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## 1.0 Water System Design Criteria

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### 1.1 General

Water system improvements proposed for inclusion into the City shall be designed in accordance with the criteria set forth herein, unless otherwise approved in writing by the City.

The design shall take into consideration physical conditions known to exist at the time and place of each installation and the probable operating requirements. Where such conditions render sections of these Specifications inapplicable, alternate methods of design may be submitted to the City, and upon approval thereof, may be incorporated in the plan.

### 1.2 General Layout

The system shall be designed as a circulating grid with at least three (3) main line valves at each four way intersection. Tee's shall be designed with at least two (2) main line valves.

Each line shall be valved so that any segment not exceeding one block (1000 + feet) or two fire hydrants of the system may be isolated from service.

Permanent dead ends over 300 feet in length, at the option of the City, shall have circulating ties on twenty feet easements through side lot lines.

Dead end mains shall be provided with means of flushing with a blow-off or fire hydrant.

Pipelines 8-inches and smaller shall be installed with a minimum of 42-inches of cover between the top of the pipe and the finished grade. Pipelines 12-inches or greater shall be installed with a minimum of 48-inches from the top of the pipe to the finished grade.

### 1.3 System Demand Criteria

System demand criteria shall be in accordance with the City of Ontario Public Works Agency Report "POTABLE AND RECYCLED WATER GUIDELINES FOR THE PREPARATION AND REVIEW OF HYDRAULIC ANALYSIS FOR NEW DEVELOPMENTS IN THE CITY OF ONTARIO UPDATED DECEMBER 1, 2005".

### 1.4 Pipe Sizing Criteria

The standard water mainlines sizes allowed in the City shall be 8-inch, 12-inch, 16-inch, 18-inch, 24-inch, 30-inch, 36-inch and 42-inch in diameter.

Pipeline velocities shall not exceed 10 feet per second during peak hourly domestic flow. Use a "C" value of 120 in the Hazen-Williams formula for flow computations utilizing CML/CMC or DI pipe. A "C" value of 150 shall be used for PVC pipe.

The City reserves the right to require 12-inch diameter minimum size pipelines in residential areas, with no incremental pipeline diameter upsizing cost to the City, when necessary, as determined by the City.

Whenever possible, pipelines shall be looped to provide dual direction supply and system flexibility.

In commercial and industrial areas, the standard minimum pipe size shall be 12-inch diameter.

The City may require pipe sizing in excess of the minimum size as determined by the design criteria herein when the facilities being constructed will serve, or may be extended to serve, additional lands.

Services and meters shall be sized in accordance with the provisions of Section 1009 of the Uniform Plumbing code, using minimum pressure expected in the system. Minimum service pipe diameter and meter size shall be: 1" line and 5/8" x 3/4" meter.

### **1.5 Pipeline Materials**

Per the Water Pipeline Material Specification and Approved Material List.

### **1.6 Potable Pipeline Location**

Potable water lines shall be located on south side or east side of the street and out of the main traveled lanes of the road where possible. Locate 8 feet from curb face or berm. Location is not to interfere with other existing utilities.

Installation of potable water lines adjacent to existing or proposed sewer lines, recycle water lines, and storm drain lines shall be in accordance with Department of Health Services regulations, or City requirements; whichever is greater. Generally, always cross above sewer lines and recycle water lines, preferably with a minimum clearance of 1 foot, and parallel at least 10 feet (O.D. to O.D.) away from sewer lines.

When minimum cover cannot be provided, concrete encasement or protective slab construction over the pipeline may be substituted. Consult with City staff as it would require special approval.

City will require pipeline looping whenever possible. Dead end mains are undesirable.

### **1.7 Valves**

Small mains (12-inch and less). Full line size gate valves 12-inches and less in diameter shall be resilient seat gate valves. All gate valves shall be ductile-iron, epoxy coated and lined in accordance with AWWA C509.

Large mains (16-inch and greater). Full line size butterfly valves 16-inches in diameter and larger shall be epoxy lined and coated ductile-iron flanged butterfly valves. All butterfly valves shall be Class 150B in accordance with AWWA C504.

Valves shall be located on discharge side of pipe connections; minimum 3 at crosses, 2 at tees and always at beginning of dead end mains. City may require additional valving on critical sections or where proposed valving requires closing more than 3 valves to isolate a section of pipeline. Maximum spacing for mainline valves shall not exceed 1000 feet or as directed by the City.

Isolation valves shall be flanged to the tee or cross within the street intersection. All isolation valves shall be direct buried (no vaults are required).

### **1.8 Backflow Prevention**

Backflow prevention device shall be required on domestic water service connections and irrigation water service connections on all industrial or commercial buildings.

Backflow prevention device shall be required on domestic water service connections where recycle water is used on the property.

Backflow prevention device shall be required on domestic service connections where water from other sources may become cross-connected to other water supplies or sources as determined by the City, an approved backflow prevention device is required by Title 17, Drinking Water Supplies, of the California Administrative code, and shall be installed in accordance with City requirements.

All materials, installation, and testing shall be in accordance with City of Ontario Municipal Code, Title 6 Sanitation and Health, Chapter 8B Water Services, Section 6-8.57 Water Quality Control. The water meter shall not be installed until an approved backflow prevention device is installed.

### **1.9 Pressure Reducing Station**

Where required by the City, pressure reducing station shall be individually designed specifically for each installation, subject to City review and approval of design and materials.

### **1.10 Fire Service Installations**

Where fire service installations are necessary, the minimum construction requirement shall be in accordance with City Standards.

### **1.11 Corrosive Soil Design**

Where pipelines are to be constructed in known or likely corrosive soil conditions, cathodic test stations shall be provided in accordance with City requirements and standards at the locations determined by the City. The City, at its option, may also require cathodic test stations for its transmission mains and major pipelines, regardless of existing soil conditions.

In order to determine whether or not unfavorable soil conditions exist, the City may request that soil boring samples and laboratory analysis be provided as part of the project. The analysis shall include an evaluation of PH, Redox, Sulfide, Resistivity and Sulfate.

Under certain circumstances, the City may require special pipe installation procedures or types of pipe, including special protective coatings for pipe and fittings.

All test stations shall be installed behind existing or proposed curbs to allow safe access for personnel during testing. Test boxes shall be from City approved manufacturers list. Test stations shall be installed at 1000 foot intervals or as directed by the City.

### **1.12 Water Sampling Stations**

Where water sampling stations are required, as determined by the City, the stations shall be constructed in accordance with City Standards.

### **1.13 Service Installations**

All services shall be constructed in accordance with the applicable City Standard Drawings. Services shall not be connected to 18-inch or larger mains unless specifically permitted by the City. In addition to a domestic water service meter, all commercial/industrial projects shall be required to provide a separate landscape irrigation meter, in conformance with City Standards.

**1.14 Fire Hydrants**

All fire hydrants shall be installed at 300-foot intervals with the exception of fire hydrants located on arterial roads, which will be spaced at 500-foot intervals on alternate sides of the roadway (1000 feet separation same side). Fire hydrants shall be installed with a minimum separation of 5-feet from any driveway, street light, power pole, sign, fence, walls, etc.

Fire hydrants shall be installed 12-inches behind sidewalk when sidewalk is adjacent to curb and 20-inches behind curb face when sidewalk is not adjacent to curb. All fire hydrants piping shall be same as main and installed with a break-off check valve.

**1.15 Blow-Offs**

Appropriately sized blow-offs shall be located at all low points along the pipeline alignment and at all "dead end" locations. Additionally, for all pipelines 16-inches in diameter and greater, a blow-off shall be located on the upstream side of all mainline valves. All blow-offs shall be constructed to City Standards.

Blow-offs should be located as near to storm drain catch basins whenever possible. On arterial streets blow-offs are to be placed prior to the curb radius with service line perpendicular with mainline.

The size of the blow-off shall be based on the mainline pipe diameter as follows:

Main Size	Blow-Off Size
12-inch to 16-inch	4-inch
18-inch to 24-inch	6-inch
Greater than 24 inch	8-inch

**1.16 Combination Air/Vacuum Release Valves**

Appropriately sized air vacuum release valves shall be located at all high points along the pipeline alignment and at all "dead ends" that occur at a high point. Additionally, for all pipelines 16-inches in diameter and greater, an air vac valve shall be located on the downstream side of all mainline valves. On arterial streets air vac valves are to be placed prior to the curb radius with service line perpendicular with mainline. All air vac's shall be constructed per City Standards.

The size of the air vac's shall be based using the APCO APSLIDE Model or engineering calculations.

**1.17 Temporary End of Line Appurtenances**

A 4-inch blow off shall be installed at the end of each segment of pipeline that is installed for future use. If the section of pipe is installed creating a high point an air vac will be required.

**1.18 Tracer Wire**

Tracer wire shall be installed on all PVC waterlines for the purpose of providing a continuous signal path used to determine pipe alignment after installation. Locator wire shall be brought to

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the surface at all appurtenances (i.e. fire hydrants, water services, air valves, blow-offs, etc.), thus providing continuous "looping" between the appurtenances and the water main.

### **1.19 Ductile Iron Fittings for PVC**

All fittings for use with PVC C900 pipe shall be cast-iron outside diameter (C.I.O.D.) push-on or mechanical joint fittings with the exception of fittings with valves which shall be push-on or mechanical joint by flange. Ductile iron fittings shall be classified as "compact ductile iron fittings" and shall be produced in strict accordance with ANSI/AWWA A21.53/C153. Unless otherwise specified, the interior of the ductile iron fitting shall be lined with a uniform thickness of cement mortar "double thickness" then sealed with a bituminous coating in accordance with AWWA C 104. The outside surfaces of the DIP fittings shall be coated with a bituminous coating in accordance with ANSI A21.6 or ANSI A21.51.

All ductile iron fittings shall be polyethylene encased at the time of installation. Polyethylene encasement and installation shall be accordance with AWWA C105.

### **1.20 Restrained System**

Restrained joints shall be utilized for thrust restraint on all pipelines per City Standards. The acceptable method of restraint for PVC would be Uni-flange or Mega-lug type restraints, field-lock gaskets or TR-Flex joints for DIP and welded joints for CML&CMC steel pipe.

All restraint devices for shall have a water working pressure rating equivalent to the full rated pressure of the pipe on which they are installed, with a minimum 2:1 safety factor in any nominal pipe size. Restraining devices shall provide full (360 degree) support around the circumference of the pipe.

Length of pipe to be restrained on each side of bends, tees, reducers and other fittings shall be determined by the Private Engineer or manufacturer of the restraint device in accordance with City Standards.



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## 2.0 Recycle Water System Design Criteria

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### 2.1 Off-Site Recycled Water System

#### 2.1.1 General

The City of Ontario (City) recycled water program is supervised by the California Department of Health Services. As set forth in the City of Ontario Municipal Code, Title 6 Sanitation and Health, Chapter 8C Recycle Water Use. The City shall determine whether a given service will be furnished with recycled water or potable water. The determination shall be in accordance with the standards of treatment and water quality requirements set forth in Title 22, Chapter 4 of the California Administrative Code, with the intent of the City to work in conjunction with the health agencies to protect the public health, and with the availability and/or feasibility of making available recycled water facilities. All on-site facilities using recycled water will have a cross connection test every four years unless otherwise approved by the state based on a case by case basis. However, in unusual circumstances, the cross connection test could be required on an annual basis. All inspections and any cross connection found are reportable to California Department of Health Services.

All potential uses of recycled water, including, but not limited to, uses for landscape irrigation systems, agricultural irrigation systems, systems used for industrial process or construction purposes, or recreational impoundment systems shall be reviewed by the City. If recycled water is to be used, the facilities shall be constructed in accordance with the procedures and requirements set forth below.

#### 2.1.2 General Layout

- A. The tertiary treated recycled water lines shall be constructed in accordance with the color-coding, and labeling requirements per Section 116815, California Health and Safety Code of Regulations. All pipeline material used in the recycle water system shall be purple in color or installed with a purple polyethylene sleeve at the time of installation.
- B. The system shall be designed as a circulating grid with at least three (3) main line valves at each four way intersection. Tee's shall be designed with at least two (2) main line valves.
- C. Recycled water facilities shall typically be located 8-feet from the curb face on the opposite side of the street from the potable water
- D. Each line shall be valved so that any segment does not exceed 2000 feet.
- E. Dead end mains shall be provided with means of flushing with a blow-off.
- F. Pipelines 8-inches and smaller shall be installed with a minimum of 54-inches of cover between the top of the pipe and the finished grade.
- G. Pipelines 12-inches or greater shall be installed with a minimum of 60-inches from the top of the pipe to the finished grade. Recycle water pipes shall be installed at a depth greater than the potable waterlines.

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### **2.1.3 SYSTEM DEMAND CRITERIA**

System demand criteria shall be in accordance with the City of Ontario Public Works Agency Report "POTABLE AND RECYCLED WATER GUIDELINES FOR THE PREPARATION AND REVIEW OF HYDRAULIC ANALYSIS FOR NEW DEVELOPMENTS IN THE CITY OF ONTARIO UPDATED DECEMBER 1, 2005".

### **2.1.4 Pipe Sizing**

The standard recycle water mainlines sizes allowed in the City shall be 8-inch, 12-inch, 16-inch, 24-inch, 30-inch and 36-inch in diameter. For recycled water, the minimum pipeline size in arterial streets of new development is 8-inch diameter. Smaller diameter pipeline will be considered in collector streets on a case-by-case basis by the City. These mains shall be sized so that sufficient water is regularly drawn to prevent stagnation

Whenever possible, pipelines shall be looped to provide dual direction supply and system flexibility. The City may require pipe sizing in excess of the minimum size as determined by the design criteria herein when the facilities being constructed will serve, or may be extended to serve, additional lands.

### **2.1.5 Pipeline Materials**

Per the Water Pipeline Material Specification and Approved Material List.

