

VOLUME I

TECHNICAL SPECIFICATIONS

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SECTION 01350
NOTIFICATION TO RESIDENTS AND BUSINESSES

PART 1 - GENERAL

1.1 DESCRIPTION

Work Includes

1. Advance notice door hangers shall be distributed to residents and businesses on all streets where work within this Contract is included.
2. **"NO PARKING TOW AWAY"** signs shall be posted on the street in which the work is to be performed in accordance to the directions in this Section.

PART 2 - PRODUCTS

2.1 ADVANCE NOTICE DOOR HANGERS OR NOTICES

Advance notice door hangers or notices shall be provided by the Contractor after approval of the City.

2.2 NO PARKING SIGNS

"NO PARKING TOW AWAY" signs shall be provided by the Contractor.

PART 3 - EXECUTION

3.1 DISTRIBUTION

- A. Advance notice door hangers or notices will be hand delivered by the Contractor to businesses, residents, or others that will be impacted by the work, 14 days in advance of construction and/or street closure.
- B. Dated **"NO PARKING TOW AWAY"** signs shall be posted a minimum of 48- hours in advance of all work which requires that cars not be parked on the street. Date and time of work shall be written on these signs in 2" high letters with a 1/4" felt marker. These signs shall be placed on barricades per these specifications or located near the curb and gutter. All signs must be removed immediately after the specific work has been completed. Any cars which remain parked on the street in violation of the posted **"NO PARKING TOW AWAY"** sign shall be towed away under the direction of the Sheriff's Office.
- C. The Contractor shall call the Sheriff's Office Communications Dispatch Center prior to the start of work each day, to report all street closures for that day.
- D. **Sign Posting**
 1. **No Parking Signs**
 - a. All signs indicating a **"NO PARKING TOW AWAY"** zone shall be posted a minimum of 48-hours in advance.
 - b. Signs shall be properly filled out including dated time of posting, and initialed by the Contractor.
 - c. Signs shall be posted on both sides of the barricade.

- d. Signs shall be placed on both ends of the **"NO PARKING"** zone.
- e. All signs indicating a **"NO PARKING"** zone, shall be removed the same day that the work requiring **"NO PARKING"** zone is completed.
- f. The **"NO PARKING TOW AWAY"** signs (see above) shall be provided by the Contractor and shall be ordered immediately after the Notice to Proceed is issued.
- g. The Inspector and the Half Moon Bay City's Community Development Department and Sheriff's Office shall be notified of the **"NO PARKING TOW AWAY"** zone, before the 48-hour period, for their approval.

2. **Use of Barricades**

- a. Shall be Type III barricades, with properly working and maintained flashing lights.
- b. Shall be placed at intervals of no greater than 50 feet.
- c. Shall be placed in the street or in the parkway as close to the street as possible where it is easily visible.
- d. Shall be removed from the street the same day the work is completed.

3. **Certification of Posting**

- a. After the **"NO PARKING"** zone is established, the Contractor shall provide the Engineer with a signed certificate stating when the signs were posted, what time periods the zone covers, and a sketch showing the location.
- b. The Contractor shall also provide photographs of the posting to verify the condition of the **"NO PARKING"** at the time of posting.

NOTE: IF POSTING PROCEDURES ARE NOT PROPERLY FOLLOWED, THE CONTRACTOR SHALL RESCHEDULE THE WORK FOR THAT SITE AND ABSORB ANY INCURRED COSTS.

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SECTION 01550
TRAFFIC REGULATIONS

PART 1 - GENERAL

1.1 OBJECTIVES

- A.** The Contractor shall provide for safe movement of vehicular, bicycle and pedestrian traffic, including persons with disabilities in accordance with the American's with Disabilities Act of 1990 (ADA), through and around construction operations. Traffic control requirements set forth herein are the minimum requirements imposed. The Contractor shall be solely responsible for providing all protective measures necessary.
- B.** Proper traffic movement through the work area depends upon the driver controlling and directing his/her vehicle properly under unexpected situations and pedestrian attention to signs. The means of clarifying such conditions to the public include signs, flaggers, pavement markings, barricades, lights, cones and delineators.
- C.** No one standard sequence of signs or control devices will suit all conditions, which may result from construction operations. Even for the same work the conditions may vary from hour to hour, requiring adjustment and revision of the traffic control program in effect.
- D.** The traffic control requirements specified herein are intended to establish general principles to be observed in the control and regulation of traffic through and around construction operations anticipated for this project. All pedestrian and vehicular detours are subject to review by the sheriff or enforcement officer of the agencies having jurisdiction, and the Contractor shall revise the detours as ordered at no additional cost.
- E.** Clean up site each day after completing work and remove all traffic hazards. Daily traffic control measures shall continue until cleanup activities have been satisfactorily completed and all of the Contractor's equipment has been removed from the traveled way area.

1.2 DESCRIPTION OF WORK

- B.** Work Included:

 - 1. At all times, the Contractor shall provide safe and adequate passage for vehicular and pedestrian traffic through, around and adjacent to all construction operations by use of detours, bridging, backfilling, paving, traffic barriers or other favorably reviewed means.
 - 2. The Contractor shall establish and maintain detours and conduct his construction operations in such a manner as to minimize hazard, inconvenience and disruption to the public.
 - 3. Traffic control shall be directed equally to the regulation and protection of pedestrian traffic including pedestrians, bicyclists, joggers, skaters, skateboarders, etc.
 - 4. The Contractor shall provide for protection of pedestrians and separation of pedestrians from construction operations at all times.
 - 5. The Contractor shall direct, divert and detour traffic through, around and adjacent

to construction operations in accordance with the traffic control plans as specified herein or in accordance with favorably reviewed Traffic Control Plans. The Contractor may revise the Traffic Control Plan as necessary only with the favorable review of the Engineer.

