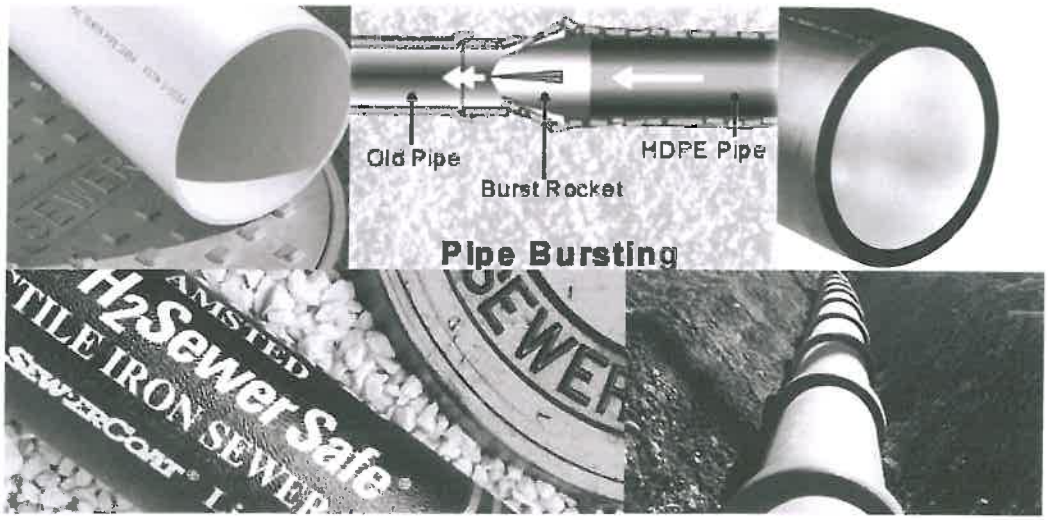
CITY OF
HAYWARD
HEART OF THE BAY

DEPARTMENT OF PUBLIC WORKS

SPECIFICATIONS FOR THE CONSTRUCTION OF

SANITARY SEWER MAINS AND APPURTENANCES (12" DIAMETER OR LESS) USING

POLYVINYL CHLORIDE (PVC), VITRIFIED CLAY (VC), DUCTILE IRON (DI) AND HIGH DENSITY POLYETHYLENE (HDPE) PIPE



November 2006

Note: Standard Detail SD-310 is superseded by SD-125

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FOR USE IN CONNECTION WITH THE LATEST REVISIONS OF THE "STANDARD SPECIFICATIONS FOR CONSTRUCTION OF LOCAL STREETS AND ROADS" AND THE "STANDARD PLANS FOR CONSTRUCTION OF LOCAL STREETS AND ROADS" OF THE CALIFORNIA DEPARTMENT OF TRANSPORTATION, AND THE CITY OF HAYWARD STANDARD DETAILS

Note: Standard Detail SD-310 is superseded by SD-125

November 2006

ALEX AMERI
Deputy Director of Public Works/Utilities

Prepared by:
Utilities Administration
Department of Public Works
City of Hayward, CA

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November 2006

PART 1 - GENERAL REQUIREMENTS

1.01 SCOPE

These Sewer Specifications cover the installation of polyvinyl chloride (PVC), vitrified clay (VC), lined ductile iron (DI) and high density polyethylene (HDPE) sanitary sewer mains to be installed by Applicants to the City for sanitary sewer service, using materials provided by the Applicant. Pipe installations under these Sewer Specifications are limited in size to not more than twelve (12) inches diameter. In cases where pipe larger than twelve (12) inches is to be installed by the Applicant, additional and supplementary specifications will be provided by the City.

1.02 DEFINITIONS AND TERMS

Wherever in these Sewer Specifications, the Standard Specifications or Standard Details the following definitions and terms are used, the intent and meaning shall be interpreted as follows:

ANSI – American National Standards Institute. www.ansi.org

Applicant – The person, firm, company, or corporation that applies for connection to the City's Sewer System.

ASTM – American Society for Testing and Materials. www.astm.org

AWWA – American Water Works Association. www.awwa.org

Backwater Valve – Any approved check valve or other approved device to prevent the flow of wastewater from the public sewer into the building. Also called a *Backflow Preventer*. See Standard Detail SD-314.

Building – Any structure erected for the support, shelter, and enclosure of persons, animals, or movable property of any kind.

Building Court – 2 or more buildings containing 4 or more dwelling units or 2 or more commercial and/or industrial buildings on premises or parcel under one ownership and to remain under one ownership.

Building Court House Sewer – The extension from the building drain to the building court main sewer, and shall be located within the building lot boundaries. Also called a sewer *lateral*.

Building Court Main Sewer – The extension from the building court house sewer to a public sewer or other place of disposal. See Standard Detail SD-301. Also called a *common lateral*, *shared lateral*, *common private main* or *shared private main*.

Building Drain, House Drain or Main Drain – That part of the lowest piping of a drainage system which received the discharge from soil, waste and other drainage pipes inside the walls of the building and conveys it to the building sewer beginning two (2) feet outside the building wall that faces the public sewer.

Building Sewer or House Sewer – The extension from the house drain to the public sewer or other place of disposal, which is not less than two (2) feet from any building or structure foundation or footing that faces the public sewer. See Standard Detail SD-312. Also called a sewer *lateral*.

City – City of Hayward. www.hayward-ca.gov

CalOSHA – California Occupational Safety & Health Administration. www.dir.ca.gov/dosh/

Caltrans – State of California Department of Transportation. www.dot.ca.gov

Cleanout – A pipe rising from the Building Sewer to the ground surface with a removable cap or plug. It is used to access the sewer pipe to free blockages.

Department – Department of Public Works of the City of Hayward.

Director – The Director of the Public Works Department of the City of Hayward acting either directly or through properly authorized agents, such agents acting within the scope of the particular duties entrusted to them. On all questions regarding applications, permits, design, layout, location, conditions of approval and acceptance of work, the decisions of the Director shall be final and binding upon all parties.

Drainage Piping or Drainage System – All piping within public or private premises which convey wastewater, or other liquid wastes, to a point of disposal, but shall not include the mains, laterals, manholes, and pipe encasements of the public sewer system.

Dwelling Unit – A building or portion of a building arranged, intended or designed to be occupied by not more than one family, a congregate residence for 10 or fewer people, and having facilities for sleeping, eating, cooking and sanitary purposes, independent of another dwelling or dwellings.

Engineer – The Deputy Director of Public Works/City Engineer or the Deputy Director of Public Works/Utilities who by definition are authorized agents of the Director of Public Works. The Engineer may act either directly or through properly authorized agents, such agents acting within the scope of the particular duties entrusted to them. On all questions concerning the acceptability or classification of materials, the execution of the work, and conflicting interests of Contractors performing related work, the decisions of the Engineer shall be final and binding upon all parties.

Grease Interceptor – A receptacle designed to collect and retain grease and fatty substances normally found in kitchen, food processing, or similar wastes. An interceptor is a vault with a minimum capacity of 500 gallons that is located on the exterior of a building. The vault includes a minimum of two compartments, and flow between each compartment is through a 90º fitting designed for grease retention. The capacity of the interceptor provides adequate residence time so that the wastewater has time to cool, allowing any remaining grease not collected by the traps time to congeal and rise to the surface where it accumulates until the interceptor is cleaned. Grease interceptors should be cleaned at least once each month.

Grease Trap – Similar to an interceptor, a trap is a small reservoir built into the wastewater piping a short distance from the grease producing area. Baffles in the reservoir retain the wastewater long enough for the grease to congeal and rise to the surface where it accumulates until the trap is cleaned. Grease traps may need to be cleaned twice per month or more frequently.

House Drain – See Building Drain.

House Sewer – See Building Sewer.

Insanitary – A condition which is contrary to sanitary principals or is injurious to health.

Inspector – A City inspector who by definition is an authorized agent of the Director and Engineer.

Main Drain – See Building Drain.

Municipal Sewer System – All of the property, heretofore or hereafter constructed and/or owned by the City of Hayward, involved in the collection and treatment of wastewater. It includes land, wastewater lines and appurtenances, pumping stations, treatment works, and general property. Also known as Sanitary Sewer System.

Outside Sewer – Sewer lines and facilities owned by City lying outside the City limits.

Plans – Project plans that have been approved and signed by the Director of Public Works and are marked “Approved for Construction.”

Public Sewer – Any sewer which is part of the municipal sewer system, including any sewer main within any public street or sewer easement and any outside sewer.

Regulations – The Wastewater Discharge Regulations of the City of Hayward contained in Appendix “A” of Chapter 11, Article 3 of the Hayward Municipal Code, “Sanitary Sewer System.”

Senior Utility Services Representative (SUSR) – A City Public Works Department employee who by definition is an authorized agent of the Director and Engineer. The SUSR assesses fees for connection to the City’s water distribution system and to discharge wastewater into the City’s wastewater collection system, completes water and sewer service applications, and provides requests to City field crews to install pipe and meters for water delivery.

Service Sewer – A shallow (typically ≤10 feet) Sewer Main that collects wastewater from Building Sewers and conveys wastewater to a parallel and deeper Sewer Main.

Sewer Interceptor – A Sewer Trunk that receives wastewater from a smaller parallel Sewer Main in order to reduce the flow in the Sewer Main. Also called a *relief sewer*.

Sewer Main – A sewer in a public street or easement maintained and operated by the City that collects wastewater from Building Sewers and Building Court Main Sewers and conveys wastewater to a Sewer Trunk.

Sewer Specifications – This document.

Special Provisions – The special provisions are specific clauses setting forth conditions or requirements peculiar to the work and supplementary to the Standard Specifications.

Standard Dimension Ratio (SDR) – The ratio of the outside diameter of the pipe divided by the minimum wall thickness.

Standard Plans – The Standard Plans for Construction of Local Streets and Roads, State of California Department of Transportation, latest revision, and the Standard Details of the City of Hayward, latest revisions. The Standard Details of the City of Hayward shall govern over both the State of California Department of Transportation Standard Plans and Standard Specifications.

Standard Specifications – The Standard Specifications for Construction of Local Streets and Roads, State of California Department of Transportation, latest revision, and Section 90, "Portland Cement Concrete" of the "Amendments to 2002 Standard Specifications."

Surveyor – A City surveyor who by definition is an authorized agent of the Director and Engineer.

Trunk Sewer – A Sewer Main typically larger than 12 inches that collects wastewater from several Sewer Mains and may also collect wastewater from Building Court Mains and Building Sewers.

Water Pollution Control Facility (WPCF) – An arrangement of devices and structures for treating wastewater and industrial wastes. This facility provides treatment and disposal of residential and industrial wastewater using state-of-the-art technology and complex biological processes. Also known as wastewater treatment plant or sewer treatment plant.

Water Pollution Source Control (WPSC) – Operates the City's industrial wastewater pretreatment program and administers regulations affecting businesses that discharge industrial wastewater into the City's sanitary sewer system. The WPSC also administers the City's Stormwater Management and Urban Runoff Control Program to reduce pollution of San Francisco Bay caused by urban activities. Staff coordinates activities performed by outside agencies and other City operating divisions, and performs inspections associated with the industrial and illicit discharge.

1.03 CITY SERVICE CONTACTS

CONTACT	SERVICE DESCRIPTION	PHONE (510)	EMAIL
Sr. Utility Services Representative PW-Utilities Admin. Div., Water Engineering	Service connections & fees, permit plan reviews & conditions of approval	583-4727	Edith.Jacklin @hayward-ca.gov
Utilities Superintendent PW-Utilities Operation and Maintenance	Water distribution & sewer collection preventative maintenance & repairs	881-7901	Mike.Higares @hayward-ca.gov
Water Pollution Control Administrator PW-Utilities Admin. Div., Water Pollution Source Ctrl. & Stormwater Management	Stormwater pollution prevention, illicit discharge/dumping investigation & industrial wastewater pretreatment	881-7900	Dije.Ndreu @hayward-ca.gov
Permit Center, Community & Economic Development, Building Division	Building & Planning permits, inspections (non-Public Works)	583-4140	Permits.Counter @hayward-ca.gov
Development Services PW-Engineering & Transportation Division	Encroachment Permits for work in City easements or right-of-ways.	583-4785	Jim.Lear @hayward-ca.gov
Survey & Right-Of-Way PW-Engineering & Transportation Division	Construction staking requirements, monument & elevation information.	583-4796	Norman.Payne @hayward-ca.gov
Construction Inspection PW-Engineering & Transportation Division	Inspection of Public Works projects & utility improvements by Applicants.	583-4755	Jason.Whipple @hayward-ca.gov

1.04 CITY STANDARDS AND CODES

The City's currently adopted State of California, Department of Transportation (Caltrans) Standard Specifications for Construction of Local Streets and Roads and the City of Hayward Standard Details form a part of these Sewer Specifications and shall be followed in the construction and installation of sanitary sewer mains and services by the Applicant. Wherever in the Standard Specifications the word "Contractor" is used, it shall mean Applicant. Any and all provisions in the Standard Specifications regarding compensation of the Contractor by the City and provisions of like import, are not applicable to work performed by an Applicant. In case of conflict between these Sewer Specifications and the Standard Specifications, the general requirements herein shall govern.

All sewer installations and services within the City shall comply with the minimum separation requirements set forth in the “California Waterworks Standards” which are contained in Section 64630, Title 22, of the California Administrative Code and incorporated herein (see Section 1.11). In addition, these Sewer Specifications comply with Chapter 11, Article 3 of the Hayward Municipal Code, “Sanitary Sewer System”. Excerpts of the Municipal Code are presented and referenced below:

> Section 11-3.201 Duty To Connect To Municipal Sewer. “The owner of any property … which abuts on any street, alley or right of way in which there is located a public sanitary sewer of the City, is hereby required at the owner’s expense to … connect … directly with said public sewer… Properties that connect to the City system will be required to pay all connection charges in effect at the time of connection.”
>
> Section 11-3.251 Application For Construction Permit. “At the time that a construction permit is issued, the applicant shall pay the established permit fee.”
>
> Section 11-3.252 To Whom Construction Permits May Be Issued. “No sewerage work for which a construction permit is required shall be commenced until a construction permit to do such work shall have first been obtained.”

Section 11-3.311 New Materials And Methods Of Construction. "The provisions of this Article are not intended to prevent the use of any material or method of construction not specifically prescribed herein, provided any such alternate has been approved and its use authorized by the … Engineer."

Section 11-3.354, Building Sewer. "The building sewer shall be vitrified clay sewer pipe, polyvinyl chloride pipe, or, in special circumstances, lined ductile iron pipe or other suitable material approved by the … Engineer… If installed in filled or unstable ground, the building sewer shall be of lined ductile iron pipe."

Section 11-3.361, Cleanouts. "Cleanouts shall be placed in every building sewer at the connection with the building drain and shall be installed at uniform intervals not to exceed one hundred (100) feet."

Section 11-3.362, Back Water Protection. "If the lowest fixture or outlet in any building is below the rim elevation of the nearest manhole, cleanout, or riser upstream from the connection to the public sewer, a backwater valve or overflow device of an approved type shall be installed in the building sewer." See Standard Detail SD-314.

Section 11-3.500, Extension of Sewer Main Facilities. "Sewer main facilities may be extended by an applicant in accordance with plans and specifications approved by the … Engineer. The applicant shall deposit an amount which when added to any previous deposits on the same application is equal to all estimated inspection costs. Engineering costs plus an administrative charge equal to three percent (3%) of the total cost of installation shall be deposited before applicant begins such work."

Section 11-3.503, Applicant to File Surety Bond. "In the event the applicant installs sewer main extension facilities, the applicant shall furnish the City a surety company bond in an amount equal to at least one-half of the … Engineer's estimate of the installation costs to guarantee faithful performance by the applicant, and a surety company bond in an equal amount to guarantee claims of persons employed by applicant and claims of persons who furnish materials, supplies and implements used by applicant on such work."

Section 11-3.504, Sewer Main Extension Facilities – Bill of Sale. "When sewer main extension facilities are installed and upon the execution and delivery by applicant of a good and sufficient bill of sale of said facilities to the City of Hayward, sewer service shall be furnished to applicant's property."

A copy of the Hayward Municipal Code is available via the Internet at: www.hayward-ca.gov/municipal/hmcPDM.shtm.

1.05 DRAWINGS

A. STANDARD PLANS. The Caltrans Standard Plans for Construction of Local Streets and Roads and the Standard Details of the City of Hayward, latest revisions, form a part of these Sewer Specifications and shall be followed in the installation of sanitary sewer mains and services. The Standard Details shall govern over both the State of California Department of Transportation Standard Plans and Standard Specifications.

B. PROJECT DRAWINGS OR PLANS. Drawings showing the size and location of the mains to be installed and other pertinent details shall be provided by the Applicant for each project, and when approved will become a part of these Sewer Specifications in regards to the Applicant's project. Abbreviations and symbols shown on the Drawings shall be as shown on Standard Details SD-100 and SD-101.

C. CONFLICTS. In case of conflict between the approved Project Drawings and these Sewer Specifications, including the Standard Plans, then the approved Project Drawings shall govern.

1.06 CHANGES

If, during the progress of the work, changes in design, material, or location are deemed necessary by the City for proper construction of the work, the City reserves the right to make such changes. The increase or decrease in cost of material and construction caused by such changes shall be borne by the Applicant, unless the changes are made on mains installed for the convenience of the City, in which case the increase or decrease in cost shall be borne by the City.

1.07 PERMITS, RIGHT OF WAY AND LICENSES

A. PERMITS. The Applicant shall obtain all necessary permits for doing work and copies of the permits shall be provided to the Engineer. In the case where the requirements of a permit differ from those of the City Standards, the more stringent requirements shall apply. Where a main location is not public property, a right of way satisfactory to the City shall be obtained at the Applicant's expense by the City or by the Applicant, at the option of the Applicant, and the title shall be vested in the City.

An encroachment permit is required whenever work or an activity is to be performed within City easements or right-of-ways. For additional information regarding Public Works Encroachment Permits, see the City's Web Site at www.hayward-ca.gov, then follow the links "City Services", "Permits", and "Encroachment Permit."

B. CITY BUSINESS LICENSE. Any business operating within the City is required to possess a valid City Business License. Applicant shall verify that any consultant, contractor or subcontractor performing work on their behalf possesses a valid City Business License, and shall furnish satisfactory proof to the Engineer upon request. For additional information regarding City Business Licenses, contact the Revenue Division at (510) 583-4600 or see the City's Web Site at www.hayward-ca.gov, then follow the links "City Services", "Licenses and Certificates", and "Business License Tax."

C. CONTRACTOR'S LICENSE. The Applicant or his/her agent performing the work shall possess such State and local licenses as are required by law, and shall furnish satisfactory proof to the Engineer upon request that such licenses are in effect during the entire period of construction.

1.08 SUBMITTALS

Prior to delivery of materials to the job site, the Applicant shall furnish to the Engineer a complete list of materials by manufacturer and model number for approval and certificates of compliance where applicable.

1.09 INSPECTION

All work performed under this project shall be subject to thorough inspection to ensure full compliance with these Sewer Specifications. The Engineer shall have access to all parts of the work at all times. Work or material that does not conform to these Sewer Specifications may

be rejected at any stage of the work. The Applicant shall remove and rebuild at his/her own expense any part of the work that the Engineer determines has been improperly executed.

For inspections on public streets and utilities (sewers, storm drains, etc.), the Public Works Supervising Construction Inspector in the Design and Construction Services Section of the Engineering and Transportation Division should be contacted at 510-583-4755. For inspections on private utilities, the Building Inspection Division should be contacted at 510-583-4140. For additional information, see the City's Web Site at www.hayward-ca.gov, then follow the links "City Services", "Building and Land Development", and "Inspections."

Work under these Sewer Specifications can be performed on Saturday, Sunday, or holidays only if the conditions of approval allow work during these days and if a City construction inspector is available to inspect this work. Weekend work is discouraged. Requests to perform work or for inspections on weekends or holidays must be submitted during normal work hours a minimum of seventy-two (72) hours prior to the beginning of the work.

