

SECTION 91: SANITARY SEWER SYSTEM CONSTRUCTION

91-1 GENERAL

Sewer pipe and fittings shall be installed in accordance with the requirements of these Construction Standards and as recommended by the manufacturer. These Construction Standards and manufacturer's guidelines shall be present at the construction site at all times.

91-2 CONNECTION TO EXISTING FACILITIES

Connection to existing City sewer facilities may be made upon approval of the Environmental Utilities Department.

A. The Environmental Utilities Department has the option of making any system tap as required on the plans. Should the Environmental Utilities Department elect to perform the tap, the Contractor shall pay for such work on a time and materials reimbursement basis. The Contractor shall be responsible for the following task associated with the tap, and as determined by the Environmental Utilities Department:

- 1.** Coordinating the work requested with the Sewer Division and the Development Services Inspector. This shall include discussions on provisions for materials and equipment required to complete the work.
- 2.** Providing traffic control per the City's Public Works Department requirements.
- 3.** Excavating the work area, as agreed upon by the Environmental Utilities Department.
- 4.** Providing sheeting, shoring, and bracing as required.
- 5.** Providing lighting as required if the tap is to be performed at night.
- 6.** Backfilling, compacting, and pavement restoration of the excavation(s) upon tap completion.

B. Existing Sewer Stubs: The contractor shall excavate and connect to an existing sewer stub in the presence of the Development Services Inspector. Existing stubs shall be air tested by contractor and CCTV'd by Environmental Utilities before connecting. If an existing stub is found damaged or otherwise exceeding tolerances, the contractor shall remove and replace prior to connecting. Contractor shall incur all expenses. A note to this effect shall be placed on the improvement plans.

C. Sewer System Outfalls: Sewer system outfalls shall be mechanically plugged and grouted. The plug shall remain in place until final acceptance by the Environmental Utilities Department.

91-3 CONSTRUCTION STAKING

The sewer main shall be staked prior to installation. Such staking shall provide the station and offset to the sewer main, as well as the cut to the nearest 0.10 foot. Stakes shall be provided at a minimum of every 50 feet in tangent sections and every 25 feet in curved sections, and every 10 feet in approved vertical curve sections.

91-4 EARTHWORK

Earthwork required to construct sewer facilities and appurtenances shall be performed to the lines and grades shown on the approved project plans and as specified in the following:

- A. Excavations:** Pipeline excavations shall be open-cut trenches, unless otherwise specified on the approved improvement plans, with vertical sides to the pipe crown as specified on Construction Standard Detail SS-1. Excavations shall conform to all applicable Federal and State safety requirements. The contractor shall appoint a designated “competent person” to be present during construction.
- B. Trench Width:** The trench bottom width to 6 inches above top of pipe shall comply with Construction Standard Detail SS-1 or as approved by the Environmental Utilities Department.
- C. Compaction:** Compaction of the trench shall conform to Construction Standard Detail SS-1. Compaction test results shall be supplied to the Development Services Inspector/Environmental Utilities Department upon request. Jetting of trenches is not allowed.
- D. Weather:** During inclement weather, trenches shall be excavated only as far as pipe can be laid and backfilled during the course of the day.
- E. Existing Roadways:** Trenching in existing roadways shall be limited to the length of pipe that can be laid that day. No open trenches shall be left overnight. Exposed trenches shall be plated or backfilled as approved by the Development Services Inspector/Development Services Department.
- F. Excess Material:** Excess material and materials determined unsuitable for backfill by the Development Services Inspector shall be removed from the project site.

91-5 DEWATERING

Dewatering for the installation of structure and pipelines shall commence when groundwater is first encountered and shall be continuous until the excavation is backfilled. Best Management Practices, including but not limited to scouring and erosion measures, shall be used to eliminate sediment-laden discharges in accordance with the approved SWPP.

91-6 PIPE BEDDING

Conform to Construction Standard Detail SS-1 and the following:

- A. Bedding shall provide uniform and continuous support along the barrel of the pipe. The minimum depth of bedding material shall be provided under the bell. Blocking of the pipe is not permitted.
- B. Loose material shall be removed from the trench bottom and replaced with imported material.
- C. Where rocky, unyielding or unsuitable foundation material is encountered, the subgrade shall be over-excavated a minimum of 4 inches and replaced with imported bedding material.
- D. Where the trench bottom is soft, yielding or unstable, the trench bottom shall be over-excavated and $\frac{3}{4}$ -inch crushed rock shall be placed in the trench to provide a stable foundation, to the satisfaction of the Development Services Inspector. The rock is in addition to the required pipe bedding used in the pipe zone.
- E. Where a saturated trench condition is encountered, the trench wall and pipe shall be lined with a geotextile fabric as shown on Construction Standard Detail SS-1, and to the satisfaction of the Development Services Inspector.
- F. Bell holes shall be excavated per the manufacturer's recommendations. The minimum depth of bedding material shall be provided under the bell. Care shall be taken to ensure that the bell hole is no larger than necessary to accomplish proper joint assembly.

91-7 CONCRETE CRADLES, ARCHES & ENCASEMENTS AND TRENCH DAMS

Concrete cradles, arches and encasements and trench dams shall conform to the Construction Standard Details W-23, W-24, and the following:

- A. Concrete shall conform to the requirements of the construction standards.
- B. The pipe shall be placed in proper position on temporary cradles or arches consisting of concrete block or bricks. When necessary, the pipe shall be rigidly anchored or weighted to prevent flotation when the concrete is placed.
- C. Cradles and arches shall be constructed with an ability to adjust the pipe to proper grade in order to avoid vertical joint pull. Cradles and arches shall be placed at $\frac{1}{3}$ and $\frac{1}{2}$ way points along each pipe segment where specified. Concrete placed beneath the pipe shall be sufficiently workable to fill the voids without excessive vibration. The concrete shall be allowed to cure and remain undisturbed for a minimum of 24 hours prior to backfill and compaction of the trench.
- D. Restrained pipe within casings, bridges, shall be fully extended or "stretched out" to remove the slack between the joints the entire length of the structure.
- E. Water shall not be permitted to enter, seep, or run onto the concrete while curing.