### **2.1.6 Recycle Pipeline Location**

Recycle water lines shall be located on the opposite side of the street from the potable waterlines and out of the main traveled lanes of the road where possible. Locate 8 feet from curb face or berm. Location is not to interfere with other existing utilities.

#### **Separation Between Water, Sewer, and Recycled Water Lines**

Installation of recycle water lines adjacent to existing or proposed sewer lines, recycle water lines, and storm drain lines shall be in accordance with Department of Health Services regulations, or City requirements; whichever is greater.

The basic separation criteria for water mains and pipelines conveying tertiary treated recycled water or storm drainage lines are a 4-foot horizontal separation where lines are running parallel and a 1-foot vertical separation (water line above recycled or storm drainage) where the lines cross each other. Generally, always cross above sewer lines with the recycle water lines, preferably with a minimum clearance of 1 foot, and parallel at least 10 feet (O.D. to O.D.) away from sewer lines.

### **2.1.7 Valves**

Small mains (12-inch and less). Full line size gate valves 12 inches and less in diameter shall be resilient seat gate valves. All gate valves shall be ductile-iron, epoxy coated and lined in accordance with AWWA C509.

Large mains (16-inch and greater). Full line size butterfly valves 16 inches in diameter and larger shall be epoxy lined and coated ductile-iron flanged butterfly valves. All butterfly valves shall be Class 150B in accordance with AWWA C504.

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Valves shall be located on discharge side of pipe connections; minimum 3 at crosses, 2 at tees and always at beginning of dead end mains. City may require additional valving on critical sections or where proposed valving requires closing more than 3 valves to isolate a section of pipeline. Maximum spacing for mainline valves shall not exceed 2000 feet or as directed by the City.

Isolation valves shall be flanged to the tee or cross within the street intersection. All isolation valves shall be direct buried (no vaults are required).

### **2.1.8 Backflow Prevention**

Backflow prevention devices will not be required on the on-site recycled water facilities using recycled water. However, in accordance with the section on water backflow prevention in the City's Rules and Regulations, "backflow protection devices may be required of the developer's, owner's, or customer's potable water service."

### **2.1.9 Pressure Reducing Station**

Where required by the City, pressure reducing station shall be individually designed specifically for each installation, subject to City review and approval of design and materials.

### **2.1.10 Corrosive Soil Design**

Where pipelines are to be constructed in known or likely corrosive soil conditions, cathodic test stations shall be provided in accordance with City requirements and standards at the locations determined by the City. The City, at its option, may also require cathodic test stations for its transmission mains and major pipelines, regardless of existing soil conditions.

In order to determine whether or not unfavorable soil conditions exist, the City may request that soil boring samples and laboratory analysis be provided as part of the project. The analysis shall include an evaluation of PH, Redox, Sulfide, Resistivity and Sulfate.

Under certain circumstances, the City may require special pipe installation procedures or types of pipe, including special protective coatings for pipe and fittings.

All test stations shall be installed behind existing or proposed curbs to allow safe access for personnel during testing. Test boxes shall be from City approved manufacturers list. Test stations shall be installed at 1000 foot intervals or as directed by the City.

### **2.1.11 Service Installations**

All services shall be constructed in accordance with the applicable City Standard Drawings. Services shall not be connected to 18-inch or larger mains unless specifically permitted by the City.

### **2.1.12 Blow-Offs**

Appropriately sized blow-offs shall be located at all low points along the pipeline alignment and at all "dead end" locations. Additionally, for all pipelines 16-inches in diameter and greater, a blow-off shall be located on the upstream side of all mainline valves. All blow-offs shall be constructed to City Standards.

Blow-offs should be located as near to storm drain catch basins whenever possible. On arterial streets blow-offs are to be placed prior to the curb radius with service line perpendicular with mainline.

The size of the blow-off shall be based on the mainline pipe diameter as follows:

Main Size	Blow-Off Size
12-inch to 16-inch	4-inch
18-inch to 24-inch	6-inch
Greater than 24 inch	8-inch

**2.1.13 Combination Air/Vacuum Release Valves**

Appropriately sized air vacuum release valves shall be located at all high points along the pipeline alignment and at all "dead ends" that occur at a high point. Additionally, for all pipelines 16" in diameter and greater, an air vac valve shall be located on the downstream side of all mainline valves. On arterial streets air vac valves are to be placed prior to the curb radius with service line perpendicular with mainline. All air vac's shall be constructed per City Standards.

The size of the air vac's shall be based using the APCO APSLIDE Model or engineering calculations.

**2.1.14 Temporary End of Line Appurtenances**

A 4-inch blow off shall be installed at the end of each segment of pipeline that is installed for future use. If the section of pipe is installed creating a high point an air vac will also be required.

**2.1.15 Tracer Wire**

Tracer wire shall be installed on all PVC waterlines for the purpose of providing a continuous signal path used to determine pipe alignment after installation. Locator wire shall be brought to the surface at all appurtenances (i.e. fire hydrants, water services, air valves, blow-offs, etc.), thus providing continuous "looping" between the appurtenances and the water main.

**2.1.16 Ductile Iron Fittings for PVC**

All fittings for use with PVC C900 pipe shall be cast-iron outside diameter (C.I.O.D.) push-on or mechanical joint fittings with the exception of fittings with valves which shall be push-on or mechanical joint by flange. Ductile iron fittings shall be classified as "compact ductile iron fittings" and shall be produced in strict accordance with ANSI/AWWA A21.53/C153. Unless otherwise specified, the interior of the ductile iron fitting shall be lined with a uniform thickness of cement mortar "double thickness" then sealed with a bituminous coating in accordance with AWWA C104. The outside surfaces of the DIP fittings shall be coated with a bituminous coating in accordance with ANSI A21.6 or ANSI A21.51.

All ductile iron fittings shall be polyethylene encased at the time of installation. Polyethylene encasement and installation shall be accordance with ANSI/AWWA C105.

**2.1.17 Restrained System**

Restrained joints shall be utilized for thrust restraint on all pipelines per City Standards. The acceptable method of restraint for PVC would be Uni-flange or Mega-lug type restraints, field-lock gaskets or TR-Flex joints for DIP and welded joints for CML&CMC steel pipe.

All restraint devices shall have a water working pressure rating equivalent to the full rated pressure of the pipe on which they are installed, with a minimum 2:1 safety factor in any nominal pipe size. Restraining devices shall provide full (360 degree) support around the circumference of the pipe.

Length of pipe to be restrained on each side of bends, tees, reducers and other fittings shall be determined by the Private Engineer or manufacturer of the restraint device in accordance with City Standards.

## **2.2 On-site Recycled Water Facilities**

### **2.2.1 General**

Design of all on-site facilities including, but not limited to, landscape irrigation systems, agricultural irrigation systems, systems used for industrial process, construction purposes, or recreational impoundment systems shall conform to the provisions set forth herein and to any conditions, standards, and requirements set forth by the City in addition to these standard specifications.

### **2.2.2 Design of Recycled Water Facilities with Temporary Potable Water Service**

Before design, the developer should obtain the following from the City:

- A. Approval to use recycled water for the proposed system, as stated in the previous section.
- B. Verification of locations and size of proposed points of connection (meter facilities).
- C. Design pressures for the proposed facilities.

Where recycled water is not immediately available for use when the design area is ready for construction, and if the City has determined that recycled water will be supplied in the future, the on-site facilities shall be designated to use recycled water. The on-site system shall be designed and constructed to the City's construction specifications as set forth herein. Provisions shall be made as directed by the City and these specifications followed to allow for connection to the recycled water facilities when they become available. In the interim, potable water will be supplied to the recycled water facilities through a temporary potable water connection. Until recycled water is available, potable water rates will be charged as set forth in the City of Ontario Municipal Code Title 6 Sanitation and Health, Chapter 8B Water Service.

A backflow prevention device acceptable to the Health Department and the City will be required as long as the on-site facilities area uses potable water. The backflow prevention device shall be downstream of the meter and a part of the on-site facilities. When recycled water becomes available, the backflow prevention device will be removed by the owner and the on-site facility reconnected to the meter.

### **2.2.3 Backflow Prevention Devices and Signage**

Backflow prevention devices will not be required on the on-site recycled water facilities using recycled water. However, in accordance with the section on water backflow prevention in the City's Municipal Code Title 6 Sanitation and Health, Chapter 8B Water Service, backflow protection devices shall be required of the developer's, owner's, or customer's potable water service." All new common areas where recycled water is used and that are accessible to the

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general public shall be posted with conspicuous signs that include the following wording in a size no less than 4 inches high by 8 inches wide: "RECYCLED WATER DO NOT DRINK "or "RECLAIMED WATER DO NOT DRINK ". Each sign shall also display an international symbol conveying the same warning.

#### **2.2.4 Prohibitions and Limitations**

Design of on-site recycled water facilities shall conform to the following:

- A. The recycled water system shall be separate and independent of any potable water system. Cross connections between potable water facilities and on-site recycled water facilities are prohibited.
- B. Hose bibs on recycled water facilities are prohibited.
- C. Drinking fountains shall be protected from the spray of recycled water in a manner approved by the City Engineer, prior to installation.
- D. Overspray and runoff shall be limited or prevented.
- E. Potable and recycled lines are not to be installed in the same trench.
- F. Recycled water shall not be used for any purpose other than the approved uses as set forth herein.
- G. The system shall be designed to irrigate the design area within the allowable time periods as set forth herein.
- H. On-site looped meters are prohibited.

#### **2.2.5 Control of Runoff and Application Areas**

The City encourages new and innovative methods of irrigation. The use of drip or subsurface irrigation may prove effective in the reduction of total water consumption and control of unnecessary runoff by containment of the water to the design area.

In accordance with the requirements of the City's Rules and Regulations for control of runoff and for control of the areas to which recycled water is applied, the design of irrigation systems shall conform to the following:

- A. The on-site recycled water facilities shall be designed to meet the peak moisture demand of all plant materials used within the design area. The use of moisture sensors is encouraged, but not mandatory.
- B. On-site recycled water facilities shall be designed to prevent discharge onto areas not under control of the customer. Part circle sprinklers shall be used adjacent to roadways and property lines to confine the discharge from sprinklers to the design area.
- C. The design of the on-site recycled water irrigation facilities shall provide for watering during the periods of minimal use of the service area. This is typically between the hours of 9 p.m. and 6 a.m., or as directed by the City Engineer. Consideration shall be given to allow a maximum dry out time before the design area will be used by the public.
- D. The total time required to irrigate the design area shall not exceed 9 hours in any 24-hour period. Irrigation systems shall be designed to operate within this time requirement.

- E. Recycled water shall be applied at a rate that does not exceed the infiltration rate of the soil. Where varying soil types are present, the design of the recycled water facilities shall be compatible with the lowest infiltration rate present. Copies of the developer's soils test reports shall be made available to the City upon request.

### **2.2.6 Minimum Depth to Top of On-Site Recycled Water Piping**

For on-site recycled water piping, the minimum depth from finished grade to top of pipe (minimum cover) shall be as follows:

- A. Constant pressure lines 3 inches and larger: 24"
- B. Constant pressure lines 2-1/2 inches and smaller: 18"
- C. Intermittent pressure lines: 12"

Where piping is under paved areas, these dimensions shall be considered below subgrade.

### **2.2.7 Data Required on Plans**

- A. Meter Data - The following information shall be supplied for each recycled water meter desired; information is to be provided and shown at each meter location.
  - 1. The meter location and size (inches); meter address.
  - 2. The peak flow through the meter (gpm).
  - 3. The (static) design pressure at the meter (psi).
  - 4. The total area served through the irrigation meter in square feet or acres.
  - 5. An estimate of the yearly water requirement through the meter (acre-feet).
- B. Drinking Fountains – Exterior drinking fountains must be shown and called out on the recycled water system plans. If no exterior drinking fountains are present in the design area, it must be specifically stated on the plans that none exist. The potable water line supplying the drinking fountain must have a warning tape installed as provided in Section 5.10.8 herein and shall be so stated on the plans. Drinking fountains must be protected from the direct spray of recycled water either by proper placement of the drinking fountain within the design area or the use of a covered fountain approved for this purpose.
- C. Irrigation Equipment Legend – For irrigation systems, a legend showing the pertinent data for the materials used in the system shall be recorded on the plans. The legend shall include a pipe schedule listing pipe sizes and materials of construction, a listing of valve types including quick-coupling valves, and the following information for each type of sprinkler head:
  - 1. Manufacturer and model number.
  - 2. Sprinkler radius (feet).
  - 3. Operating pressure (psi).
  - 4. Flow (gpm).
  - 5. Sprinkler pattern

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## 3.0 Sewer System Design Criteria

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### 3.1 General

Sewer system improvements proposed for inclusion into the City's shall be designed in accordance with the criteria set forth herein, unless otherwise approved in writing by the City.

The design shall take into consideration physical conditions known to exist at the time and place of each installation and the probable operating requirements. Where such conditions render sections of these Specifications inapplicable, alternate methods of design may be submitted to the City, and upon approval thereof, may be incorporated in the Plan.

### 3.2 Unit Flow Factors

System design criteria and flow factors shall be in accordance with the City of Ontario Public Works Agency Report "SEWER SYSTEM DESIGN GUIDELINES FOR THE PREPARATION AND REVIEW OF SEWER ANALYSIS FOR NEW DEVELOPMENTS IN THE CITY OF ONTARIO UPDATED DECEMBER 27, 2005"

### 3.3 Locations of Mains

In local residential and industrial streets, sewer mains are to be located six (6) feet from the centerline of the street in the center of the driving lane. In major, primary, and secondary highways, the sewer mains will be located in the center of the driving lane nearest to the center of the street, but will not be located in the median strip or parking lanes. On curved streets, sewer mains shall be parallel with the centerline of the street by use of horizontal curves for the alignment, unless approved by the City Engineer.