1.3 REFERENCES

- A.** Standard Plans and Specifications, California Department of Transportation, latest edition.
- B.** California Manual on Uniform Traffic Controls (CAMUTCD), California Department of Transportation, latest edition.
- C.** Work Area Traffic Control Handbook, Building News Incorporated, P.O. Box 3031, Terminal Annex, Los Angeles, California 90051.

1.4 SUBMITTALS

- A.** Traffic Control Plans:
 - 1. Submit Traffic Control Plans to clearly describe proposed traffic control measures. The plans shall be in accordance with the Standard Plans and Specifications and the CAMUTCD. When required by the City Engineer Traffic Control Plans shall be prepared by a licensed Civil or Traffic Engineer.
 - 2. The Traffic Control Plan shall provide a detailed approach for detours and to control traffic through the construction zone, shall conform to Caltrans and City standards, and will be approved by the City Engineer before construction begins.
 - 3. The submittals shall consist of scaled drawings for each situation anticipated to be encountered, i.e., intersections, mid-block (each during working and non-working hours), etc. and necessary details.
 - 4. The scaled drawings shall show signs, traffic control devices and flaggers as required.

PART 2 - PRODUCTS

2.1 CONSTRUCTION SIGNS

- A.** Construction signs shall conform to the standards of the Standard Plans and Specifications and the CAMUTCD.
- B.** Temporary warning signs in construction areas shall have a black legend and border on an orange background. Color for other signs shall follow the standard for all highway signs.
- C.** All signs used during hours of darkness shall be retroreflective.

2.2 OTHER TRAFFIC CONTROL DEVICES

- A.** General: Traffic control devices shall conform to the standards of the Standard Plans and Specifications, and the CAMUTCD.

- B. Cones or Delineators:**
 1. Cones or delineators shall consist of cylindrical or cone shaped plastic devices, which shall be 18 inches to 48 inches in height.
 2. Cones or delineators shall have a flexible base of suitable weight, which will ensure stability.
 3. Cones or delineators used during hours of darkness shall be affixed with retroreflective sleeves or be internally illuminated meeting the requirements of the CAMUTCD.

- C. Barricades:**
 1. Barricades shall be Type I, Type II or Type III barricades as set forth in the Standard Plans and Specifications, and the CAMUTCD.
 2. Barricades used during hours of darkness shall be equipped with flashers.

PART 3 - EXECUTION

3.1 DIVERTING PEDESTRIAN TRAFFIC

- A.** Whenever construction operations obstruct the flow of pedestrian traffic or present a hazard to pedestrians, the Contractor shall take appropriate action to protect and separate pedestrians from the work area and to direct pedestrians to alternate routes.

- B.** Such action may include placement of barricades between pedestrians and work areas, placement of warning signs, and provision of personnel as required to protect pedestrians as conditions warrant.

3.2 DIVERTING VEHICULAR TRAFFIC

- A.** Whenever construction operations obstruct the flow of vehicular traffic or present a hazard to vehicles operating in the vicinity of construction operations, the Contractor shall take appropriate action to warn, detour and otherwise protect approaching drivers and vehicles.

3.3 TRAFFIC CONTROL DEVICES

- A. General:**
 1. Provide traffic control devices in sufficient quantities and types as required to provide safe and adequate traffic control.
 2. During hours of darkness approved lights shall be included, in proper working order, to illuminate signs and hazards and alert approaching traffic.
 3. Provide and maintain barricades along all open trenches in contact with traffic.
 4. No work may begin on any day or at any time before traffic control devices have been placed, test driven and, if required, adjusted and revised.

- B. Placement:**
 1. Place all traffic control devices in accordance with the Standard Plans and Specifications, the CAMUTCD and approved Traffic Control Plan.
 2. Adjust locations of devices to suit the conditions and circumstances of each detour situation. In all cases, place signs to most effectively convey their messages to approaching traffic.

3. The Contractor shall adjust and revise all traffic control devices if determined to be required by the City Engineer or Sheriff's Office.
4. The Contractor shall provide additional traffic control devices if required to maintain the safe flow of traffic through construction operation.

C. Maintenance of Devices:

1. The Contractor shall maintain all traffic control devices, at proper locations and in proper working order, at all times during construction operations and whenever a hazard resulting from Contractor's operations exists.
2. The Contractor shall adjust and revise traffic control devices, placement, etc., to suit changing conditions around construction operations.

D. Removal of Devices:

1. Traffic control devices shall remain in place at all times required to alert approaching traffic of upcoming hazards.
2. After hazard has been removed, remove all traffic control devices. Remove signs or completely cover their messages.

3.4 FLAGGERS

A. General: The Contractor shall employ flaggers:

1. As required for each specific detour.
2. At all locations on a construction site where barricades and warning signs cannot control the moving traffic.

B. Placement: Where flaggers are required, they shall be logically placed in relation to the equipment or operation so as to give adequate warning and shall be placed in accordance with the Standard Plans and Specifications, the CAMUTCD, and the approved Traffic Control Plan.

C. Warning Signs:

1. Place warning signs ahead of the flagger in accordance with the Standard Plans and Specifications, the CAMUTCD, and the approved Traffic Control Plan. The distance between signs and the flagger shall be based on the posted traffic approach speed.
2. During hours of darkness, illuminate flagger stations such that the flagger will be clearly visible to approaching traffic. Lights for illuminating the flagger station shall comply with the Standard Plans and Specifications, the CAMUTCD, and the approved Traffic Control Plan.

D. Equipment:

1. Provide flaggers with high-visibility safety apparel in accordance with the Standard Plans and Specifications, and the CAMUTCD at all times. Provide flaggers with hand signs in accordance with the Standard Plans and Specifications, and the CAMUTCD.
2. Provide flaggers with two-way radios for communication when necessary. Red flags shall only be used for traffic control in emergency situations.