1.10 DESIGN & LOCATION OF SEWER MAINS AND BUILDING COURT MAINS

All new public sanitary sewer mains and building court main sewers shall be designed to comply with these Sewer Specifications and shall be located and installed to the lines and grades shown and the approved Plans.

A. SIZING AND SLOPE. Sewer mains shall be sized to serve the entire tributary area at buildout densities conforming to the General Plan. Large developments may be required to provide collection system calculations or perform a wastewater model run so that their impact can be accurately assessed.

When designing or analyzing a sewer system, Manning's Formula shall be used (additional analyses, such as Froude Number, may also be performed). The minimum Manning's Roughness coefficient, η , shall be 0.0130 for any new sewer main, regardless of the pipe material (a higher value can be used). $\eta \geq 0.015$ should be used when analyzing existing sewers.

1. The minimum I.D. of all sanitary sewer mains is eight (≥8) inches.
2. All sanitary sewer mains shall be designed and constructed at a uniform grade (constant slope) between manholes and cleanouts.
3. A Building Court Main Sewer serving up to ten (≤10) dwelling units shall have an absolute* minimum slope of 0.0060 ft/ft (0.60%); A Building Court Main Sewer serving more than ten (>10) dwelling units shall have an absolute* minimum pipe slope of 0.0040 ft/ft (0.40%). It is recommended that these sewers be designed at a minimum slope of 1.25 times the absolute minimum pipe slope, to make allowances for adjustments during construction.
4. Public Sewer Mains up to 15" I.D. shall be designed to achieve a minimum flow velocity of two (≥2) fps when the pipe is less than 50% (half) full. The table below lists the standard* minimum slope and the absolute* minimum slope for various pipe sizes, and the flow quantity when the pipe is half full.

   For trenchless installation methods, the minimum design slope shall be based on the accuracy/tolerance of the method and equipment used, such that it is feasible to install the sewer without exceeding the minimum slope limits. For example, say a Mini-Horizontal Directional Drill (HDD) has an accuracy/tolerance of ±12" in 600' of

bore, which for a manhole spacing of 400' is equivalent to ±0.167%. Then the minimum (flattest) slope this Mini-HDD could install a 10" pipe at is 0.417% (0.417%-0.167% = 0.25%). See Section 3.03, "Alignment and Slope", for additional information.

MINIMUM PIPE SLOPES FOR PUBLIC SANITARY SEWER MAINS					
Manning Roughness Coefficient, η = 0.0130					
Pipe I.D. in.	**Standard * Minimum Slope ft/ft (% slope)**	**Flow Quantity @ Std. Min. Slope, gpm**	**Absolute * Minimum Slope ft/ft (% slope)**	**Flow Quantity @ Abs. Min. Slope, gpm**	**Flow Depth as % of Pipe I.D.**
8	0.0050 (0.50%)	194.0	0.0035 (0.35%)	162.4	50
10	0.0035 (0.35%)	293.9	0.0025 (0.25%)	248.4	50
12	0.0025 (0.25%)	403.5	0.0020 (0.20%)	360.9	50
15	0.0020 (0.20%)	653.3	0.0015 (0.15%)	565.8	50

* Use of the "absolute" minimum slope will require specific approval by the Engineer and survey of pipe crown prior to covering the pipe with backfill. Trenchless installation methods must be designed at a slope steeper than or equal to the "standard" slope. *(The difference between the "standard" and "absolute" values is a safety factor of 1.2 to 1.5.)*

5. The design flow velocity of any sewer shall not exceed fifteen (≤15) fps. Drop manholes shall be used to break the steep slopes and to limit velocities in the sewer pipes between manholes. Where drop manholes are impracticable for reduction of high velocity flow, additional design features will be required. These conditions may include, but not be limited to: use of PVC, DI or other abrasion resistant pipe material or coating; mechanical or restrained joints; trench dams and drainage measures to prevent buildup of hydrostatic pressure in trenches; and any additional measures required by the Engineer.

   The table below lists the maximum slope by pipe size at which fifteen (15) fps is achieved and the flow quantity when the pipe is half full.

MAXIMUM PIPE SLOPES FOR PUBLIC SANITARY SEWER MAINS			
Manning Roughness Coefficient, η = 0.0130			
Pipe I.D. in.	**Maximum Slope ft/ft (% slope)**	**Flow Quantity @ Max. Slope gpm**	**Flow Depth as % of Pipe I.D.**
8	0.1832 (18.32%)	1174.6	50
10	0.1365 (13.65%)	1835.6	50
12	0.1073 (10.73%)	2643.2	50
15	0.0800 (8.00%)	4131.9	50

B. DEPTH OF COVER. Building Court Mains and Sewer Mains shall be designed and installed at elevations which will provide a minimum of four (≥4) feet of cover measured from the top of the pipe barrel to the established street grade or the surface of the permanent improvement (i.e., finished grade). The depth of a sewer shall be limited to a maximum of twelve (12) feet unless otherwise approved in writing by the Engineer. In

addition, the maximum depth of any sewer pipe shall not exceed the manufacturer's recommended maximum depth and loading limit for the specific type, class and size of pipe. Request for approval of sewers deeper than twelve (12) feet shall include a sewer alignment and profile study showing that no other way of providing a sewer at a depth of twelve (12) feet or less is feasible.

Where Building Sewers (laterals) connect to a Sewer Main, the maximum cover of the sewer Main shall be limited to nine (9) feet, plus or minus one (±1) foot, measured from the top of the pipe barrel to the finished surface grade. If the Sewer Main must be constructed deeper than the above limit, a shallow "Service Sewer" that runs roughly parallel (in plan view) to the deeper sewer Main can be used, and the Service Sewer shall discharge to the deeper sewer main via a manhole. As an alternative to the parallel shallow service and deep sewer main, a lift station may be used.

C. ALIGNMENT. In general, Building Court Mains and Sewer Mains in straight street sections shall be designed to run parallel to the street centerline. All sanitary sewer mains must be:

1. Designed with a straight alignment (no curves) between manholes and cleanouts;
2. A minimum of five (≥5) feet from all structures, building overhangs, gutters, property lines and edges of easements; and
3. A minimum of three (≥3) feet from all monuments and lips of gutters.

In addition, the alignment shall be designed such that any 48-inch manhole is centered a minimum of three (≥3) feet from the lip of gutter and any 60-inch manhole is centered a minimum of four (≥4) feet from the lip of gutter.

In curved streets, the public sanitary sewer main shall be aligned on one side of the street centerline to allow installation of other facilities without using transverse crossings and such that no part of the sewer main is less than one (<1) foot from the lip of gutter.

Horizontal and/or vertical curves in gravity sanitary sewer mains are not allowed.

D. CRITERIA FOR THE SEPARATION OF WATER MAINS, SANITARY SEWER AND STORM DRAIN PIPELINES. Section 64630, Title 22, of the California Administrative Code, "California Waterworks Standards," sets the minimum separation requirements for water mains and sewer pipelines. The City's minimum separation requirements, with the addition of storm drain pipelines comply with the California Waterworks Standards and are as follows:

1. Basic Separation Standards.
   a) **Parallel Construction.** The minimum horizontal distance between water mains and sanitary sewer pipelines shall be ten (≥10) feet. The minimum horizontal distance between potable water mains and storm drain pipelines shall be six (≥6) feet, measured from the nearest edges of the facilities.
   b) **Perpendicular Construction (Crossing).** Water mains shall be at least twelve (≥12) inches above sanitary sewer and storm drain pipelines where these pipelines must cross, measured from the nearest edges of the facilities (see Standard Detail SD-224, "Ductile Iron Drop").

The required separation between sanitary sewer or storm drain pipelines and other utility pipes (except water mains) shall be greater than six (>6) inches (see Standard Detail SD-303, "Construction in the Vicinity of Other Utilities").

c) **Common Trench.** Water mains and sanitary sewer or storm drain pipelines must not be installed in the same trench.

Local conditions may create a situation where there is no alternative but to install water mains, sanitary sewer or storm drain pipelines at a distance less than that which is required by the Basic Separation Standards above. In such cases, the Alternative Criteria for Construction (item 2. below) shall be followed, subject to the Special Provisions (item 3. below).

2. Alternative Criteria for Construction. The construction criteria for water mains, sanitary sewer or storm drain pipelines where the Basic Separation Standards cannot be attained are detailed below in Case 1 and 2, and illustrated in Figures 1 and 2. There are two standard situations encountered:

CASE 1 – New Sanitary Sewer or Storm Drain & New or Existing Water Main. The Alternative Construction Criteria shall apply to the sanitary sewer and/or storm drain pipelines.

CASE 2 – New Water Main & Existing Sanitary Sewer or Storm Drain. The Alternative Construction Criteria may apply to the water main, sanitary sewer and/or storm drain pipelines.

The Alternative Construction Criteria shall also apply to service laterals that cross above a potable water main, but not to service laterals that cross below a potable water main.

3. Special Provisions. The Basic Separation Standards are applicable under normal conditions for sewers, storm drains and water mains. More stringent requirements may be necessary if adverse conditions, such as high groundwater, exist.

a) **Low Pressure Water Mains**. Sanitary sewer and storm drain pipelines shall not be installed within (<) 25 feet horizontally of a low head (≤5 psi) water main.

b) **Pressure Testing of Pipelines**. New water mains, sanitary sewer and storm drain pipelines shall be pressure tested where the pipelines must be located ten (≤10) feet apart or less.

c) **Maintain Support of Existing Pipelines**. Measures must be taken during the excavation and installation of water mains, sanitary sewer or storm drain pipelines to prevent, or at least minimize, disturbance to existing mains or pipelines (i.e., shoring and/or bracing). Disturbance of the supporting base material of a main or pipeline could result in the pipeline's eventual failure.

d) **Corrosive Conditions**. Special consideration shall be given to the selection of pipe materials if corrosive conditions are likely to exist. These conditions may be due to soil type and/or the nature of the fluid conveyed in the conduit, such as a septic wastewater which produces corrosive hydrogen sulfide.

e) **Force Mains (Sanitary Sewer and Storm Drain)**.

- Force mains shall comply with the Basic Separation Standards above.

- When a force main must cross a water main, the crossing shall be perpendicular (90º) or as close to perpendicular as is practical. The force main shall be at least twelve (≥12) inches below the water main.
- When a new force main crosses under an existing water main, all portions of the force main within ten (≤10) feet horizontally of the water main shall be enclosed within a continuous sleeve or casing pipe.
- When a new water main crosses over an existing force main, the water main shall be constructed of pipe materials with a minimum rated working pressure of 200 psi or equivalent pressure rating.

CASE 1 - NEW SANITARY SEWER OR STORM DRAIN PIPELINE

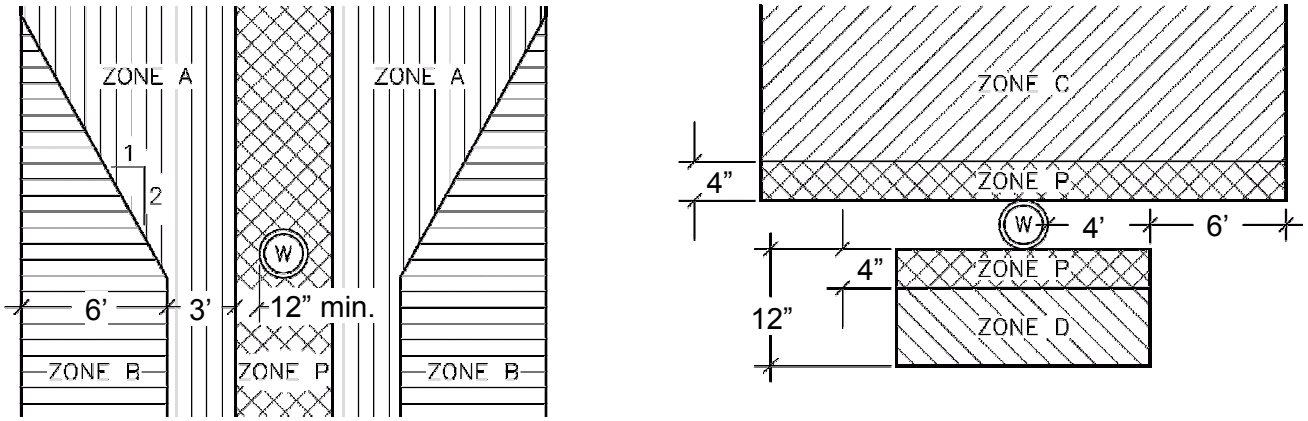
(See Figures 1 and 2)

ZONE	SPECIAL CONSTRUCTION REQUIREMENTS, SANITARY SEWER/STORM DRAIN
A	**PARALLEL** – No new sanitary sewer or storm drain pipeline to be installed parallel to an existing water main shall be permitted within Zone A without special approval from the Director.
B	**PARALLEL** – A new sanitary sewer or storm drain pipeline to be installed parallel to an existing water main and in Zone B shall be constructed of: 1. PVC SDR 26 with rubber ring joints (per ASTM D3034, D3212 & F477); 2. Ductile Iron pipe, polyethylene lined & coated, with compression joints (per AWWA C150/A21.50, C151/A21.51, C104/A21.4 & C105/A21.5); or 3. Reinforced Concrete Pressure Pipe with compression (gasketed) joints (per AWWA C302, *Not for sanitary sewer, storm drain only*).
C	**CROSSING** – A new sanitary sewer or storm drain pipeline to be installed crossing an existing water main and in Zone C shall be constructed of: 1. Ductile Iron pipe, polyethylene lined & coated, with mechanical joints or continuous section (per AWWA C150/A21.50, C151/A21.51, C104/A21.4 & C105/A21.5); 2. A continuous section of Class 200 PVC SDR 14 (per AWWA C900), centered over the pipe being crossed; or 3. A continuous section of Reinforced Concrete Pressure Pipe with compression joints (per AWWA C302), centered over the pipe being crossed (*For storm drain only*). *Alternative piping systems may be proposed, subject to the review and approval of the Director.*
D	**CROSSING** – A new sanitary sewer or storm drain pipeline to be installed crossing an existing water main and in Zone D shall be constructed of: 1. Ductile Iron pipe, polyethylene lined & coated, continuous section (per AWWA C150/A21.50, C151/A21.51, C104/A21.4 & C105/A21.5); 2. A continuous section of Class 200 PVC SDR 14 (per AWWA C900), centered over the pipe being crossed; 3. A continuous section of Reinforced Concrete Pressure Pipe with compression joints (per AWWA C302), centered over the pipe being crossed (F*or storm drain only*); or 4. Standard sewer or storm drain pipeline materials separated from the water main by a ten (10) foot by ten (10) foot by four (4) inch thick reinforced concrete slab. *Alternative piping systems may be proposed, subject to the review and approval of the Director.*
P	**PARALLEL or CROSSING** – Zone P is a PROHIBITED zone. Water mains and sanitary sewer or storm drain pipelines must never be constructed within four (≤4) inches vertically and/or within twelve (≤12) inches horizontally of each other.

CASE 2 - NEW WATER MAIN

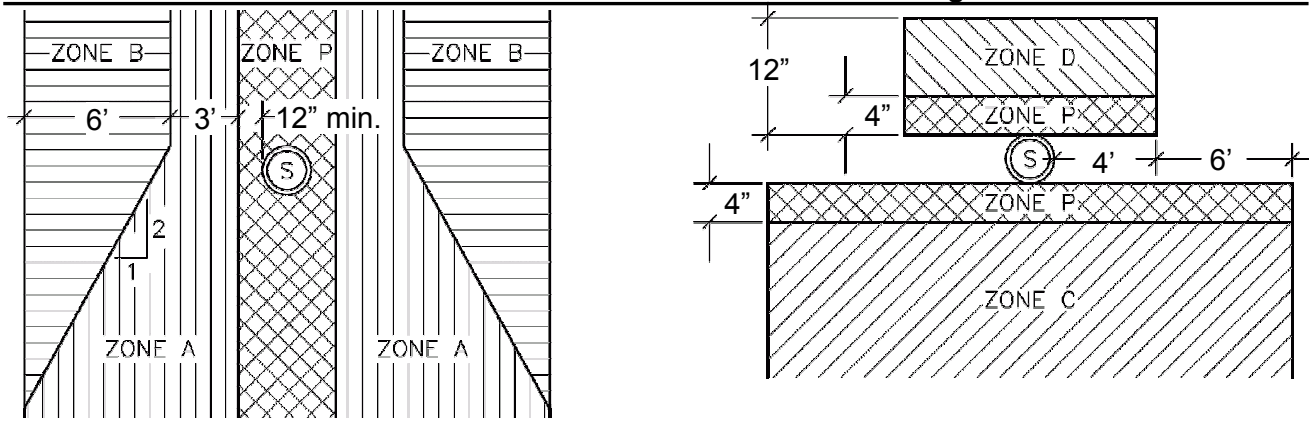
(See Figures 1 and 2)

ZONE	SPECIAL CONSTRUCTION REQUIREMENTS
A	**PARALLEL** – No new water mains parallel to existing sanitary sewers or storm drains will be permitted within Zone A without approval from the Director of Public Works.
B	**PARALLEL** – Existing sanitary sewer or storm drain pipeline paralleling a new water main and does not meet the requirements of Case 1 - Zone B: the new water main shall be constructed of either Ductile iron pipe or Class 200 PVC SDR 14, per these Sewer Specifications.
C	**CROSSING** – Existing sanitary sewer or storm drain pipeline crossing a new water main and does not meet the requirements for Case 1 - Zone C: the new water main shall have no joints in Zone C and shall be constructed of the same materials specified for Case 2 - Zone B, above.
D	**CROSSING** – Existing sanitary sewer or storm drain pipelines crossing a new water main and does not meet the requirements of Case 1 - Zone D: the new water main shall have no joints within four (≤4) feet from either side of the existing sanitary sewer or storm drain pipeline and shall be constructed of the same materials specified for Case 2 - Zone B, above.



PARALLEL **CASE 1** **CROSSING**

NEW SANITARY SEWER OR STORM DRAIN – Figure 1



PARALLEL **CASE 2** **CROSSING**

NEW WATER MAIN – Figure 2

1.11 DESIGN & LOCATION OF BUILDING SEWERS/HOUSE SEWERS

All Building Sewers/House Sewers shall be designed to comply with these Sewer Specifications and shall be located and installed to the lines and grades shown and the approved Plans. A separate and independent Building Sewer shall be provided for every building. Exceptions to the "Separate Sewers" rule are detailed in Section 11-3.351 of Chapter 11, Article 3 of the Hayward Municipal Code.

Building Court House Sewers shall meet the requirements for Building Sewers/House Sewers.

A. SIZING AND SLOPE. All Building Sewers shall be sized according to the requirements of the California Plumbing Code. Subject to the approval of the Engineer, the minimum size for Building Sewers is four (≥4) inches. All sanitary sewers shall be designed at a uniform grade (constant slope) between cleanouts. The table below lists the absolute minimum and maximum slopes for Building Sewers/House Sewers, and the flow quantity when the pipe is half full. It is recommended that Building Sewers be designed at a minimum slope of 1.25 times the absolute minimum pipe slope, to make allowances for adjustments during construction.

MINIMUM PIPE SLOPE FOR BUILDING SEWERS, HOUSE SEWERS, BUILDING COURT HOUSE SEWERS & SEWER LATERALS					
Manning Roughness Coefficient, η = 0.0130					
Pipe I.D. inch	**Absolute Minimum Slope ft/ft (% slope)**	**Max. Flow Cap. @ Min. Slope gpm**	**Maximum Slope ft/ft (% slope)**	**Max. Flow Cap. @ Max. Slope gpm**	**Flow Depth as % of Pipe I.D.**
4	0.0208 (2.08%)	134.6	0.2035 (20.35%)	195.9	50
6	0.0142 (1.42%)	152.0	0.1191 (11.91%)	440.6	50

B. DEPTH OF COVER. Whenever possible, the Building Sewer shall be brought to the building at an elevation below the lowest floor being served. The Building Sewer shall be laid at a uniform grade (constant slope) and the depth shall be sufficient to afford a minimum of thirty (≥30) inches of cover for non-metallic pipe and twenty-four (≥24) inches for metallic pipe, within the lot boundaries.