Horizontal curves are allowed on all pipe sizes 8" and larger, but are not encouraged except where necessary to maintain the required clearance from water pipelines. The minimum curve radius for sewers shall conform to the manufacturer's minimum recommendations. No reverse curves shall be allowed between manholes. No vertical curves shall be allowed.

Sewer main lines shall have a minimum cover over pipe which should be sufficient to service adjacent property by gravity, and cover shall not be less than 7.5' to finish grade of street, unless otherwise approved by City. In addition, sewer mains must be sufficiently deep in subdivisions to allow water lines to be set with 4' min. cover without interference from sewer laterals.

Sewer installation shall provide a minimum clearance of 50 feet from all potable, non-potable, and water quality monitoring wells.

### 3.4 Pipe Sizing

The standard sewer mainlines sizes allowed in the City shall be 8-inch, 10-inch, 12-inch, 15-inch, 18-inch, 21-inch, 24-inch, and 27-inch in diameter.

### 3.5 Pipe Material

Per the Sewer Pipeline Material Specification and Approved Material List.



### **3.6 Manholes**

Manholes are required at the end of each line, change in grade or size, change in alignment or intersection of two or more sewer mains. Manholes shall be spaced at a maximum distance of 350-feet, unless otherwise approved by City. Manholes shall be located at or near all BC's, EC's, PRC's and PCC's on curved sewers. Distance noted between manholes shall be measured to manhole centerlines.

Minimum 48-inch ID manhole shall be required for sewers with a diameter of 18-inch or less and/or at a depth of 12-feet or less. A 30-inch frame and cover shall be used on a 48-inch manhole. Minimum 60-inch ID manholes shall be required for sewers with a diameter of 20-inch or larger and/or deeper than 12-feet. A 36-inch frame and cover shall be used on a 60-inch manhole. Minimum 72-inch ID manhole shall be required for sewers with a diameter of 30-inches. A 36-inch frame and cover shall be used on a 72-inch manhole.

Manholes shall have 0.2-feet of elevation differential through the manhole on straight runs and at angles. Pipe flow line elevations at inlet and outlet of manhole as well as centerline manhole stationing shall be shown on plans. Unless otherwise approved by the City, junction manholes shall have the crowns (soffits) of the intersecting pipes at the same elevation where their projections intersect the manhole centerline.

Drop manholes may be utilized only upon prior approval by the City. Drops shall not be less than 3 feet ("Steep" slopes from the first manhole upstream are preferred to drop manholes). Manholes shall not be buried except where approved by City. Manholes shall be raised above ground level where necessary to maintain them in farmed areas and in waterways.

Manholes may be required on laterals 8-inch or larger at the point of connection to the mainline and at the property line. A monitoring manhole can be used for the manhole at the property line.

Manholes located outside of the pave area shall be installed with the frame and cover .1-foot above finish grade with a 3-foot concrete collar. Manholes located in landscape area and in fields shall be installed 18-inches above finish grade.

### **3.7 Cleanouts**

The use of cleanouts is not permitted except on laterals at the property line.

### **3.8 Laterals**

Minimum 4-inch lateral shall be required for single family residences. Minimum 6-inch lateral shall be required for multi-family dwellings, commercial and industrial use. Lateral shall be constructed of same material as main line.

House Connection Laterals at 2% slope, utilizing 45° connection at main.

### **3.9 Bedding**

Minimum requirements per City Standard Drawings No. 2104 and No. 2105

### **3.10 Backflow Valves**

Backflow valves shall be required in accordance with the Uniform Plumbing Code, Latest Edition.

Backflow valves shall be installed at shallowest location allowing access for future inspection and maintenance. Where backflow valves are required, they shall be installed on private property by the property owner or tract developer and are to be maintained by property owner.

### **3.11 Industrial Waste Provisions**

The developers of all commercial/industrial projects shall provide the City with detailed information concerning the project's expected wastewater quality and quantity. The City will review this information and determine which of the following facilities are required.

1. Building sewer sampler.
2. Wastewater flow monitoring station.
3. Gravity separator.
4. Industrial waste clarifier.
5. Pretreatment facilities.

## 4.0 Material Specifications–Water Pipeline

### 4.1 General

All pipe and fittings delivered to the job site shall be clearly marked to identify the manufacturer's name, material, class, and thickness. All material shall be new and free of blemishes. Acceptance of pipe and accessories by the City will be based on load bearing tests, and inspection of the complete products as specified hereinafter. Acceptance of installed piping will be based on inspection and leakage tests as specified hereinafter.

#### 4.1.1 Piping Schedule

Unless noted otherwise on the plans or in the specifications, pipe shall be furnished in accord with the following materials schedule.

Piping Schedule			
Diameter	Domestic Water		Recycle Water
	OMC	NMC	
2-inch and smaller	Copper	PE Tubing	PE Tubing w/purple tape wrap or sleeve
8-inch & 12-inch	CML/CMC DIP	PVC C900	Purple PVC C900
16-inch	CML/CMC DIP	CML/CMC PVC C905	Purple PVC C905
18-inch to 42-inch	CML/CMC DIP	CML/CMC	CML/CMC w/purple warning tape
DIP – Ductile iron pipe CML/CMC – Cement Mortar lined and coated steel pipe PVC C900 – Polyvinyl Chloride pressure pipe			

#### 4.1.2 Welded Steel Pipe, CML & CMC

Shop fabricated pipe with machine-applied lining and coating, dye-check shop welding performed after hydrostatic testing of cylinders, pipe per A.W.W.A. C200, steel plate per A.S.T.M. A-570, 10 ga. minimum, minimum yield 33,000 psi, cement mortar coating and lining per AWWA C-205. Design stress shall not exceed 16,500 psi. Each pipe section shall be provided, prior to delivery, with temporary plastic end covers, with exposed steel shopcoated, 40' maximum joint lengths, lap weld bell x plain end spigot, or rubber gasket bell x rubber gasket spigot, including rubber gaskets and gasket lubricant.

Cement used in mortar lining and coating shall be Portland Cement per ASTM C 150, Type V for coating and Type II or Type V for lining. Cement-mortar coating shall be reinforced in accordance with AWWA C205.

**4.1.3 Welded Steel Fittings**

All bends, reducers, increasers, tees, crosses, wyes, and other special fittings, except as specifically noted on the Drawings, shall be constructed of cement mortar lined steel pipe with coating as specified for balance of pipeline, and shall be shop fabricated in accordance with the latest revision of A.W.W.A. C208. (as modified below).

ELBOWS				
Angle	0-22 1/2°	22 1/2°-45°	45°-67 1/2°	67 1/2°-90°
No. Pieces	2	3	4	5

NOTE: At the break point angles (i.e. 22 1/2°, 45°, and 67 1/2°) use the elbow with the largest number of pieces.

All fittings shall have a steel cylinder thickness equal to or greater than the specified wall thickness of the pipeline, but not less than 10-gauge. The minimum radius for all bends shall not be less than 2.5 times the nominal diameter of the pipelines. Where simulated weld bells are used for lap-welded fittings, the bell plate thickness shall be 1/4". Fittings shall be designed and fabricated for a pressure which is 150 percent of the pressure class as designated for the pipeline, except where otherwise indicated.

Special fittings shall be fabricated from machine cement mortar lined and machine outside coated. The individual parts of the fittings shall be cut from the pipe, welded together, and the coating and lining of shop joints shall be hand applied to provide a finished cement mortar lined and finished outside coated joint comparable to the mechanically applied lining and coating detailed herein.

Special fittings and sections shall be reinforced with stiffener rings, collars, crotch plates, etc. as necessary to keep the maximum working stress to that level permitted for the pipe in accordance with AWWA M11 Steel Pipe Manual, Section 13.3.

Non-flanged joints shall be designed for lap-weld joints, and shall have bell ends for receiving the O.D. of the mating steel pipe cylinder.

Specials and fittings fabricated from cylinders that have been hydrostatically tested in accordance with these specifications shall be tested by the dye-check method, or approved equal, prior to the lining and coating of said material. Contractor shall submit fabrication drawings for all AWWA shop fabricated fittings to the City for approval prior to construction.

**Butt Straps**

Use two-piece rolled steel straps with a minimum thickness of ¼-inch and a minimum width of 10-inch. Straps shall be fabricated to snugly fit over the plain pipe ends, and shall be centered over the ends of the pipe sections to be joined. Weld one or more standard 5-inch, 3000 lb. threaded half-couplings to the butt strap. Provide a threaded billet steel plug for each half-coupling. Two hand-holes shall be required on pipelines 14-inch and larger.

**4.1.4 Ductile Iron Water Pipe**

Ductile iron pipe and fittings shall be manufactured per AWWA C110, C111, C115, C150, C151 and C153. The minimum wall thickness for ductile iron pipe shall be as specified in AWWA C150 for the design pressure class, and thickness Class 53 for flanged spools. Gray iron and cast iron fittings or flanges shall not be used.

Joints for ductile iron pipe and fittings shall be mechanical, flanged, or push-on in accordance with AWWA C110, C111 and C153. The joint dimension and gasket shall be as specified in AWWA C111. All pipe joints shall be bonded to provide electrical continuity for corrosion monitoring and future cathodic protection.

The standard restrained joints shall be of the type utilizing cast lugs, shop welded retainer lugs, retainer rings bearing against pipe shoulders, or retainer rings in pipe grooves. Where the restrained joint is of the grooved type, the wall thickness beneath the groove shall be equal to or greater than the minimum specified wall thickness. Retainer glands or uni-flange adapters utilizing setscrews bearing against the pipe wall are not acceptable.

The exterior surfaces of all pipe and fittings shall be factory coated with a minimum one 1-mil thick petroleum asphaltic material per AWWA C110 and C151. All pipe and fittings shall be cement-mortar lined in accordance with AWWA C104. Cement-mortar shall be in accordance with ASTM C150, Type II or Type V.

Ductile pipe and fittings shall be polyethylene encased in accordance with AWWA C105.

**4.2 Polyvinyl Chloride (PVC) PIPE**

PVC pressure pipe shall be manufactured per AWWA C900 and C905. C900 PVC pipe shall be used for mains and related appurtenances 12-inches or less in diameter. C905 PVC pipe shall be used for mains and related appurtenances 16-inches and greater. PVC pipe shall be provided in standard 20-foot lengths, unless otherwise detailed or required on the Approved Plans. The minimum length of PVC pipe sections used for tie-ins and stub-outs shall be 3 times the pipe diameter or 48-inches, whichever is longer, unless otherwise approved by the City.

PVC pipe shall have common profiles for inter-changeability between rough-barrel dimensions, couplings, ends, and elastomeric gaskets to facilitate future repairs. When assembled, the pipe shall have only one gasket per bell and spigot end, and/or two gaskets per coupling. These rubber rings (elastomeric gaskets) shall be manufactured to conform to the requirements of ASTM F-477 and furnished by the pipe manufacturer.

In areas where it is required to lay the pipe along a curve, the use of deflection couplings will be used to form the arc. The pipe shall not be bent to form the arc, nor shall the pipe be deflected within integral bells or ductile-iron fittings. Deflection couplings shall be limited to use only on 8-inch and 12-inch AWWA C900 PVC pipe. Unless otherwise approved by the City, PVC pipe shall be installed using 5° deflection couplings (2½° at each bell) to form arcs with radii no less than the minimums noted below:

Pipe Length Used Minimum Radius	
20-foot length	229-foot radius
10-foot length	115-foot radius

All pipe to be supplied under these specifications must have the following markings on the pipe barrel: Nominal size and O.D. base (for example, 8" C.I.O.D.); dimension ratio number; AWWA pressure class; and manufacturer's name or trademark and production record code. PVC pipe shall carry a current certification of the National Sanitation Foundation (NSF) as acceptable to use in the transport of potable water.

PVC pipe shall be installed within one year of its manufactured date. Pipe older than one year shall not be delivered to the construction site. The City shall require the manufacturer to submit a certificate stating that all pipe has been manufactured and tested in accordance with this specification.

#### **4.2.1 Pipe Outlets 2 Inches and Smaller**

Outlet connections to PVC water mains two (2) inches and smaller shall be bronze service saddles with double stainless steel straps designed specifically for C.I.O.D. PVC pipe. No single strap saddles or full circle saddles are allowed.

#### **4.2.2 Pipe Outlets Larger Than 2 Inches**

Outlets in PVC pipe larger than two (2) inches shall be accomplished through the use of ductile fittings.

For outlets to be installed after initial pipeline construction, a tapping tee may be used subject to advanced written approval by the City.

#### **4.2.3 Ductile Iron Fittings for PVC**

This specification covers ductile iron fittings for use with AWWA C900 polyvinyl chloride (PVC) pipe including tees, crosses, elbows, reducers, and related special fittings. Cast iron fittings are not permitted. All fittings for use with PVC C900 and C905 pipe shall be cast-iron outside diameter (C.I.O.D.) push-on or mechanical joint fittings with the exception of fittings with valves which shall be push-on or mechanical joint by flange. Ductile iron fittings shall be classified as "compact ductile iron fittings" and shall be produced in strict accordance with ANSI/AWWA A21.53/C153. Unless otherwise specified, the interior of the ductile iron fitting shall be lined with a uniform thickness of cement mortar "double thickness" then sealed with a bituminous coating in accordance with AWWA C104 (latest). The outside surfaces of the DIP fittings shall be coated with a bituminous coating in accordance with ANSI A21.6 or ANSI A21.51.

All ductile iron fittings shall be polyethylene encased at the time of installation. Polyethylene encasement and installation shall be accordance with ANSI/AWWA C105.

#### **4.2.4 Restrained System**

Restrained joints shall be provided by a clamping ring and an additional ring designed to seat on the bell end of the pipe. The rings shall be connected with T-Head bolts or rods. Restraining devices shall provide full (360 degree) support around the circumference of the pipe. No point loading shall be permitted.