- F.** Trench dams shall be constructed of controlled density fill or clay as shown on the drawings or as directed by the Development Services Inspector. Trench dam excavations shall be made into native earthen materials to the dimensions shown on the drawings or as directed by the Development Services Inspector. Clay materials shall be moisture conditioned to near-optimum moisture content prior to placement in the excavation and compacted to the required relative compaction.

91-8 PIPE ZONE BACKFILL

Pipe zone backfill shall conform to Construction Standard Detail SS-1 and the following:

- A.** Extreme care shall be taken when consolidating the backfill around the pipe zone. For pipe 12 inches in diameter and smaller, no more than 1/2 of the pipe shall be covered prior to shovel slicing the haunches of the pipe. For pipe greater than 12 inches in diameter, no more than 6 inches shall be covered prior to shovel slicing. Shovel slicing shall be witnessed by the Development Services Inspector prior to shading the pipe.
- B.** Compaction equipment shall not make direct contact with the pipe.
- C.** Where the pipe is to be installed below historic groundwater levels or where the trench is subject to inundation, crushed rock material shall be placed to the crown of the pipe. Additionally, woven geotextile fabric Mirafi® 600x or approved equal shall be installed per Construction Standard Detail SS-1.

91-9 PIPE INSTALLATION

The sewer system outfall(s) shall be mechanically plugged and grouted, and shall remain plugged until final acceptance. Sewer pipe (gravity and pressure) shall be installed in accordance with the following provisions:

- A.** The Contractor shall keep the pipe interior free from foreign materials and in a clean and sanitary condition until acceptance by the City. At times when pipe-laying is not in progress, the open pipe end shall be sealed with a tight cap or plug to prevent foreign matter from entering the pipe. Provisions shall apply to the break times as well as overnight.
1. Trenches shall be in a reasonably dry condition when pipe is laid.
 2. Care shall be taken, when lowering pipe into the trench, to protect the pipe from damage. Chains are not permitted. The pipe shall be laid carefully to the lines and grades shown without grade breaks, unless designed with such, or to minimum depths shown on the approved plans. If field conditions exist such that the pipe may not be laid to the specified grade, the approved plans will require revisions prior to proceeding with construction.
 3. Pipe sections shall be closely jointed to form a smooth flowline. Care shall be taken in placing the pipe and making field joints.

4. Improvements installed without proper inspection shall be exposed and inspected as required by the Development Services Inspector.
5. All installations shall follow manufacturer's recommendations unless otherwise noted on the approved plans. The manufacturer's installation guide shall be on the job site at all times.
6. A 12 inch wide metallic backfill tape with the warning "BURIED SEWER MAIN" shall be placed in the trench lines of all mains and services, within 12 to 24 inches of the subgrade or finish grade (outside of aggregate base).
7. Mains in unpaved areas shall be marked every 125 lineal feet with a green composite utility marker having a decal stating "CAUTION BURIED SEWER PIPELINE". Appurtenances (such as manholes, valves, ARV's, test stations, etc.) and angle points shall also be marked. Mains in landscaped areas shall be delineated with a brass marker set in an 8 inch diameter concrete cylinder.

B. Vitrified Clay Pipe (VCP) Installation: Pipe-laying shall proceed upgrade with the bell end of the pipe placed upstream, and shall follow manufacturer's guidelines for installation.

C. Gravity Ductile Iron Pipe (DIP) Installation: DIP for gravity sewer applications shall have an interior coating with "Permashield 431" (or approved equal) unless otherwise specified on the approved plans. The pipe bedding and shading shall be 1/2 inch or 3/4 inch crushed rock. DIP sewer systems shall be constructed per the manufacture's recommendations and the following:

1. **Gravity Installations:** Transitions from DIP to VCP pipes shall be in accordance with Section 91-9.K of these specifications.
2. **Force Main Installations:** The force main shall be constructed and tested in accordance with the water pressure pipe standards established in Section 81, Domestic Water Supply System Construction, of these Construction Standards, with the following deviations:
 - a) The force main will not require disinfecting or water quality testing. The main shall be pre-flushed again with a properly sized "pig" after the pressure test. Flushing shall occur in the presence of a Development Services Inspector.
 - b) Backfill tape shall be 12 inch wide green plastic stating "BURIED FORCE SEWER MAIN".
 - c) Exothermic welds shall be made on the bell of the pipe as near to the edge as possible and on the weld pads provided on the spigot end of the pipe. Exothermic welds shall