The top of the Building Sewer pipe at the point of connection shall be at the same or at a higher elevation than the top of the public sewer pipe.

The portion of the Building Sewer in the street shall be at right angles to the right-of-way lines and at least three (≥3) feet below the top-of-curb grade. In the situation where it is necessary to install a Building Sewer in the street at less than three (<3) feet below the top-of-curb grade, the Building Sewer must be covered with at least six (≥6) inches of concrete or it must be constructed of ductile iron pipe. Where it is necessary to increase the slope of the Building Sewer in order to connect to the Sewer Main, one (1) change in slope not to exceed 45º (⅛ bend) is permitted with the written approval of the Engineer (see Standard Detail SD-312, "House Sewer").

C. ALIGNMENT. The Building Sewer shall be laid in a straight alignment and a minimum of three (≥3) feet from a building foundation. No Building Sewer shall be laid parallel and within the soil bearing area of the footing of any bearing wall which might be weakened

thereby. Where direct alignment is not practical, one (1) change in alignment not to exceed 22-½ º may be made in the portion of the Building Sewer within the lot boundaries without additional cleanouts. Any additional changes in alignment shall be served by a cleanout (see Standard Detail SD-313, "Alteration to Existing House Sewer").

D. SEPARATION CRITERIA. Building Sewers shall conform to the following separation requirements:

1. Parallel Construction. The minimum horizontal distance between Building Sewer pipelines and water service pipes, including the water meter and any underground water pipes shall be six (≥6) feet measured from the nearest edges of the facilities.

2. Perpendicular Construction (Crossing). Building Sewer pipelines shall be at least twelve (≥12) inches below water service pipes and any underground water pipes where these pipelines must cross, measured from the nearest edges of the facilities.

3. Common Trench. Building Sewer and building drainage piping shall not be run or laid in the same trench with water service pipes or any underground water pipes, except as provided in this section. A water service pipe may be placed in the same trench with a Building Sewer or building drain, provided all of the following conditions are met (note that the resulting "joint trench" will be more than six (>6) feet wide):

   a) The bottom of the water service pipe, at all points, shall be at least twelve (≥12) inches above the top of the sewer line;

   b) The water service pipe shall be placed on a solid shelf excavated at one side of the common trench;

   c) The required minimum six (≥6) foot horizontal separation is maintained; and

   d) Any additional conditions required by the Engineer are incorporated into the design.

4. Alternative Criteria for Construction. Local conditions, such as available space, limited slope, existing structures, etc.; may create a situation where there is no alternative but to install water service, Building Sewer and/or building drain lines at a distance less than that which is required above. In such cases, the Engineer will require alternative piping materials be used to prevent insanitary conditions.

1.12 DESIGN & LOCATION OF MANHOLES, CLEANOUTS & BACKWATER VALVES

A. MANHOLES. For pipe diameters up to 30 inches, a standard 48-inch diameter manhole shall be used (see Standard Detail SD-304, "Precast Concentric Sanitary Sewer Manhole"). Manholes shall be installed at the following locations on Building Court Main Sewers and public sewers:

1. At the connection of a Building Court Main Sewer to the public sewer;

2. At any change in direction or grade;

3. At intervals not to exceed 400 feet;

4. At the upstream end of the pipeline.

B. CLEANOUTS. Cleanouts are not allowed in a street and shall not be used on public sewer mains unless specifically required by the Engineer. Cleanouts shall be installed at the following locations on Building Sewers:

1. At any change in alignment;
2. At the connection with the building drain; and
3. At uniform intervals not to exceed 100 feet.

C. BACKWATER VALVES. If the lowest fixture or outlet in any building is below the rim elevation of the nearest manhole, cleanout, or riser upstream from the connection to the public sewer, a backwater valve or overflow device of an approved type shall be installed in the building sewer (see Standard Detail SD-314, “Backflow Preventer).

1.13 CONNECTIONS TO EXISTING SEWER MAINS

Connections to the existing sanitary sewer mains shall be constructed at the locations shown on the approved Plans. The Applicant shall perform all work necessary to complete the connection at Applicant's expense. Refer to Section 3 "Installation" for detailed sewer installation and connection requirements.

Connections of new sewer main pipe to existing sewer main pipe shall be made with the appropriate stop, repair or mechanical/compression coupling as detailed in Section 2.06, “Couplings and Reducers.”

Existing sanitary sewer manholes which are effected by the new vertical alignment of the new sanitary sewer pipe shall be replaced or reconstructed with the manhole base channelized for the connection of the new pipe(s), as required by the Engineer (see Section 3.19, “Sanitary Sewer Manhole Repair”). Applicant may elect to replace the existing sanitary sewer manholes that the Engineer has indicated must be reconstructed with new standard precast concentric manholes, frames and covers. Refer to Section 3.18, “Sanitary Sewer Manhole Construction,” for detailed construction requirements.

A. WASTEWATER FLOW CONTROL. All existing sanitary sewer flows must be accommodated throughout construction. All work shall be done without interruption of service or inconvenience to the public at all times. It shall be the Applicant’s responsibility to maintain sewer flows through the project site at all times. Applicant shall schedule and coordinate the work to avoid any interference with normal operation of the sewer. Refer to Section 3.04, “Wastewater Flow Control,” for detailed wastewater flow control requirements.

B. DEBRIS PROTECTION. Debris protection shall be provided by installing false manhole bottoms, or other acceptable methods approved by the Engineer, to keep debris and foreign materials from entering the sewer system and shall be required for all existing sanitary sewer manholes within the project limits.

If any debris or foreign materials enter the sewer system due to Applicant’s operations, the Applicant shall clean and flush the effected lines at his/her expense. If the Applicant is unable to clean and flush the lines, City crews and equipment can be used at the Applicant's expense.

1.14 GUARANTEE

The Applicant hereby guarantees that:

A. Any work performed by him under this project shall be performed in a manner approved by the Engineer;

B. Any material furnished by him shall be materials listed upon the City's "Sewer System Approved Materials" list (included in Appendix 'A');

C. Both the work and the materials shall meet fully the requirements of these Sewer Specifications; and,

D. The completed sewer mains, manholes and appurtenances shall be located in accordance with the requirements of these Sewer Specifications.

The Applicant hereby agrees to promptly reinstall, at his/her own expense, any part of the sewer main, manhole or any appurtenance that has not been installed in accordance with these Sewer Specifications.

The City has sole responsibility for making repairs to the pipeline once it is placed in service. The Applicant further agrees that if, within a period of one (1) year after written final acceptance of any portion of the work done under the project, any part of said pipelines or other structures furnished and installed or constructed by him/her shall develop leakage or fails to fulfill any of the requirements of these Specifications, or should the pavement or ground surface over the trench be damaged due to settlement of the backfill or due to poor material and/or workmanship, he/she shall reimburse the City for all costs of said repairs (including 15% overhead).

The Applicant shall be responsible for the full expense incidental to making good any and all of the above guarantees and agreements. The above guarantees and agreements are covenants, the performance of which shall be binding upon the Applicant and his/her sureties.

1.15 CLEANUP OF SITE

During the progress of the work, the Applicant shall keep the premises occupied by him in a neat and sanitary condition and shall leave them so at the conclusion of the work. He/she shall dispose of refuse as often as directed by the Engineer or as may be necessary, so that at no time shall there be any accumulation of rubbish. In the event that known contaminates are encountered during the installation of a sewer main, manhole or appurtenance, Applicant shall provide and carry out a remediation plan at his/her own expense.

1.16 RESPONSIBILITY OF THE APPLICANT

The Applicant shall protect, restore or cause to be restored all damaged property, including sidewalks; curb and gutter; pipes; conduit; gas, water and other services; meter boxes; sewers; monuments; stakes; trees; shrubs and other planting; and other public or private property to a condition as good as it was when he/she entered upon the work. The Applicant shall provide and maintain such fences, barricades, signs, warning lights, traffic control and flaggers as may be required to provide safety against accidents to the public. The maximum spacing between the warning lights be less than or equal to fifty (≤50) feet along the length of the trench where it is adjacent to or within the boundaries of a thoroughfare. No material or other obstruction shall be placed within fifteen (≤15) feet of fire hydrants. Convenient access to driveways, houses,

and buildings along the line of work must be maintained at all times. Temporary approaches to, and crossings of, intersecting streets shall be provided and kept in good condition.

All safety orders, rules, and recommendations of the Division of Industrial Safety of the Department of Industrial Relations of the State of California applicable to the work to be performed under this contract shall be obeyed and enforced by the Applicant. The Applicant shall comply with all applicable City regulations, to include the current CAL-OSHA Standards.

PART 2 - MATERIALS

2.01 MINIMUM STANDARDS

All materials used and all joints made in or entering into the construction of sewerage systems or parts thereof shall be watertight and free from defects. The materials and joints specified in these Sewer Standards are the minimum approved standards that shall be used. All materials used shall be of adequate strength and durability and of such design as to provide a substantial watertight system free from irregularities in flow lines. All joints and connections shall be made gas-tight and water-tight. Cement joints will not be permitted.

2.02 POLYVINYL CHLORIDE (PVC) PIPE AND FITTINGS

PVC pipes, fittings, couplings and joints shall meet the requirements of ASTM D3034 for sizes 4" to 15". SDR 26 shall be used to a maximum depth of fifteen (15) feet; SDR 21 shall be used to a maximum depth of thirty (30) feet; and for depths deeper than thirty (30) feet a specific pipe material analysis and design shall be required. Gaskets shall meet the requirements of ASTM F477 and gasketed fittings shall meet the requirements of ASTM F1336. Joints shall be of the bell-and-spigot type and meet the requirements of ASTM D3212. PVC pipe shall be by Diamond Plastics, J-M Manufacturing, PW Eagle, or approved equal.

PVC pipe and fittings shall have proper markings which shall remain legible during normal handling, storage and installation. The markings shall clearly identify the manufacturer's name, nominal pipe size, standard dimension ratio or dimension ratio, product type and standard specification designation.

A Certificate of Compliance with all provisions of these Sewer Specifications shall be furnished by the manufacturer for all pipe furnished.

2.03 VITRIFIED CLAY PIPE AND FITTINGS

Vitrified clay pipe (VCP) and fittings shall be new, first quality pipe and shall meet the requirements of ASTM C700 for Extra Strength VCP. Pipe and fittings shall be of the bell-and-spigot type with factory fabricated compression gasket. Gaskets and compression joints shall meet the requirements of ASTM C425. VCP and fittings shall be by Mission Clay Products, Gladding-McBean, or approved equal.

VCP pipe and fittings shall have proper markings which shall remain legible during normal handling, storage and installation. The markings shall clearly identify the manufacturer's name, nominal pipe size, product type and standard specification designation.

A Certificate of Compliance with all provisions of these Sewer Specifications shall be furnished by the manufacturer for all pipe furnished.

2.04 DUCTILE IRON PIPE AND FITTINGS

Ductile Iron pipe and fittings shall conform to AWWA C150/A21.50 and AWWA C151/A21.51. Pipe and fittings shall be polyethylene lined and seal coated in conformance to AWWA C104/-A21.4. Thickness Class shall be Number 50 for pipe six (6) inches through thirty-six (36) inches and Number 51 for four (4) inch pipe (four inch pipe is for laterals only). All ductile iron pipe shall be polywrapped with black eight (8) mil thick polyethylene (see Section 2.11, "Protection from Corrosion"). If the pipe is cut to fit the required length, the exposed cut area of the pipe shall be coated with a minimum of one (≥1) mil of bituminous material. Ductile Iron soil pipe shall be U.S. Pipe, Pacific States, or approved equal.

The outside coating shall be a minimum of one (≥1) mil of bituminous paint conforming to AWWA C151/A21.51. Prior to lining, the exterior and interior of the spigot end, including the spigot face, shall be coated with a minimum of eight (≥8) mils of epoxy. Before lining the inside of the socket, including a portion of the gasket cavity and a portion of the pipe barrel, shall be coated with a minimum of eight (≥8) mils of epoxy.

Fittings shall be ductile iron, at least Class 54 thickness, and in conformance with AWWA C110/A21.10 or AWWA C153/A21.53 if compact fittings are to be used. Mechanical joints shall conform to AWWA C111/A21.11.

Each length of ductile iron pipe and fitting used shall be stamped or indelibly marked with the weight or grade thereof and the manufacturer's mark or name.

A Certificate of Compliance with all provisions of these Sewer Specifications shall be furnished by the manufacturer for all pipe and fittings furnished.

2.05 HIGH DENSITY POLYETHYLENE (HDPE) PIPE

HDPE sewer pipe for trench, bursting and trenchless installations, shall be minimum SDR 17 Extra High Molecular Weight, High Density Polyethylene PE 4308, Type III, Grade P34, Cell Class PE345434C, D or E. SDR 17 and PE 4308 shall be used to a maximum depth of thirty (30) feet; and for depths deeper than thirty (30) feet a specific pipe material analysis and design shall be required. Pipe shall have a co-extruded inner wall that is white or light in color. All pipe shall conform to ASTM D3350 and ASTM F714. HDPE pipe shall be Camcore™ by WL Plastics, Plexvue™ by Driscoplex, LightView™ by PolyPipe, or approved equal.

HDPE sewer pipe for sliplining shall the same as above, except it shall be SDR 26 minimum.

HDPE to HDPE pipe connections shall be butt fusion welded prior installation. Where a mechanical coupling must be used (i.e., repair, final connection, connection to dissimilar pipe material), an internal stainless steel stiffener sleeve that is expanded hydraulically to create an interference fit with the pipe must also be used.

HDPE pipe shall have proper markings which shall remain legible during normal handling, storage and installation. The markings shall clearly identify the manufacturer's name, nominal pipe size, standard dimension ratio or dimension ratio, product type and standard specification designation.

A Certificate of Compliance with all provisions of these Sewer Specifications shall be furnished and signed by an authorized agent of the manufacturer. The date that the pipe was manufactured shall be included in the certification. A report of test results shall be furnished if requested by the City.

All materials used in the manufacture of the pipe shall meet the requirements for Type III, Class B, Category 5, Grade P34 material as described in ASTM D1248. The pipe shall contain no recycled compounds except that generated in the manufacturer's own plant from resin of the same specification from the same raw material for the pipe. Pipe shall be homogeneous throughout and free of: 1) serious abrasion, cutting or gouging of the outside surface extending to more than ten (10) percent of the wall thickness in depth; 2) visible cracks; 3) kinking caused by excessive or abrupt bending; 4) flattening; 5) holes; 6) blisters; and 7) foreign inclusions or other injurious defects. The pipe shall be uniform in color, opacity, density, and other physical properties. The average outside diameter and wall thickness of pipe and fittings shall be in accordance with ASTM D2122.

2.06 COUPLINGS AND REDUCERS

Connections where the bell end of the pipe has been removed or where a new sewer main pipe is to be connected to existing sewer main pipe shall be made with the appropriate stop, repair or mechanical/compression coupling, or an approved equal, as detailed below. Couplings shall only be used and installed in accordance with the manufacturer's recommendations. All couplings shall be marked with the nominal size, product type and manufacturer's name/mark.

A. VITRIFIED CLAY PIPE (VCP). For connecting VCP to VCP a stainless steel and rubber mechanical compression coupling with shear rings conforming to ASTM C425 shall be used. The mechanical compression coupling shall be a "Type 2 Band-Seal" by Mission Clay Products, "Calder Repair Coupling" with stainless steel sheer ring by Joints, or approved equal. An adjustable repair coupling with shear rings may also be used.

B. POLYVINYL CHLORIDE (PVC). For connecting PVC to PVC a heavy wall gasketed PVC stop coupling of the same SDR as the pipe and conforming to ASTM D3034 and ASTM F1336 shall be used. The stop coupling shall be a H60 Series by PTI, or approved equal.

C. DUCTILE IRON PIPE AND DISSIMILAR PIPE MATERIALS. For connecting Ductile Iron and dissimilar pipe materials an adjustable repair coupling with a stainless steel sheer ring and conforming to ASTM C425 and ASTM C1173 shall be used. The adjustable repair coupling shall be by Mission Clay Products, Joints, or approved equal.

Pipe ends shall be cut square prior to installing a coupling. When a coupling does not have a "stop" rib for the ends of the pipes to butt against (i.e., a repair or closure coupling), the pipe ends must be marked at a distance equal to half the width of the coupling to ensure proper installation. During post-installation inspection, the gap between a pipe end and a stop rib shall not exceed ½-inch at any point around the joint. If the coupling does not have a stop rib, the gap between pipe ends shall not exceed ¾-inch at any point around the joint. Additional measures to secure the coupling to the pipes (i.e., a mechanically restrained joint) may also be required as determined by the Engineer.

Where reducers are necessary and approved for connections to existing service lines, reducers shall be eccentric type manufactured of approved pipe material. Coupling connections shall not be made to a reducer and reducing couplings will not be allowed. Reducers will only be allowed for special situations as determined necessary by the Engineer.

2.07 MANHOLES

Concrete for special manhole structures shall conform to Section 90-10, "Minor Concrete," of the Standard Specifications. Reinforcing steel for special manhole structures shall conform to Section 52, "Reinforcement," of the Standard Specifications.

Standard manholes shall conform to Standard Detail SD-304 "Preset Concentric Sanitary Sewer Manhole", ASTM C478, and the following requirements. The top and bottom of all manhole sections shall be parallel. Joints shall be tongue-and-grove type. The portland cement used in the precast sections shall conform to ASTM C150, Type II. Reinforcing steel shall have a minimum cross sectional area of three-tenths (≥0.30) square inches per foot in both directions.

Cones shall be manufactured of the same materials, strength and quality requirements as the straight sections. The cones shall be concentric and shall have a maximum height of three (≤3) feet.

Precast manhole sections shall be joined using preformed plastic gaskets conforming to Federal Specification SS-S-00210A, “Sealing Compound, Preformed Plastic for Pipe Joints,” and sized in accordance with the recommendations of the manufacturer of the precast sections. Gaskets shall be KentSeal No. 2 by Hamilton Kent Manufacturing Co., Ram-Nek by K.T. Snyder Co., or approved equal.

Mortar shall be standard premixed mortar conforming to ASTM C387 or proportion 1 part portland cement to 2 parts clean, well-graded sand which will pass a ⅛-inch screen. Admixtures may be used but not to exceed the following percentages by weight of cement: Hydrated Lime, 10%; Diatomaceous earth or other inert materials, 5%.

The throat of the manhole, including grade rings and frame, shall not exceed eighteen (≤18) inches.

The manhole frame, cover and pan shall be in accordance with Standard Detail SD-307, “Manhole Frame, Cover, and Pan”. Castings shall be tough, close-grained gray iron, free from all defects, and shall conform to ASTM A48, Class 30B. Bearing surfaces shall be planed or ground to ensure flat, true surfaces. Covers shall be true and seat within ring at all points.

Drop assemblies shall be constructed as shown on Sheet 1, of Standard Detail SD-306 "Sanitary Sewer Drop Connection".

All plastic pipe connections to manholes and stubouts shall have a rubber waterstop tightly banded to the pipe and cast into the manhole base. Banding material shall be stainless steel or other corrosion resistant material.

Pipe for stubouts shall be the same sewer pipe as approved and furnished for the project, unless otherwise indicated on the approved Plans. Each stubout will require a rubber gasketed watertight plug similar to the gasketed joints of the sewer pipe being used or an expandable type standard sewer plug.

2.08 SEWER MAIN RISER

Risers on sewer mains shall conform to Standard Detail SD-308, “Sanitary Sewer Riser and Minimum Grades”.