Restraint of mechanical joint fittings shall be provided by a clamping ring installed on the PVC pipe and connected to the mechanical joint fitting with T-Head bolts or rods. All restraint devices for PVC pipe shall have a water working pressure rating equivalent to the full rated pressure of the PVC pipe on which they are installed, with a minimum 2:1 safety factor in any nominal pipe size. In addition, restraining devices shall meet or exceed requirements of UNI-Bell B-13

"Recommended Performance Specification for Joint Restraint Devices for Use with PVC Pipe." Restraining devices shall be approved by the City.

All buried steel parts shall be sand blasted in accordance with the coating manufacturer's technical data sheet for "submerged" service and coated with two-coat epoxy. Epoxy shall be Tnemec Series 66 or approved equal. All bolts and connecting hardware shall be of high strength low alloy material in accordance with ANSI/AWWA C111/A21.11. Buried steel parts shall be covered with grease and wrapped with polyethylene encasement.

#### **4.2.5 Locator Wire**

Locator wire shall be installed over all PVC waterlines, non-ferrous services and pipelines. Locator wire shall be 14-1 solid insulated copper wire (UF), in a continuous strand, placed on top of pipe and secured with tape. Locator wire shall be brought to the surface at all appurtenances (i.e. fire hydrants, water services, air valves, blowoffs, etc.), thus providing continuous "looping" between the appurtenances and the water main.

After all trench backfill operations are complete, the Contractor shall conduct the conductivity test to confirm that the wire is continuous. The Contractor shall be responsible for all costs to confirm, locate, and repair any breaks in the locator wire identified in the conductivity test. The Contractor is advised to use care in the installation and backfilling operations to prevent damage to the wire.

Splices shall be made at locations approved by the City. The wire connecting device shall be an underground electrical wire connector to splice and effectively moisture-seal the conductors. Wire connectors shall be approved by the City and shall be UL listed and CSA certified for direct burial splices.

#### **4.2.6 Polyethylene Water Service Pipe (PVC Mains Only)**

1-inch diameter polyethylene water service pipe shall conform to all applicable requirements of the latest revision of AWWA C901. Polyethylene water service pipe shall be iron pipe size and supplied by a City approved manufacturer.

The PE pipe or tubing shall be marked in accordance with ASTM D2239 for IPS pipe sizes. It shall also carry the seal of the National Sanitation Foundation (NSF). The PE pipe and tubing shall be rated for use with water at 73.4°F at a maximum working pressure of 200 psi, based on ASTM D2837.

For iron pipe sizes (IPS), the standard inside dimension ratio (SIDR) shall be SIDR 7 with the average inside diameter, minimum wall thickness and respective tolerances for any cross section as specified in ASTM D2239. The minimum burst pressure at 73.4°F determined in accordance with ASTM D1599 latest revision shall be 630 psi. The time of testing of each specimen shall be between 60 and 70 seconds. The PE pipe and tubing shall not fail, balloon, burst or weep as defined in ASTM D1598, latest revision, when tested in accordance with Section 7.6 of ASTM D2239.

### **4.3 A.W.W.A. GATE VALVES**

All resilient seat gate valves shall meet the requirements of A.W.W.A. C509 (latest) for rubber seated gate valves and shall be tested bubble-tight. In addition, RS gate valves shall be furnished with low zinc bronze stems, stainless steel body hardware and valve body and bonnet

fusion bonded epoxy coated inside and out (10 mils nominal thickness) and meet all requirements of AWWA C550.

#### **4.4 Rubber Seated Butterfly Valves**

Butterfly valves shall conform to the latest revision of A.W.W.A. C504. Butterfly valves and operators shall be Class 150B, constructed for direct burial and have flanged ends to mate A.S.A. 150 lb. steel flanges.

Butterfly valves shall be furnished with operators of the traveling nut or worm gear type, self-locking in any position, and sealed, gasketed, and lubricated to withstand a submersion in water to 10 psi. The valve shall open by counter-clockwise rotation of a 2 inch square A.W.W.A. operating nut. The operator shall be capable of meeting the torque requirements for opening and closing the valve against 150 psi upstream and 0 psi downstream pressure and a maximum inlet-outlet flow rate of 12 FPS, normal flow rate of 6 FPS, and shall be provided with A.W.W.A. stops capable of absorbing up to 300 foot-pounds of input torque without damage to the valve or operator.

Butterfly valves shall have Buna N seat bonded or mechanically retained, without use of metal retainers or other devices located in the flow stream, to the body and have a disc seating edge of ni-crome or stainless steel. All internal mountings or working parts shall be stainless steel.

Butterfly valves shall have the shaft V-type self-adjusting packing. The shaft shall not be exposed between the valve body and the operator.

Butterfly valves shall have their internal and external surfaces (except flange faces, stainless steel and rubber surfaces) epoxy coated, to meet all requirements of A.W.W.A. C550. All butterfly valves shall be lined (holiday free) with a minimum of 10-mils (2,5-mil coats) of Keysite 750, (white); or DeVoe Bar-Rust No. 235 (white). The epoxy lining shall be applied at the valve manufacturer's plant in accordance with the coating manufacturer's application specifications.

#### **4.5 COPPER TUBING (CML & DI Pipe)**

Copper tubing shall conform to the requirements of the "Specifications for Seamless Copper Water Tube" (ASTM Designation B88) and shall be Type K. As required by the City, copper tubing shall be installed with a 6-mil (minimum) polyethylene sleeve "Polywrap C" by Northtown Company or City approved equal.

#### **4.6 Red Brass Pipe**

Brass pipe and fittings shall conform to the requirements of the "Specifications for Seamless Red Brass Pipe, Standard Sizes" (ASTM Designation B43). As required by the City, brass pipe shall be installed with a 6-mil (minimum) polyethylene sleeve "Polywrap C" by Northtown Company or City approved equal.

#### **4.7 Protecto Wrap**

For specified outside wrapped steel pipelines and/or where specifically directed by the City, outside pipe wrapping shall be Protecto Wrap No. 200, or 310 bituminous resin tape with No. 1170 primer.



#### **4.8 Precast Concrete Vaults**

All precast concrete manhole sections shall be manufactured in a plant especially designed for that purpose. All units will conform to the design shown on the drawings, and all work shall be conducted under strict plant controlled supervision.

Design loads shall consist of dead load, live load, impact, and in addition, loads due to water table, and any other loads which may be imposed upon the structure.

Live loads shall be for H-20 and/or H-20-S16 per AASHTO Standard Specifications for Highway Bridges with revisions. Design wheel load shall be 16 kips. The live load shall be that loading which produces the maximum shears and bending moments in the structure. All reinforcing steel shall be intermediate or hard grade billet steel conforming to ASTM A615/A706. Bars other than ¼-inch round, or smaller, shall be deformed in accordance with ASTM A305.

All vaults shall have a 2 piece torsion hinged cover specified for traffic loads where required. The effort necessary to lift the cover shall not exceed OSHA requirements. Also, cover shall be provided with a safety chain capable of limiting the travel of the cover. Precast sections shall be joined with a plastic joint sealing compound.

Vaults shall be located outside of sidewalk areas. The dimension from the top of the vault to the centerline of the piping within the vault shall not exceed 5-feet.

#### **4.9 Fusion Bonded Epoxy Coating**

Wherever fusion-bonded epoxy coating is specified on steel piping or equipment for potable water, the coating system shall consist of two or more coats of Scotchkote 306; Tnemec Series 104 or City approved equal. Minimum dry film thickness shall be 10-mils. Surface preparation shall be SSPC-10. Coating shall be in accordance with NSF-61. Method of application shall be either electrostatic method or heat fusion method.

Submit manufacturer's data sheets for review and approval, including: method of application; minimum and maximum DFT for prime, intermediate and finish coats; percent solids by volume; recommended surface preparation; application instructions and curing requirements; etc.

#### **4.10 Test Cable and Bonding Cable**

All test cable and bonding cable shall be stranded copper wire with insulation rated at 600 volts. Cable with cut or damaged insulation is not acceptable. All cable shall be of sufficient length to extend from the point of connection to the appropriate corrosion monitoring test box without splices. The cable shall have a 7/64-inch thick, high molecular weight polyethylene (HMW/PE) insulation specifically designed for cathodic protection service and suitable for direct burial in corrosive soil or water, conforming to ASTM D 1248, Type I, Class C, Category 5 (HMW/PE Type CP) Grade E-5 or J-1. Test cable shall have at least 18-inches of slack in the test box. Cable size shall be in accordance with the Standard Drawings.

#### **4.11 Pipe Flange Insulating Kits**

All pipe flange-insulating materials shall be of the type designated by the manufacturer as suitable for service at the operating temperatures and pressures of the pipeline. Insulating gaskets shall be full-face dielectric neoprene-faced phenolic. Insulating sleeves shall be full-length phenolic. Insulating washers shall be phenolic.

### **BRASS IDENTIFICATION TAGS**

All wires terminating in CP Test Boxes shall be identified with brass tags securely attached to the wires with nylon fasteners. The tags shall be 1½-inch in diameter, 1/16-inch thick, and shall be die-stamped with identifying letters and numbers ¼-inch high.

### **4.12 Steel Flanges, Bolts, Nuts and Gaskets**

Flanges for steel pipe shall conform to requirements for ASA 150-lb. flanges and flanged fittings or ASA 300-lb. flanges and flanged fittings, as noted on Drawings. All flanges shall be forged steel welding-neck or slip-on flanges. Dimensions and drilling of flanges for steel pipe shall conform to ASA 150 or 300, respectively, steel pipe flanges and flanged fittings, and all flanges shall be attached with bolt holes straddling vertical axis of pipe, unless otherwise shown on Drawings. Flanges and their attachment to pipe shall conform to applicable requirements of latest edition of API-ASME Code for Unfired Pressure Vessels. Welding-neck flanges shall be bored to same inside diameter as adjoining pipe.

Bolts shall be standard hexhead machine per ASTM A-307, Grade B. Nuts shall be hexagonal, cold pressed, semi-finished steel, per ASTM A-194, Class 2H. Studs with nuts on both ends shall be furnished wherever close clearances make removal and replacement of fixed head bolts difficult. Bolts and studs shall be of such lengths that not less than two or more than four threads shall project through nut when nut is drawn tight. All bolts, studs, or cap screws used in tapped holes shall be of sufficient length to provide an engagement of length of threaded portion of not less than nominal diameter of bolt for steel nor less than one and one-half times the diameter for cast iron fittings.

Unless stainless steel nuts and bolts are used, each steel/iron type fitting shall be equipped with at least one (1) sacrificial zinc anode cap. Said cap shall be "protecto-cap" or City approved equal.

Slip-on flanges shall be welded along the inner seam surrounding the pipe diameter as well as along the outside pipe and flange interface.

Gaskets for flanged joints shall be 1/16-inch thick compressed non-asbestos sheet, produced by a "City Approved Manufacturer". Flat-faced flanges shall be provided with full face gaskets with bolt holes pre-punched. Raised-face flanges shall be provided with ring gaskets.

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## 5.0 Materials Specifications—Sewer Pipeline

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### 5.1 General

Where alternate pipeline materials are allowed by the City, the Contractor shall select such materials and construction methods as will result in a satisfactory completed project. All pipe materials shall be new and unused unless otherwise specified. Materials and strength of pipe shall be as shown on the plans or as specified herein.

### 5.2 Gravity Mains

#### 5.2.1 Vitrified Clay Pipe (VCP)

Vitrified clay pipe and fittings shall be extra strength Vitrified Clay Pipe (VCP) and shall conform to the requirements of ASTM C-700 "Specifications for Extra Strength Vitrified Clay Pipe), the "Green Book" 207-8, 208-2, and the requirement specified herein. Vitrified clay pipe shall be of the best quality, vitrified, homogeneous in structure, thoroughly burned throughout the entire thickness, free from cracks or other imperfections and must give a clear metallic ring when struck with a hammer.

All Vitrified Clay Pipe shall be subject to the Bearing Strength Tests and hydrostatic pressure tests described in ASTM C-301. The City may select at random and test one length of pipe for each 200 lengths of pipe (or fraction thereof) delivered to the project site.

#### 5.2.2 Joints

Joints in vitrified clay pipe shall be made using a factory-made mechanical compression joint, consisting of a plastic material (Polyurethane), and shall be produced by a City Approved Manufacturer and shall conform with the requirements of Section 208.2.3 Type "G" Joints of the "Standard Specifications for Public Works Construction", Latest Edition.

#### 5.2.3 Fittings

Vitrified Clay Pipe fittings shall include branches of every type and stoppers. These fittings shall conform to these specifications, ASTM C-301, and shall equal or exceed the pipe in quality. Branches shall be of the type called for on the plan and standard drawings and shall be securely and completely fastened to the barrel of the pipe in the process of manufacture. Stoppers shall be strong enough to sustain all applied earth and hydrostatic tests or air testing. Stoppers shall be capable, unbraced, of remaining in place when subjected an air pressure up to 5 psi.

#### 5.2.4 Ductile Iron Pipe (DIP)

Ductile iron pipe shall comply with the provisions of Section 207-9 of the "Standard Specifications for Public Works Construction", Latest Edition. All pipe/fittings shall be coated inside and outside per ANSI Standard A21.6 - (latest edition) unless otherwise noted. Ductile iron pipe shall be compression (slip) joint, conforming with ANSI A21.11 and A21.51, latest, and have a standard thickness class (minimum CL 50) based on internal pressures and external loadings as supported by engineering calculations signed by a professional engineer registered in the State of California. All ductile iron pipe shall be provided with an 8 mil polyethylene

encasement for the entire length of the pipeline. The minimum bedding class shall be Class "C" per the City's specifications and standards.

Where restrained joints are required, ductile iron pipe/fittings shall be U.S. Pipe TR flex restrained joint or equal, conforming with ANSI A21.11 and A21.51, latest.