- conform to Section 81, Domestic Water Supply System Construction, of these Construction Standards.
- d) When it is necessary to cut a “Permashield 431” treated pipe, the City’s Wastewater Division shall make all repairs prior to installation. Coordinate through the Development Services Inspector.
 - e) All DIP fittings for wastewater use shall have an interior coating with “Permashield-431” Or approved equal.
 - f) Tracing wire shall be installed per Section 81, Domestic Water Supply System Construction, of these Standards. Above ground access to the tracing wire shall not exceed 500 linear feet along the main. Access shall be provided by raising and securing the tracing wire through a conduit into a valve box. This location shall be 2 feet minimum from back of walk and marked per standards.
- D. Transitions between VCP and DIP:** When specified on the approved Improvements Plans, transitions between VCP and DIP shall be made using one of the following two methods:
- 1. Manufactured “speed-seal” gasketed DIP spigot. The transition fitting shall be manufactured by Gladding McBean. The Contractor shall incur all expenses.
 - 2. At a manhole, if a pre-cast manhole is to be used, a manufactured transition shall be used. If a cast-in-place manhole is used, a flex joint is not required.
- E. Boring:** Borings for installation of sewer lines shall be made per Detail W-22 and as follows:
- 1. The equipment, method and sequence of operation and casing pipe grades shall be approved by the Environmental Utilities Department. A minimum of 48 hours notice shall be given prior to the start of work. Excavation for the boring operation shall be the minimum necessary to satisfactorily complete the work. Bracing and shoring shall be adequate to protect workers and any adjacent structure or roadbed.
 - 2. **Casing:** Welded steel casing pipe shall have a minimum wall thickness of a 1/4 inch for pipe 24 inches in diameter and smaller and 5/16 inch for pipe 27 inches through 36 inches in diameter. Casing material larger than 36 inches shall be engineered on a case by case basis.
 - 3. **Installation of Casing:** The casing shall closely follow the boring operation. The bored hole shall not be more than 0.10 of a foot larger in diameter than the outside diameter of the conductor. Guide rails shall be accurately set to line and grade to insure installation of the casing within allowable limits. The casing diameter shall be sufficient to allow

adjustment of line and grade of the conducted pipe to meet allowable tolerances and to allow sand to be placed between the conductor and the conducted pipe.

The inside diameter of the casing shall be a minimum of 10 inches larger than the outside diameter of the conducted pipe bell or joint, as approved by the Environmental Utilities Department. A minimum of 4 inches clearance shall be required between the conducted pipe and the casing, taking the skids into consideration.

- 4. Placing Pipe in Casing:** Conducted pipe shall be fully restrained ductile iron with Permashield 431 interior coating, supported by a minimum of 3 sets of Calpico or equal synthetic skids per stick of pipe, or as required by the Environmental Utilities Department. Pipe sections shall be joined outside of the casing. The skids and casing entrance shall be lubricated prior to sliding the conducted pipe into place. The height of the skids may be adjusted to meet specified grades.

The space between the conducted pipe and casing shall be completely filled with clean, dry silica sand, blown into place. Both ends of the casing shall be plugged with non-shrink grout a minimum of 12 inches into the casing. Both ends shall have a pipe of sufficient diameter placed through the mortar plug and parallel with the conducted pipe. 1 pipe shall be used for blowing the sand into the annular space. The other pipe shall remain open for venting. Prior to starting, the method of placing sand in the void shall be approved by the Environmental Utilities Department.

- 5. Backfill of Voids:** When, in the opinion of the Developer's design engineer or geotechnical engineer, the nature of the soil indicated the likelihood of ground loss which would result in a greater space between the outer surface of the casing than allowed, the Contractor shall take immediate steps to prevent such occurrences by installing a jacking head extending at least 18 inches from the leading edge of the casing.

The jacking head shall cover the upper 2/3 of the casing and project not more than 1/2 inch beyond the casing outer surface. Excavation shall not be made in advance of the jacking head. Voids greater than allowable shall be filled with sand, soil cement, grout, or as approved by the Environmental Utilities Department. Where voids are suspected, the Developer's design or geotechnical engineer may direct the Contractor to drill the casing, to pressure inject grout to refusal and repair the drilled hole. Grouting pressure shall not exceed 50 pounds per square inch at the nozzle.

- 6. Utilizing the City's drainage system for residual discharge from boring operations without the required measures is prohibited.** This discharge is a violation of the City's Stormwater Ordinance and the Clean Water Act. Discharge fluid shall be recovered, contained and discharges at an appropriate location, or if the situation allows, fluid may be discarded into an open area with the pre-written approval of the property owner and approval from the Regional Water Quality Control Board (RWQCB) provided it meets RWQCB requirements and does not impact sensitive areas such as wetlands, creeks or other natural water conveyances.

All street boring shall include adequate measures to mitigate sediment-laden water discharge. An acceptable measure is pumping the discharge fluid into a tanker and hauling it away. Other measures suggested by the Contractor will be considered by the City. The City stormwater or Development Services Inspector shall inspect and monitor the discharge recovery, containment, and restoration process.

91-10 MANHOLE INSTALLATION

Manholes shall be installed in accordance with the Construction Standard Details and as specified herein:

- A.** Manholes shall be set flush with finish grade, unless otherwise noted on the approved plans.
- B.** Manholes placed in off-site, unimproved areas shall be constructed with the top of the casting cover a minimum of 1 foot above the final surrounding grade. A minimum 12 inch wide concrete collar with a #4 rebar ring shall be constructed around the casting and centered in collar.
- C.** Manholes placed in landscape areas adjacent to City improvements shall be constructed with the top of the casting cover a minimum of 6 inches above the final surrounding grade. A minimum 12 inch wide concrete collar with a #4 rebar ring shall be constructed around the casting and 6 inches below finish grade.
- D.** VCP pipe entering a sewer manhole shall have a flex joint at the manhole base. A flex joint consists of a bell and spigot joint at the manhole with only bell ends cast into the manhole base, and a second bell and spigot joint located 12 to 24 inches outside of the manhole. Service “Y’s” shall not be installed directly onto a manhole.
- E.** Manhole lids and castings for 48 inch diameter barrels shall be 24 inch diameter. Manhole lids and castings for 60 inch barrels shall be 36 inch diameter. Lid shall be bolt-down type with 2 cast-in-place bars and a gas detector probe hole, and have no poke holes. Lids shall be bolted when a manhole is constructed outside a paved area, as specified on the approved plans, or as directed by the Development Services Inspector. Manholes constructed outside of paved area shall use a GMI composite lid and frame. All manhole openings 36 inches or larger shall use a GMI composite lid and frame.
- F.** Sewer mains or services entering an existing manhole shall be core drilled, without exception. The space between the pipe and the manhole shall be filled with non-shrink grout.
- G.** Any work on an existing sewer manhole shall require the manhole to pass a vacuum test as described in section 91-13 of these Construction Standards. The work completed shall remain exposed until the vacuum test has been accepted by the Development Services Inspector.
- H.** Concrete manhole bases may be either pre-cast or cast-in-place. Pre-cast bases shall conform to section 91-16 of these Construction Standards.