3.5 NOTICE TO AGENCIES

- A.** The Contractor shall notify in writing all agencies having jurisdiction at least forty- eight (48) hours, excluding holidays and weekends, prior to instituting any lane closure or detour. At the end of each day's work, the Contractor shall inform the ambulance services, sheriff's office and fire departments of the status of all detours and/or lane or road closures that will be in effect after the next day.
- B.** List of Agencies:
 - 1. City of Half Moon Bay
 - 2. Coastside Fire Protection District
 - 3. Sheriff's Office
 - 4. U.S. Postal Service
 - 5. School District Transportation Office, as appropriate
 - 6. SamTrans for bus services
 - 7. Ambulance Companies
 - 8. Allied Waste

3.6 EMERGENCY VEHICLE ACCESS THROUGH DETOURS

- A.** During construction in or adjacent to roadways in the project site, Contractor shall maintain at least one lane open in each direction of the road to allow emergency vehicle access for sheriff, fire and ambulance to the project vicinity.
- B.** During all detours and/or street closures the Contractor shall provide for movement of emergency vehicles through the work area.
- C.** When temporary traffic control is provided by flaggers they shall be instructed to give immediate passage to emergency vehicles with active lights or sirens.
- D.** It is essential that the Contractor's work and equipment do not impede egress from any fire station or sheriff's office to other areas of their service area.

3.7 ACCESS TO PRIVATE PROPERTY

- A.** General: The Contractor shall schedule operations to minimize disruption of access to private property.
- B.** Notice to Residents: Prior to blocking access to any private driveway or parking lot entrance, the Contractor shall notify the resident or business owner or tenant of pending closure and allow resident to remove vehicles.
- C.** Nights: During non-working hours no driveway, house or parking lot shall be denied access to a public roadway.

3.8 DETOURS DURING NON-WORKING HOURS

- A.** General: The Contractor shall not be permitted to maintain any lane closure or road closure during non-working hours without first obtaining written approval of the Engineer.

- B. Restoration of Pavement:
 - 1. During non-working hours the Contractor shall restore travel lanes to their original alignment and configuration by means of backfilling and temporary pavement or bridging in accordance with City Standards and approved by the City Engineer.
 - 2. The Contractor shall place signs conforming to the Standard Plans and Specifications, and the CAMUTCD at uneven temporary pavement or bridging.

3.9 PARKING RESTRICTIONS

- A. General: The Contractor shall post approved "**NO PARKING – CONSTRUCTION TOW-AWAY ZONE**" signs at all locations necessary to establish work areas and detour traffic.
- B. Signs:
 - 1. Signs shall read: "**NO PARKING - CONSTRUCTION TOW-AWAY ZONE**".
 - 2. Signs shall be placed at least 48 hours in advance of restriction.

3.10 BRIDGING OVER TRENCHES AND EXCAVATIONS

- A. General: Bridging shall be placed across all trenches and excavations in existing streets and at driveways when work is not in progress. Bridging shall be in accordance with the Standard Plans and Specifications and the CAMUTCD and approved by the City Engineer.
- B. Design of Bridging:
 - 1. Bridging for vehicular traffic shall be of sufficient width to accommodate the required number of travel lanes.
 - 2. Bridging shall be designed to support H-20 vehicular traffic.
 - 3. All bridging shall be set flush with travel surface or a satisfactory transition from travel surface to top of bridging shall be provided.
 - a. A satisfactory transition shall mean a change in elevation between the levels of not less than twelve (12) inches horizontal to one (1) inch vertical.
 - b. Transition may be accomplished by means of temporary pavement.

3.11 TEMPORARY TRAFFIC LANES

- A. Temporary traffic lanes shall be at least 10 feet wide. Provide an additional 2 feet of clearance from curbs. The length of temporary lanes should be limited to the area under construction and the distance necessary to divert traffic in accordance with the Standard Plans and Specifications, the CAMUTCD, and the approved Traffic Control Plan.

3.12 STAGING AREAS

- A. The Contractor shall provide his own staging areas.

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SECTION 02100

CLEARING, GRUBBING AND STRIPPING

PART 1 - GENERAL

1.1 WORK INCLUDED

- A.** Clearing the entire area within the limits of work of all rubbish, debris and other objectionable material, and disposal of same.
- B.** Stripping the entire area within the limits of work of all swamp grass, shrubs, weeds, and other vegetative growth of any nature, and disposal of same.
- C.** Grubbing the entire area within the limits of work of all vegetative material and disposal of same.
- D.** Removal of trees and preservation, care, and pruning of trees to remain in place.
- E.** Trimming of tree (limbs and tree roots) as may be required to construct the improvements.
- F.** Dust alleviation and control.
- G.** The work shall include the provision of all labor, materials, equipment and apparatus not specifically mentioned herein or noted on the plans, but which are incidental and necessary to complete the work specified.

1.2 JOB CONDITIONS

- A.** The Contractor will be held responsible for any damage to trees injured during construction, i.e., limb breakage, tearing of bark along trunk or excessive root damage
- B.** Contractor shall provide adequate dust alleviation and control measures at all times during the course of the work.

1.3 QUALIFICATIONS

- A.** All tree pruning and removal performed shall be executed by a company, having in full-time employment, an Arborist certified by the Western Chapter International Society of Arboriculture. Certification must be verified, and the Arborist must be directly responsible for decisions made, and should visit the work sites, as required.
- B.** Pruning shall be performed to the standards of the International Society of Arborists Pruning Guidelines, and to ANSI A-300.
- C.** Tree pruning shall not occur without first securing a "Heritage Tree" pruning permit for all trees meeting the Tree Preservation Ordinance's size description. Permit applications shall be submitted to the Public Works Services Department.

- D. Tree removal shall not occur without first securing a “Heritage Tree” Removal Permit. For regulations on size description, application procedure and fees, refer to the City’s Tree Preservation Ordinance available from the Planning Section.