Unless otherwise specified, all ductile iron pipe shall be cement-mortar lined with a to the specifications of ASTM designation C150. The weight, class or nominal thickness, and casting period shall be shown on each pipe/fittings. The manufacturer's mark, the year in which the pipe/fitting was produced and the letters "DI" or "DUCTILE" shall be cast or stamped on the pipe.

### **5.3 Force Mains**

Polyvinyl Chloride Plastic Pipe (PVC), (4" to 12" Dia.) The pipe to be used shall be rubber gasket joint polyvinyl chloride pressure pipe, Class 150, conforming to A.W.W.A. C900 (latest), outside dimensions of cast-iron pipe, plain end x gasket bell ends.

Fittings shall be cast iron A.N.S.I./A.W.W.A. C101(latest), 250 psi rated working pressure, cement mortar lining with Type 5 cement conforming to the specifications of ASTM designation C150, mechanical joint ends (MT) to fit Class 150 and 200 PVC C-900 pipe, flange ends (F) shall conform in dimensions and drilling to A.N.S.I. B16.1 for cast-iron flanges and flanged fittings for 125 lb.

The PVC force main pipe shall be accompanied with a reinforced detectable underground marking tape "Terra Tape Sentry Line 1350" or approved equal for use in the protection and location of the force main. Tape shall be green in color imprinted with the message "Caution Sewage Force Main Buried Below" and shall be installed approximately 12 inches above the pipeline.

### **5.4 Manholes**

Precast concrete manhole components shall be in accordance with ASTM C 478 and the Standard Drawings. Manhole components shall be designed for H-20 highway wheel loading and specific site conditions. Manhole shafts shall be fabricated only from precast shaft sections, eccentric cone sections and grade rings.

Manhole bases may be either precast or cast-in-place, as appropriate for the application, with a formed recess shaped to match the first precast shaft section. The manhole base shall extend 9-inches below the bottom of the lowest pipe and 6-inches above the top of the largest pipe.

### **5.5 Manhole Frames and Covers**

Manhole frames shall be 30-inch and 36-inch in diameter made of cast-iron in accordance with ASTM A 48, Class 30, the Standard Drawings and the Approved Materials List. Frames and covers shall be designed for H-20 highway wheel loading.

Castings shall be smooth, clean, and free from blisters, blowholes, and shrinkage. Mating surfaces of the frame and cover shall be machined to prevent movement of the lid. Frames and covers shall be match marked in sets before shipping to the site. Locking frames and covers may be required as determined by the City.

Covers shall have the words "City Of Ontario" and "SEWER" cast into the cover as appropriate to the application. No other lettering will be permitted on the top portion of the cover.



All castings shall be dipped twice in a preparation of asphalt or coal tar and oil applied at a temperature of not less than 143.3 degrees C (290 degrees F) nor more than 154.4 degrees C (310 degrees F) and in such a manner as to form a firm and tenacious coating.

## BASIC SPECIFICATIONS

### WATER PIPELINE CONSTRUCTION SPECIFICATIONS

(In addition to Green Book Standards)

#### **1. EARTHWORK**

##### **1.1 GENERAL**

(Per Green Book)

Unless otherwise approved, all pipeline trenches shall have vertical sides and shall have a minimum width equal to the outside diameter of the pipe plus 12-inches and a maximum width equal to the outside diameter of the pipe plus 16-inches.

##### **1.2 TRENCH EXCAVATION**

(Per Green Book)

##### **1.3 TRENCH AND EXCAVATION SHORING**

(Per Green Book)

##### **1.4 PIPE BEDDING**

(Per Green Book)

Where the bottom of the trench is in rock or boulders, such material shall be removed to a minimum depth of 6 inches below the grade of the bottom of the pipe and the trench refilled to the grade of the pipe with sand or suitable selected sandy material. The material shall be properly moistened and thoroughly compacted in layers not exceeding 4 inches in thickness by means of a hand-operated, power-driven tamper.

##### **1.5 TRENCH BACKFILL AND COMPACTION REQUIREMENTS**

(Per Green Book)

##### **1.6 GEOTECHNICAL TESTING**

The Developer or Contractor shall engage the services of a geotechnical engineering firm or individual licensed in the State of California to monitor soil conditions during earthwork, trenching, bedding, backfill and compaction operations. Sampling and testing procedures shall be performed in accordance with the Reference Standards and as follows:

- A. The soils technician shall be present at the site during all backfill and compaction operations. Failure to have the soils technician present will subject such operations to rejection.

- B. Density and optimum moisture content of soil shall be determined by the use of the sand cone method, ASTM D 1556, or nuclear density gauge method, ASTM D 2922 & D 3017. Since the composition of the pipe and the walls of the trench have an effect on the nuclear density gauge output, a minimum of 25% of the density and optimum moisture tests shall be made using the sand cone method.
- C. Determine laboratory moisture-density relations of existing soil by ASTM D 1557, Method C and/or D (formerly ASTM D 4253 and ASTM D 4254).
- D. Determine the relative density of cohesionless soils by ASTM D 1557, Method C and/or D (formerly ASTM D 4253 and ASTM D 4254).
- E. Sample backfill material by ASTM D 75.
- F. Express "relative compaction" as a percentage of the ratio of the in-place dry density to the laboratory maximum dry density.

A report of all soils tests performed shall be stamped and signed by the soils firm or individual and shall be submitted by the Contractor prior to the filing of the Notice of Completion or acceptance by the City. The report shall document the sampling and testing of materials, the location and results of all tests performed, and shall certify that materials and work are in compliance with this specification.

## **1.7 COMPACTION REQUIREMENTS**

(Green Book)

Compaction shall be accomplished by mechanical means at the appropriate lifts for the type of soil (1 to 2 foot maximum). Consolidation by water settling methods such as jetting or flooding is prohibited. If the backfill fails to meet the specified relative compaction requirements; the backfill shall be reworked until the requirements are met. All necessary excavations for density tests shall be made as directed by the Soils Technician, and as acceptable to the City. All excavations are subject to compaction tests.

Compaction tests shall be performed at random depths, and at random intervals not to exceed 300-feet, and in addition at least 20% of all service laterals shall be tested as directed by the Soils Technician or City.

## **1.8 CONTROL OF WATER**

The Contractor shall provide and maintain at all times during construction, ample means and devices with which to promptly remove and dispose of all water entering the excavations or other parts of the work. Ground water shall not be allowed to rise around pipe installations until jointing compound in the joints has set.

The Contractor shall dispose of the water from the work in a suitable manner without damage to adjacent property. No water shall be drained into work built or under construction. Water shall be disposed of in such a manner as not to be a menace to the public health.

Dewatering for structures and pipe lines shall commence when ground water is first encountered, and shall be continuous until such times as water may be allowed to rise in accordance with the provisions of this Section.

## **2. WATER PIPE INSTALLATION**

### **2.1 GENERAL**

The Contractor shall furnish and install all water pipeline material required for the construction of the water pipeline and appurtenances as herein specified and shown on the Drawings. All pipeline material shall be installed per manufacturer's published recommendations and per the applicable published standards for the particular material being installed unless otherwise modified herein. In case of any conflict, the most stringent and highest requirement shall govern, and the Contractor shall adhere to said requirement.

### **2.2 INSTALLATION**

Pipe shall be accurately laid to alignment and grade shown on Drawings or established by City. Each section of pipe shall be lowered into trench in a manner that will prevent injury to pipe, coating, or joints and shall be carefully bedded to provide continuous bearing and prevent uneven settlement. Inside of pipe shall be clean and free from foreign material of any kind before being installed. Contractor will lay pipe units with bell ends in direction of laying, unless otherwise ordered by City or set forth in these Specifications and Drawings.

### **2.3 HANDLING**

Contractor may find it necessary to move or haul pipe during progress of the work. Dropping or bumping of pipe will not be permitted, and all damaged pipe will be rejected. Rejected pipe may be repaired if permitted by City, and such repairs shall be subject to approval of City.

Contractor shall take all necessary precautions to prevent pipe from floating due to water entering trench from any source, shall assume full responsibility for any damage due to this cause, and shall restore and replace pipe to its specified condition and grade if it is displaced due to floating. Contractor shall maintain inside of pipe free from foreign materials and in a clean, sanitary condition until its acceptance by City.

At all times when work of installing pipe is not in progress, all openings into pipe and ends of pipe in trench shall be tightly closed to prevent entrance of animals and foreign materials.

### **2.4 JOINTS (CML/CMC PIPELINES)**

Water pipeline joints shall be constructed in accordance with City Standards. All rubber gasket joints shall be bonded (in the field) per City Standard. Where indicated on the Drawing, Contractor shall install insulation flange kits in accordance with City requirements.



## **2.5 FIELD JOINTS - CEMENT MORTAR LINING**

Mortar shall be Hubs all patch quickset non shrink commercial grout or a City approved equal packaged dry mortar mix consisting of one part cement and three parts sand. Quantity of water shall be sufficient so that when mortar is firmly compressed into a ball shape, it will hold its shape without slump. Mortar shall be mixed separately for each joint to be patched.

Special care should be taken to avoid damage to lining or coating during lowering pipe into trench.

## **2.6 FIELD JOINTS - CEMENT MORTAR COATING**

Outside field joints are required to be coated with cement-mortar. This shall be accomplished by wrapping a canvas or paper diaper around the joint. The diaper is held on each side by steel strapping. Cement mortar shall be composed of 1 part cement and not more than 3 parts sand and mixed to a consistency of thick cream. The top of the pour must be covered with a protective material, such as cloth or paper.

## **2.7 CURVED ALIGNMENT**

Laying pipe on curved alignment with unsymmetrical closure of spigot into bell rings shall be permitted as recommended by pipe manufacturer. For the purpose of reducing angular deflection at pipe joints and for closure sections, Contractor shall be permitted to install pipe sections of less than standard length. Closing courses and short sections of pipe shall be fabricated and installed by Contractor as found necessary in the field. Where closing pieces are required, Contractor shall make the necessary measurements and shall be responsible for their correctness.

## **2.8 MANUFACTURER ACCESS**

Pipe manufacturer shall have free access to the work during laying operations and testing. Any improper act on the part of Contractor which pipe manufacturer may observe shall be reported to City.

## **2.9 ALLOWABLE VARIATIONS IN PIPELINE ALIGNMENT**

Pipeline cover as shown on the attached Standard Drawings and/or the Design Drawings, is hereby defined to be Design Cover over pipeline. Therefore, should field conditions determined at time of construction show that any pipe grade changes are required, City reserves the right to authorize said changes in pipeline grades, and Contractor shall trench and lay pipeline accordingly.

All pipelines within public roadways shall be installed with no less than 42-inches of cover below road grade (or projected existing road grade, in case of embankments) unless otherwise shown on the Drawings or approved by the City.

## **2.10 PVC WATERLINES**

Each section of pipe shall be lowered into the trench in a manner that will prevent injury to the pipe, or joints and shall be carefully bedded to provide continuous bearing and prevent uneven settlement. The inside of the pipe shall be clean and free from foreign material of any kind before being installed.

For PVC pipe and ductile iron pipe with mechanical joints, the gasket shall be placed in the groove of the bell. Lubricate the spigot end into the bell and force into position per manufacturer's recommendation. See attached Pipeline Manual page 11

Trenches shall be in a reasonably dry condition when the pipe is laid. Necessary facilities shall be provided for lowering and properly placing the pipe sections in the trench without damage. The pipe shall be laid carefully to the lines and grades given and the sections shall be closely jointed to form a smooth flow line. Where no grades are given, pipe shall be laid in a smooth continuous grade between connections to other mains, blow-offs and/or air release valves. Immediately before placing each section of pipe in final position for jointing, the bedding for the pipe shall be checked for firmness and uniformity of surface.

For convenience of testing, the pipeline may be divided into sections and each section tested separately. All pipes shall be tested under a pressure 1-1/2 times the pressure rating of the pipe, but not less than 150 psi. Maximum test pressure shall not exceed that determined by the City.

If any leakage is evidenced in the testing of the pipeline, the various sections of the pipeline shall be isolated for testing between available valves, or between bumpheads located as approved by the City. The maximum allowable leakage for PVC pipe shall be six (6) gallons per day per mile of pipe per inch of pipe inside diameter. If the leakage exceeds this amount, the section being tested will be considered defective. The Contractor shall determine the points of leakage, make the necessary repairs and perform another test. This procedure shall be continued until the leakage in each section falls below the allowable maximum for that section of pipeline.

The Contractor shall provide all calibrated meters for measurement of leakage, all bumpheads or skilllets, piping, calibrated gages, pumps and other equipment, all water not furnished by City, and all power and labor necessary for the performance of pressure tests satisfactory to the City. The Contractor shall furnish all necessary equipment and labor to fill each section of pipeline tested and for pumping the water from one test section to another as may be necessary for obtaining and maintaining the required water pressure and for filling the entire pipeline with water after the conclusion of the testing, as hereinafter provided.

The Contractor, at his own expense, shall do any excavation necessary to locate and repair leaks or other defects which may develop under test, including removal of backfill already placed, shall replace such excavated material, and shall make all repairs necessary to meet the required water tightness after which the test shall be repeated until the pipe meets the test requirements. All tests shall be made in the presence of the City. After the pipe has successfully met all test requirements specified herein, the entire pipeline shall be filled with water and so maintained until the completion of the contract unless otherwise ordered by the City.

Thrust restraint shall be accomplished by the use of restrained joints as specified herein. Thrust blocks will not be allowed for PVC pipelines unless otherwise ordered by the City.

## **2.11 Locator Wire**

Locator wire shall be installed over all PVC waterlines, non-ferrous services and pipelines. Locator wire shall be 14-1 solid insulated copper wire (UF), in a continuous strand, placed on top of pipe and secured with tape. Locator wire shall be brought to the surface at all appurtenances (i.e. fire hydrants, water services, air valves, blowoffs, etc.), thus providing continuous "looping" between the appurtenances and the water main.