This section covers all the work necessary to complete the installation of a cast in place manhole base, comprising cast-in-place concrete manhole base slab and wall.

1. Concrete

Cement shall be ASTM C-150, Type V Portland cement with proportioning and mix design as follows:

1. Specified 28-day Compressive Strength: 4000 psi minimum.
2. Air content: 2% ± 1%.
3. Slump, after addition of superplasticizer: 8" maximum

Coarse Aggregate Size	Cementitious Content-Pounds Per Cubic Yard	Water-Cement Ratio by Weight
3/4"	625 min, 800 max	0.375
1"	600 min, 800 max	0.385
1 1/2"	590 min, 800 max	0.400

2. Reinforcing

- a. Bars shall be ASTM A615, Grade 40 for all non-welded bars.
- b. Position, support, and secure reinforcement against displacement during formwork construction or concrete placement. Locate and support reinforcing by chairs, spacers and hangers, as required. Arrange, space, and securely tie bars with 16-gage wire to hold reinforcement accurately in position during concrete placement operations.
- c. Place reinforcement to obtain the minimum concrete cover as shown in detail SS-2A.
- d. Reinforcement with bends, kinks or reduced cross section due to excessive rusting or other causes will not be permitted.
- e. Reinforcement around pipe openings shall be in accordance with detail SS-2A.
- f. Provide reinforcement lap splices as noted in detail SS-2A, by placing bars in contact and tying tightly with wire.
- g. Do not place concrete until the reinforcing steel is inspected and permission for placing concrete is granted by ENGINEER. All concrete placed in violation of this provision will be rejected.

3. Concrete Placement

I. General

- a. Place concrete continuously so that no concrete will be placed on concrete, which has hardened sufficiently to cause the formation of seams or planes of weakness within the section. Deposit concrete as nearly as practical in its final location to avoid segregation due to rehandling or flowing.

- b. Do not use concrete which becomes non-plastic and unworkable, or does not meet the required quality control limits, or which has been contaminated by foreign materials. Do not use retempered concrete. Remove rejected concrete from the job site and dispose of it in an acceptable location.
- c. Do not place concrete until all forms, bracing, reinforcement, and embedded items are in final and secure position.
- d. Consolidate concrete during placing operations using mechanical vibrating equipment, so that concrete is thoroughly worked around reinforcement and other embedded items and into corners.
- e. Force concrete under pipes, sleeves, openings and inserts from one side until visible from the other side to prevent voids.
- f. The forms shall be limited in height to allow visual observation of the concrete and the vibrator operators shall be required to see the concrete being consolidated to ensure good quality workmanship.
- g. Unless otherwise approved, place concrete only when ENGINEER is present.

II. Cold Weather Placing:

- a. Do not place base slab on frozen soil.
- b. Protect all concrete from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
- c. When the air temperature has fallen to or may be expected to fall below 40°F, provide adequate means to maintain the temperature, in the area where concrete is being placed, at between 50°F and 70°F for at least seven days after placing. Provide temporary housings or coverings including tarpaulins or plastic film. Avoid rapid dry-out of concrete due to overheating, and avoid thermal shock due to sudden cooling or heating.
- d. When air temperature has fallen to or is expected to fall below 40°F, uniformly heat all water and aggregates before mixing as required to obtain a concrete mixture temperature of not less than 55°F and not more than 85°F at point of placement.
- e. Do not use frozen materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials. Ascertain that forms, reinforcing steel, and adjacent concrete surfaces are entirely free of frost and ice before placing concrete.
- f. When temperatures are expected to be below 32°F the night before the concrete is placed, then all reinforcing steel, forms and the ground shall be preheated, for a minimum of 12 hours, under a minimum temperature of 50°F.
- g. Do not use salt and other materials containing antifreeze agents or chemical accelerators, or set-control admixtures, unless approved by ENGINEER, in mix designs.

III. Hot Weather Placing:

- h. Cool ingredients before mixing to maintain concrete temperature at time of placement below 85°F. No concrete shall be placed if its temperature exceeds 90°F. Mixing water may be chilled or chopped ice may be used. The addition of ice shall not increase the specified water to cement ratio.

- i. Cover reinforcing steel with water-soaked burlap if it becomes too hot, so that the steel temperature will not exceed the ambient air temperature immediately before embedment in concrete.
- j. Thoroughly wet forms before placing concrete. Forms shall be free of standing water when concrete is placed.
- k. Do not use set-control admixtures, unless approved by ENGINEER in mix designs.
- l. Fog spray shall be used during finishing operations whenever necessary to avoid surface plastic shrinkage cracking. Fog spray shall also be used after finishing and before the specified curing is commenced to avoid surface plastic shrinkage cracking.
- m. Obtain ENGINEER'S approval of other methods and materials proposed for use.