2.09 BUILDING SEWER CLEANOUT FITTINGS

Each cleanout shall consist of a wye of the same material as the building sewer in which it is installed and fitted with a watertight removal plug of the same material as the building sewer pipe. The cleanout shall consist of an extension of ductile iron soil pipe from the cleanout wye to the ground surface and fitted with a ductile iron ferrule and a brass plug. The top of the plug shall be a minimum of two (≥2) inches below the subgrade and a minimum of four (≥4) inches below the top of the cleanout box. See Standard Detail SD-313, “Alteration to Existing House Sewer,” for additional requirements.

2.10 BACKWATER AND GATE VALVES

Backwater valves (also called backflow preventers) shall have cast iron bodies, with bearing parts of non-corrosive metal or material, be so constructed as to insure a positive mechanical seal and remain closed except when discharging wastes, such as a ball-type polyethylene backflow preventer. Backwater valves shall be so designed as to not cause a restriction of flow or deposit of solids. The backwater valve shall be installed in a round precast concrete valve box with a perforated cover. Valve box and access cover shall be installed in an approved manner so as to be readily accessible at all times. See Standard Detail SD-314, “Backflow Preventer,” for installation requirements.

Gate valves, when used on sewerage work, shall be fullway-type with working parts of non-corrosive metal. Valves four (≥4) inches or more in diameter shall have cast iron bodies, and valves smaller than four (<4) inches may have either cast iron or brass bodies. All valve boxes and covers installed in easements or right-of-ways shall be Chisty G-5 Traffic Valve Box or approved equal, per Standard Detail SD-205, “Valve Installation.” Note that for sewers, the covers shall have “S” or "SEWER" cast on or engraved into the top, and thrust blocks may not be required (as determined by the Engineer).

2.11 PROTECTION FROM CORROSION

Corrosion protection shall meet the requirements of these Sewer Specifications and as shown on the Plans. Where corrosion protection requirements for directly buried ferrous metal have not been shown on the Plans or specified in detail, a mastic or tape coating shall be applied. The determination of the type of coating to be applied in each instance shall be reserved to the Engineer. Ferrous metal items to be protected shall include, but not be limited to, valves, fittings, service lines, reinforcing steel, anchor rods, flexible couplings, bolts, and nuts, flanges, saddles, tapping sleeves, hydrant buries, and plugged end and blow off assemblies. Mastic and tape coated ferrous metal shall also be protected with polywrap. All copper piping or any copper or brass part shall not be permitted to contact steel or cast iron pipe at any point. If contact is unavoidable, the copper or brass part shall be mastic or tape coated. All cast iron, steel or other ferrous metal shall be insulated from any concrete structure, such as footings, anchor blocks, encasements or structure walls using mastic, tape coating or other specified coating system extending a minimum of six (≥6) inches beyond the concrete. All coatings shall be continuous, unbroken, and pinhole free. Protective coatings shall only be applied over a properly prepared surface.

A. POLYWRAP (Polyethylene Protective Wrapping). General purpose adhesive tape shall be two (2) inches wide by 10 mils thick, Scotchrap No. 50, Polyken No. 900, Tapecoat CT, Protecto Wrap No. 200, or approved equal. Polywrap shall conform to AWWA C105/A21.5 for Type 1, Class C (black), Grade E1. Minimum tube sizes are listed below:

POLYWRAP FLAT TUBE WIDTH (Inches)

Nom. Pipe Diam. (Inches)	DI Pipe with Bell & Spigot Joints	DI Pipe with Mechanical Joints
4	14	16
6	17	20
8	21	24
10	25	27
12	29	30

If pipe sizes larger than 12 inches are to be installed, additional and supplementary specifications are required and shall be provided by the City.

B. MASTIC COATING. Protective mastic coating shall be a coal tar synthetic resin solvent release, cold applied coating. The mastic coating shall be Protecto Wrap CA 1200 Mastic or approved equal.

C. TAPE COATING PRIMER. Primer for tape coating shall be Protecto Wrap No. 1170, or approved equal.

2.12 TRENCH SECTIONS

Materials for trench sections shall be as shown on Standard Detail SD-310, "Permit and Subdivision Trench Sections," and per these Sewer Specifications.

A. ASPHALT CONCRETE. Asphalt concrete (AC) for pavement replacement shall be Type A and shall conform to the provisions in Section 39, "Asphalt Concrete," of the Standard Specifications and these Sewer Specifications. AC shall be produced from commercial quality virgin asphalt and aggregates and shall conform to the following requirements:

1. Asphalt concrete shall be produced at a central mixing plant;
2. Aggregate shall conform to the ½ inch maximum, medium grading specified in Section 39-2.02, "Aggregate," of the Standard Specifications, except that ¾ inch maximum medium grading may be used below the top 0.15 feet (i.e., final lift);
3. The amount of asphalt to be mixed with the aggregate shall be between four (4) percent and seven (7) percent by weight of dry aggregate;
4. The grade of asphalt to be mixed with the aggregate shall be PG 60-10;
5. Paint binder (tack coat) shall conform to the provisions of Section 94, "Asphaltic Emulsions," of the Standard Specifications and shall be SS-1H, unless otherwise directed by the Engineer;
6. Temporary pavement shall consist of AC conforming to the requirements herein or cutback asphalt concrete consisting of a mixture of cutback asphalt and minimum sized aggregate as specified by the Engineer. The use of cutback asphalt for trenches is not be allowed during the months of April through October.

B. AGGREGATE SUBBASES and AGGREGATE BASES. Aggregate subbase (ASB) shall be Class 2 and shall conform to the provisions in Section 25 of the Standard Specifications and these Sewer Specifications. Reclaimed asphalt concrete, portland cement concrete, lean concrete base, cement treated base, and/or glass may be processed and used as aggregate for aggregate subbase.

Note: Standard Detail SD-310 is superseded by SD-125

Aggregate Base (AB) shall be ¾ inch maximum Class 2 and shall conform to the provisions in Section 26 of the Standard Specifications and these Sewer Specifications. Reclaimed AC, portland cement concrete, lean concrete base, cement treated base, and/or glass may be processed and used as aggregate for aggregate base.

Aggregate for ¾ inch maximum Class 2 AB shall conform to the following gradation requirements:

PERCENTAGE PASSING (¾" Maximum)

Sieve Sizes	Operating Range	Contract Compliance
2″	-----	-----
1-½″	-----	-----
1″	100	100
¾″	90-100	87-100
No. 4	35-60	30-65
No. 30	10-30	5-35
No. 200	2-9	0-12

C. The 2nd paragraph in Section 26-1.02A, "Class 2 Aggregate Base," is waived.

D. QUARRY FINES and DRAIN ROCK. Aggregate for quarry fines and drain rock shall conform to the following gradation requirements as shown on Standard Detail SD-310 "Permit and Subdivision Trench Sections", Sheet 2 of 3:

PERCENTAGE PASSING

Sieve Sizes	Quarry Fines	Drain Rock
2″	-----	-----
1-½″	-----	-----
1″	100	100
¾″	95-100	95-100
No. 4	40-90	0-25
No. 30	15-40	0-5
No. 200	5-20	0

In addition, Drain Rock shall have a minimum durability of 40.

2.13 PORTLAND CEMENT CONCRETE

Materials for portland cement concrete shall conform to the provisions in Section 90, "Portland Cement Concrete," of the Standard Specifications. (Note: Section 90, "Portland Cement Concrete," can only be found in Caltrans' "Amendments to 2002 Standard Specifications." Copies of Section 90 are available upon request).

The concrete Classes A, B, C and D specified in the City of Hayward Standard Details are defined as follows:

Class A Concrete (6-sack-mix) shall contain not less than 564 pounds of cementitious material per cubic yard. (Typical for Precast Concrete Manhole sections)

Class B Concrete (5-sack-mix) shall contain not less than 470 pounds of cementitious material per cubic yard. (Typical for Valve Boxes and Manholes)

Class C Concrete (4-sack-mix) shall contain not less than 376 pounds of cementitious material per cubic yard. (Typical for Thrust, Reaction & Support Blocks)

Class D Concrete (7-sack-mix) shall contain not less than 658 pounds of cementitious material per cubic yard.

Materials for minor concrete shall conform to the requirements of Section 90-10, "Minor Concrete," of the Standard Specifications and these Sewer Specifications.

Reinforcing steel shall be Grade 40 or better and shall conform to Section 52, "Reinforcement," of the Standard Specifications.

2.14 REPLACE EXISTING SIDEWALK AND CURB & GUTTER

Where the existing sidewalk or curb & gutter are damaged by the installation of sewer mains, service lines, valve boxes or other construction activities, Applicant shall replace them in accordance to Standard Details SD-107 and SD-108. Base rock material shall be Class 2 Aggregate Subbase.

Concrete for sidewalk shall be Class B containing not less than 470 pounds of portland cement per cubic yard and shall conform to Section 90, "Portland Cement Concrete," of the Standard Specifications. In addition, concrete shall contain one (1) pound of lamb black per cubic yard.

2.15 SLURRY SEAL

If the approved plans require slurry sealing of a street, slurry seal shall conform to the provisions in Section 37-2, "Slurry Seal," of the Standard Specifications and these Sewer Specifications.

Aggregate for slurry seal shall be Type II.

2.16 MARKER POSTS

Marker posts shall be as shown on Standard Detail SD-222, "Facility Reference" and shall be placed at the locations shown on the approved Plans except where location can be marked on curbs.

PART 3 - INSTALLATION

3.01 GENERAL

All new sewer mains shall be in conformance with these Sewer Specifications and shall be installed to the lines and grades shown and the approved Plans. The alignment and elevation of the sewer main and appurtenances shall be established in the field by the Applicant either by measurements from curb and gutter or by surveying based upon and conforming to the approved Plans.

The location of manholes, valves, and other appurtenances to be installed shall be clearly referenced by offset stakes or by marking the curb. All installed appurtenances shall be protected from damage. Operating nuts (in the valve pots) of valves controlling live lines shall be accessible and operational at all times.

Connections of a new sewer main pipe to an existing sewer main pipe shall be made with the appropriate couplings, as detailed previously in Section 2.06, “Couplings and Reducers.” When a coupling does not have a “stop” rib for the ends of the pipes to butt against, the pipe ends must be marked at a distance equal to half the width of the coupling to ensure proper installation. Refer to Section 1.13 "Connections To Existing Sewer Mains," for requirements for work in the vicinity of existing sewer mains.

The sanitary sewer pipe shall be installed without interruption of service or inconvenience to the public at all times. Existing flow of wastewater shall be rerouted during construction by the Applicant using satisfactory bypass facilities at his/her expense and with the approval of the Engineer. Temporary rerouting of wastewater flow shall be done in a safe and sanitary manner without creating health and safety problems, and without allowing sand, silt, rock, or any debris to enter the system. Use of storm drains, gutters, or the pipe trench for wastewater flow is strictly forbidden. The Applicant shall be held responsible for any damages resulting from rerouting the wastewater and from the use of any bypass facilities in rerouting the wastewater. Refer to Section 3.04, “Wastewater Flow Control,” for detailed wastewater flow control requirements.

The Applicant is specifically cautioned as to the possibility of empty pipeline floating due to flooding of the trench by ground water, rain water or backfill consolidation. For this reason, “jetting” for backfill consolidation will not be allowed. Should any pipe sections be flooded by water in the trench, that reach of pipeline shall be removed, any damaged pipe repaired, the trench re-excavated, de-watered, and the pipe reinstalled at the Applicant's expense.

The interior of pipes shall be kept relatively free from dirt and debris as the pipe laying progresses. Open ends shall be plugged when work is stopped, or for any other reason work is left unattended. All openings in the pipeline shall be kept covered or plugged at all times. Existing manholes shall be protected from debris by installation of false bottoms, or other acceptable methods approved by the Engineer.

If any debris or foreign materials enter the sewer system due to Applicant’s operations, the Applicant shall clean and flush the effected lines and manholes at his/her expense. If the Applicant is unable to properly clean and flush the lines, City crews and equipment will be used at the Applicant's expense.

Pipe shall be inspected in the field before and after laying. If any cause for rejection is discovered in a pipe after it has been laid, it shall be rejected, at the sole discretion of the Engineer. Any corrective work shall be approved by the Engineer and shall be at no cost to the City.

Pipe shall be laid up-grade with the bell (socket or collar) ends of the pipe up-grade. The pipe ends shall be marked to indicate insertion stop position and to ensure that pipe is inserted into pipe or fitting bells to this mark. If full entry is not achieved, the joint shall be disassembled, cleaned and lubricated, and reassembled.

The spigot end of the pipe shall be lubricated with lubricant recommended by the pipe manufacturer. No other lubricant shall be used. The spigot end of a pipe shall be inserted into the bell end of another pipe so that it contacts the ring. The pipe sections should then be aligned and the spigot end pushed into bell end of the other pipe using methods recommended by the manufacturer.

Pipe shall be laid with uniform bearing under the full length of the barrel of the pipe. Suitable excavation shall be made to receive the socket or collar, which shall not bear upon the subgrade or bedding.

All excavations required to be made for the installation of a sewerage system, or part thereof, inside or outside of a building, shall be kept open until the piping has been inspected and preliminarily approved. (Final approval occurs after successful completion of backfilling, testing and video inspection.) If any sewerage system or part thereof is covered or concealed before being regularly inspected and preliminarily approved, it shall be exposed upon the direction of the Engineer at no cost to the City.

When connections are to be made to any existing pipe, conduit, or other appurtenances, the actual elevation or position of which cannot be determined without excavation, the Applicant shall excavate for, and expose, the existing improvement before laying pipe or conduit. The Engineer shall be provided adequate notification and opportunity to inspect the existing pipe or conduit before connection is made. Any adjustments in line or grade which may be necessary to accomplish the intent of the Plans shall be made at no extra cost to the City.

Applicant must reconnect all existing service laterals and intercepted operational sewer mains.

3.02 GRADING AND CURBS & GUTTERS

Prior to installing a sanitary sewer main, earthwork and rough grading shall be completed and approved cut-sheets of pipeline construction staking shall have been provided by the Construction Inspector. The pavement subgrade shall be acceptable to the City, or Alameda County if work is located in the unincorporated area, and curbs & gutters shall have been constructed. For construction staking requirements, contact the survey section in the Engineering and Transportation Division at 510-583-4796 or see the City's Web Site at www.hayward-ca.gov, then follow the links "City Services", "Building and Land Development", and "Construction Staking Standards."

Installation of a sewer main prior to curb & gutter construction may be considered for approval by the Engineer if the Applicant submits written verification to the Engineer that all of the following conditions are met and are available for inspection:

A. The street area has been rough graded to the extent that the sanitary sewer main shall have at least two (≥2) feet of cover from the grading plane to the top of pipe when ductile iron sanitary sewer main is used, three (≥3) feet of cover when PVC SDR 26 is used, and five (≥5) feet of cover when VCP is used. Placing the grading plane closer to the top of sanitary sewer pipe than is stated above is not allowed;

B. Construction survey stakes have been placed indicating curb grade and alignment, water main alignment and cuts for excavation for the water main in accordance with City requirements;

C. Cut-sheets indicating the elevation of the streets, curbs and the water main have been submitted to the City Survey Section and approved by the Engineer;

D. The alignment and grade of the street area are in accordance with the improvement plans approved by the City;

E. The main and appurtenances shall be located in accordance with Section 1.10, "Design and Location of Sewer Mains and Building Court Mains," of these Sewer Specifications; and

The Applicant agrees to promptly relocate the main and appurtenances at his/her own expense should the street grade or alignment be changed for any reason after the main is installed.

3.03 ALIGNMENT AND SLOPE

All pipes shall be laid and maintained to the lines and grades shown on the approved Plans.

A. Open Trench Installation. For pipes installed by open trench methods, the allowed variance from the designed location and elevation of the pipe end at a manhole shall not be greater than three (≤3) inches horizontally (0.06%) and two (≤2) inches vertically (0.04%), while still maintaining the minimum required positive slope of the pipe. The maximum allowed variance from the design slope is ±0.05%. At no point shall the slope be permitted to drop less than the minimum slope specified in Sections 1.10 and 1.11 of these Sewer Specifications, or the design slope shown on the approved Plans, whichever is less.

   If the approved Plans indicate the pipe is to be laid at or less than the "absolute" minimum slope specified in Sections 1.10 and 1.11, the elevation and the slope of the crown of the installed pipe shall be surveyed every fifteen (≤15) feet to verify that the design slope or absolute minimum slope limit, whichever is less, is not exceeded. The results of the survey shall be submitted to the Engineer for approval on a weekly basis at a minimum.

B. Trenchless Installation. For pipes installed by trenchless methods, the allowable variance from the design locations and elevations shall not be greater than the accuracy/tolerance of the trenchless method used. Any installation method with an accuracy/tolerance greater than 0.2% shall be pre-approved in writing by the Engineer. In addition, the minimum slope of the pipe to be installed shall be based on the accuracy/tolerance of the trenchless method and equipment used. For example, if a Mini-Horizontal Directional Drill (HDD) has an accuracy/tolerance of ±12" in 600' of bore (= ±0.167%), then the minimum (flattest) design slope for a 10" pipe installed by this Mini-HDD is 0.417% (- 0.167 = 0.250). The table below lists various trenchless installation methods and their typical properties (Note that the use of a method listed below should not be considered as "pre-approved" nor should the use any method not listed be considered as "prohibited"):

Trenchless Method	Bore Diameter (in)	Max. Length (ft)	Typical Casing and Pipe Material	Typical Accuracy/Tolerance
Jack & Bore (Auger Boring)	4 to 60	600	Steel Casing, any Carrier Pipe	±1% of Bore Length ±12 inches if Steered
Compaction (Push, Rotary or Percussion)	≤ 12	40 to 60	Any	Not Accurate
Pipe Ramming	2 to 55	200	Steel Casing, any Carrier Pipe	Not Accurate
Horizontal Directional Drill (HDD) Mini-HDD	12 to 60 2 to 12	2000 600	Steel, HDPE, PVC	±1% of Bore Length ±6 inches to ±12 inches
Microtunneling	≥ 8	750	Any	±1 inch Horizontal ±1.5 inches Vertical
Pipe Jacking	≥ 48	1600	Continuous Circumference Shield	±3 inches Horizontal ±2 inches Vertical
Utility Trenching (Tunnel Boring Machine)	≥ 48	Any	Segmented Circumference Shield	±1 inch

C. Connecting to Existing Building Sewers. Applicant shall make any necessary adjustments to the slope of the new pipe (i.e., raise or lower it) when connecting to existing Building Sewers (laterals) such that positive flow and minimum slopes are maintained in both the new sewer pipe and existing lateral. If the required adjustment to the new pipe exceeds the limits specified herein, the Applicant shall relay or replace up to five (≤5) feet of a sewer lateral at his expense and at no cost to the City or owner of the sewer lateral (if not the Applicant). These adjustments shall be documented, including a scaled sketch or plan, and submitted to the Engineer.

D. Other Utilities. Sewer mains shall not be run or laid in the same trench with water mains or services. Where a sanitary sewer or storm drain line parallels the path of a water main, standard horizontal separation shall be a minimum of ten (≥10) feet for sewers and six (≥6) feet for storm drains. Where these standard separation requirements can not be met, the horizontal separation and pipe materials shall be constructed in accordance with the requirements in Section 1.10-D of these Sewer Specifications.

Where a sanitary sewer or storm drain line crosses the path of a water main, the standard vertical separation shall be a minimum of twelve (≥12) inches with the water main located above the other utility. Where the standard separation requirement can not be met, the vertical separation and pipe materials shall be constructed in accordance with the requirements in Section 1.10-D and as shown on Standard Details SD-224 and SD-303.

Water service lines or any underground water pipes shall not be run or laid in the same trench with Building Sewer or drainage service lines, except as provided in this section and specifically approved by the Director of Public Works. If approved, the water service pipe may be placed in the same trench with such building drain and Building Sewer, provided it complies with the requirements in Section 1.10-D and both of the following conditions are met:

- The bottom of the water service pipe, at all points, shall be at least twelve (≥12) inches above the top of the sewer line; and
- The water service pipe shall be placed on a solid shelf excavated at one side of the common trench. It should be noted that this may require excavating a trench twice as wide, or more, as that for a single utility trench.