1.4 APPLICABLE PUBLICATIONS

- A. Trees and Building Sites: Official Publication of the International Society of Arboriculture.
- B. Arboriculture: The care of trees and shrubs by Dr. Richard Harris.

PART 2 - PRODUCTS

NONE

PART 3 - EXECUTION

3.1 PERFORMANCE

- A. Clearing shall consist of the removal of ground cover of every nature including grass, shrubs, weeds, and vegetation that will otherwise impede construction operations, as approved by Engineer.
- B. At sites where the excavation has taken place near trees to remain, and many living roots remain exposed to the air, the contractor shall cover the exposed roots within 2 hours with sand, soil, moist burlap or other means acceptable to the Engineer.
- C. Spoils from the work site resulting from clearing, grubbing and stripping operations shall be removed from the entire limits of worksite and properly disposed of in accordance with applicable laws and regulations.

3.2 TREE PRUNING

- A. Tree pruning shall be performed to balance the crown and eliminate hazards. The main work performed shall be to reduce the sail effect through thinning, reducing end weights, shortening long heavy limbs, removing deadwood, weak limbs and sucker growth. Limbs shall be pruned back to an appropriate lateral branch.
- B. All final cuts shall be made at the outer edge of the branch collar per City Details. The pruning work shall be performed in a safe and proper manner, adhering to CAL-OSHA and ANSI Standards.
- C. The Contractor shall be responsible for the preservation of all public and private property. Pruning includes the cutting of limbs, cleanup, removal and disposal of cuttings and debris. Elm logs must be properly disposed of per State Quarantine. Work shall be performed by a two-man crew with one climber, one ground person, a dumping chipper truck and chipper, and any other necessary saws, lines, tools

and safety equipment. The work area shall have appropriate cones and signs for safe pedestrian and vehicle traffic.

3.3 TREE REMOVAL

- A.** Trees designated by the Engineer for removal shall be removed prior to the construction of the new improvements. The work shall be performed in a safe manner, adhering to CAL-OSHA and ANSI Standards. The work area shall have appropriate cones and signs for safe vehicle and pedestrian traffic. The contractor shall be responsible for the preservation of all public and private property. All wood shall be properly disposed of.
- B.** Stumps shall be ground to a minimum 8" below finished subgrade, including the removal of surface roots, all woody portions and stump debris, within 24" of the tree trunk.
- C.** For sidewalk repair work, trees shall be removed in the order designated by the Engineer, at least 2 weeks prior to start of work.

3.4 ROOT PRUNING

- A.** Tree roots greater than 3" in diameter and less than 12" below ground level shall not be cut without approval of the Engineer.
- B.** Roots shall be cut cleanly, as far from the trunk of the tree as possible, and not underneath the newly constructed sidewalk. Root pruning shall be to a depth of 18".
- C.** Root pruning shall be performed using a Vermeer Root Cutting Machine. Alternate equipment or techniques must be approved by the Engineer. Root pruning shall be completed prior to base or subgrade preparation.
- D.** Root pruning shall be completed prior to base or subgrade preparation, or to any excavation adjacent to the tree.
- E.** Excavation in an area where roots are present shall not cause the tearing or ripping of tree roots. Roots must first be cleanly severed prior to continuing with the excavation, or tunneled around to prevent damage to the root.
- F.** Tree roots shall not remain exposed to drying out. Root ends shall be covered with soil or burlap and kept moist until the final backfill or grade is established.

3.5 TREE PROTECTION

- A.** Construction materials, debris, washout water and stockpiles shall not be stored within the drip line or protective fencing area under any tree.
- B.** Vehicles shall not be parked under any tree within the drip line or protective fencing area.
- C.** Where vehicles or equipment must operate or travel under drip line or unpaved

landscape areas, Contractor shall place a minimum 10-inch layer of woodchips or other cushioning surface material approved by the Engineer before starting work there. This mulch layer shall be replenished as necessary to maintain a ten- inch depth until operations in this area are complete and shall be removed upon completion of work unless directed by Engineer. Where crane outriggers or other heavy equipment must be positioned in drip line or unpaved landscape areas, contractor shall provide additional protection against soil compaction and landscape damage. Means of providing additional protection may include placement of additional mulch, base rock, heavy timbers or steel plates. Contractor shall obtain Engineers approval for protective measures prior to placing or operating heavy equipment in unpaved landscape over the root areas of tress to remain.

- D. Where called for on the plans, place storm fence or other approved protective barriers around trees to be saved.

3.6 DUST ALLEVIATION AND CONTROL

- A. Contractor shall be responsible for providing pollution and dust abatement and control measures continuously during the course of the work.
- B. Contractor shall utilize reclaimed water, or dust palliatives, in compliance with the City's Water Conservation Ordinance.

3.7 CLEANUP

- A. Upon completion of clearing and stripping operations, the entire work site shall be cleaned of all construction debris, waste, rubbish of any nature.
- B. Contractor shall repair any damage to the existing irrigation system caused by the work and replace any portion of the existing irrigation system that is removed as a result of work per section 02910. Contractor shall incur these costs at own expense.
- C. Except where shown or specified otherwise, any lawn area or existing groundcover area disturbed by the work shall be restored to existing grade and replanted with sod or plants as those removed with Engineers approval.
- D. Construction debris, waste and rubbish remaining on-site upon completion of clearing and stripping operations shall become the property of the Contractor, and shall be removed from the work site and disposed of in a lawful manner.

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SECTION 02133

STORMWATER POLLUTION PREVENTION

PART 1 - GENERAL

1.1 WORK INCLUDED

- A.** Prohibit illicit discharge (non-rainwater) into the storm drain system.
- B.** Construct any and all necessary systems to eliminate contaminants from entering the storm water system.
- C.** Clean up and control of work site materials, spoils and debris.
- D.** Removal of contaminants produced by the project.
- E.** The work shall include the provision of all labor, materials, equipment and apparatus not specifically mentioned herein or noted on the plans, but which are incidental and necessary to complete the work specified.