4. Execution

- a. Construct manhole base slab and stem per dimensions shown in detail SS-2A. Concrete may be poured monolithically or in 2 separate pours with slab and wall with prior approval from City Engineer.
- b. The poured manhole base must not be moved until adequate hydration has occurred. The concrete on cast-in-place bases shall cure a minimum of 24 hours before stacking the barrel sections.
- c. Excavation at manhole location shall be wide enough to provide working room around manhole. Concrete in the cast-in-place portion shall be placed against a stable subgrade. All loose material shall be removed from the excavation prior to installation. The bedding shall consist of a minimum of 4 inches of compacted 1/2 inch or 3/4 inch crushed rock, compacted to 95% relative density.
- d. Belled pipes set in the manhole base wall shall be set flush with the exterior of the wall. The "speed-seal" on the spigot end shall be cut off prior to setting.
- e. Unless specified on the approved plans, there shall be a 0.10-foot drop constructed across the manhole base. U channel can pour monolithically with the base or hand placed per City's approval. Install PVC or hydrophilic water stop as shown in detail around the base, if slab and stem for base is constructed in separate pours.
- f. The top of the base shall be formed to accept the first barrel section. Wet setting is not permitted. Ram neck shall be installed on this first joint after the Environmental Utilities Department inspector has approved the manhole base for stacking.
- g. Flow through manholes shall have the pipe laid continuously as a whole pipe with flex joints and a minimum 0.10-foot drop, or as approved. After the initial 24-hour curing period, the top half of the pipe shall be carefully cut off without cracking the bottom. The sides shall be mortared smooth.
- h. Backfill shall be placed in layers of not more than 12 loose measure inches and mechanically tamped. Flooding will not be permitted. Backfill shall be placed in such a manner as to prevent any wedging action against the manhole structure.

5. Final Testing and Approval

- a. Acceptance: Manholes will be accepted with relation to the vacuum test requirements in section 91-12 E of this document.
- b. No repairs shall be allowed for manhole base with cracks, holes or other defective concrete in areas of potential leakage. Any manhole base which fails the initial test will be rejected and must be replaced prior to backfilling.

I. Adjusting Manholes: The manhole neck and frame shall be adjusted to grade. Use of metal grade rings is not permitted. The finished manhole shall conform to Construction Standard Detail SS-2, or as approved by the Environmental Utilities Department.

J. Frame and Lid: The manhole frame and lid shall be sealed with an approved rubber gasket. Manholes constructed in streets shall have the lid bolt holes filled with silicone (91-16,F.10). Manholes constructed outside of the street or paved area shall be bolted down or closed by other locking mechanism.

K. Manholes Coatings: Approved materials include epoxy or calcium aluminate.

Epoxy Coating: Sewer manholes requiring an epoxy coating shall first pass a vacuum test, per Section 91-12,E.4 of these Construction Standards, and shall then be constructed as follows:

1. The exterior of the manhole shall be coated with an asphaltic material and wrapped in 8 mil polyethylene sheeting (81-16,G.26) prior to backfilling. Use to 10 mil vinyl tape (81-16,G.25) to secure and seal the polyethylene per Section 81 of these standards.
2. All voids and imperfections in the interior of the manhole shall be mortared or “sacked” smooth with a cement paste composed of 50 percent Portland cement and 50 percent sand. The mortar mixture shall be manually worked into the dampened surface with sufficient pressure to completely fill voids and imperfections. The surface shall then be finished smooth.
 - a. This process shall be continued until the entire manhole surface (base, barrel, cone, neck and joints) is smooth and free of imperfections. Note that it is not required to cover the entire interior surface area of the manhole, only where voids or imperfections exist.
 - b. Upon receiving the Development Services Inspector's approval of the sacking, the outlet channel(s) of the manhole to be epoxied and the first upstream manhole shall be mechanically plugged to prevent water flow. The newly sacked manhole shall cure for a period of 28 days.
3. The epoxy coating and applicator’s certification must be submitted to the Environmental Utilities Department for approval. The approved coating may be applied after the 28 day curing period has ended. An accepted method of epoxy application is as follows:
 - a. Mask off the metal frame.

- b.** Sandblast the interior concrete surfaces of the sewer manhole.
- c.** Apply a sealer/primer approved by Development Services Inspector and allow curing per the manufacturer's recommendations. Application may be withheld if, in the opinion of the Development Services Inspector, the walls of the manhole exceed the recommended moisture content. A visqueen test may be performed to determine the absence of moisture.
- d.** Apply an approved epoxy to obtain a minimum thickness of 80 mils and allow curing per the manufacturer's recommendations.
- e.** Verify the thickness and adherence of the coating by coring samples, to the satisfaction of the Development Services Inspector.
- f.** Repair the sampled areas and allow the repairs to cure.
- g.** "Spark test" the entire epoxy surface area. The electrode shall provide a minimum of 10,000 volts. Areas failing the spark test shall be removed, repaired and retested.
- h.** After approval from the Development Services Inspector, remove the masking from the metal frame and use "Sikaflex" (or approved equal) sealant to caulk to transition joint between the epoxy coating and the metal frame.
- i.** Use "Sikaflex" (or approved equal) sealant at the concrete VCP interface and for all epoxy transitions.
- j.** Remove the plugs.

Calcium aluminate: Calcium aluminate may be used in lieu of epoxy coating. The manhole shall pass a vacuum test, per section 91-12,E.4 of these Construction Standards. Calcium aluminate shall be SewperCoat by Kerneos Aluminate Technologies or approved equal and shall be installed per manufacture specifications. Whenever Calcium Aluminate is used, the contractor shall immediately TV the sewer line to ensure no grout entered the line during application. Use "Sikaflex" (or approved equal) sealant at the concrete VCP interface and for all epoxy transitions.

91-11 SERVICE INSTALLATION

Sewer services shall be installed in accordance with Construction Standard Details SS-4 and SS-5.