3.04 WASTEWATER FLOW CONTROL

All existing sanitary sewer flows must be accommodated throughout construction. All work shall be done without interruption of service or inconvenience to the public at all times. Applicant shall schedule and coordinate the work to avoid any interference with normal operation of the sewer. Applicant shall immediately correct any undesirable conditions, which result from bypassing or other operations.

Applicant shall provide labor, equipment, materials and supervision to temporarily control wastewater flow around or through the construction area. Applicant shall not interrupt the functions of the existing sewers and is responsible for any penalties and expenses incurred by the City in the event that his/her operations cause any violation of the City's discharge permit.

It shall be the Applicant's responsibility to maintain the wastewater flows through the project site at all times. A bypass shall be made by plugging the existing manholes upstream of the Applicant's work and pumping the wastewater to manholes downstream of the Applicant's work. The pumps and bypass lines shall be of adequate capacity and size to handle the anticipated flows as provided by the Engineer and shall be shown on the approved Plans. The bypass system shall be subject to approval by the Engineer.

Bypass pumping shall be done in a manner that will not damage private or public property, or create a nuisance. The pumped wastewater shall be in an enclosed pipe or hose that is adequately protected from traffic and shall be redirected into the sanitary sewer system. Discharging of wastewater on private property, gutters, streets, sidewalks, or into storm drains is prohibited. The Applicant shall be liable for all damages or fines (including fines imposed on the City as a result of the Applicant's operations) associated with this work. After the work is completed, flow shall be restored to original conditions and temporary facilities shall be removed.

The Applicant shall submit a plan showing the size and layout of pumps and temporary pipelines. The layout shall also show how facilities will be protected during use. Applicant shall submit calculations and/or specifications showing the selected pumps are capable of pumping the anticipated flow. Calculations shall be stamped and signed by a Civil or Mechanical Engineer licensed in the State of California. Applicant shall submit catalog data for the pump controls and audible alarms and for generators. Applicant shall submit an emergency response plan to be followed in the event of a failure of the bypass pumping system.

Applicant shall provide 48-hour advance notice to the Engineer of the location and schedule of flow control.

Wastewater shall not be allowed to escape or leak from the sewer system or from any bypass facilities at any time. Any leak, overflow or spill shall be documented and reported to the Engineer. Any leak or spill on the order of 1,000 gallons or more must immediately be reported to the Engineer, Utilities Superintendent at 510-881-7901 and to Water Pollution Source Control at 510-881-7900.

Applicant shall clean and repair without cost to the City any damage that may result from his/her negligence, inadequate or improper installation, maintenance and operation of bypassing and flow control system including mechanical or electrical failure.

3.05 MAINTAINING TRAFFIC

Attention is directed to Sections 7-1.08, "Public Convenience," 7-1.09, "Public Safety," and 12, "Construction Area Traffic Control Devices," of the Standard Specifications. Nothing in these Sewer Specifications shall be construed as relieving the Applicant from his/her responsibility as provided in said Section 7-1.09.

A. STANDARD REQUIREMENTS.

1. "No Parking" signs must be posted at no greater than 50 foot intervals at least 48 hours prior to effective time of parking restriction. Applicant must clearly indicate on the signs the day, date(s), and hours that "No Parking" is necessary.
2. Adequate traffic warning and control devices shall be provided and maintained by the Applicant during the contract period, in accordance with the current "Manual of Traffic Controls for Construction and Maintenance Work Zones," issued by the State Department of Transportation. When inadequate traffic warning and control devices have been installed, the City shall provide whatever facilities are deemed necessary and shall charge the Applicant for the costs thereof, as provided in Chapter 7, Article 2 of the Hayward Municipal Code.
3. Personal vehicles of the Applicant's employees shall not be parked on the traveled way at any time, including any section closed to public traffic. When entering or leaving roadways carrying public traffic, the Applicant's equipment, whether empty or loaded, shall in all cases yield to public traffic. Safe and convenient pedestrian access shall be provided, at all times.
4. Flaggers are mandatory at locations where equipment is intermittently blocking a traffic lane, or where only one lane is available for two-directional traffic. One flagger is required for each direction of traffic affected where only one lane is available for over 100 feet, or when required by the Engineer. When less than 20 feet of street width is available for two-directional traffic, one lane control shall be imposed with appropriate flaggers. Flaggers shall wear approved distinctive clothing.
5. Applicant shall cooperate with local authorities relative to handling traffic through the area and shall make their own arrangements relative to keeping the working area clear of parked vehicles.
6. Police services for traffic control are available upon request and shall be coordinated through the City of Hayward Police Department, Traffic Division, at 510-293-7011, 48 hours in advance. If excessive traffic congestion occurs at any time during the period of project construction due to the neglect of the contractor to provide adequate controls, the Engineer shall arrange the services of the Police Department. The traffic control services of the Police Department shall be at the Applicant 's expense.
7. On all streets, the full width of the traveled way shall be open for use by public traffic on Saturdays, Sundays, and designated legal holidays, after 4:00 p.m. on Fridays, and when construction operations are not actively in progress. Any exceptions will be described in the "Special Requirements" of this Section.
8. For the purpose of maintaining traffic, designated legal holidays mentioned above are: January 1st, the third Monday in January, the third Monday in February, the last Monday in May, July 4th, the first Monday in September, November 11th,

Thanksgiving Day and December 25th. When a designated legal holiday falls on a Sunday, the following Monday shall be a designated legal holiday. When November 11th falls on a Saturday, the proceeding Friday shall be a designated legal holiday.

B. SPECIAL REQUIREMENTS.

1. Traffic control for lane closure shall conform to the details shown on the on State Standard Plans T-11, T-12, and T-13.
2. A minimum of one traffic lane, not less than ten (≥10) feet wide, shall be maintained in all areas. If only one lane is available for two way traffic, appropriate flagmen shall be used as specified in this section of these Sewer Specifications.
3. Safe and convenient pedestrian access shall be provided at all times.
4. Applicant shall install and maintain all construction signs conforming to State of California Standards and as directed by the Engineer.
5. Applicant shall place new striping in kind for lane lines and pavement markings that have been removed by excavation.

3.06 DUST CONTROL AND STORM DRAIN POLLUTION PREVENTION

A. DUST CONTROL. Applicant shall implement dust control measures conforming to the provisions in Section 10, “Dust Control,” of the Standard Specifications.

B. STORM DRAIN POLLUTION PREVENTION. Applicant shall comply with the requirements of Chapter 11, Article 5 of the Hayward Municipal Code, “Stormwater Management And Urban Runoff Control.”

“Where best management practice guidelines or requirements have been adopted by any federal, State of California, regional, and/or City agency, for any activity, operation, or facility which may cause or contribute to stormwater pollution or contamination, illicit discharges, and/or discharge of non-stormwater to the stormwater system, every person undertaking such activity or operation, or owning or operating such facility, shall comply with such guidelines or requirements.”

3.07 WATERING

Watering shall conform to the provisions in Section 17, "Watering," of the Standard Specifications, except that no compensation for water supply shall be considered.

Water is available from the City of Hayward fire hydrants at or near the site of work. The Applicant shall make application to the Hayward Water Department and make payment of the appropriate fee or deposit for a construction water meter. The Applicant shall meter all water taken from the Hayward Water System and pay the current rates for water consumed.

3.08 OBSTRUCTIONS

Attention is directed to Sections 8-1.10, "Utility and Non-Highway Facilities," and Section 15, "Existing Highway Facilities," of the Standard Specifications.

Applicant shall show the approximate location of all existing utilities on the Plans. Five (≥5) working days prior to the start of work, the Applicant shall request the applicable utility companies to mark the appropriate locations of their facilities.

Prior to performing any excavation one (≥1) foot or more in depth, the Applicant shall notify Underground Services Alert at least two (≥2) working days prior to the beginning of any excavation.

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It shall be the Applicant's responsibility to locate all utilities at least ten (≥10) days before working in any area where other utilities are located. All utilities should be remarked every 14 days.

Where required on the approved Plans, Applicant shall pothole existing utilities to determine their exact location and depth prior to performing any excavation operations in the subject area. Applicant shall submit to the Engineer drawings indicating the location and depth of all utilities encountered during potholing and/or trenching operations.

3.09 TRENCH EXCAVATION AND BACKFILL

All trenching and backfilling shall conform to the provisions in Section 19, "Earthwork", of the Standard Specifications and these Sewer Specifications.

The Applicant shall notify adjacent property owners of the work schedule and necessary access restrictions a minimum of five (≥5) working days prior to start of operations.

The Applicant shall verify the location of existing underground utilities before trenching in accordance with Section 3.08, "Obstructions," of these Sewer Specifications.

Surplus excavated material shall become the property of the Applicant and shall be disposed of outside the street right-of-way and water, sewer, or storm drain easements in accordance with the provisions in Section 7-1.13, "Disposal of Material Outside the Highway Right-of-Way," of the Standard Specifications.

The Applicant shall make his/her own arrangements for a staging area for the temporary stockpiling of material and equipment storage. The Applicant shall not be allowed to use public streets or property for such purpose.

Prior to using any property as a staging area, the Applicant shall submit to the Engineer a written release from the property owner absolving the City of any and all responsibility in connection with the use of such property in accordance with Section 7-1.13 "Disposal of Material Outside the Highway Right of Way".

Excavation for pipes shall be by open trench unless otherwise specified, or shown on the approved Plans, or permitted by the Engineer. No excavated material shall be allowed to be stockpiled overnight in or adjacent to public right-of-ways.

Existing concrete and bituminous pavement to be removed for installation of a pipeline, before being broken and removed, shall be neatly sawed along the edges of the area to be removed to a depth of one-and-one-half (1-½) inches, with a concrete pavement saw. This shall be in straight lines parallel to the trench and in the case of bituminous pavement twelve (12) inches outside the sides of the pipe trench.

Except by permission of the Engineer, the maximum length of open trench shall be 200 feet or the distance necessary to accommodate the amount of pipe installed in a single day,

Note: Standard Detail SD-310 is superseded by SD-125

whichever is greater. The distance is the collective length at any location, including open excavation, pipe laying and appurtenant construction and backfill which has not been temporarily resurfaced.

All excavation limits, backfill materials and compaction shall conform to the requirements shown on Standard Detail SD-310, "Permit and Subdivision Trench Sections," or as shown on the approved Plans and as directed by the Engineer. In the event trench width exceeds the indicated maximums, the Applicant shall provide special bedding or extra strength pipe, as required by the Engineer. Backfill shall be replaced around exposed existing utilities to the same conditions as existed prior to excavation.

All trenches in State Highways or in unincorporated areas of Hayward shall be backfilled strictly in accordance with the provisions of the encroachment permits issued by the respective agencies.

Permanent pavement shall be placed to the finish grade on the same work day temporary pavement is removed. Testing, backfilling, compacting to the required relative compaction, and placing of temporary pavement shall be performed immediately after placing pipe.

A. DEWATERING. All water encountered in constructing the sanitary sewer shall be disposed of by the Applicant in such manner as shall not damage public or property or create a nuisance or health menace. The Applicant shall furnish, install, and operate pumps, pipes, appliances, and equipment of sufficient capacity to keep all excavations and accesses free from water until the excavation is backfilled, unless otherwise authorized by the Engineer. The Applicant shall provide all means of facilities necessary to conduct water to the pumps. Water, if odorless and stable, may be discharged into an existing storm drain, channel, or street gutter in a manner approved by the Engineer. When required by the Engineer, Applicant shall provide a means for desilting the water before discharging it at his/her expense. If water has an odor or appears contaminated, immediately contact City's Water Pollution Source Control Division at 510-881-7900 for further information regarding discharge requirements and notify the Engineer.

B. EXCAVATION. The trench shall be excavated to a depth required to allow for placement of bedding material. Bedding material shall provide a uniform and continuous bearing and support for the pipe at every point between bell holes or joints unless otherwise shown on the Plans. It will be permissible to disturb the finished bedding surface over a maximum length of eighteen (≤18) inches near the middle of each length of pipe by the withdrawal of pipe slings or other lifting tackle.

   Any part of the bottom of the trench excavated below the specified grade shall be backfilled with approved material thoroughly compacted as directed by the Engineer. The finished grade of the bedding material shall be prepared accurately by means of hand tools.

   Where the bottom of the trench at subgrade is found to be unstable or to include ashes, cinders, all types of refuse, vegetable or other organic material or large pieces or fragments of inorganic material which in the judgment of the Engineer should be removed, the Applicant shall excavate and remove such unsuitable material to the width and depth ordered by the Engineer. Before the pipe is laid, the subgrade shall be made by backfilling and compacting in two (2) inch layers with material as specified on Standard Detail SD-310, "Permit and Subdivision Trench Sections" or as specified by the Engineer.

All excavated materials shall be exported off-site. The delivery site must be approved by the Engineer prior to use.

All excavated material shall be removed from the project site concurrent with the excavation operations. Hydrants under pressure, valve pit covers, valve boxes, curb stop boxes, fire and police call boxes, or other utility controls shall be left unobstructed and accessible until the work is completed. Gutters and drainage channels shall be kept clear at all times. All excavated material shall be piled in a manner which will not endanger the work and which will avoid obstructing sidewalks and driveways.

C. MECHANICALLY COMPACTED BACKFILL. Backfill shall be mechanically compacted by means of tamping rollers, sheepsfoot rollers, pneumatic tire roller, vibrating rollers, or other mechanical tampers. All such equipment shall be of a size and type approved by the Engineer. Impact-type pavement breakers (stompers) will not be permitted.

Permission to use specific compaction equipment shall not be construed as guaranteeing or implying that the use of such equipment will not result in damage to adjacent ground, existing improvements, or improvements installed by Applicant. The Applicant shall make its own determination in this regard.

Material for mechanically compacted backfill shall be placed in lifts which, prior to compaction, shall not exceed the thickness specified below for the various types of equipment:

1. Vibratory equipment, including vibratory plates, vibratory smooth-wheel rollers, and vibratory pneumatic-tired rollers – Maximum lift thickness of one (≤1) foot.
2. Rolling equipment, including sheepsfoot (both vibratory and nonvibratory), grid, smooth-wheel (nonvibratory), pneumatic-tired (nonvibratory), and segmented wheels – Maximum lift thickness of eight (8) inches.
3. Hand-directed mechanical tampers – Maximum lift thickness of four (≤4) inches.

Regardless of the backfill materials and equipment used, the Applicant is responsible to achieve the required compaction in such a manner that the pipe is not damaged.

Mechanically compacted backfill shall be placed in horizontal layers of thickness (not exceeding those specified above) compatible to the material being placed and the type of equipment being used. Each layer shall be evenly spread, moistened (or dried, if necessary) and then tampered or rolled until the specified relative compaction has been attained.

Testing for relative compaction shall be performed by the City as outlined in Section 6-3, "Testing," of the Standard Specifications.

Relative compaction of trench backfill materials shall conform to the requirements shown on the Standard Detail SD-310, as shown on the Plans, and shall be done concurrently with pipe installation and placement of backfill materials. In unpaved areas backfill shall match to existing ground grade.

3.10 TRENCH SHORING AND TRENCH SAFETY

Attention is directed to Section 5-1.02A, "Trench Excavation Safety Plans," and Section 7-1.01E, "Trench Safety," of the Standard Specifications, and to the applicable provisions of Sections 6422, 6423, and 6424 of the Labor Code of the State of California and these Sewer

Specifications. The current CAL-OSHA trench shoring regulations shall be used as a guide for minimum shoring requirements.

No excavations shall remain open longer than is necessary to perform the work. If, in the opinion of the Engineer, the Applicant is not pursuing the work with diligence, the Engineer may require an excavation to be backfilled and protected with temporary paving or covered with steel traffic plates, even though that particular installation is not complete.

At the close of work each day, all open trenches shall be backfilled or covered with steel traffic plates and full access to all roads and driveways shall be provided. In roadway areas, backfilled excavations shall be covered with a minimum three (≥3) inch layer of temporary asphalt conforming to the requirements of Section 2.12 of these Sewer Specifications. Trench plates shall be tightly butted to each other and fine graded asphalt concrete shall be compacted to form ramps, maximum slope of 8.5% with a minimum twelve (≥12) inch taper to cover all edges of the steel plates. Upon request of the Engineer, Applicant shall anchor the trench plates (if longitudinal, the approach and ending plates only) to the roadway with a minimum of two (2) dowels pre-drilled into the opposite corners of the plate and drilled two (2) inches into the pavement.

When close sheeting is required, it shall be so driven so as to prevent adjacent soil from entering the trench either below or through such sheeting. Where sheeting and bracing are used, the trench width shall be increased accordingly.

The Engineer reserves the right to order the sheeting driven to the full depth of the trench or to such additional depths as may be required for the protection of the work. Where the soil in the lower limits of a trench has the necessary stability, the Engineer, at his/her discretion, may permit the Applicant to stop the driving of sheeting at some designated elevation above the trench bottom. However, the granting of permission by the Engineer shall not relieve the Applicant in any degree from his/her full responsibility for the work.

Sheeting and bracing, which have been ordered left in place, must be removed for a distance of three (3) feet below the established street grade or the existing surface of the street, whichever is lower. Trench bracing, except that which must be left in place, may be removed when the backfilling has reached the respective levels of such bracing. Sheeting, except that which has been left in place, may be removed after the backfilling has been completed or has been brought up to such an elevation as to permit its safe removal. Sheeting and bracing may be removed before backfilling the trench, but only in such manner as shall insure the adequate protection of the completed structures and adjacent underground or surface structures, and prevent the disturbance of the adjacent ground. If the trench shields or any other type of sheeting system is needed under current CAL-OSHA regulations, the Engineer reserves the right to require using and installing the trench shields or other type of shoring system for the protection and safety of the workers.

The Applicant is responsible for maintenance of plates, shoring, and temporary pavement and shall perform any necessary maintenance or repairs immediately upon request by the Engineer.

3.11 PLACING VITRIFIED CLAY PIPE IN TRENCH

The installation of vitrified clay pipe shall conform to ASTM C12 and these Sewer Specifications. Pipe bedding, trench backfill and relative compaction shall be in accordance with Standard Detail SD-310, "Permit and Subdivision Trench Sections." Pipe shall be uniformly supported throughout its length with no voids under or around the pipe.

Pipe and fittings shall be carefully handled so as to protect them from damage, especially damage due to impact, shock, and free-fall. Pipe shall be handled so that premolded joining surfaces or attached couplings do not support the weight of the pipe. Do not drag, use hooks or impact other hard materials as these actions can damage the joining surfaces of the pipe and fittings.

The bell socket and the plain end of the entering pipe shall be absolutely clean and free of foreign material (e.g. sand, dirt, debris, etc.) prior to joining. Use only joint lubricants and joining methods recommended by the pipe manufacturer.

Following the placement and desification of backfill, and prior to the placing of permanent pavement, all pipe shall be cleaned, inspected for obstructions and measured for uniform grade (offset joints, lateral pipe intrusions, deflections, sags, etc.). See Section 3.21, “Cleaning and Testing of Sanitary Sewer Mains” for additional requirements.

3.12 PLACING PVC PIPE IN TRENCH

The Applicant is specifically cautioned as to the possibility of empty pipeline floating due to flooding of the trench by ground water, rain water or backfill consolidation. Should any pipe sections be floated by water in the trench, that reach of pipeline shall be replaced, and damaged pipe repaired, the trench re-excavated, de-watered, and the pipe reinstalled at the Applicant's expense.

The installation of PVC pipe shall conform to ASTM D2321 and these Sewer Specifications. Pipe bedding, trench backfill and relative compaction shall be in accordance with Standard Detail SD-310, "Permit and Subdivision Trench Sections." Pipe shall be uniformly supported throughout its length with no voids under or around the pipe.