1.2 APPLICABLE PUBLICATIONS

- A.** National Pollution Discharge Elimination system (NPDES) Permit No. CAS612008 - October 14, 2009, revised May 11, 2015.
- B.** California Storm Water Best Management Practice Handbooks:
 - 1. Municipal
 - 2. Industrial/Commercial
 - 3. Construction Activity
- C.** C.3 Stormwater Technical Guidance Ver. 4.1, October 2014.
- D.** California State Water Resources Control Board, Construction General Permit CAS000002 Order No. 2010-0014 DWQ (for sites greater than 1 (one) acre.

1.3 QUALITY ASSURANCE

- A.** All work performed under this contract and all contractors and their associates and/or employees are required to comply with all applicable storm water regulations and to implement Best Management Practices (BMP's) at all times.
- B.** A plan shall be submitted for the proposed control of contaminants entering the storm water system. The plan must be approved by the Engineer prior to the commencement of work.
- C.** All employees and subcontractors shall be trained on the storm water pollution prevention requirements contained in these specifications.

- D. A supply of spill clean-up materials such as rags or absorbents shall be kept readily accessible on-site.

1.4 ALLOWABLE DISCHARGES

- A. Under current NPDES regulations, the following discharges to the storm drainage system are permitted, as long as the discharges are not significant pollutants:
 1. Diverted stream flows, springs and natural drainage courses;
 2. Rising flood waters;
 3. Air conditioning condensation;
 4. Domestic water line and hydrant flushing; and
 5. Landscape irrigation.
- B. Groundwater from dewatering and foundation drains will need additional certification that the groundwater has been tested or evaluated for the presence of pollutants subject to non-stormwater discharge regulations. In such a case, a Special Sewer Discharge Permit shall be required for the water to be discharged to the Sanitary Sewer System, as directed.

PART 2 - PRODUCTS

NONE

PART 3 – EXECUTION

3.1 RECYCLING

- A. At the end of each working day, all scrap, debris and waste material shall be collected and materials disposed of properly.
- B. Dry, empty paint cans/buckets, old brushes, rollers, rags and drop cloths shall be disposed of in approved waste collection.
- C. Dumpsters shall be inspected for leaks. As leaks are detected, the trash hauling contractor shall be contacted to replace or repair dumpsters that leak.
- D. Water from cleaning dumpsters shall not be discharged on-site.
- E. Regular waste collection shall be arranged for before dumpsters overflow.

3.2 HAZARDOUS MATERIAL/WASTE MANAGEMENT/MATERIALS MANAGEMENT

- A. Designated areas of the project site shall be proposed by the contractor for approval by the Engineer suitable for material delivery, storage and waste collection as far from catch basins, gutters, drainage courses and creeks as possible.
- B. All hazardous materials such as pesticides, paints, thinners, solvents and fuels; and all hazardous wastes such as waste oil and antifreeze shall be labeled and stored in accordance with State and Federal regulations.

- C. All hazardous materials and all hazardous wastes shall be stored in accordance with secondary containment regulations, and it is recommended that these materials and wastes be covered as needed, to avoid potential management of collected rain water as a hazardous waste.
- D. The contractor shall dispose of all excess thinners, solvents, chemicals, oil-based and water-based paint as hazardous waste.
- E. Regular hazardous waste collection shall be arranged for to comply with time limits on the storage of hazardous wastes.
- F. Granular materials shall be stored a minimum of ten feet from the closest catch basin and curb return. The contractor shall not allow these granular materials to enter the storm drain or creek.
- G. Warning signs shall be posted in areas containing or treated with chemicals.
- H. An accurate up-to-date inventory, including Material Safety Data Sheets (MSDS) of hazardous wastes stored on site shall be kept and available to assist emergency response personnel in the event of a hazardous materials incident.
- I. Maintenance and fueling of vehicles and equipment shall be performed in a designated, bermed area, or over a drip pan that will not allow run-off of spills. Vehicles and equipment shall be regularly checked and have leaks repaired promptly. Secondary containment, shall be used to catch leaks or spills any time that vehicle or equipment fluids are dispensed, changed or poured.

3.3 CHEMICAL USAGE

- A. When rain is forecast within 24 hours, or during wet weather, the Engineer may prevent the contractor from applying chemicals in outside areas.
- B. Pesticides or fertilizers shall not be over-applied and material manufacturer's instructions shall be followed regarding uses, protective equipment, ventilation, flammability and mixing of chemicals. Over-application of a pesticide constitutes a "label violation" subject to an enforcement action by the San Mateo County Agriculture Commissioner.

3.4 DUST CONTROL

- A. Reclaimed water shall be used to control dust on a daily basis or as directed by the Engineer
- B. At the end of each working day, or as directed by the engineer, the roadways and on-site paved areas shall be cleaned and swept of all materials attributed to or involved in the work. Streets shall not be washed down into a storm drain or creek in lieu of street sweeping. Water wash may be picked up by a vacuum unit in lieu of sweeping.

3.5 SAWCUTTING

- A. The contractor shall cover or barricade catch basins using control measures such as

filter fabric, straw bales, sand bags and fine earthen dams to keep slurry out of the storm drain system. The contractor shall ensure that the entire opening is sealed.

- B. Sawcutting debris and spoils be removed by shovel, absorption, vacuum or pick up of waste prior to moving to the next location or at the end of each working day, whichever is sooner.
- C. If slurry enters a catch basin, the slurry shall be removed from the storm drain immediately.