After all trench backfill operations are complete, the Contractor shall conduct the conductivity test to confirm that the wire is continuous. The Contractor shall be responsible for all costs to confirm, locate, and repair any breaks in the locator wire identified in the conductivity test. The Contractor is advised to use care in the installation and backfilling operations to prevent damage to the wire. Splices shall be made at locations approved by the City. The wire connecting device shall be an underground electrical wire connector to splice and effectively moisture-seal the conductors. Wire connectors shall be approved by the City and shall be UL listed and CSA certified for direct burial splices.

## **3. WELDING SPECIFICATIONS**

### **3.1 GENERAL**

All welding operators shall be qualified under the Standard Qualification Procedure of the American Welding Society and all applicable provisions of the latest edition of "Structural Welding Code" (ANSI/AWS D1.1) published by the American Welding Society are incorporated into this Specification. Contractor shall adhere to all Cal-OSHA, American Welding Society, American National Standards Institute and local agency safety regulations (including fire) regarding all welding operations.

The City shall have the right at any time to call for and witness making of test specimens by any welder in accordance with these Specifications, and the expense of such tests shall be borne by Contractor.

The provisions of these sections do not apply to the fabrication of pipe or special fittings in conflict with AWWA Standard Specifications for pipe. All hand welding in both shop or field shall be done by welders certified in accordance with ASA B31.1 latest (AWWA C-206-latest). All welds shall be made by an electric shielded arc method of welding. Plates shall be held in correct position. Abutting edges shall be properly prepared. Each deposited layer of welded metal shall be thoroughly cleaned before additional metal is applied to its surface. Finished weld bead shall be central to the seam, and the finished joint shall be free from depressions, undercut edges, burrs, irregularities resulting from welding, other than normal bead necessary.

All welds shall be a type that will produce complete fusion with base metal and shall be free from cracks, oxides, and gas pockets within the limits set forth under these Specifications. If the automatic welding machine does not obtain a fusion weld that will

penetrate through to the inside of the pipe and protrude beyond the contour of the plate surface, an inside pass shall be made in the root of the groove on the inside of the pipe. Chipping out of the weld in the root of the groove will be required when deemed necessary by the City.

If welding is stopped for any reason, special care shall be taken when welding is resumed to obtain complete penetration between welded metal, plate, and welded metal previously deposited, and if flux is used, it must be redistributed before work is resumed.

The height of the outside weld bead above the contour of the plate surface shall be measured and shall be not less than 1/16-inch. Heights of the outside weld bead above the contour of the plate surface exceeding 1/8-inch shall be removed by grinding or chipping.

Welds found deficient in dimensions but not in quality shall be enlarged by additional welding after thorough cleaning of the surface of previously deposited metal and adjoining plate. However, if work performed since making a deficient weld has rendered the weld inaccessible or has caused new conditions which would make such reinforcement dangerous or ineffective, the original conditions shall be restored by removal of welds, members, or both, before enlarging the deficient weld or the deficiency shall be compensated by additional work as prescribed by the City.

Welds considered by the City to be deficient in quality or made contrary to any mandatory provision of these Specifications shall be removed by chipping or melting and shall be remade. The weld metal shall be removed throughout its depth to expose clean base metal, but if a strictly local deficiency, the weld need not be removed throughout its entire length, provided that sufficient amount shall be removed to insure that sound weld metal only remains. A cracked weld shall be removed throughout its length.

When removing part or all of a weld by cutting or chipping, such cutting or chipping shall not extend into the base metal beyond the depth of weld penetration. When removing part or all of a weld by melting, care shall be taken not to burn or otherwise injure the base metal. After the melting operation, burned metal shall be removed to clean, sound metal.

Overheated weld metal and any overheated base metal adjoining same shall be removed and replaced by new weld metal properly applied. However, if the plate is so badly or extensively injured by overheating that it cannot satisfactorily be replaced by weld metal, such additional work as prescribed by the City shall be performed.

All longitudinal, spiral, and girth seams of straight pipe sections, and special sections when practicable, shall be welded with an automatic welding machine. If requested, sample welds shall be submitted to the City for testing in accordance with these Specifications. Approval of such tests shall be required prior to welding of pipe.

Fillet welds shall have full penetration into the corner. Excessive cutting back of the edges of fillet welds is a defect and shall be repaired. Butt welds shall be made by adding weld metal to both sides of the joint, and the underside of the weld in groove shall be chipped out, removing all slag and unsound metal, containing a clean surface for the application of weld metal; in making butt and fillet welds, weld metal shall be

deposited in successive layers, so there will be as many passes as there are complete multiples of 1/8-inch in the plate thickness, provided there shall be a minimum of two passes.

**3.2 FIELD WELDED PIPE JOINTS**

Welded field joints in steel pipe shall be lap welded unless otherwise shown. Welders shall be certified in accordance with the American Standard Code for Pressure Piping (ASA B31.1) or the "Standard for Field Welding of Steel Water Pipe Joints" (AWWA C206). Thermal stress should be considered and reduced when welding of each field joint. When closure joints are made, they shall be performed at a time when the temperature is approximately the lowest during the 24-hour day, and after at least 150 linear feet of pipe have been laid and the joints have been welded ahead of said joint. In all hand welding, the metal shall be deposited in successive layers so that there will be at least as many passes or beads in the completed weld as indicated in the following table:

Fillet Weld	
Plate Thickness Inches	Minimum Number of Passes
3/16	2
1/4	2
5/16	3
3/8	3
13/32	3
7/16	4
15/32	4
1/2	4
More than 1/2	1 for each 1/8 of an inch

Each pass, except the final one shall be thoroughly bobbed or peened to relieve shrinkage stresses and to remove dirt slag, or flux, before the succeeding bead is applied. Each pass shall be thoroughly fused into the plates at each side of the welding groove or fillet, and shall not be permitted to pile up in the center of the weld. Under-cutting along the side will not be permitted.

**3.3 TACKWELDED AND WELDED JOINTS - INSTALLATION**

All rubber gasket joints shall be bond welded in accordance with the City standards, unless an alternate method is approved by the City.

The pipe manufacturer shall direct the Contractor on the method of welding the fully welded joints, or the cut-to-fit joints, in order that the joints shall not pull apart or leak when subjected to design pressures stated herein.

#### **4. ELBOWS, SIDE OUTLETS, TEES, BUTTSTRAPS, CROSSES**

For steel pipe, all elbows, side outlets, top outlets, tees, crosses, etc., shall be furnished by the Contractor and shall be shop fabricated in accordance with A.W.W.A. C-208 (latest); except the minimum radius for all bends shall not be less than 2.5 times the nominal diameter of the pipelines. Whenever the Contractor must perform minor amounts of field fabrication, he will be required to do all fabrication in a manner such that the lining and wrapping/coating may be repaired by hand to a quality equal to the shop applied lining and wrapping/coating. Buttstraps, shear rings, etc. shall be per the applicable A.W.W.A. Standards or Manuals.

Service outlets shall be constructed in accordance with the Standard Drawing.

Wherever collar reinforcement is required, both the collar and the plain-end of the flanged x p.e. (plain-end) outlet shall be pre-shaped to mate with curvature of the main line pipeline, and both the collar and the flanged x p.e. (plain-end) outlet shall be welded into place.

All collar and wrapper reinforcing shall be in accordance with the following reinforcement guides:

- A. Steel Pipe, Design and Installation, A.W.W.A. Manual M-II, latest.
- B. An equal pipeline manufacturer's reinforcing guide, as approved by City.
- C. API-ASME Code for Unfired Pressure Vessels for Petroleum liquids and gases.

If case of conflict, the highest and most stringent standard shall govern.

#### **5. DUCTILE-IRON PIPE**

Ductile-iron pipe and ductile iron fittings shall be installed in accordance with the applicable sections of AWWA C600. The Contractor shall furnish and install all pipe, specials, fittings, closure pieces, valves, supports, bolts, nuts, gaskets, jointing materials, and all other appurtenances as shown on the Approved Plans and as required to provide a complete and workable installation.

At all times when the work of installing pipe is not in progress, including worker break times, ends of the pipe shall be closed with vermin-proof and child-proof caps or plugs. Do not permit trench water to enter the pipe. Do not place tools, clothing, or other materials in the pipe. The Contractor shall maintain the interior of the pipe in a sanitary condition free from foreign materials.

Install pipe according to the manufacturer's approved order of installation. Install pipes uphill if the grade exceeds 10%. Lower the pipe onto the bedding at the proper lines and grades.

The manufacturer's printed installation guide outlining the radius of curvature that can be negotiated with pipe sections of various lengths shall be followed, except they shall not exceed the deflections allowed in AWWA C600 according to joint type. Combined deflections at rubber gasket or flexible coupling joints shall not exceed that recommended by the manufacturer.

The pipe shall have firm bearing along its full length, and bell holes shall be provided at each joint to permit visual inspection of the joint and prevent the pipe from being supported by the bell end or coupling.

Pipe Assembly:

1. Push-On Type: Assemble the pipe joint using a lubricant recommended by the manufacturer. Insert the spigot end into the bell or coupling to the proper insertion mark. Check that the elastomeric ring has not left the groove during assembly by passing a feeler gauge around the completed joint. Drive spigot ends of the pipe into bell ends in accordance with the manufacturer's recommendations. Stabbing shall not be permitted.

2. Mechanical Joint Type: Assembly of mechanical joint fittings shall be in accordance with the manufacturer's recommendations regarding installation.

Bonding of joints to provide continuity, flange insulation kits, internal epoxy linings, and other cathodic protection items and materials shall be installed where shown on the Approved Plans in accordance with the City Standards.

All ductile-iron pipe and fittings buried underground shall be protected with a polyethylene encasement wrap in accordance with AWWA C105. Wrap shall be a loose 8-mil thick LLD polyethylene tube or a 4-mil thick HDCL polyethylene tube. All joints between plastic tubes shall be wrapped with 2-inch wide, 10-mil thick, polyethylene adhesive tape.

## **6. FILLING, TESTING, AND CHLORINATION**

Upon completion of laying, joining, and backfilling, and after pipe lengths comprising the line are not less than 7 days old, and prior to resurfacing, pipeline shall be hydrostatically tested. Prior to performing the test, the section of pipeline to be tested shall be filled with water and placed under a slight pressure for at least 48 hours. Required test pressure shall then be applied and maintained for a 4-hour period. Water required to maintain test pressure shall be measured by meter or other means acceptable to City. Contractor shall provide all necessary thrust restraint required for the hydrostatic testing.

Contractor shall either install the proposed pipelines about 3-feet to 4-feet short of the connection points to the existing pipelines or install to valve using an approved test plate. Hydro-static/leakage tests SHALL NOT be performed against closed valves that separate the proposed system from the existing system.

The Contractor shall fill all new pipelines (through an approved backflow device) with construction water and may obtain said construction water through hydrants, blow-offs, etc.

Care shall be taken to see that all air vents are open during filling. After section has been completely filled, it shall be allowed to stand under slight pressure for a sufficient length of time to allow escape of air from any air pockets. During this period all fittings, and connections shall be examined for leaks. If any are found, they shall be stopped, using a method approved by City. The required test pressure shall then be applied and maintained for the 4-hour period. All tests shall be made in the presence of the City Inspector.

The measured leakage shall not exceed 6 gallons per diameter per mile per 24-hours. Should leakage exceed this amount, the section being tested will be considered defective and Contractor shall determine points of leakage, make necessary repairs, and conduct a second test. This procedure shall be continued until leakage equals or is less than the allowable mini-mum. Note:-No leakage is allowed for welded steel pipe with fully welded joints.

Contractor shall provide calibrated meters for measurement of leakage, necessary bulkheads, piping, gauges, pumps, power, and labor, and furnish everything necessary for making all tests required, at his own expense, and shall furnish to City copies of all tests performed. The City will provide the pressure gauge to be utilized for pressure testing purposes.

All pipes shall be pressure tested to at least 150% of the pipe class rating; i.e. Class 150 = 225 psi test pressure, as measured near the low point of the section of pipe being tested.

## **7. DISINFECTING PIPELINES**

Contractor shall furnish all equipment, labor, material, and water for proper disinfection of pipelines. Disinfection shall be accomplished by chlorination after lines have been tested for leakage but before they have been connected to existing system. The new mains shall be cleaned and flushed prior to disinfection. The flushing velocity to be obtained for pipes 12-inches and smaller in diameter shall not be less than 2.5 feet per second. The Contractor shall make the necessary arrangements to attain the minimum velocity. The Contractor shall take due precaution in providing for adequate drainage from the site.

The entire pipeline, including all valves, fittings, hydrants, service laterals, and other accessories, shall be disinfected in accordance with the specifications provided herein.

A chlorine gas-water mixture shall be applied with a solution-feed chlorinating device. **DOSAGE APPLIED TO WATER WITHIN PIPELINE SHALL BE AT LEAST 50 PPM.**

Chlorinated water shall be retained in pipeline long enough to destroy all non-sporeforming bacteria. This period shall be at least 24 hours. After chlorine-treated water has been retained for required time, **CHLORINE RESIDUAL AT PIPE EXTREMITIES AND AT OTHER REPRESENTATIVE POINTS SHALL BE AT LEAST 25 PPM.** Following chlorination, all disinfection water shall be thoroughly flushed from the pipeline.



The flushed water shall have a residual chlorine content not to exceed 0.10 mg/l prior to discharging into the storm drain system. The flushing operation shall be in accordance with the California Regional Water Quality Control Board requirements. Dechlorination prior to or during flushing may be required. The Contractor shall provide adequate drainage from the site.