Before joining bell and spigot PVC pipe, the plain end of the pipe shall be beveled to avoid damage to the rubber ring as the pipe is pushed home. The bell socket and the plain end of the entering pipe shall be absolutely clean and free of foreign material (e.g. sand, dirt, debris, etc.) prior to the seating of the rubber ring. The ring groove shall be cleaned prior to inserting a clean rubber ring. The ring shall be seated evenly all around and be free from twists. The rubber rings should not be lubricated.

The spigot end of the pipe shall be lubricated with lubricant recommended by the pipe manufacturer. No other lubricant shall be used. The spigot end should be inserted into the bell so that it is in contact with the ring. The pipe sections should then be aligned and the spigot end pushed in.

PVC sewer pipe may be installed with a curved alignment only if:

A. It is specifically approved or required by the Director;

B. Approved deflection fittings or couplings are used;

C. Pipe lengths are reduced to allow more angular joint deflection but within the maximum allowed by the pipe manufacturer; and

D. Bending of solid wall pipe is done without any application of heat or mechanical means (only by workers applying uniform forces along the pipe length) and subject to the following limitations (but within the specifications of the pipe manufacture):

PVC BENDING RADII

Pipe Size (Inches)	Minimum Allowable Radius (Feet)
6	150
8	200
10	250
12	300

The approximate force per 20 feet of pipe length to accomplish the above curvatures for Class 150 pipe and the offset per 20 feet of pipe length are tabulated below:

PVC BENDING FORCES AND OFFSETS

Pipe Size (Inches)	Approximate Force (Pounds)	Offset (Inches)
6	60	16
8	135	12
10	250	9
12	450	8

Offsets are calculated assuming no deflection at the joint and the bent pipe is curved uniformly throughout its length.

In the case where the manufacture's specifications are more restrictive than the above values, the manufacture's specifications shall govern.

If pipe sizes larger than twelve (>12) inches are to be installed, additional and supplementary specifications are required and shall be provided by the City.

Following the placement and desification of backfill, and prior to the placing of permanent pavement, all pipe shall be cleaned, inspected for obstructions and measured for uniform grade (offset joints, lateral pipe intrusions, deflections, sags, etc.). See Section 3.21, "Cleaning and Testing of Sanitary Sewer Mains" for additional requirements.

3.13 PLACING DUCTILE IRON PIPE IN TRENCH

The installation of Ductile Iron pipe shall conform to these Sewer Specifications. Pipe bedding, trench backfill and relative compaction shall be in accordance with Standard Detail SD-310, "Permit and Subdivision Trench Sections." Pipe shall be uniformly supported throughout its length with no voids under or around the pipe.

Before joining bell and spigot of ductile iron pipe, the plain end of the pipe shall be beveled to avoid damage to the rubber gasket as the pipe is pushed home. The bell socket and the plain end of the entering pipe shall be absolutely clean and free of foreign matter, (such as mud, sand, cinders, gravel, frozen material, etc.) prior to the seating of the gasket. The gasket shall be wiped clean, flexed and then placed in the socket with the large round end entering first, so that the gasket is seated evenly around the inside of the socket with the groove fitted over the bead. As the gasket fits snugly in the gasket seat, it shall be necessary to smooth out the gasket around the entire circumference to remove any bulges which might interfere with the proper entry or the spigot end.

A thin film of clean lubricant shall be applied to the inside surface of gasket which will come in contact with the plain end of the pipe. If necessary, apply a thin film of lubricant to the outside of the plain end for about one (1) inch back from the end. Lubricant other than recommended by the manufacturer shall not be used.

All ductile iron pipe and fittings shall be polywrapped in accordance with Section 2.11, "Protection from Corrosion," of these Sewer Specifications. Polywrap installation shall conform to the requirements of AWWA C105/A21.5, Method A or B. Method A is preferred.

If specifically approved or required by the Director, ductile iron sewer pipe may be installed in a curved alignment in accordance with the maximum allowable deflection tabled below:

MAXIMUM ALLOWABLE DEFLECTION FOR DUCTILE IRON PIPE JOINTS

Size of Pipe (Inches)	Mechanical Joint Pipe							Push-On Joint Pipe						
	Maximum Deflection Angle (Degrees)	Maximum Offset or Deflection per Length (Inches)			Radius of Curvature For Pipe Length (Feet)			Maximum Deflection Angle (Degree)	Maximum Offset or Deflection per Length (Inches)			Radius of Curvature For Pipe Length (Feet)		
		12 FT	18 FT	20 FT	12 FT	18 FT	20 FT		12 FT	18 FT	20 FT	12 FT	18 FT	20 FT
4″	8º	20″	31″	35″	85′	125′	140′	5º	12″	19″	21″	135′	205′	230′
6″	7º	18″	27″	30″	95′	145′	160′	5º	12″	19″	21″	135′	205′	230′
8″-12”	5º	13″	20″	22″	135′	195′	220′	5º	12″	19″	21″	135′	205′	230′

In the case where the manufacture's specifications are more restrictive than the above values, the manufacture's specifications shall govern.

If pipe sizes larger than twelve (>12) inches are to be installed, additional and supplementary specifications are required and shall be provided by the City.

Following the placement and desification of backfill, and prior to the placing of permanent pavement, all pipe shall be cleaned, inspected for obstructions and measured for uniform grade (offset joints, lateral pipe intrusions, deflections, sags, etc.). See Section 3.21, "Cleaning and Testing of Sanitary Sewer Mains" for additional requirements.

3.14 INSTALLING HDPE PIPE BY TRENCHLESS METHODS

The installation of HDPE pipe shall conform to these Sewer Specifications. Pipe bedding, trench/pit backfill, and relative compaction shall be in accordance with Standard Detail SD-310, "Permit and Subdivision Trench Sections." Pipe exposed in trenches or access pits shall be uniformly supported throughout its length with no voids under or around the pipe.

Per Section 11-3.311 of the City's Municipal Code, Applicant may request authorization to use alternative pipe materials (i.e., fusible PVC) and installation methods not specifically prescribed herein. This request must be submitted in writing to the Engineer and shall include suggested specifications, installation procedures and quality control methods.

A. QUALIFICATIONS. Contractor shall be trained by the particular pipe bursting or trenchless system manufacturer such that contractor is a fully trained user of the system. Polyethylene pipe joining shall be performed by personnel trained by the manufacturer of the butt-fusion equipment to be used. Personnel directly involved with installing the new pipe shall have received training in the proper methods for handling and installing polyethylene pipe. Copies of the training certifications shall be submitted to the Engineer prior to the delivery of materials to the project site.

B. ACCESS PITS. Access pit locations shall be chosen and recommended by the Contractor with the intent of minimizing excavation and traffic disruption. Recommended locations shall be at service connections, new manhole locations, or at points where spot repairs need to be performed. The Contractor shall submit the number, location, and size of pits to Engineer for review prior to start of the work.

The access pits shall be excavated to allow adequate width for access of workers, sheeting and shoring installation, and to provide clearance necessary to avoid damage to the pipe during insertion. Care shall be taken to protect existing utilities.

The minimum length of each access pit as measured at the bottom of trench shall be determined by the formula,

Length = (12 x New pipe O.D. in feet) + (2.5 x Trench depth in feet).

C. PRE-INSTALLATION VIDEO INSPECTION. Contractor shall perform pre-installation video inspection on all existing sewer pipes to be burst or lined. Video inspections shall be performed in accordance with Section 3.21, "Cleaning and Testing of Sanitary Sewer Mains." The locations of service laterals, obstructions, sags and debris shall be accurately documented. Any obstructions that will prevent the completion of the pipe installation process, and that cannot be removed by conventional sewer cleaning equipment, shall be excavated and removed prior to installation of the new pipe. All existing rise/sags, high/low spots or bellies greater than 33% of the diameter of the existing pipe shall be excavated and eliminated prior to installation of the new pipe. The Engineer may also require that existing rises or sags between 25% and 33% of the diameter of the existing pipe be eliminated, depending upon the diameter and slope of the pipe to be burst or lined.

D. JOINING. Pipes shall be joined to one another and to plastic fittings by thermal butt-fusion or saddle fusion in accordance with ASTM D2657, or by automatic electrofusion. Weld on flanges may be used to join pipes in access pits if pre-approved by the Engineer.

Fusing procedures shall be per the fusing equipment manufacturer's recommendations. All manufacturer specifications/recommendations shall be submitted to the Engineer prior to the delivery of material to the project site. Temperature, pressure and time shall be automatically logged or manually documented during fusing operations and the records shall be submitted to the Engineer for final approval. At a minimum, butt fusion procedure shall be as follows:

1. Secure the pipes in the butt fusion equipment and use pipe supports to provide a straight alignment;
2. On the inside of both of the pipe ends, print the sequential number of the joint that matches the number used in the logging or documenting of the fusing operation. Use a permanent ink or paint-type marker that does not easily wipe off and in a color that contrasts to the interior color of the pipe. Note that during joining operations, the numbers on either pipe end need not be aligned.
3. Face (plane) the pipe ends and remove the shavings and chips from the inside and outside of the pipes with a clean, untreated, dry, lint-free cloth. If any oil or other hydrocarbon contaminates are on the pipe, the ends must be cleaned with isopropyl alcohol.

4. Align and melt the pipe ends. Do not force the pipe ends against the heating tool surface. Proper heating tool temperature is 400-450°F (typ.). Heating time ends when the proper melt bead size has formed all around both pipe ends.

MELT BEAD SIZE & TRANSFER (HEATING) TIMES

Pipe Size (Inches)	Approx. Melt Bead Size (Inches)	Typical Transfer Time (Seconds)
3 to 8	$^1/_8$ to $^3/_{16}$	5
8 to 12	$^3/_{16}$ to $^1/_4$	6
12 to 24	$^1/_4$ to $^7/_{16}$	9
24 to 36	$^7/_{16}$	12

5. Join the melted pipe ends together and apply joining pressure. Proper hydraulic fusion machine joining pressure is 60-90 psi (typ.). The correct fusion joining force is the minimum force required to adequately roll the melt beads over the pipe surfaces.

6. Maintain joining pressure until the external fusion beads have cooled to 125°F or lower. Use of water, wet cloths or other rapid cooling devices is prohibited. Only fans may be used to accelerate the cooling process. While waiting for the joint to cool, print the joint number, date and time on the outside of the pipe near the joint. Use a permanent ink or paint-type marker that does not easily wipe off and in a color that contrasts to the exterior color of the pipe.

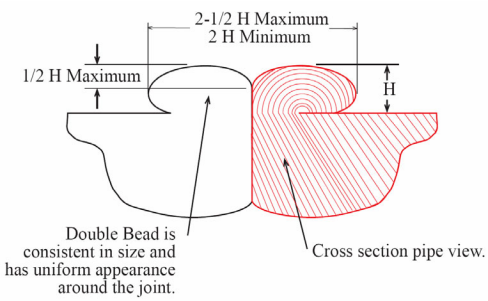
WALL THICKNESS VS. COOLING TIME

Pipe Wall Thickness (Inches)	Typical Cooling Time At 74°F Ambient (Minutes)
0.6 to 0.8	15 to 20
0.8 to 1.2	20 to 30
1.2 to 1.6	30 to 40
1.6 to 2.0	40 to 50
2.0 to 2.4	50 to 60
2.4 to 2.8	60 to 70
2.8 to 3.2	70 to 80

7. Carefully remove the pipe from the butt fusion machine and allow the joint to cool a minimum of 30 additional minutes before subjecting the joint to any rough handling or severe bending.

Both the outside and inside of all fused joints shall be inspected prior to installation. The inside of the joint shall be videoed and a copy of the video submitted to the Engineer for review. The video shall be in color and be of sufficient resolution to clearly show the details of the entire weld and the joint number. If a “push cam” is used, it shall be mounted in a device that centralizes it within the pipe diameter. It is recommended that the video inspection of the joint be done during the cooling phase. At a minimum, properly fused joints shall have:

- Beads rolled over on the outside of the pipe, be rounded on the top and be of uniform size and shape;
- A combined width of the beads 2 to 2.5 times the height of the bead above the outside pipe surface; and
- A v-groove between the beads not deeper than half the bead height above the outside pipe surface.



Butt Fusion Bead Proportions (Typ.)

Joints exhibiting the following will be rejected: A concave or cupped melt surface, beads not rolled over on the outside of the pipe, flat on top or of non-uniform size and shape; v-groove between the beads too deep; or a pockmarked/bubbly appearance (hydrocarbon contamination). Other factors may also be cause for rejection. It should be noted that in the case of hydrocarbon contamination, if the pipe has been permeated with liquid hydrocarbon (oil, gas, kerosene, etc.), the pipe can not be joined by fusion and must be joined by mechanical means.

Outside beads shall be removed for all trenchless installations. The Engineer may require the beads on the inside of the pipe to be removed if the post-fusion video indicates they are excessively large or may impede flow. Joints must be completely cool before bead removal.

The table below presents typical daily butt fusion joining rates with one hydraulic butt fusion machine. Actual rates will vary depending upon pipe wall thickness, site conditions, crew size, experience, equipment, etc.

FIELD JOINING RATES FOR HDPE

Nominal Pipe Size (Inches)	Fusions per Day (Typical)
≤ 10	15 to 40
10 to 18	10 to 24
18 to 24	6 to 16
24 to 36	5 to 15
36 to 48	4 to 10
54	3 to 8

E. PIPE INSTALLATION. Polyethylene pipe shall be supported on rollers or skids throughout its entire exposed length during installation. Dragging of the pipe along the ground shall not be permitted. Following the pipe installation, placement and desification of backfill, and prior to the placing of permanent pavement, all pipe shall be cleaned, inspected for obstructions and measured for uniform grade (offset joints, lateral pipe intrusions, deflections, rises, sags, etc.). See Section 3.21, “Cleaning and Testing of Sanitary Sewer Mains” for additional requirements.

1. Sliplining. For sliplining operations, the existing sewer pipe in the access pit shall be cut with a chainbreak (snap-cutter) or saw and completely removed. The access pit shall then be overexcavated to allow for a minimum of 4 inches of bedding material. The bedding shall then be placed and compacted to the line and grade of the

existing sewer. A stringline shall be used between the ends of existing sewer to verify proper grade.

The liner may be pulled or pushed into the existing piping. In either case, a molded or bolt-on closed steel face head shall be used to guide the liner past minor obstructions and to prevent debris from entering the liner during insertion. An insert protective sleeve shall be used to protect the liner from being scratched during insertion.

If the liner is pulled, the pulling apparatus shall be equipped with a load gauge to read the developing winching force directly. Maximum allowable stress on the liner is 1,000 psi. The top half of all liners through manholes shall be cut out to form a channel. The ends of all liners shall be sealed. The sealing material shall be compatible with the HDPE liner pipe and shall provide a watertight seal.

2. Pipe Bursting. All sharp edges shall be removed from the exposed pipe opening. The Contractor shall also expose the main at every lateral connection to a depth equal to the outside diameter of the main under the invert of the existing main to allow free movement of the bursting head.

   The maximum pulling length shall be limited to one reach (from manhole to manhole) at a time.

   The pipe bursting tool shall make a tunnel along the path formerly occupied by the old sewer and shall install the new pipe by either pulling, pushing, or a combination of both. The pipe bursting tool shall be of the type and size recommended by the tool manufacturer for the size of pipe being burst and for the ambient ground conditions.

   When the tool is pulled along the existing pipe, the pipe shall be broken up into small fragments and these fragments driven into the surrounding pipe zone. The tool shall then install the new pipe by pulling it into place. The new sewer pipe shall be installed in a straight horizontal and vertical line with the invert of the new sewer pipe matching the invert of the existing sewer at the exit of the upstream manhole and the entrance into the downstream manhole regardless of the size and alignment of the existing pipe.

Contractor shall allow the new HDPE pipe to return to its original length and shape in the unstressed state before trimming the excess pipe in the manholes. The manufacturer's recommendations shall be followed regarding the relief and normalization of stress and strain due to temporary stretching or elongation of the pipe after pulling operations are completed. Time allowed for stress and strain relief shall not be less than 24 hours.

F. SERVICE CONNECTIONS. After the pipe has been inserted into place and after testing, Contractor shall reconnect all active service connections to the new pipe. For sliplining, a portion not to exceed 24 inches of the existing sewer around each active service connection shall be cut with a chain-break (snap-cutter) and the host pipe removed to expose the liner pipe and provide sufficient working space for making the new service connection.

All services shall be reconnected within 24 hours after the liner has been pulled in to place.

G. GROUTING OF THE ANNULAR SPACE (Sliplining Only). Grouting shall be performed for pipes with annular spaces of one (1) inch or larger. Sealing of annular spaces shall not be done until a minimum of 24 hours has elapsed from completion of the insertion of the new pipe. After the liner is pulled into place, tested, and the active sewer services reconnected, the entire annular space between the outside of the liner and the inside of the existing pipe shall be grouted. The annular space shall be filled with a non-shrink grout (less than 1 percent shrinkage by volume). Contractor shall design a grout mix with a density to prevent floating of the liner pipe. The apparent viscosity shall not exceed 20 seconds in accordance with ASTM C939.

Samples of grout shall be obtained in accordance with ASTM C172. One set of three standard cylinders shall be cast for each sliplined sewer reach in accordance with ASTM C31. Testing of specimens for compressive strength shall be in accordance with ASTM C39. One test shall be made 24 hours from time of casting and two tests shall be made 28 days from time of casting. The average of the 28-day strength tests shall be equal to or greater than 300 psi tested in accordance with ASTM C495 or C109. If the 24 hour strength is less than 100 psi for any reach, per ASTM C403, the cement ratio shall be increased on subsequent reaches as directed by the Contractor's engineer. All testing shall be at the Contractor's expense.

The Contractor shall submit to the Engineer the proposed grouting mix, the proposed densities and viscosities, initial set time of the grout, the proposed grouting method, the maximum injection pressures, the 24-hour and 28-day minimum compressive strength, the proposed grout stage volumes, Bulkhead designs, Buoyant force calculations, flow control, provisions for service connections, pressure gauge certification, and vent location plans. The grouting system shall have sufficient gauges, monitoring devices, and tests to determine the effectiveness of the grouting operation and to ensure compliance with the liner pipe specifications and design parameters.

The grouting materials shall be mixed in equipment of sufficient size and capacity to provide the desired amount of grout material for each stage in a single operation. The equipment shall be capable of mixing the grout at densities required for the approved procedure and shall also be capable of changing density as dictate by field conditions any time during the grouting operation.

Grouting of the annular space shall be done in such a manner as to prevent deformation or collapse of the liner. Grout shall be pumped into the annular space at manholes, service connections, and wherever the line is exposed. The Contractor shall excavate additional grouting points if necessary. A grout pressure gauge and recorder shall be installed immediately adjacent to each injection port. During grouting operations, the recorder shall continuously record the actual grouting pressure versus time. The gauge shall conform to an accuracy of ±0.5 psi. The range of the gauge shall not be more than 100 percent greater than the design grout pressure. Pressure gauges shall be instrument oil filled and attached to a saddle-type diaphragm seal (gauge saver) to prevent clogging with grout. All gauges shall be certified and calibrated in accordance with ANSI B40, Grade 2A. The grout pressure recordings shall be identified, as a minimum, with the date, batch, and time of day grouting was performed and shall be submitted to the Engineer at the end of the work day that grouting was performed. The gauged pumping pressure shall not exceed the liner pipe manufacturer's approved recommendations or 8 psi for SDR 26 HDPE pipe. The grout shall fill at least 95 percent of the calculated volume of the annular space. The Contractor shall trowel the grout to form a smooth transition between manhole base and liner.

3.15 PLACING HDPE PIPE IN TRENCH

The installation of HDPE pipe shall conform to these Sewer Specifications. Pipe bedding, trench/pit backfill, and relative compaction shall be in accordance with Standard Detail SD-310, "Permit and Subdivision Trench Sections." Pipe exposed in trenches or access pits shall be uniformly supported throughout its length with no voids under or around the pipe.

Installation procedures shall be a combination of the applicable portions of Section 3.13 and 3.14 above.