3.6 DEWATERING OPERATIONS

- A. Water shall be routed through a control measure as determined and approved by the Engineer such as a sediment trap, sediment basin or Baker tank to remove settleable solids prior to discharge to the storm drain system. Filtration of the water following the control measure may be required on a case-by-case basis.
- B. The filtered water shall be reused for other purposes such as dust control or irrigation to the extent possible.
- C. If the project is within an area of known groundwater contamination, the water from dewatering operations shall be tested prior to discharge. If the water meets the Regional Water Quality Control Board standards, it may be discharged into the storm drain. With Sewer Authority Mid-Coastside (SAM) permit, water may be discharged into the sanitary sewer. Otherwise, the water shall be treated and hauled off-site for proper disposal.

3.7 CONCRETE GROUT AND MORTAR WASTE MANAGEMENT

- A. Concrete, grout and mortar shall be stored away from the drainage areas and ensure that these materials do not enter the storm drain system.
- B. Concrete trucks shall not be washed out into streets, gutters, storm drains, drainage channels or creeks.
- C. Concrete trucks and equipment shall be washed out off-site or in a designated area on-site where the water will flow onto dirt or into a temporary pit or bermed area. The water shall percolate into the soil and the hardened concrete placed in a waste container for disposal. If a suitable soil or bermed area is not available on-site, the wash water shall be collected and removed off-site and disposed of properly.
- D. Water created by the washing of exposed aggregate concrete finish shall be collected in a suitable dirt area or filtered through straw bales or equivalent material before entering the storm drain system. Sweepings from exposed aggregate finish shall be collected and disposed of in a waste container or removed off-site and disposed of properly.

3.8 PAVING OPERATIONS

- A. Catch basins and manholes shall be covered when paving or applying seal coat, tack coat, slurry seal or fog seal.

- B. The Engineer may direct the contractor to protect drainage courses by using control measures such as earth dike, straw bale and sand bag to divert run-off or trap filter sediment.
- C. Excess sand (placed as part of a sand seal or to absorb excess oil) shall not be swept or washed down into gutters, storm drains or creeks. The sand shall be collected and returned to the stockpile or disposed of in a trash container or hauled to an approved dump site. Water shall not be used to wash down fresh asphalt concrete.

3.9 PAINTING

- A. The cleaning of painting equipment and tools shall be performed in a designated area that will not enter the gutters, storm drains or creeks.
- B. Excess paint shall be removed from brushes, rollers and equipment prior to cleanup.
- C. Wash water from aqueous cleaning of water-based paint tools and equipment shall be disposed of in a sanitary sewer or onto a designated dirt area.
- D. Paint thinners and solvents from oil-based paints shall be filtered and re-used when possible. Waste sludge, thinner and solvent from cleaning tools and equipment shall be disposed of as a hazardous waste.

3.10 SITE CLEANUP

- A. The cleaning of equipment of materials shall not be performed on-site or in the street using soaps, solvents, degreasers, steam cleaning or equivalent methods.
- B. All cleanup must be performed in a designated area that will not allow the cleaning rinse to flow off-site or into streets, gutters, storm drains, or creeks.

* * *

SECTION 02202

TRENCHING AND BACKFILL

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. This section covers trenching and backfill requirements for buried piping systems specified in Storm Drainage - Section 02720; Sanitary Sewers -Section 02730; Irrigation Systems - Section 02910, Street and Safety Lighting -Section 16500. For Water Systems, refer to Coastside County Water District (CCWD) Standards.
- B. This Section also covers requirements for excavation and for compaction of succeeding layers after backfill has been placed around pipe.

1.2 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the general designation only.
- B. American Society for Testing and Materials (ASTM) Publications: C-33
Specification for Concrete Aggregates
C-36 Sieve Analysis of Fine and Coarse Aggregates
C-50 Portland Cement
C-260 Air Entraining Admixtures
D-424 Plastic Limit and Plasticity Index of Soils
C-618 Fly Ash and Raw or Calcined Natural Pozzolan for use as a Mineral
Admixture in Portland Cement
D-1557 Moisture-Density Relations of Soils and Soil Aggregate Mixtures
Using 10-lb. (4.54 KG) Rammer and 18-in. (457 mm) Drop
D-2419 Sand equivalent Value of Soils and Fine Aggregate
D-2487 Classification of soils for Engineering purposes
D-3017 Density of Soil and Soil Aggregate in Place by Nuclear Methods (Shallow
Depth)

1.3 SUBMITTALS

- A. Certified test reports for the permeable material backfill tested in accordance with ASTM C 136.
- B. Samples: Submit 1 gallon size sample of permeable material for approval.
- C. Shoring and Sheet piling Plan: Before starting work submit a CAL-OSHA permit for the shoring and sheet piling plan when trench excavation is five feet deep or more.
- D. Dewatering Plan: If required in the Special Conditions, before starting work submit a dewatering plan describing the basic components of the dewatering including silt control, etc.

- E. Traffic Plan: When work will occur on or adjacent to the right-of-way submit a Traffic Control Plan in accordance with Section 01550 72 hours in advance for approval prior to starting work.

1.4 QUALITY ASSURANCE

- A. Percentage of compaction specified shall be the minimum acceptable. The percentage represents the ratio of the dry density of the compacted backfill material to the maximum dry density of the material as determined by the procedure set forth in ASTM Designation D1557. For field density tests, ASTM D-3017 may be used.
- B. D-load or class of pipe requirements shown or called for on the plans shall be the minimum acceptable.

1.5 JOB CONDITIONS, PROTECTION, AND SHORING

A. Existing Utilities:

1. Unless shown to be removed, protect active utility lines shown on the Plans or otherwise made known to the Contractor prior to excavating. If damaged, repair or replace at the Contractor's expense. Pothole as required to verify utility location. Contractor shall be responsible for contacting all utility companies and coordinating any work which requires relocation or abandonment of existing utilities.
2. If active utility lines are encountered and are not shown on the Plans or otherwise made known to the Contractor, promptly take necessary steps to assure that service is not interrupted.
3. If a known service is interrupted as a result of work under this section, immediately restore service by repairing the damaged utility at Contractor's expense.
4. If foreseen or unforeseen existing utilities are newly found to interfere with the permanent facilities being constructed under this Contract, immediately notify the Engineer for directions.
5. Do not proceed with permanent repair or relocation of utilities until written instructions are received from the Engineer.
6. No construction water shall be disposed of in the City's storm drain system.
7. Comply with all conditions and requirements indicated and specified under the specific utility section of these specifications.