- A.** Sewer services originating from sewer mains 14 feet in depth or greater shall have the crotch on the VCP "Y" fitting filled with concrete.

91-12 TESTING OF INSTALLED IMPROVEMENTS

Sewer mains, services, manholes and appurtenances shall be tested by the following procedures:

- A. Sewer Mains and Services:** Public and private sewer mains and services shall be air-tested per ASTM C828 by the Contractor and the Environmental Utilities Department shall provide closed circuit TV inspection, after installation of the joint trench utility crossings and subgrade elevations have been met. Additionally, pipeline segments beneath road bases to be lime-treated shall be tested before and after the lime treatment process.
- B. Air Pressure Test:** Sewer mains and laterals shall be pressure tested in accordance with the National Clay Pipe Institute recommended guidelines with the following amendment:
1. Minimum test time shall be 60 seconds.
 2. For mains installed in an area where the water table is higher than the pipe, the test pressure shall be increased 0.5 PSI per foot of water over the pipe.
 3. The test gauge shall be liquid-filled, capable of testing up to 15 PSI, and graduated to 1/10 PSI.
- C. TV Inspection:** TV inspection of sewer mains and services shall be performed by the Environmental Utilities Department, Wastewater Division. Costs for said inspection shall be borne by the Contractor. Preliminary inspections may be performed by outside contractors, but shall not be accepted by the Environmental Utilities Department as an official record.
1. The sewer system shall be completely cleaned by an approved method prior to TV inspection. The sewer system shall be rejected if any of the following conditions exist:
 - a. For main lines 12 inches and smaller - standing water or sags greater than 1/2 inch in depth at acceptance or greater than 1 inch at warranty.
 - b. For main lines exceeding 12 inches - standing water or sags greater than 3/4 of an inch in depth at acceptance and greater than 1 1/2 inches at warranty.
 - c. Standing water in services.
 - d. Offset joints.
 - e. Joint separations greater than 1/2 inch wide.
 - f. Damaged pipe.
- D. Inspection Criteria for Coated Ductile Iron Pipe:** All ductile iron sewer will have the following additional inspection requirements:

1. The condition of the barrel section of pipe as well as 360° at each joint shall be recorded to a DVD or portable drive. Once completed, and the inspection demonstrates the pipe meets the City's construction standards, the contractor may proceed with the backfill of the trench. The Contractor shall provide the DVD and a map of the section inspected, to the Wastewater Collection Division for review prior to the City's acceptance inspection.
 2. Upon finding any deficiency in the pipe which does not meet the design and construction standards of the City of Roseville, it is strongly encouraged that the contractor make the necessary corrections at that time. If deficiencies aren't corrected City forces at time of acceptance CCTV will identify these deficiencies and require the contractor to dig and replace the pipe sections; there will be no exceptions.
 3. The observation data on the DVD provided to the City shall include the following:
 - a. City wide job number.
 - b. Encroachment permit number.
 - c. Project name.
 - d. Location (street name).
 - e. Manhole numbers (based on approved plan set or city asset numbers if applicable).
 - f. Direction of inspection (upstream or downstream).
 - g. Date of inspection.
 4. The speed of travel shall be slow enough to inspect each pipe joint, wye connection, coating integrity, and potential sags. Camera speed should travel at a rate of no more than 30 feet per minute. The camera speed shall be steady and slow enough to record features and defects.
- E. Manholes:** Sewer manholes shall pass a vacuum test consisting of the following criteria and procedures:
1. The test shall be performed after assembly of the manhole and installation of the pipe entering or exiting the manhole, but prior to backfilling. The Contractor shall perform the test and supply all test equipment. The Development Services Inspector shall witness the test results.
 2. Lift holes shall be filled with non-shrink grout prior to testing.
 3. Pipe entering and exiting the manhole shall be plugged. The plug shall be placed on the flex joint outside of the manhole base. Securely brace the plugs to prevent them from being drawn into the manhole. Unused channels shall be permanently plugged with a plastic or clay stopper.

4. A vacuum of 10 inches of mercury shall be drawn to start the test. The amount of time required for the vacuum to drop to 9 inches shall be measured. The manhole will pass the test if the amount of elapsed time is greater than 60 seconds for a 48 inch manhole, 75 seconds for a 60 inch manhole, 90 seconds for a 72 inch manhole and 120 seconds for an 84 inch manhole. A liquid-filled vacuum gauge shall be used for testing. All detectable leaks shall be repaired with non-shrink grout while the vacuum is drawn. No mortar shall be applied to the inside of the manhole until the vacuum test has passed.
5. If the manhole fails the initial test, necessary repairs shall be made with a non-shrink grout while the vacuum is still being drawn. Retesting shall proceed until elapsed times are satisfactory.
6. After passing the vacuum test, all joints shall then be mortared, inside and out. Outside mortared joints shall be allowed to dry 24 hours or as approved by the Development Services Inspector before backfilling.
7. If damage to the manhole is evident any time during the construction, the Development Services Inspector may require repairs to be made on the manhole which will require a new vacuum test prior to acceptance.

F. Topside Improvements: When all water, recycled water and sewer infrastructures have passed air, vacuum, pressure and continuity test as well as CCTV inspection the Development Services Inspector will email a notification to internal departments indicating that the project is ready for road bases and top side improvements only. This does not constitute approval for use of the infrastructure.

G. Tying Into the City System: A tie-in procedure shall be submitted and approved by the Environmental Utilities Department prior to the proposed work. The contractor shall allow for up to 7 days for review of the procedures by the Environmental Utilities Department. The sewer system shall be tied into the City system within 10 working days upon completing and passing all the testing procedures. Tie-ins shall be conducted as specified in Section 91-2 of these Construction Standards.