3.16 SETTING FITTINGS AND VALVES

Fittings and valves shall be installed as shown on the approved Plans. Such fittings and valves shall be lowered into the trench and cleaned and jointed as specified in these Sewer Specifications and per the manufacturer's recommendations.

Sanitary sewer risers shall be installed where indicated on the plans and in accordance with Standard Detail SD-308 "Sanitary Sewer Riser & Minimum Grades".

Where the approved Plans require restrained mechanical joints for pipe joints, fittings or valves, a ductile iron retainer gland shall be used that conforms to AWWA C111/A21.11, as manufactured by EBAA Iron (Megalug®) or approved equal, and installed in conformance with the manufacturer's recommendations.

All valves shall be installed complete with valve boxes and the required Class C concrete slab. Valve box extensions shall be machine cut or saw cut. Valve extension stems shall be installed when required. See Standard Detail SD-205 "Valve Installation."

All fittings and valves shall be protected from corrosion in accordance with Section 2.11 of these Sewer Specifications.

3.17 SEWER SERVICE CONNECTIONS

All installations and materials shall conform to the approved Plans and Standard Details SD-301 "Building Court Sewer Main," and SD-312 through SD-314 ("House Sewer," "Alteration To Existing House Sewer," and "Backflow Preventer").

All existing sanitary sewer laterals in use shall be reconnected to the new sanitary sewer main with suitable adapters or couplings. All junctions connecting any pipe or fitting to the sanitary sewer main shall utilize a "WYE" fitting. Vitrified clay "WYE" fittings shall conform to ASTM C425. PVC "WYE" fittings shall conform to ASTM D3034 and shall have a Standard Dimension Ratio (SDR) of 26. "TEE" connections will not be permitted on any new pipe. "Tap" connections shall only be allowed at extreme cases where "WYE" fittings can not be installed. "Tap" connections shall not be used unless approved by the Engineer.

The Contractor must reconnect all existing sanitary sewer laterals and intercepting sewer mains in use. All sanitary sewer lateral runs shall have a minimum of ¼ inch per foot slope for 4-inch pipe and a minimum of ⅛ inch per foot slope for 6-inch pipe and greater.

3.18 SANITARY SEWER MANHOLE CONSTRUCTION

Existing sanitary sewer manholes which are effected by the new vertical alignment of the new sanitary sewer pipe shall be replaced or reconstructed with the manhole base channelized for the connection of the new pipe(s), as required by the Engineer and as detailed in Section 3.19,

“Sanitary Sewer Manhole Repair.” Applicant may elect to replace the existing sanitary sewer manholes that the Engineer has indicated must be reconstructed with new standard precast concentric manholes, frames and covers.

Concrete for special manhole structures shall conform to Section 90-10, "Minor Concrete," of the Standard Specifications. Reinforcing steel for special manhole structures shall conform to Section 52, "Reinforcement," of the Standard Specifications.

Standard manholes shall conform to Standard Detail SD-304 "Preset Concentric Sanitary Sewer Manhole," ASTM C478, and the requirements herein. The top and bottom of all manhole sections shall be parallel.

Drop assemblies shall be constructed as shown on Sheet 1 of Standard Detail SD-306 "Sanitary Sewer Drop Connection." All plastic pipe connections to manholes shall have a rubber waterstop tightly banded to the pipe and cast into the manhole base. Banding material shall be stainless steel unless an alternative corrosion resistant material is pre-approved by the Engineer. Materials with corrosion resistant coatings, such as zinc galvanizing or epoxy, will not be allowed.

Pipe for stubouts shall be sewer pipe as approved and furnished for the project. Rubber gasketed watertight plugs shall be furnished at each stubout and shall be adequately braced against all hydrostatic or air test pressures.

Covers and frames shall conform to Standard Detail SD-307 "Manhole Frame, Cover and Pan".

Backfill around manholes shall be of the quality of trench backfill immediately adjacent.

All water in the excavation must be removed prior to placement of materials. A minimum of six (6) inches of base rock material shall be placed in the bottom of the excavation and thoroughly compacted with a mechanical vibrating or power tamper. The concrete base shall be constructed in conformance with the Standard Details. The concrete shall be vibrated for densification and screed so that the joint for the first precast manhole section can be formed level and uniform for the full circumference.

Manhole inverts shall be constructed as part of the concrete base in conformance with details shown on the approved Plans, and with smooth transitions to ensure an unobstructed flow through manhole. All sharp edges or rough sections which may obstruct flow shall be removed. No pipe joints are allowed within the base of a manhole. If the pipe was constructed such that a joint will be located inside or within twelve (≤12) inches of a manhole, the pipe sections shall be cut and replaced with a continuous section of pipe such that the joints occur at least twelve (≥12) inches away from the outside of the manhole base. Within the manhole, the top section of the pipe shall be neatly cut and removed (not broken out with a hammer or similar). The exposed edges of pipe shall be removed of all sharp edges and completely covered with mortar. All mortar surfaces shall be troweled smooth.

Precast manhole sections to be joined shall be carefully inspected. Any sections with chips or cracks in the tongue shall not be used. Preformed plastic gaskets shall be installed in strict conformance with the manufacturer's recommendations. Only pipe primer furnished by the gasket manufacturer shall be approved.

Stubouts from manholes for future sewer connection shall be installed as shown on the plans or as required by the Engineer. Maximum length shall be three (≤3) feet outside the manhole wall. Pipe stubouts shall have a rubber waterstop tightly bonded to the pipe and cast into the manhole base.

Semi-permanent plugs shall be installed in the end of stubouts. Plugs shall have gasket joints similar to sewer pipe being used or shall be an expandable type standard sewer plug. Plugs shall be capable of withstanding all internal or external pressures without leakage. All plugs shall be braced to prevent blowoffs.

Extensions shall be installed in conformance with the Standard Details and to the height determined by the Engineer. Grade rings shall be laid in mortar with sides plumb and tops level. Joints shall be sealed with mortar. Extensions shall be watertight.

Frames and covers shall be installed on top of manholes in conformance with the Standard Details. Frames shall be set in a bed of mortar with the mortar carried over the flange of the ring. Set frames so tops of covers are flush with surface of adjoining pavement or ground surface, unless otherwise shown or directed.

Not less than ten (≥10) percent of the total number of manholes on the project, or two manholes minimum, shall be hydrostatically tested. The Engineer shall designate the manholes to be tested. The test shall consist of plugging all inlets and outlets and filling the manhole with water to the top of the cone section. Leakage in each manhole shall not exceed 0.1 gallon per hour per foot of head above the invert. A manhole may be filled 24 hours prior to time of testing, if desired, to permit normal absorption into the walls to take place. Minimum time for a test shall be one (≥1) hour.

All manholes that do not meet the leakage test, or are unsatisfactory from visual inspection shall be repaired by Applicant at no cost to City. Manholes shall be watertight to infiltration, and any leakage of groundwater shall be eliminated by permanent repairs.

If more than 25 percent of the manholes tested fail the hydrostatic test, the Applicant shall be required to test all or as many manholes as the Engineer may deem necessary.

3.19 SANITARY SEWER MANHOLE REPAIR

Where shown on the approved Plans, the Applicant shall clean the existing manhole base and expose all depressed areas and holes, and re-channelize the base to accommodate the new pipe size. The re-channelization of the manhole base shall conform to Standard Detail SD- 304 "Precast Concentric Sanitary Sewer Manhole" and Section 1.13, “Connections To Existing Sewer Mains of these Sewer Specifications. Chipping and patching of the manhole base shall have a minimum concrete or mortar thickness of two (2") inches, and commercial quality concrete shall be used. Portland cement concrete shall be the same as those specified in Section 3.13, “Portland Cement Concrete,” of these Sewer Specifications. Debris protection shall be provided by installing a false bottom, or other acceptable methods approved by the Engineer. All plastic pipe connections to manholes shall have a rubber waterstop tightly banded to the pipe and cast into the manhole base and cemented in place. Band material shall be stainless steel or other corrosion resistant material.

If the plans indicate a manhole drop connection, this connection shall be an "outside drop", unless an "inside" drop is specifically required or approved by the Engineer, and shall be constructed in compliance with Standard Detail SD-306 "Sanitary Sewer Drop Connection".

3.20 PROTECTION FROM CORROSION

Attention is directed to Section 2.11 of these Sewer Specifications for corrosion protection material requirements.

Where corrosion protection requirements for directly buried ferrous metal has not been shown on the plans or specified in detail, a mastic or tape coating shall be applied. The determination of the type of coating to be applied in each instance shall be reserved to the Engineer. Ferrous metal items to be protected shall include, but not be limited to, valves, fittings, service lines, reinforcing steel, anchor rods, flexible couplings, bolts, and nuts, flanges, saddles, tapping sleeves, hydrant buries, and plugged end and blow off assemblies. Mastic and tape coated ferrous metal shall also be protected with polywrap. All copper piping or any copper or brass part shall not be permitted to contact steel or cast iron pipe at any point. If contact is unavoidable, the copper or brass part shall be mastic or tape coated. All cast iron, steel or other ferrous metal shall be insulated from any concrete structure, such as footings, anchor blocks, encasements or structure walls using mastic, tape coating or other specified coating system extending six (6) inches beyond the concrete. All coatings shall be continuous, unbroken, and pinhole free. Protective coatings shall only be applied over a properly prepared surface.

A. MASTIC COATINGS. Mastic coating shall be applied with spray equipment or by hand with brush or rubber gloves. A two-coat system shall be applied. The metal surface shall first be cleaned of all loose scale, dirt and other foreign matter. No primer is required before application. Each coat shall be applied to produce a minimum wet film thickness of 15 mil. with a minimum cure time of two hours between coatings. The second coat shall be allowed to dry a minimum of three hours before beginning backfilling operations.

B. TAPE COATINGS. Tape coatings shall be applied over a clean surface (no loose rust, scale, dirt, oil or grease). A minimum of two layers shall be applied with a minimum overlap of ½ inch, or half the width of the tape if the tape is less than one (1) inch wide. Tape shall be applied immediately following the application of the primer (wet) and pulled tight enough to conform to the surface being coated.

3.21 CLEANING AND TESTING OF SANITARY SEWER MAINS

These cleaning and testing specifications shall be used when there is a conflict between Standard Detail SD-311 "Test Requirement For Sanitary Sewer" and these testing procedures, unless otherwise directed by the Engineer. Wastewater flow control shall conform to Section 3.04 of these Sewer Specifications.

The Contractor shall perform the following tests in the presence of the Engineer and in the order cited below:

A. CLEANING. Pipelines and structures shall be cleaned using a high velocity jet cleaner. The equipment shall be truck mounted for ease of operation. The equipment shall have a minimum of six hundred (≥600) feet of high pressure hose with a selection of two or more high velocity nozzles. Nozzles shall be capable of producing a scouring action from 15 degrees to 45 degrees in all designated line sizes. The equipment shall carry its own water tank capable of holding corrosive or caustic cleaning or sanitizing chemicals, auxiliary engines and pumps, and hydraulically driven hose reel. All controls shall be located so that the equipment can be operated above ground. Equipment shall include a high-velocity gun for washing and scouring manhole walls and floor. The gun shall be capable of producing flows from a fine spray to a solid stream.

Any dislodged material resulting from the cleaning operation shall be intercepted at the down-stream manhole of the reaches being cleaned, through the use of a filtering device, and removed. The material collected at the downstream manholes shall become

the property of the Contractor. It shall be removed from the site by the Contractor in a closed container and disposed of in a legal manner. It shall not be dumped into streets, ditches, catch basins, or storm sewers. Flushing of the material from manhole reach to manhole reach is unacceptable.

Acceptance of the sewer line cleaning shall be made upon the successful completion of the video inspection and shall be to the satisfaction of the Engineer. If video inspection shows the cleaning to be unsatisfactory, the Contractor shall be required to re-clean and re-inspect the sewer main at no additional cost to the City.

Contractor shall screen all debris collected prior to analysis and disposal. Contractor shall haul and properly dispose of material at a Class 3 or Class 2 landfill, as appropriate.

B. VIDEO TESTING (ALL PIPE). The Applicant shall perform or have performed a video recorded inspection of the new sewer main in compliance with the NASSCO PACP reporting format and coding standards. Such inspection shall be performed by a firm who has been actively performing such services for a minimum of two (2) years and an operator who has completed NASSCO PACP certified training, or an equivalent training program subject to approval by the Engineer. The Applicant may request to have City crews and equipment perform the video testing at Applicant's expense and subject to the availability of the City crews.

Not less than ten (≥10) working days prior to performing a video recorded inspection of the sewer main, the Applicant shall submit to the Engineer the name and qualifications of the firm and personnel who will be performing the video inspection, the specifications of the video inspection system to be used, and the date of the proposed video inspection for review and approval by the Engineer.

1. Video Equipment. The video equipment shall include a multi-angle color video camera capable of spanning 360-degrees circumference and 270-degrees on horizontal axis to televise sewer lines 6-inch diameter or larger and focal distance shall be adjustable through a range of one (1) inch to infinity (∞). The video camera shall have a minimum of 400 lines of resolution, be specifically designed and constructed for operation in connection with sewer inspection, and for operation in sewers under 100% humidity conditions. The camera shall be mounted on a self-propelled wheel or track-mounted transporter. Lighting and camera quality shall produce a clear, in-focus picture of the entire periphery of the pipe for a minimum distance of six (≥6) feet. The transporter and camera assembly shall be equipped with a slope measuring device (inclinometer) capable of detecting pipe grade variations ±5 degrees from true horizontal (±8.7% grade) with a maximum error of ±0.1 degree with readings taken at minimum intervals of two (≤2) feet. Inclinometer data shall be capable of being displayed in both numerical and graphical formats that can be printed or exported to an external database. The inclinometer data submitted shall allow easy identification of any high and/or low sections, correlated with the proper footage, that exceed the limits per Section 3.03 of these Sewer Specifications.

2. Inspection Procedures and Requirements. The video recorded inspection shall be done with no flow in the sewer. The camera shall be moved through the pipeline in the downstream direction at a uniform rate, stopping when necessary to ensure proper documentation of the sewer's condition. In no case shall the television

camera be pulled or propelled at a speed greater than thirty (≤30) feet per minute. The camera height shall be adjusted such that the camera lens is always centered in the pipe being inspected. The equipment shall have an accurate footage counter, which shall display on the monitor the exact distance of the camera from the centerline of the starting manhole. Unless otherwise required by the Engineer, footage measurements shall begin at the centerline of the upstream manhole.

The recorded video inspection shall be continuous and be of such quality to provide a clear, sharp, color image when played back. The image shall show sufficient detail and quality to determine the approximate size of cracks in the pipe, offset joints, leaking joints, sags, and other defects or flaws in the installed sewer main. The date, identification of sewer reach(es) by upstream and downstream manhole numbers, and manhole to manhole footage shall be displayed on the video data view at all times.

Video inspection logs submitted by the Contractor shall be typed or printed as a computerized report. The Engineer will provide the log format, or a sample copy may be submitted for approval. Data of significance includes the locations of service connections, types of upstream and downstream manhole structures, and any pipe defects.

The inspection video shall be submitted on either CD-ROM or DVD-R disks in either MPEG-2 (352x240 minimum) or MPEG-4 (640x480 minimum) format viewable on a standard PC running MS Windows with Windows Media Player. If a different video software is required to play the files on the submitted disk, a fully licensed version of that software shall be included with the submittal at no additional cost to the City. Each disk shall have a protective case and be permanently labeled with the Contractor's name, date recorded, project name, street name(s), identification of the sewer reach(es) inspected, and run number. Labeling shall consist of either hand or computer printed information in non-water soluble ink on a circular disk label that equally covers the surface of the disk. All video recordings shall become the property of the City.

All video recorded inspection shall be done in the presence of the Engineer. Upon completion of the video recording, the video shall be replayed for the Engineer. Any video recordings not meeting the quality standards stated above and as determined by the Engineer will be rejected and the video recording process repeated at no cost to the City.

After inspection of the video recording by the Engineer, the Applicant, at his/her own expense, shall replace or repair any materials or workmanship, which, in the opinion of the Engineer, do not meet the specification requirements. Upon completion of the repairs or replacements, the repairs shall be video inspected a second time and the process repeated until all the specification requirements are met.

3. Construction Deficiencies. The following construction deficiencies shall be considered as in need of correction prior to acceptance of the work:

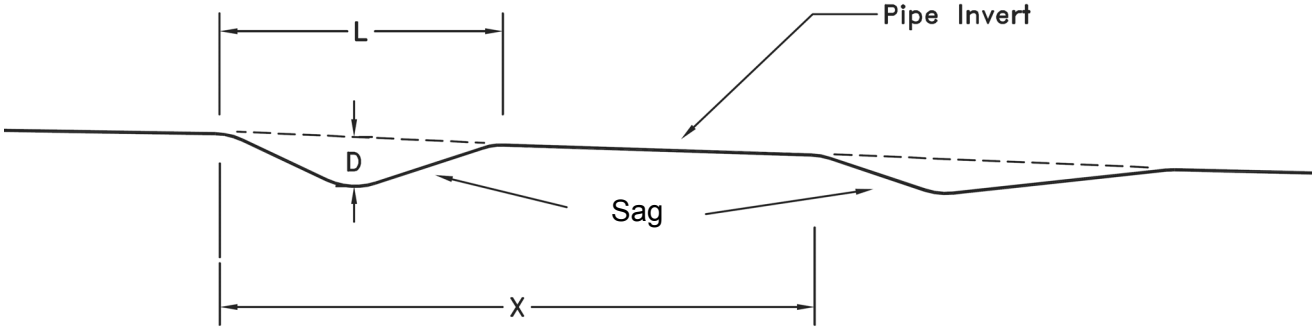
   - Damaged pipes including cracks, gouges and chipped ends of pipe sections;
   - Slope less than the specified or absolute minimum slope;
   - Changes in slope greater than ±0.05% of the design slope;
   - Low spots, sags or bellies that hold water (see limits below);

- Dropped, offset or separated joints including failed welds;
- Excessive gap between pipe ends within a coupling or fitting (greater than 0.5” to 0.75”, depending upon materials, size and conditions);
- Oversized, raised or protruding internal weld beads including melted pipe material (≤0.25” for pipe ≤8”, ≤0.50” for 10” to 18” pipe);
- Infiltration/leaking joints; or
- Other noted deficiencies.

Sags (low spots, bellies, etc.) in pipes that hold water after all flow has been stopped in the pipe are typically the result of settlement or consolidation of the bedding material and/or the native material below it in response to loading on the pipe from backfill operations and/or surface loading. The table below lists the allowable limits of sags in sanitary sewer pipes. Newly constructed pipes that exceed these limits must be excavated and relayed, including replacing the pipe if damaged. It should be noted that pipes installed by trenchless methods are typically not susceptible to settlement/consolidation due to surface loads. As such, the allowable sag in pipes installed by trenchless methods is zero (0).

SAG LIMITS

Nominal Pipe Size inch	**Allowable Depth of Sag (D)** inch	**Allowable Length of Sag (L)** feet	**Allowable Distance between Sags (X)** feet
Any Size by Trenchless	None	None	None
4” by Open Ex.	None	None	None
6” by Open Ex.	None	None	None
8” by Open Ex.	≤ 0.25”	≤ 4’	≥ 40’
10” by Open Ex.	≤ 0.50”	≤ 6’	≥ 60’
12” by Open Ex.	≤ 0.66”	≤ 8’	≥ 80’
> 12” by Open Ex.	≤ 0.75”	≤ 10’	≥ 100’



C. AIR TEST (ALL PIPE). Air testing shall conform with the requirements of ASTM C828 "Standard Test Method for Low-Pressure Air Test of Vitrified Clay Pipe Lines" and these Sewer Specifications.

The pipeline shall be made as nearly watertight as practicable, and leakage tests and measurements shall be made using low-pressure air. All infiltration that was observed during the video testing shall be remedied before proceeding with the air test.

For making the low-pressure air tests, the Applicant shall use equipment specifically designed and manufactured for the purpose of testing sewer pipelines using low-pressure air. The equipment shall be provided with an air regulator valve or air safety valve so set that the internal air pressure in the pipeline cannot exceed 8 psig.