B. PROTECTION OF PERSONS & PROPERTY:

1. Install all necessary underpinning, shoring, lagging, cribbing, and bracing of ample strength to support adjoining soils, paving and structures. All such items shall be so constructed that they will not interfere with the building of any structural elements, and shall be removed upon completion of the shoring operation.
2. Barricade open depressions and holes occurring as part of this work, and post warning lights on property adjacent to or with public access.
3. Operate warning lights during hours from dusk to dawn each day and as otherwise required.

4. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by operations of Contractor.
5. No trenches shall be left open during non-working hours.
6. Install fences and barricades to secure the area from the public.

C. SHORING

1. The Contractor is solely responsible for all bracing and shoring. The Contractor shall forward their application for shoring to the California Division of Industrial Safety for their review. Contractor's application shall include the basic design, assumed soils conditions and estimation of forces to be resisted, together with plans and specifications of the materials and methods to be used, and shall be prepared by a Civil Engineer registered in California.
2. If an application for a shoring permit is required, no excavation in trench section or around structures shall proceed until the approved shoring plan has been received by the Engineer.

D. DEWATERING

1. Remove all water, including rain water, encountered during trench and sub-structure work to an approved location by pumps, drains, and other approved methods.
2. Keep excavations and site construction area free from water.

E. DUST CONTROL

1. Use means necessary to control dust on and near the work, and on and near off-site areas, if such dust is caused by the Contractor's operations during performance of the Work, or if resulting from the condition in which the Contractor leaves the site.
2. Thoroughly moisten surfaces as required to prevent dust being a nuisance to the public, neighbors, and personnel performing other work on the site.
3. Use dust palliatives or reclaimed water (not potable water).

F. Maintain access to adjacent areas at all times.

G. Maintain and/or replace all bench marks, monuments, construction stakes and other reference points.

H. Repair or restore damage to any portion of the work resulting from movement of the sides or bottom of trenches or other excavation which is attributable to the Contractor's acts or omissions, whether sides are braced or not.

PART 2 - PRODUCTS

2.1 GENERAL SOIL MATERIALS

A. In general, soils used for backfill shall be select material free of debris, roots, wood,

scrap material, vegetation, refuse, soft unsound particles, frozen, deleterious, or objectionable materials, satisfactory to the Engineer, free of stones or lumps exceeding 3 inches in greatest dimension.

2.2 PIPE BEDDING AND INITIAL BACKFILL MATERIAL

- A.** Pipe bedding and initial backfill up to six inches above the top of the pipe shall be Class I, Type A, ¾" maximum size gradation permeable material, conforming to Section 68-202F(2) of the State of California Department of Transportation Standard Specifications.
- B.** Material shall contain at least 75% of the particles having one or more fractured faces.
- C.** Bedding and backfill material shall be subject to the approval of the Engineer.

2.3 SELECT BACKFILL ABOVE INITIAL BACKFILL OR BEDDING

- A.** In non-paved areas unless otherwise shown on plans, select backfill shall conform to the requirements for soil materials above, and shall be classified as (GW), (GP), (GM), (SW), (SP) or (SM) by ASTM D 2487 and meet the following:
 - 1. Sand equivalent shall not be less than 25 when tested in accordance with ASTM D 2419, plasticity index shall not exceed 15 when tested in accordance with ASTM D 424, and not more than 25% by weight shall be finer than the No. 200 sieve.
 - 2. On-site native material may be used as backfill if it conforms to 2.03A.1, above.
- B.** In paved areas, select backfill shall be Class 2 aggregate base, ¾" maximum size gradation conforming to Section 26-1.02B of the State of California Standard Specifications.

2.4 SUBDRAIN MATERIAL

- A.** Where required for trench drainage and for subsurface drains, bedding shall conform to the requirements of Class 1, Type A Permeable material per Section 68 of State Standard Specifications.

2.5 CONTROLLED DENSITY FILL (CDF) (in trenches)

- A.** Controlled density fill will be accepted in lieu of the standard backfill specifications. It shall be mandatory in trenches eight (8) inches wide or less where the prevention of subsequent settlement after placement of backfill is required. CDF shall conform to the following requirements:
 - 1. Strength Requirements
 - a. Non-structural CDF that can be excavated by hand shall produce unconfined compressive 28 day strengths from 50 psi to a maximum of 150 psi. CDF that is to be excavated by hand shall contain aggregate no larger than ¾" top size nor shall the ¾" aggregate comprise more than 30% of the total aggregate content.
 - 2. Materials
 - a. Cement shall meet the standards as set forth in ASTM C-150, Type II Cement.

- b. Fly ash shall meet the standards as set forth in ASTM C-618, for Class F pozzolans. The fly ash shall not inhibit the entrainment of air.
 - c. Air entraining agent shall meet the standards as set forth in ASTM C-260.
 - d. Aggregates need not meet the standards as set forth in ASTM C-33. Any aggregate, producing performances characteristics of the CDF, for any project will be accepted for consideration as follows. The amount of material passing a #200 sieve shall not exceed 12% and no plastic fines shall be present.
3. Mix Proportions
- a. CDF shall be a mixture of cement, Class F pozzolan, aggregate, air entraining agent and water. CDF shall be batched by a ready mixed concrete plant and delivered to the job site by means of transit mixing trucks.
 - b. The actual mix proportions shall be determined by the producer of the controlled density fill to meet job site conditions, minimum and maximum strengths, and unit weight. Entrained air content shall be a minimum of 4.0%. The actual entrained air content shall be established for each job with the materials and aggregates to be used to meet the placing and unit weight requirements. Entrained air content may be as high as 20% for fluidity requirements.
4. Mix Design
- a. Mix design shall meet the Engineer's approval.