91-13 PUNCHLIST PROCESS

After the sewer manholes have been raised and finished to grade, the sewer system shall have a final ball and flushed in the presence of the Development Services Inspector. The system shall then have a final TV inspection to ensure the entire sewer system is intact for warranty. Final ball and flush can be done by city forces on a time and material basis at the request of the contractor.

When all improvements are complete, the contractor shall provide a written request for a punch list inspection of the improvements. With the assistance and presence of the Contractor, the wastewater facilities punch list shall be generated by the Development Services Inspector and Wastewater Collection Division.

91-14 REPAIRING INSTALLED IMPROVEMENTS

Sewer mains, services, manholes and appurtenances shall be repaired per these Construction Standards and by the following procedures:

A. Repairing Vitrified Clay Pipe

1. Damaged pipe shall be exposed and replaced in-kind by “bridging” the new pipe into place. Coupling devices shall not be used.
2. Sagging or misaligned pipe shall be exposed and corrected in place if possible. If the pipe is defective, then a new pipe shall be bridged in place.
3. After the correction has been completed, the excavation shall be backfilled and compacted to grade as specified. The repairs shall then be retested per section 91-12 of these Construction Standards.

91-15 ABANDONING SEWER STUBS AND SERVICES

In new construction, sewer stubs and services to be abandoned shall be removed to the main or manhole of origination. Abandonment of existing sewer stubs shall be as directed by the Environmental Utilities Director.

91-16 MATERIALS

A. Approved Equal: The words “approved equal” shall mean any material deemed by the Environmental Utilities Department to be acceptable for use within the City’s sewer system as compared to products of specified manufacturers. Contractors proposing to use materials which are not specifically named shall submit all necessary documentation to allow review of said material for use as an approved equal.

The submittal shall include a letter with:

1. **Product:** A description of the product and the appropriate materials specification section number. A sample of the product may be required for review and testing.
2. **Contact:** The name and telephone number of the contact person for the proposed product.
3. **Reference:** A list of a minimum of 3 agencies using the proposed product (include names and telephone numbers).
4. **Performance:** Information and reference for 3 locations with a performance record of 3 years in operation of the installation.
5. Address the letter to the Environmental Utilities Department Engineering Division, 2005 Hilltop Circle, Roseville, CA 95747, ATTN: EUD, Chairman of METAC. City staff may request a sample of the product for review.

6. The Contractor shall submit all material for review 35 days prior to contract award. All submittals shall include documentation verifying contract award date. Contractors shall allow 2 to 4 weeks review time by the Environmental Utilities Department.

B. Conditionally Approved Material: Materials or products that have met the reference and performance requirements shall be conditionally approved for a minimum trial period of 2 years. Upon completion of the 2 year period, the product may be approved, the evaluation period may be extended, or the product may be denied approval as determined by the Environmental Utilities Director. A list of conditionally approved products may be obtained from the Environmental Utilities Department.

C. Unapproved Materials: Materials not approved for use on the project shall be removed from the site within 24 hours if requested by the Development Services Inspector.

D. Sewer Main and Services: Unless noted on the approved plans, all gravity pipe shall be Vitrified Clay Pipe Bell and Spigot (VCP), conforming to ASTM C700-C301, C828 Standards manufactured by Gladding McBean or approved equal. The VCP shall be Extra Strength and shall not be dipped in solution or glazed to enhance air pressure tests.

All commercial sewer services shall be VCP up to 5' outside the building footprint.

All force main pressure pipe will be Ductile Iron Pipe (DIP) manufactured by Pacific States Company, US Pipe, Griffin, Electrosteel USA or approved equal. The interior of the DIP shall be coated with Permashield 431, or approved equal, from bell gasket seat to 8 inches of spigot end exterior. The coated DIP shall be manufactured with an exothermic weld (cadweld) plate installed on the spigot end.

E. Manholes: Manholes, frames and covers are to be in accordance with details SS-2 and SS-3. All materials used in cast-in-place concrete or precast concrete shall conform to ASTM C-150 Specifications with Type V cement for sulfate protection.

1. Barrels, Cones, and Lids

a. 48 inch Manhole Material:

- Jensen Precast 36 inch eccentric cone, #CN48E36 or approved equal
- Jensen Precast 30 inch concentric cone, #CN48C30 or approved equal
- Jensen Precast 24 inch concentric cone, #CN48C24 or approved equal
- Jensen Precast 18 inch concentric cone, #CN48C18 or approved equal
- Jensen Precast 12 inch barrel, #BL485812S or approved equal
- Jensen Precast 18 inch barrel, #BL485818 or approved equal
- Jensen Precast 24 inch barrel, #BL485824S or approved equal
- Jensen Precast 36 inch barrel, #BL485836S or approved equal
- Jensen Precast 48 inch barrel, #BL485848S or approved equal
- Armorock

b. 60 inch Manhole Material:

- Jensen Precast 36 inch concentric reducer cone, #CNR603636 or approved equal
- Jensen Precast 48 inch transition slab #TS604812 or approved equal
- Jensen Precast 36 inch barrel, #BL607236 or approved equal
- Jensen Precast flat lid with 24 inch opening, (either eccentric or concentric opening) #FT6024C or #FT6024E ++ or approved equal
- Jensen Precast flat lid with 36 inch opening (either eccentric or concentric opening), #FT6036C or #FT6036E or approved equal
- Armorock

c. 72 inch Manhole Material:

- Jensen Precast 12 inch barrel section, #BL728612 or approved equal
- Jensen Precast 24 inch barrel section, #BL728624 or approved equal
- Jensen Precast 36 inch barrel section, #BL728636 or approved equal
- Jensen Precast flat lid with 24 inch concentrate opening, #FT7224C or approved equal
- Jensen Precast flat lid with 36 inch concentric opening, #FT7236C or approved equal
- Armorock

2. Grade Rings

- Jensen Precast 3 inch grade ring (5 inch walls), #GR243403 or GR304003 or approved equal
- Jensen Precast 6 inch grade ring (5 inch walls), #GR243406 or GR304006 or approved equal
- Jensen Precast 6 inch grade ring (6 inch walls), GR364806 or approved equal
- Jensen Precast 3 inch grade ring (6 inch walls), #GR364803 or approved equal

3. Manhole Frame and Cover

- a. For 24 inch Openings:** South Bay Foundry, #SBF 1920 RV-S, GMI Composite frame and cover 2600 Series, Saint-Gobian PAM, Rexus – CDRU60EHSEW, D&L Supply - #A-1021 with “sniffer plug” and “O” ring gasket, National Casting Corporation - NC 1021 or approved equal
- b. For 36 inch Openings:** GMI Composite frame and cover 3800 Series or approved equal due to safety reasons.

4. Precast Bottom

- Jensen Precast 6 inch two way, #MBS4824-2W-6C or approved equal

- Jensen Precast 8 inch two way, #MBS4824-180-8C or approved equal
- Jensen Precast 6 inch 90 degree left, #MBS4824-90L-6C or approved equal
- Jensen Precast 6 inch 90 degree right, #MBS4824-90R-6C or approved equal
- Jensen Precast 8 inch 90 degree left, #MBS4824-90L-8C or approved equal
- Jensen Precast 8 inch 90 degree right, #MBS4824-90R-8C or approved equal
- Jensen Precast 6 inch clay, three way, #MBS4824-3W-6C or approved equal
- Jensen Precast 8 inch clay, three way, #MBS4824-3W-8C or approved equal
- Jensen Precast 6 inch clay, four way, #MBS4824-4W-6C or approved equal
- Jensen Precast 8 inch clay, four way, #MBS4824-4W-8C or approved equal
- Jensen Precast 6 inch outlet, 4 inch cul-de-sac base, #MBS4824-6W-6CUL or approved equal
- Jensen Precast 8 inch clay outlet, 4 inch cul-de-sac base, #MBS4824-6W8CUL or approved equal
- Jensen Precast 10 inch two way, #MBS4824-2W-10C or approved equal
- Jensen Precast 12 inch two way, #MBS4824-180-12C or approved equal

5. Precast Flat Lid

- Jensen Precast 6 inch lid, 24 inch concentric opening, #FT4824C or approved equal
- Jensen Precast 6 inch lid, 36 inch concentric opening, #FT4836C or approved equal

F. Appurtenances

1. **Air Release Valve:** Crispin UX41 (4”), Crispin UX20 (2”), Crispin Sewer Pressure Air Release Valves Series S or approved equal.
2. **Clay to Concrete Sealant:** SikaFlex or approved equal.
3. **Trench Dam:** Clay or Controlled Density Fill.
4. **Cleanout Caps:** ABS.
5. **Couplings:** For 4 inch lines, use Flex Seal Repair Coupling for ABS cap only, or approved equal. For 4 to 12 inch lines, use Mission Rubber Repair Coupling or approved equal. Couplings may not be used in new construction.
6. **Flange Gaskets:** All flange gaskets to be neoprene rubber or red rubber, USSO Standard B.16.21 insulation flange kits—Calpico Type E full-faced gasket and two-side insulation.
7. **Joint Sealing Compound:** Ram-Nek, Con Seal Compound or approved equal.
8. **Location Stakes:** Carsonite 4 inch x 5 feet CUM 375 with anchor barb kit or approved equal.
 - a. Caution stickers attached, #CW-112 and organization identification decal #P101, stating: “CITY OF ROSEVILLE - CALL BEFORE DIGGING (916) 774-5750”.

- b.** For pressurized sewer mains, use decal #CPS-1977. For gravity sewer mains, use decal # CS-225.
- 9. Mortar:** Non-shrink grout during manhole vacuum testing and as specified. Standard mortar mix for all other applications.
- 10. Silicone:** 100 percent clear silicone with a 25-year life, or approved equal.
- 11. MH Coatings**
 - Hydro Pox 204 or approved equal.
 - Calcium aluminate
- 12. Wastewater Marking Tape:** Terra Tape Extra Stretch 450 Material, detectable, 12 inch wide or approved equal. Non-Detectable for sewer force mains.
- 13. Grease Interceptor:** Jensen Precast or approved equal.
- 14. Reinforcement Bar:** Rebar shall be grade 60 steel, deformed type. Smooth bar shall not be allowed. All rebar shall be number four (4) unless otherwise specified on the plans.
- 15. Eccentric Non-Lubricated AWWA Plug Valves:** Crispin Series 800 or approved equal.

91-17 ILLEGAL USE OF SEWER SYSTEM

If Stormwater enters the sewer system, the Contractor and/or Owner/Developer shall be charged according to Title 14.16.220 of the City of Roseville Municipal Code. Stormwater run-off shall be classified as “low-strength metered commercial users.” The sewer unit shall be 1 sewer unit per 1,000 cubic feet discharge. The Environmental Utilities Department shall determine the volume of discharge.

91-18 CONDITIONALLY APPROVED

The following products are conditionally approved in the City for a period of 2 years conditional acceptance period, the product may be granted approved equal status and be added to the list of approved products in the City of Roseville Standards.

- A.** Old Castle Precast (U.S. Concrete)
 - 1.** Sewer Manholes and Appurtenances
 - 2.** Grease interceptors