The leakage test using low-pressure air shall be made in each manhole-to-manhole section of the pipeline after placement and acceptable compaction of the backfill up to but not including AC pavement.

Pneumatic plugs shall have a sealing length equal to or greater than the diameter of the pipe to be tested. Pneumatic plugs shall resist internal test pressures without requiring external bracing or blocking.

All air used shall pass through a single control panel.

Low-pressure air shall be introduced into the sealed line until the internal air pressure reached 4 psig. At least two minutes shall be allowed for the air pressure to stabilize in the section under test. After the stabilization period, the low-pressure air supply hose shall be quickly disconnected from the control panel. The time required in minutes for the pressure in the section under test to decrease from 3.5 to 2.5 psig shall not be less than that determined in the nomograph in Standard Detail SD-311 Sheet 2 of 2 "Test For Sanitary Sewer".

The testing shall be performed after backfilling but before permanent pavement replacement. If the pipe fails to pass the test, the Applicant shall make repairs and retest the pipe until the pipe passes the test. All repairs and testing shall be made at the Applicant's expense.

D. DEFLECTION TEST FOR FLEXIBLE PIPE. Deflection tests shall be performed on all installed flexible pipe (PVC, HDPE, etc.) to ensure that vertical deflections do not exceed the maximum allowable deflection. Deflection testing shall be performed in accordance with ASTM D2321 and these Sewer Specifications. Maximum allowable deflections shall be governed by the mandrel requirements stated herein and shall nominally be not greater than five (≤5) percent of the pipe's base Inside Diameter (ID). In the case where the pipe manufacture's deflection limit is less than 5%, the manufacture's deflection limit shall govern.

Ridged or stiff pipe such as VCP, DIP, RCP, etc., are exempted from this test.

Per ASTM D3034, the base ID shall be equal to the average outside diameter (OD) minus two times the minimum wall thickness. Manufacturing and other tolerances shall not be considered for determining maximum allowable deflections.

Deflection tests shall be performed no earlier than 30 days, and no later than 120 days, after completion of placement and densification of backfill. The pipe shall be cleaned and inspected for offsets and obstructions prior to testing in accordance with these Sewer Specifications.

A mandrel shall be pulled through the pipe by hand to ensure that maximum allowable deflections have not been exceeded. Prior to use, the mandrel shall be certified by the Engineer or by another entity approved by the Engineer. Use of an uncertified mandrel

or a mandrel altered or modified after certification will invalidate the test. If the mandrel fails to pass, the pipe will be deemed to be over-deflected.

Unless otherwise permitted by the Engineer, any over-deflected pipe shall be uncovered and, if not damaged, reinstalled. Damaged pipe shall not be reinstalled, but shall be removed from the work site. Any pipe subjected to any method or process other than removal, which attempts, even successfully, to reduce or cure any over-deflection, shall be uncovered, removed from the work site and replaced with new pipe. Deflection testing shall be repeated after an additional minimum 30 days have elapsed following repair or replacement and completion of placement and densification of backfill.

The mandrel shall:

1. Be a rigid, nonadjustable, odd-numbered-leg (9 legs minimum) mandrel having an effective length not less than its nominal diameter;
2. Have a minimum diameter at any point along it's full length as determined by multiplying the pipe's base inside diameter by 0.95 (per ASTM D3034). For example, if a nominal 8 inch pipe has an outside inside diameter of 8.625" and an average wall thickness of 0.507", the minimum mandrel diameter shall be [8.625" – (2 x 0.507")] x 0.95 = 7.230"; and,
3. Be fabricated of steel, be fitted with pulling rings at each end, be stamped or engraved on some segment other than a runner indicating the pipe material specification, nominal size, and mandrel OD; and be furnished in a suitable carrying case labeled with the same data as stamped or engraved on the mandrel.

HDPE/ IRON PIPE SIZES		*SOURCE:* WL Plastics **HDPE DR 17 Class 100 WP = 100 psi**		**Testing Mandrel Diam. for 5% Deflect. Limit (in)**	**HDPE/ DUCTILE IRON PIPE SIZES**		*SOURCE:* Independent Pipe Products **HDPE DR 17 Class 100 WP = 100 psi**		**Testing Mandrel Diam. for 5% Deflect. Limit (in)**	**PVC PIPE SIZES**		*SOURCE:* PW Eagle **PVC SDR 26**		**Testing Mandrel Diam. for 5% Deflect. Limit (in)**
IPS Pipe Size (in)	**Ave. O.D. (in)**	**Base I.D. (in)**	**Min. Wall Thick. (in)**		**DIPS Pipe Size (in)**	**Ave. O.D. (in)**	**Base I.D. (in)**	**Min. Wall Thick. (in)**		**Nom. Pipe Size (in)**	**Ave. O.D. (in)**	**Base I.D. (in)**	**Min. Wall Thick. (in)**	
6	6.625	5.845	0.390	5.553	6	6.900	6.088	0.406	5.784	6	6.275	5.793	0.241	5.503
8	8.625	7.611	0.507	7.230	8	9.050	7.986	0.532	7.587	8	8.400	7.754	0.323	7.366
10	10.750	9.486	0.632	9.012	10	11.100	9.794	0.653	9.304	10	10.500	9.692	0.404	9.207
12	12.750	11.250	0.750	10.688	12	13.200	11.648	0.776	11.066	12	12.500	11.538	0.481	10.961

All costs incurred by the Applicant attributable to mandrel and deflection testing shall be borne by the Applicant at no cost to the City.

3.22 PAVEMENT REPLACEMENT AND TEMPORARY PAVEMENT

Attention is directed to Section 2.12, "Trench Sections," of these Sewer Specifications for pavement material requirements.

A. TEMPORARY PAVEMENT. Temporary pavement one (1) inch thick shall be placed in all trenches over compacted untreated base which is placed to one (1) inch below finish pavement in the trench area at all locations where existing pavement has been removed and final pavement replacement is not done. Applicant shall perform all maintenance

necessary, including adding additional material or excavating and replacing it, to maintain temporary pavement such that there are smooth and firm transitions to the adjacent surfaces, and as required by the Engineer.

Temporary pavement and base in all trenches shall be removed before final pavement replacement.

The use of cutback asphalt concrete for trenches will not be allowed during the months of April through October.

B. PAVEMENT REPLACEMENT. After compaction of the trench backfill has been approved by the Engineer, the Applicant shall square the edges of the existing pavement and apply paint binder in accordance with Section 39-4 of the Standard Specifications. Prior to placing asphalt concrete, the Applicant shall apply paint binder (tack coat) to the edges of existing asphalt concrete and gutters, construction joints and driveway conforms. Paint binder shall be applied in one application at a rate from 0.02 to 0.10 gallons per square yard of surface covered. The Engineer shall determine the exact rate of application.

When shown on the Plans or directed by the Engineer, aggregate base shall be installed in accordance with the requirements of Section 26 of the Standard Specifications. Asphalt Concrete shall then be installed to the depth and width per Standard Detail SD-310, or as otherwise specified on the approved Plans. The finished surface shall be true to the existing grade and free from open cracks or joints.

The spreading and compacting requirements in Sections 39-6.02, "Spreading," and 39-6.03, "Compacting," of the Standard Specifications will not apply.

When the total compacted thickness of asphalt concrete is 0.25-foot or less, the asphalt concrete shall be spread and compacted in one layer. All other asphalt concrete thicker than 0.25-foot shall be spread and compacted in layers. The top layer of asphalt concrete shall be not more than 0.20-foot nor less than 0.15-foot in compacted thickness. The next lower layer shall be not more than 0.25-foot nor less than 0.10-foot in compacted thickness, and any lower layers shall be not less than 0.15-foot nor more than 0.40-foot in compacted thickness.

The spreading and compacting of asphalt concrete shall conform to the following requirements:

1. Spreading and compacting shall be performed by methods that will produce an asphalt concrete surfacing of uniform smoothness, texture, and density.
2. Asphalt concrete shall be compacted flush to existing grades and not "humped".
3. Asphalt concrete shall be compacted to relative compaction of not less than 95 percent. Relative compaction will be determined by California Test 375. Laboratory specimens will be compacted in conformance with California Test 304. The asphalt concrete will be tested by lots, as specified in California Test 375. Any lot of asphalt concrete that has a relative compaction of less than 95 percent shall be removed and replaced by the Applicant at no cost to the City.

3.23 PORTLAND CEMENT CONCRETE

Attention is directed to Section 2.13 of these Sewer Specifications for concrete material requirements.

3.24 REPLACE EXISTING SIDEWALK AND CURB & GUTTER

Attention is directed to Section 2.14 of these Sewer Specifications for sidewalk and curb & gutter material requirements.

Where the existing sidewalk or curb & gutter are damaged by the installation of water mains, service lines or water meter boxes, Applicant shall replace them in accordance to Standard Details SD-107 and SD-108. Base rock shall be a minimum of four (4) inches thick, unless otherwise noted on the approved Plans. The concrete shall be at least four (4) inches thick for sidewalk and seven (7) inches thick for curb & gutter.

3.25 SLURRY SEAL

Attention is directed to Section 2.15 of these Sewer Specifications for slurry seal material requirements.

If the approved Plans require slurry sealing of a street, slurry seal shall be spread at the rate of 12 pounds of dry aggregate per square yard. The actual spread rate shall be within 10% of the above-required rate. The applied slurry seal thickness shall be at least 0.125 inches at all locations.

The Applicant shall protect all utility manhole covers, gratings, valve covers, pavement markers, and monument covers from being coated with the slurry seal mixture by placing paper or plastic bags over them prior to placing slurry seal. Other methods may be used if approved by the Engineer in writing. Paper, plastic, and slurry shall be removed from water valve box covers, utility manhole covers, grating, and monument covers the same day that the slurry is placed including tape from pavement markers.

Care shall be exercised to prevent slurry from being deposited on any concrete surfaces and on existing pavement beyond the limits of work. The Applicant shall remove slurry from surfaces not designated to be sealed. The method and thoroughness of the slurry removal shall be approved by the Engineer. Additionally, no overlapping of slurry will be allowed along the pavement marker line. The slurry seal shall be placed in a neat line adjacent to the gutter line. The Applicant is responsible for wet slurry seal and shall rectify, at his/her own expense, any problems associated with wet slurry seal.

If the Applicant elects to use more than one spreader box, each additional spreader box to be used will require one additional inspector, at the Applicant's expense.

3.26 MARKER POSTS

Attention is directed to Section 2.16 of these Sewer Specifications for marker post material requirements.

Marker posts shall conform to the marker post Standard Detail SD-222 "Facility Reference" and shall be placed at the locations shown on the Plans except where location can be marked on curbs.

APPENDIX A

City of Hayward Municipal Sewer System Approved Materials

MATERIALS	SPECIFICATION [1]	SUPPLIERS/PRODUCTS
SEWER MAINS:		
PVC Pipe & Fittings	SDR 26 min., ASTM D3034, ASTM D3212, ASTM F477, ASTM F1336	J-M Manufacturing, PW Eagle, Diamond Plastics
VCP & Fittings	Extra Strength, ASTM C700, ASTM C425	Mission Clay Products, Gladding-McBean
Ductile Iron (DI) Pipe	AWWA C150/A21.50, AWWA C151/A21.51, AWWA C104/A21.4, 4" = Class 51 thick., 6" to 36" = Class 50 thick., Polyethylene lined & seal coated, Polywrapped	U.S. Pipe, Pacific States
DI Fittings	Class 54 thickness, AWWA C110/A21.10 or AWWA C153/A21.53	Star, Tyler, U.S. Pipe, Union Foundry, Sigma
DI Mechanical Joints	AWWA C111/A21.11	Same as above
HDPE Pipe [2]	SDR 17 or EHMW PE 4308 min., Type III, Grade P34, Cell Class PE345434C, D or E, ASTM D3350, ASTM F714, ASTM D1248, ASTM D2122	WL Plastics' Camcore™ Driscoplex's Plexvue™, PolyPipe's LightView™
COUPLINGS & REDUCERS:		
VCP	ASTM C425, Mechanical Compression	Mission Clay Products' Type 2 Band-Seal, Joints' Calder Repair Coupling with stainless steel shear ring
PVC (SDR-26)	ASTM D3034, ASTM F1336, Stop Coupling	PTI's H60 Series
DI Pipe & Dissimilar	ASTM C425, ASTM C1173, Adjustable Repair Coupling	Mission Clay Products, Joints
MANHOLES	ASTM C478, ASTM C150 Type II, ASTM C387, ASTM A48 Class 30B, Fed. Spec. SS-S-00210A	Gaskets: Hamilton Kent Manufacturing's KentSeal No. 2, K.T. Snyder's Ram-Nek
VALVE BOXES	Traffic Type, covers marked "Sewer" or "S"	Christy (G-5)
POLYWRAP, MASTIC & PRIMER	AWWA C105, Type I, Class C (black), Grade E1	Tape: Scotchwrap #50, Polyken #900, Tapecoat CT, or Protecto Wrap #200 Mastic: Protecto Wrap CA 1200 Primer: Protecto Wrap No. 1170
RESTRAINED MECHANIC. JOINTS	AWWA C111/A21.11	EBAA Iron (Series 1100, 2000PV Megalug®)

[1] For complete specifications see the project specifications for the particular City contract or the Standard Details and the "Specifications for the Construction of Sanitary Sewer Mains" for permits and subdivision work.

[2] For trenchless pipe rehabilitation (slip-lining) or replacement (pipe-bursting) only.

APPENDIX A

City of Hayward Municipal Sewer System Referenced Standards

AWWA Standards

Ductile-Iron Pipe and Fittings

- C104/A21.4(03): Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water
- C105/A21.5(05): Polyethylene Encasement for Ductile-Iron Pipe Systems
- C110/A21.10(03): Ductile-Iron and Gray-Iron Fittings for Water
- C111/A21.11(00): Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
- C150/A21.50(02): Thickness Design of Ductile-Iron Pipe
- C151/A21.51(02): Ductile-Iron Pipe, Centrifugally Cast, for Water or Other Liquids
- C153/A21.53(00): Ductile-Iron Compact Fittings for Water Service

ASTM Standards

- A48(03): Standard Specification for Gray Iron Castings
- A674(05): Standard Practice for Polyethylene Encasement of Ductile Iron Pipe for Water or Other Liquids
- A746(03): Standard Specification for Ductile Iron Gravity Sewer Pipe
- C12(06): Standard Practice for Installing Vitrified Clay Pipe Lines
- C150(05): Standard Specification for Portland Cement
- C387(06): Standard Specification for Packaged, Dry, Combined Materials for Mortar and Concrete
- C425(04): Standard Specification for Compression Joints for Vitrified Clay Pipe and Fittings
- C443a(05): Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets
- C478a(06): Standard Specification for Precast Reinforced Concrete Manhole Sections
- C700(05): Standard Specification for Vitrified Clay Pipe, Extra Strength, Standard Strength, and Perforated
- C828(03): Standard Test Method for Low-Pressure Air Test of Vitrified Clay Pipe Lines
- C990a(03): Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants
- C1173(06): Standard Specification for Flexible Transition Couplings for Underground Piping Systems
- D1248(05): Standard Specification for Polyethylene Plastics Extrusion Materials For Wire and Cable
- D2122(04): Standard Test Method for Determining Dimensions of Thermoplastic Pipe and Fittings
- D2321(05): Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications
- D2729(03): Standard Specification for Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings
- D3034a(04): Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings
- D3212-e1(03): Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
- D3350(05): Standard Specification for Polyethylene Plastics Pipe and Fittings Materials
- F477(02): Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe
- F679(06): Standard Specification for Poly (Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings
- F714(05): Standard Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter
- F913(02): Standard Specification for Thermoplastic Elastomeric Seals (Gaskets) for Joining Plastic Pipe
- F1336(02): Standard Specification for Poly (Vinyl Chloride) (PVC) Gasketed Sewer Fittings
- F1668(02): Standard Guide for Construction Procedures for Buried Plastic Pipe

California Test Methods

- CA304(99): Preparation of Bituminous Mixtures for Testing
- CA375(04): Determining the In-Place Density and Relative Compaction of AC Pavement

APPENDIX B

City of Hayward Index of Standard Details

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SD–101(93) Street and Utility Construction Drawing Symbols (5 sheets)

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SD–105(93) Median Tapers
SD–106(93) Median Flares
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SD–109(02) Driveways - Local Streets (3 sheets)
SD–110(02) Driveways - Arterial and Major Collector Streets (2 sheets)
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SD–111(93) Stabilized Construction Entrance
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SD–114(93) Steel Beam Barricade
SD–115(93) Steel Beam Guard Rail
SD–116(02) Monument (4 sheets)
SD–117(02) Street Sign (5 sheets)
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SD–119(93) Parking Meter Post
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SD–301(05) Building Court Sewer Main
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Storm Sewers

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CITY OF HAYWARD
Department of Public Works

NORMAL SEQUENCE OF OPERATIONS FOR CONSTRUCTION OF ROADWAYS

The following will be the normal sequence of operation for the construction of a roadway in the City of Hayward. Each operation will follow only the applicable that precedes it on this list and then only after specific permission of the City Engineer. This list is to be used in coordination with all other project documents.

1. Clearing and Grubbing
2. Common excavation or backfill to grading plane to within 6"of subgrade
3. Install wet utilities (water, sewer, storm drain) and jumpers – Cut sheets required
4. Install dry utilities (telephone, electric, fiber optic, gas, etc.) – Approved plans required prior to installation. Minimum 12" separation must be maintained at crossings between wet and dry utilities.
5. Test utility trenches for compaction – Trenches may be tested for compaction as each utility installed
6. Preliminary tests of sewers and water lines – unofficial
7. Compact subgrade
8. Compaction test on subgrade (written certification with seal by licensed engineer)
9. Grade check of subgrade (written certification with seal by licensed engineer or surveyor)
10. Place, grade, and compact aggregate subbase & aggregate base to curb & gutter grade (written certification with seal required for compaction and grade)
11. Place forms for curb and gutters, and valley gutters - Cut-sheets required
12. Grade check on curb and gutter forms (written certification with seal by licensed civil engineer or surveyor)
13. Place concrete for curbs and gutters
14. Place "back-up" material or concrete sidewalk and driveways against back of curbs
15. Complete placing roadway aggregate subbase and aggregate base
16. Compaction test on base material (written certification with seal by licensed engineer)
17. Grade check of base material (written certification with seal by licensed civil engineer or surveyor)
18. Complete hydrants, water services, and meter boxes to proper position and grade
19. Video of storm lines & sanitary sewer; air & deflection tests on sewers and pressure & leak tests on water lines
20. Disinfection and flushing of water lines
21. Remove jumper and blow off, and perform bacteriological test of water lines
22. Put water lines into service (coordinate with water company)
23. Remove and replace any damaged curbs and gutters or any concrete to abut new Hot Mix Asphalt (HMA)
24. Apply asphalt prime coat (if required)
25. Place first lift of Hot Mix Asphalt (HMA) - (written certification of compaction with seal by licensed engineer – HMA with compaction less than specified must be removed)
26. Place asphalt tack coat between HMA lifts as required by the State Standard Specifications
27. Place second lift of HMA (written certification of compaction with seal by licensed engineer – HMA with compaction less than specified must be removed)
28. Apply asphalt seal coat (if required)
29. Raise all utility structures to grade and install monuments
30. Clean and video storm and sanitary sewers
31. Install street name signs, traffic control signs, striping & pavement markings, barricades, and curb markings
32. Completion of "punch list" items
33. Final "walk-thru" inspection
34. Provide "As-Built" drawings, Engineer's Final Report, Soils Engineer's Final Report, and Surveyor's Final Report
35. Acceptance of Project

In the event of any conflict, the following order will prevail: 1) Special Provisions (City contract only), 2) Project Plans, 3) City Standard Details & Specification, 4) State Standard Plans, 5) State Standard Specifications.

YAW OWUSU
Assistant City Engineer