Should initial treatment fail to produce satisfactory disinfection of the pipeline as evidenced by the chlorine residual and/or the bacteriological test results, the chlorination procedure shall be repeated until acceptable results are obtained. Contractor shall use caution in discharging any highly chlorinated water, and shall be responsible for obtaining any necessary permission and permits from regulatory agencies. If required, the Contractor shall apply a reducing agent to the solution to neutralize residual chlorine or chloramines remaining in the water at his expense.

Bacteriological tests required by the Health Department shall be taken and conducted by a laboratory selected by the City. The bacteriological sampling shall be as follows:

1. Pipeline disinfected and flushed until the chlorine residual matches that of the source water.
2. Bacteriological samples shall be collected 24 hours after the completion of flushing.
3. A second set of bacteriological samples shall be collected 24 hours after taking the first set of samples.
4. The bacteriological sample analysis shall be provided to the City for review. All samples must be negative for bacteria with a HPC of less than 500
5. The City will approve the activation of the pipeline after two consecutive bacteriological samples have met the criteria noted above.

All costs for testing shall be paid by the Contractor. All retesting shall conform to City requirements.

Unless otherwise specified herein, minimum requirements for disinfection and bacteriological testing of new pipelines shall be in accordance with ANSI/AWWA C651 except as modified herein; and the location and number of all tests shall be determined by the City, with approval by the State Health Department.

## **8. CONNECTIONS TO EXISTING WATER SYSTEM**

Contractor shall furnish and install connections to the existing water systems at locations shown on Drawings. Prior to connecting to the existing water system, the Contractor shall "pothole" the connection location(s) and provide this information to the City for approval prior to making the connection. The contractor shall perform all work required including any necessary field measurements, cuts-to-fit, temporary connections, and field fabrications to meet existing conditions.

Connections SHALL NOT be made between existing City pipelines and proposed pipelines until successful hydrostatic/leakage and disinfection testing of the proposed pipelines has been completed. Upon successful completion of the hydrostatic/leakage and disinfection testing and only upon approval by the City, final connections can be

made to the existing pipelines. The pipeline material and appurtenances utilized to make the final connections shall be "swabbed" with a high strength chlorine solution.

Contractor shall construct all said connections so that any downtime of existing water systems, due to connection work, shall occur during normal working hours as directed by City. Contractor shall cooperate with City in scheduling said connections. City will operate all existing valves necessary for Contractor to accomplish said connection work.

## **9. TAPPING**

Connections to existing pipelines shall be made with the installation of tees or wrappers as designated on the plans. The connection sequence shall be as follows: The existing pipeline shall be drained; the tee or wrapper with valving shall be installed; and City approval of the connection shall occur prior to the re-filling of the existing pipeline.

In certain instances, and only where approved in writing by the City, wet tapping will be allowed as follows:

### **WATER MAINS**

Where connections to existing water mains are made by wet tapping, the Contractor shall perform all required excavation and shall furnish the tapping saddle and gate valve. The authorized contractor will install the tapping saddle and gate or plug valve and make the wet tap. The Contractor shall pour the thrust block, backfill, complete all compaction of backfill, make closure, set the gate "can" and cover, make all necessary pavement repairs and complete the installation in accordance with the Plans and these Standards.

### **WATER SERVICE**

Where connections to existing water mains are made by wet tapping, the Contractor shall furnish and install all necessary material and perform all required hand and machine excavation, backfill and pavement repair. The Contractor will perform the actual wet tapping.

## **10. PROTECTION OF DOMESTIC WATER MAINS FROM CONTAMINATION**

The Contractor shall protect all domestic water mains from contamination by any existing septic tank and/or leach line facilities, etc., which may be adjacent to the jobsite.

## **11. CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD, SANTA ANA REGION PERMIT**

Contractor shall channel (using sandbags or other means) flushing flow. Contractor shall protect all property from flooding and other damage during flushing operations. Contractor shall post "flooding ahead" signs in streets as required and as directed by the City. Because of demand on existing water system, the City may require Contractor to flush the pipeline over several days, in the evenings, weekends, or holidays.

Contractor shall not allow any discharges from the construction site which may have an adverse effect on receiving waters of the United States. Discharged water shall meet chlorine residual levels established by the appropriate State Water Quality Control Board. Dechlorination prior to or during flushing may be required.

**12. STEEL CASING**  
(Per Green Book)

**13. JACKED STEEL CASING**  
(Per Green Book)

**14. CORROSION PROTECTION**

Where indicated on the Drawings, cathodic protection test stations and/or flange insulation kits with test stations shall be constructed in accordance with the applicable City Standards.

All materials furnished under this specification shall be standard products from manufacturers regularly engaged in the manufacture of such products and shall be the manufacturer's latest design that complies with the specification requirements.

Electrical continuity bonding cables shall be installed across all buried or submerged metallic inline valves, flexible couplings, grooved couplings, pipe joints that are not circumferentially welded, and all other pipe joints except flange joints equipped with insulation gaskets. Where shown on the drawings, bonding cables shall be installed in vaults.

All test cable and bonding cable shall be stranded copper wire with insulation rated at 600 volts. Cable with cut or damaged insulation is not acceptable. All cable shall be of sufficient length to extend from the point of connection to the appropriate corrosion monitoring test box without splices.

The cable shall have a 7/64-inch thick, high molecular weight polyethylene (HMW/PE) insulation specifically designed for cathodic protection service and suitable for direct burial in corrosive soil or water, conforming to ASTM D 1248, Type I, Class C, Category 5 (HMW/PE Type CP) Grade E-5 or J-1. Test cable shall have at least 18-inches of slack in the test box. Cable size shall be in accordance with the Standard Drawings.

All wires terminating in CP Test Boxes shall be identified with brass tags securely attached to the wires with nylon fasteners. The tags shall be 1½-inches in diameter, 1/16-inch thick, and shall be die-stamped with identifying letters and numbers ¼-inch high.

All test stations shall be installed behind existing or proposed curbs or otherwise and out of traffic lanes to allow safe access for personnel during testing. A utility marker post shall be installed, in accordance with the Standard Drawings, when indicated on the Approved Plans.

Copper sulfate reference electrodes shall be placed 12-inches away from the pipe at spring line. Electrodes shall be placed at the opposite side of the pipe from anodes. Saturate packaged electrode in 5-gallons of water prior to installation. Backfill material around the electrode shall be as specified for the pipeline trench. Installation shall be in accordance with the Standard Drawings.

All buried test cable requiring trenching to the test station box location shall be installed, without splices, in a conduit in the trench at a minimum depth of 36-inches. Care shall be taken when installing wire and backfilling trench to prevent damage to the installation. Damaged wire shall be replaced in entirety.

Brass identification tags shall be used to identify all cables in all test boxes. Care shall be taken to accurately maintain the wire identities. The tags for all test cables shall be stamped with the City's name, the pipeline size, the contents of the pipeline, and the direction of the connection point along the pipe, in accordance with the Standard Drawings. Copper sulfate reference electrode tags at cathodic test boxes shall be stamped "CuSO4". The tags shall be securely attached to each wire with nylon fasteners prior to pipe backfilling operations.

The Contractor shall test the cathodic protection installations in the presence of the City. Contractor shall notify City of proposed test dates and times a minimum of 48 hours in advance. As a practical approach, the Contractor may choose to verify pipe continuity and flange isolation (described in Items A and B below) prior to backfilling as an unofficial test. Official testing shall occur after the backfilling and installation of the test boxes.

- A. Pipeline Electrical Continuity Testing: Test the electrical continuity of all sections of pipe to be monitored between each pair of adjacent corrosion monitoring test stations or between the ends of pipe sections. Each pipe section shall be considered electrically continuous when the measured longitudinal resistance of each pipe section is no greater than 20% higher than the theoretical resistance of that section of pipe. If testing indicates inadequate electrical continuity, the Contractor shall excavate to investigate and locate improperly bonded pipe joints and make repairs until electrical continuity is accomplished to the satisfaction of the City.
- B. Insulated Pipe Flange Testing: Each insulated pipe flange will be tested for effective electrical isolation of the two mating pipe flanges. The insulated pipe flange shall be judged for effectiveness in accordance with NACE RP0286, Section 7, Field Testing and Maintenance." The Contractor shall replace or repair any insulated pipe flange assembly until electrical discontinuity is accomplished.

At the completion of the testing, a report of the results will be prepared and presented to the City. The report shall be typed and shall include, at a minimum, test locations, date of tests, name of technician, testing methods, voltage measurements, and theoretical and calculated resistance.

## **15. VIDEO INSPECTION (CML/CML WATERLINES)**

Upon completion of the installation and backfill of the water pipeline, appurtenances, services, etc. and prior to filling the pipeline with water for the pressure test, the Contractor shall notify the City that the pipeline system is ready for video inspection. Said notification shall be made at least three working days in advance of the actual video inspection date. The video inspection will be made by a video inspection company

approved by the City and shall be made in the presence of the City Inspector. Prior to the video inspection, the contractor shall be responsible to provide the following items:

- A. Clean water pipelines free of all dirt, rock, debris, etc.
- B. Labor and equipment necessary to excavate the pipeline and provide camera access ports. Access ports shall not exceed 1000 feet in spacing shall be located at all bends in excess of 22°. Also, labor and equipment necessary to repair the access ports to the satisfaction of the City.
- C. Drivable truck access to each access port within the system to be videoed.
- D. Provide all traffic control methods required.

Should any of the aforementioned items not be in compliance by the time the video inspection is to occur, the Contractor shall be subject to compensating the City for all costs incurred.

Upon completion of the video taping of the subject waterlines, the Contractor shall reconnect the piping and backfill all access ports. The video inspection company will provide the City with the color DVD and a written report detailing the condition of the interior of the mainline and joints. Subsequent to review of the DVD and report by the City, the City will notify the Contractor within three business days that he may then proceed with the filling, testing, and disinfection of the pipeline; or the City will provide a list of corrective measures that must occur prior to acceptance.

Should remedial activities be necessary, the reconstruction methodology shall be approved by the City prior to commencement of the work. Upon completion of the remedial construction, the Contractor shall once again notify the City that the waterlines are ready for a video inspection. The City reserves the right to re-video any portions of the water system they determine may have been affected by the reconstruction work activities.

### VIDEO INSPECTION COMPANY REQUIREMENTS

(Closed Circuit Television Inspection - CCTV)

- 1. Rotating lens camera with articulating head.
- 2. Scanning capabilities of 360°.
- 3. Operative in 100% humidity conditions.
- 4. Lighting for the camera shall minimize reflective glare.
- 5. Lighting and camera quality shall be suitable to provide clear, in focus picture of the entire periphery of the pipe for all conditions.

6. Camera focal distance shall be adjustable through a range from 6" to infinity.
7. Remote reading distance (footage) counter shall be accurate to one percent (1%) over the length of the particular section being inspected.
8. The camera, television monitor, and other components of the color video system shall be capable of producing a minimum of 350 line resolution.
9. Documentation consisting of a DVD data disk and a written report detailing the condition of the mainline and joints shall be submitted to the City inspector immediately following the video inspection.
10. All video equipment used for domestic water systems shall Be certified for domestic waterline inspection only and shall never have been utilized in a non-potable system.

**16. PAINTING SPECIFICATIONS**

(Per Green Book)

**17. CONCRETE WORK**

(Per Green Book)

## BASIC SPECIFICATIONS

### SEWER PIPELINE CONSTRUCTION SPECIFICATIONS

(In addition to Green Book Standards)

#### **1.1 Earthwork**

##### **1.1.1 General** (Green Book)

##### **1.1.2 Clearing and Grubbing** (Green Book)

##### **1.1.3 Grading Along Pipeline** (Green Book)

##### **1.1.4 Trench Excavation**

###### **General** (Green Book)

###### **Limit of Excavation** (Green Book).

###### **Tunneling**

Tunneling will be permitted only where native earth is of such firmness that it will remain in its original position, without sloughing off, throughout the work of excavation and backfilling; if sloughing occurs, the roof of the tunnel shall be broken down and the trench excavated as an open trench as herein specified.

###### **Trench Width**

The maximum allowable trench width, at the top of the pipe, is the outside diameter of the barrel plus ten (10) inches on either side of the exterior of the pipe barrel. Where the trench width at the top of the pipe is wider than ten (10) inches on either side of the exterior of the pipe barrel, the pipe shall be backfilled from the bottom of the trench to a level one-fourth (1/4) of the diameter above the center of the pipe with Class "B" concrete to form a cradle for the pipe, or with -crushed rock as directed by the City.

##### **1.1.5 Trench and Excavation Shoring** (Green Book)

##### **1.1.6 Pipe Bedding**

###### **General**

All pipe bedding shall be of the type indicated on the plans and shall be in accordance with the pipe bedding Standard Drawings.

###### **Unstable Material** (Green Book)

**Rock**

Where rock is encountered, it shall be removed below grade, and the trench backfilled with suitable material to provide a compacted earth cushion with a thickness under the pipe of not less than 1/2 inch per inch of nominal diameter of the pipe to be installed, with a minimum allowable thickness of 6 inches.

**1.1.7 Special Crushed Rock Bedding**

When groundwater is encountered in the excavation, or when soft, spongy and unstable material is encountered in the bottom of the trench, and when approved by the City, the material in the bottom of the trench shall be removed to a depth directed by the City and replaced with 3/4 inch maximum crushed rock bedding. The crushed rock bedding shall be installed and compacted as shown on the Standard Drawing within these Specifications. The 3/4 inch maximum crushed rock material shall be approved by the City before use. In addition, two (2) slurry cofferdams shall be placed between each manhole as approved by the City.

