", 24", 30", 36", 42", 48" and 54" diameter force mains shall be permitted.

### 21.3.2 DESIGN FRICTION LOSSES

Friction losses through force mains shall be based on the Hazen and Williams formula. In the use of Hazen and Williams formula, the value for "C" shall be 120 for ductile iron pipe and 130 for PVC pipe. "C" values greater than 130 shall not be allowed.

When initially installed, force mains may have a significantly higher "C" factor. The higher "C" Factor should be considered only in calculating maximum power requirements and duty cycle time of the motor.

### 21.3.3 DESIGN PRESSURE AND RESTRAINT

The force main and fittings, including all restrained joint fittings and thrust blocking, shall be designed to withstand pump operating pressures and pressure surges, but not less than 100 psi.

Bearing area of thrust blocks shall be adequate to prevent any movement of the fitting. The sizes and dimensions of the thrust blocks shall be shown utilizing the format shown on the STANDARD DRAWINGS. If restrained joints are used, the restrained joint table in the STANDARD DRAWINGS shall be utilized.

### 21.3.4 TERMINATION

Force mains shall not terminate directly into a gravity sewer line. Force mains should enter the gravity sewer system at a point not more than one (1) foot above the flow line of the receiving manhole.

### 21.3.5 AIR RELEASE AND VACUUM RELIEF VALVES

Air release valves, or air/vacuum relief valves, shall be provided, as necessary, to prevent air locking and vacuum formation. All such valves shall be clearly delineated on the force main profile in the DRAWINGS. The DEVELOPER's ENGINEER shall submit calculations to the CITY justifying the valve sizing. See additional requirements in Section 45.6.

### 21.3.6 AERIAL CROSSINGS

## STRUCTURAL SUPPORT

Support shall be provided for all joints in pipes utilized for aerial crossings. The supports shall be designed to prevent overturning and settlement.

## EXPANSION PROTECTION

Expansion joints shall be provided between the aerial and buried sections of the pipe.

## FLOOD CLEARANCE

For aerial stream crossings, the impact of flood waters and debris shall be considered. The bottom of the pipe shall be placed no lower than one (1) foot above the one hundred (100) year flood evaluation.

## PIPE MATERIAL AND JOINTS

Flanged joints shall be used. Pipe and Flange material shall be ductile iron, minimum class 53. All above ground pipe shall be painted as specified in Section 45.4.4 for aboveground wastewater force mains. Use of epoxy coated steel pipe may be allowed on a case by case basis.

## VALVES

Underground valves shall be provided at both ends of the crossing so that the section can be isolated for testing or repair. The valves shall be easily accessible and not subject to flooding. An air release/vacuum relief valve shall be installed at the high point of the crossing.

## GUARDS

Appropriate guards shall be installed at both ends of the crossing to prevent pipe access to the public.

## PERMITS AND REQUIREMENTS OF OTHER AGENCIES

It shall be the responsibility of the DEVELOPER to obtain all applicable regulatory permits. When the Aerial Crossing is accomplished by attachment to a bridge or drainage structure, the DEVELOPER shall meet all requirements of the Agencies who own or have jurisdiction over such structures.

## PIPE MATERIAL AND COVER

A minimum cover of three (3) feet plus a six (6) inch concrete slab shall be provided over the pipe. The pipe material shall meet appropriate AWWA Standards for use in submerged conditions.

## VALVES

Valves shall be provided at both ends of the water crossings so that the section can be isolated for testing or repair. The valves shall be easily accessible, and not subject to flooding. Both valves shall be provided in a manhole or a valve vault.

## PERMITS

It shall be the responsibility of the DEVELOPER to obtain all applicable regulatory permits, including dredge and fill permits.

### 21. 3. 8 VALVES

Sufficient valves shall be provided on force main systems to facilitate effective isolation of the pipe system for repairs and maintenance. On straight runs of force mains, valve spacing shall not exceed two thousand (2,000) feet. Additional valves shall be provided where force mains intersect to facilitate isolation of pipe segments.

## **21. 4 MATERIAL, INSTALLATION AND TESTING**

Applicable provisions of Divisions III, IV and V shall apply. Force mains shall be green or have green strip full length or lettering full length, "Sewage Force Main" in two (2) inch high letters.

## **21. 5 LOCATION AND IDENTIFICATION**

A means for locating and identifying all force mains and valves shall be provided in accordance with the provisions in Section 45 and the STANDARD DRAWINGS.

## **21. 6 ADDITIONAL REQUIREMENTS**

While designing force main systems, consideration shall be given to possible future connecting pumping stations. If applicable, this requirement shall be reviewed with the CITY prior to finalization of the design.