Crushed rock shall be the product of crushing rock or gravel. Fifty percent of the particles by weight retained on a 3/8-inch sieve shall have their entire surface area composed of faces resulting from fracture due to mechanical crushing. Not over 5% shall be particles that show no faces resulting from crushing. Less than 10% of the particles that pass the 3/8-inch sieve and are retained on the No. 4 sieve shall be waterworn particles. Gravel shall not be added to crushed rock. Crushed rock shall have the following gradation:

Sieve Sizes	Clay Pipe Institute ASTM D 448-67 % Passing
1"	100
3/4"	90-100
3/8"	20-55
No. 4	0-10
No. 8	0-5

**1.1.8 Trench Backfill and Compaction Requirements****Pipe Zone**

(Green Book)

**Procedure Above Pipe Zone**

(Green Book)

**Compaction Above Pipe Zone**

(Green Book)



### **Compaction Tests**

Compaction tests shall be made at intervals not greater than 250', and in addition at least 20% of all service laterals shall be tested. The tests shall be in accordance with the Section herein entitled "Geotechnical Testing" and shall be made at varying depths at each test interval. All trench backfill shall be compacted to City Standards.

It shall be the Contractor's responsibility to advise the City two working days prior to performing compaction tests.

### **Excess Excavated Material**

(Green Book)

### **Imported Backfill Material**

(Green Book)

## **1.1.9 Geotechnical Testing**

The Developer or Contractor shall engage the services of a geotechnical engineering firm or individual licensed in the State of California to monitor soil conditions during earthwork, trenching, bedding, backfill and compaction operations. Sampling and testing procedures shall be performed in accordance with the Reference Standards and as follows:

- A. The soils technician shall be present at the site during all backfill and compaction operations. Failure to have the soils technician present will subject such operations to rejection.
- B. Density and optimum moisture content of soil shall be determined by the use of the sand cone method, ASTM D 1556, or nuclear density gauge method, ASTM D 2922 & D 3012. Since the composition of the pipe and the walls of the trench have an effect on the nuclear density gauge output, a minimum of 25% of the density and optimum moisture tests shall be made using the sand cone method.
- C. Determine laboratory moisture-density relations of existing soil by ASTM D 1557, Method C and/or D (formerly ASTM D 4253 and ASTM D 4254).
- D. Determine the relative density of cohesionless soils by ASTM D 1557, Method C and/or D (formerly ASTM D 4253 and ASTM D 4254).
- E. Sample backfill material by ASTM D 75.
  - F. Express "relative compaction" as a percentage of the ratio of the in-place dry density to the laboratory maximum dry density.

A report of all soils tests performed shall be stamped and signed by the soils firm or individual and shall be submitted by the Contractor prior to the filing of the Notice of Completion or acceptance by the City. The report shall document the sampling and testing of materials, the location and results of all tests performed, and shall certify that materials and work are in compliance with this specification.

## **1.2 Sewer Pipe Installation**

### **1.2.1 General**

The Contractor shall furnish and install all sewer pipeline material required for the construction of the sewer and appurtenances as herein specified and shown on the Drawings. All pipeline material shall be installed per manufacturer's published recommendations and per the applicable published standards for the particular material being installed unless otherwise modified herein. In case of any conflict, the most stringent and highest requirement shall govern, and the Contractor shall adhere to said requirement.

### **1.2.2 Installation of Pipelines**

Pipe laying shall proceed up-grade with the spigot ends of bell-and-spigot pipe pointing in the direction of the flow. Each pipe shall be laid true to line and grade and in such manner as to form a close concentric joint with the adjoining pipe, following manufacturer's instructions for the specific jointing method being used. Any pipe which is not in true alignment or shows any undue settlement after laying shall be taken up and relaid.

Notwithstanding prior factory or yard inspection, the City shall have the right to reject any damaged or defective pipe found on the job which in his opinion will affect the durability of the installation, and the City may order its removal from the work. Pipe shall be accurately laid to alignment and grade shown on the drawings or established by the City. Grade stakes are to be provided to establish the proper pipeline grade, pipe shall be laid to grade within a tolerance of 0.02', or 0.05' cumulative deviation from elevations set at 100' stations.

Standing water or sags will not be allowed and will require reconstruction. It shall be the Contractor's responsibility to prove to the City's satisfaction that sags do not exceed the limit stated. Lines must be replaced if visual measurements and documentation cannot be provided.

Due to unacceptably high operation and maintenance costs and poor system reliability, pipelines with sag depths exceeding ½-inch will be rejected. Reconstruction of the entire length of standing water plus 20 feet on each side of the standing water will be required. Damaged pipe must be removed and not reused

At all times when the work of installing sewer pipeline is not in progress, all openings into the pipe and the ends of the pipe in the trench shall be kept tightly closed to prevent entrance of animals and foreign materials. The Contractor shall take all necessary precautions to prevent the pipe from floating due to water entering the trench from any source. The Contractor shall assume full responsibility for any damage due to any cause and shall restore and replace the pipe to its specified condition and grade if it is damaged during construction.

Where sewer lines are placed crossing above existing waterlines, ductile iron pipe with hot dip bituminous coating shall be used 10 feet on each side of the waterline (or suitable concrete encasement in accordance with State Health Department requirements).

### **1.2.3 Sewer Constructed on Radius**

Whenever portions of the proposed sewer construction are to be installed on the radius of a curve, the minimum radius and installation of the pipe shall be in accordance with the manufacturer's recommendations.

#### **1.2.4 Cleaning**

Before final acceptance of sewer facilities or prior to putting any sewer into service, all sewer facilities shall be visually checked and all foreign objects, materials or obstructions removed from the facilities. The City shall require that the facilities be cleaned by flushing, balling, rodding or other means so that the materials may be removed from the system.

### **1.3 Manholes**

#### **1.3.1 General**

The manholes shall be constructed in accordance with the Standard Drawing, and at the locations shown on the plans. All concrete used in the manholes shall be Class "A" Concrete, unless otherwise indicated herein. (Class A concrete is 4,000 psi.)

#### **1.3.2 Precast Concrete Sections**

Precast manhole sections shall conform to the size, shape, form and details shown on the Standard Drawing. The precast cylinder units and precast eccentric top sections shall meet the strength requirements for "Precast Reinforced Concrete Manhole Risers and Tops", ASTM C 478. Each manhole section shall be set in a bed of grout to make a watertight joint and shall be neatly pointed on the inside and shall be set perfectly plumb. Sections of various heights shall be used in order to bring the top of the manhole ring and cover to the elevation shown on the plans.

Precast concrete rings are to be joined with a minimum thickness of one-half inch (1/2") of Portland cement mortar. Mortar for joining ring section shall be composed of not less than one (1) part portland cement to two (2) parts of clean, well-graded sand of such size that all will pass a No. 8 sieve. Mortar sand shall conform to the strength requirements specified for mortar strength under ASTM C-82.

#### **1.3.3 Manhole Bases**

Manhole bases shall be constructed of Class "A" concrete poured against native undisturbed material and to the form and dimensions shown on the Standard Drawing. The manhole base shall be poured as one monolithic pour. If the Contractor overexcavates beyond the vertical dimensions shown on the Standard Drawing, the depth of concrete below the invert of the pipe shall be increased to greater than the 9-inch minimum as required to meet undisturbed material.

The manhole stubs and sewer main shall be set before the concrete is placed and shall be rechecked for alignment and grade before the concrete has set. Invert elevations of connecting sewers may vary depending upon sizes. The crown elevation of all pipes shall be the same as the crown elevation of the largest pipe unless otherwise indicated on the plans.

The invert of the manhole base shall be formed so as to provide smooth channels conforming in size and shape to the lower portions of the inlet and outlet pipes. The channel shall vary uniformly in size and shape from inlet to outlet and a shelf shall be constructed higher than the pipe as indicated on the Standard drawing. Concrete shall be poured to a level ring-section seating surface, with the base centered over the sewer intersection unless otherwise specified. A metal forming ring shall be used to form a level joint groove in the manhole base. The groove will receive the first precast section to form a watertight joint.

The manhole base shall set a minimum of 24 hours before the installation of the Precast manhole sections unless otherwise approved by the City. Precast manhole bases will not be allowed.

#### **1.3.4 Manhole Frames and Covers** (Green Book)

#### **1.3.5 Testing of Manholes**

##### **Ground Water Conditions – Infiltration Test** (Green Book)

##### **Dry Conditions – Exfiltration Test** (Green Book)

##### **Allowable Leakage** (Green Book)

#### **1.4 Sewer Laterals**

##### **1.4.1 General**

The sewer laterals shall be constructed as shown on the Standard Drawing. Sewer laterals of the size called for on the plans shall be installed at approximately the locations shown on the plans. The exact location will be determined in the field by the City or private developer. The Contractor shall field reference each lateral connection with a surface marker.

##### **1.4.2 Materials**

All sewer laterals shall be constructed of the same material as the sewer main to which it shall be connected; and shall meet the requirements of the section of these specifications entitled "Basic Pipeline Materials Specifications."

##### **1.4.3 Wyes**

Wyes shall be of the same material as the sewer main and the longitudinal barrel of the wye shall be of the same size as the sewer main. Wyes of the size called for on the plans shall be installed at approximately the locations shown on the plans. The exact

location will be determined in the field by the City or private developer. A suitable plug shall be provided and installed prior to backfilling operations to ensure a watertight joint.

#### **1.4.4 Construction**

All sewer laterals shall be installed per the Standard Drawing. In no case shall any lateral be constructed at less than two percent (2%) slope unless shown on plans. The sewer lateral shall be constructed a minimum distance of five (5) feet horizontally from existing water services.

Unless otherwise approved by the City, any required saddle connections to existing mains shall be made with an approved sewer tapping machine. The Contractor shall submit to the City his proposed method for tapping, including manufacturer's tapping equipment descriptions, etc.

### **1.5 Tests for Leakage in Sewer**

#### **1.5.1 General**

The Contractor shall, at his own expense, furnish all materials for making the tests required under the direction of the City.

#### **1.5.2 Air Testing**

The Contractor shall test all sewers twice by means of the air test specified in the Green book, unless otherwise directed by the City. A first air test shall occur at the completion of the construction of the sewer lines (backfilled and compacted) and prior to the construction other facilities (water, storm drain, gas, etc.). A second air test will occur after all utilities are completed and prior to paving.

#### **1.5.3 Water Infiltration Test**

(Green Book)

#### **1.5.4 Force Main Pressure Test**

(Green Book)

### **1.6 Concrete Work**

#### **1.6.1 General**

#### **1.6.2 Portland Cement Concrete Classification**

(Green Book)

### **1.7 Connections to Existing Manholes**

The Contractor shall make connections to existing manholes at the location and elevation shown on the plans and as verified in the field by the Contractor. Where new flow-through channels have to be cut in the existing manhole base, they shall be cut so that the resulting section is smooth and conforms to the intended shape. Deviation from form and grade shall not be greater than 1/4 inch. The channel surface shall be

smoothed with epoxy mortar. The new V.C.P. sewer shall be firmly embedded in epoxy grout where it joins the existing manhole.

## **1.8 Temporary Handling of Sewage**

Certain work in connection with tying into existing sewers and manholes, may require the temporary handling of sewage either by temporary bypass lines, pumping, bulkheading at low flows, or other means, to be approved by the City. Sewage so diverted shall be handled in a manner such that all sewage shall be contained and properly disposed of so as not to create a public nuisance or health hazard.

Should the Contractor's operation result in fine(s) from other agency jurisdictions or result in the City's need for cleanup assistance, the payment of such fines and City assistance shall be the responsibility of the Contractor.

## **1.9 Steel Casing** (Green Book)

## **1.10 Jacked Steel Casing** (Green Book)

## **1.11 Video Inspection**

CCTV inspections on newly constructed sewer mains shall be conducted after all utilities have been installed, backfill compaction has been certified and successful completion of the final leakage test for the sewer, but prior to paving.

The contractor shall notify the City that the pipeline system is ready for video inspection. Said notification shall be made at least three working days in advance of the actual video inspection date. The video inspection will be made by a video inspection company approved by the City and shall be made in the presence of the City Inspector. Prior to the video inspection, the contractor shall be responsible to provide the following items:

- A. Clean sewer pipelines free of all dirt, rock, debris, etc.
- B. Water source with an adequate amount water, pipe, hose, etc. to place enough water in the pipelines to evaluate pipeline alignment "SAGS".
- C. Driveable truck access to each manhole within the system to be videoed.
- D. Provide all traffic control methods required.

Should any of the aforementioned items not be in compliance by the time the video inspection is to occur, the contractor shall be subject to compensating the City for all costs incurred.

Upon completion of the video taping of the subject sewerlines, the video inspection company will provide the City with the color DVD data disk and a written report detailing the condition of the interior of the mainline and joints. Subsequent to review of the video and report by the City, the City will notify the Contractor within 7 days that they may then proceed with completion of the project; or the City will provide a list of corrective measures that must occur prior to acceptance.

Should remedial activities be necessary, the reconstruction methodology shall be approved by the City prior to commencement of the work. Upon completion of the remedial construction, the contractor shall once again notify the City that the sewerlines are ready for a video inspection. The City reserves the right to re-video any portions of the sewer system they determine may have been affected by the reconstruction work activities. Further, all related costs including but not limited to reconstruction materials, labor, equipment, video inspection, District and other agency inspection, and administrative costs shall be borne by the contractor.

**VIDEO INSPECTION COMPANY REQUIREMENTS**  
(Closed Circuit Television Inspection - CCTV)

1. Rotating lens camera with articulating head.
2. Scanning capabilities of 360°.
3. Operative in 100% humidity conditions.
4. Lighting for the camera shall minimize reflective glare.
5. Lighting and camera quality shall be suitable to provide clear, in focus picture of the entire periphery of the pipe for all conditions.
6. Camera focal distance shall be adjustable through a range from 6" to infinity.
7. Remote reading distance (footage) counter shall be accurate to one percent (1%) over the length of the particular section being inspected.
8. The camera, television monitor, and other components of the color video system shall be capable of producing a minimum of 350 line resolution.
9. Documentation consisting of a DVD data disk and a written report detailing the condition of the mainline and joints shall be submitted to the City inspector immediately following the video inspection.