PART 3 - EXECUTION

3.1 GENERAL TRENCHING AND EXCAVATING

- A.** Trenches may be excavated either by hand, or mechanically. Trenches shall be cut with vertical sides, and shall be of sufficient width to provide adequate space for working therein; such space shall be a minimum clear distance of six (6) inches of shoring and a maximum of nine (9) inches clear of shoring on each side of the pipe barrel when the pipe is properly placed and aligned in conformity with the plans. Glory hole excavation or vee trenches will not be allowed. Trench sides shall be parallel to and at equal distance from the center-line of the pipe, when aligned in conformity with the plans.
- B.** Excavated material shall be loaded into trucks immediately upon removal from the trench to prevent stockpiling on roadways or walkways.
- C.** Where the excavated trench exceeds the widths specified above, furnish higher strength pipe, or other methods of construction as approved by the Engineer, to adequately provide for the increased loading, which the trench widening will cause. Stepped trenches shall meet the approval of the Engineer.
- D.** Pipe trenches shall be excavated to a depth below the bottom of the pipe sufficient to provide for pipe bedding materials as required by Section 3.02.
- E.** Where a trench has been excavated below the designed grade, the bottom of the trench shall be refilled to proper subgrade with approved material well compacted in place, in an approved manner.
- F.** The Engineer shall have the right to limit the amount of trench which is opened or

partially opened at any one time; and also to limit the amount of trench left without backfill, at any one time.

- G. No trench or holes shall be left open overnight. Use steel plates to protect open trenches overnight.
- H. Excavation for thrust blocks shall be neat to the line and dimensions shown or called for on the plans.
- I. Provide for dewatering trenches and excavations and subsequent control of ground water, utilizing such pumps or other equipment as may be necessary to control ground water and seepage until backfilling is completed.

3.2 GENERAL BEDDING

- A. Utilities shall be laid on a firm layer of firm bedding material not less than four (4) inches in depth as shown or as noted on the plans and detail drawings, except that bedding shall not be required for utilities two (2) inches or less in nominal diameter. Compact as specified herein.
- B. Upon completion of bedding operations and, prior to the installation of pipe or appurtenances, notify the Engineer who will then inspect the bedding layer. Pipe laying shall not commence until the bedding has been approved.

3.3 GENERAL BACKFILLING

- A. Backfill shall be as shown on the plans. Place in 6-inch maximum loose lifts to one foot above pipe unless otherwise specified. Bring up evenly on each side, and for the full length of the structure. Ensure that no damage is done to structures or protective coatings thereon. Place the remainder of the backfill in 8-inch maximum loose lifts unless otherwise specified. Compact each loose lift as specified in Paragraph 3.04 "General Compaction" before placing the next lift. Where unacceptable settlements occur in trenches and pits due to improper compaction, excavate to the depth necessary to rectify the problem, then backfill and compact the excavation as specified herein and restore the surface to the required elevation.
- B. No backfill shall be placed until the line has been inspected and approved for backfilling.

3.4 GENERAL COMPACTION

- A. Use hand-operated plate type vibratory or other suitable hand tampers in areas not accessible to larger rollers or compactors. Be careful to avoid damaging pipes and protective pipe coatings. Compaction shall be in accordance with the following unless otherwise specified. If necessary, the Contractor's selected equipment and construction procedure shall be altered, changed or modified in order to meet the specified compaction requirements.
- B. Initial backfill and bedding shall be carefully packed under the haunches of the pipe and brought up simultaneously on both sides so as to obviate any displacement of the pipe from its true alignment. Bedding shall be compacted in layers not more than eight (8) inches in thickness in a manner that will preclude moving the pipe, to not less than 95%

of maximum dry density as determined by the procedure set forth in ASTM Designation D1557. Jetting of backfill material will not be permitted.

- C. Select backfill above the initial backfill shall be placed in loose lifts not exceeding eight (8) inches in thickness before compaction, and compacted by the use of pneumatic tampers or other mechanical means approved. Water or dry, as required, to bring the soils as close as practicable to the optimum moisture content for proper compaction. Compaction equipment or methods that produce horizontal or vertical earth pressures which may cause excessive displacement or may damage the pipeline will not be permitted. Lifts of backfill shall be compacted to 95% of maximum dry density or greater as determined by the procedure set forth in ASTM Designation D1557. Jetting of backfill material will not be permitted.
- D. For flowable CDF, compaction is not necessary for placement. Trench sections may be filled in one lift above the initial backfill material in a manner which will; not disturb the line, prevent a misalignment, movement, floatation of or otherwise damage the utility.
- E. Backfill will be inspected and tested by the Engineer during placement. Contractor shall cooperate with the Engineer and shall provide working space for such tests in his operations. Backfill not compacted in accordance with these specifications shall be recompacted, or removed as necessary and replaced to meet specified requirements prior to proceeding with the work.

3.5 GENERAL BRACING AND SHORING

- A. The Contractor shall furnish, place and maintain such bracing and shoring as may be required to support the sides of the excavations for the proper protection of workmen; to facilitate the work; and to prevent damage to adjacent structures or facilities.
- B. Upon completion of the work, all bracing and shoring shall be removed, unless otherwise directed by the Engineer. Current requirements are for a maximum depth of 5 feet without CAL-OSHA approved shoring.

3.6 SPECIAL EARTHWORK REQUIREMENTS FOR SUBSURFACE DRAINS

- A. Excavate to the dimensions indicated.
- B. Provide a bedding surface of uniform density consisting of permeable material as indicated in paragraph 2.02 of this specifications section.
- C. Backfill around and over the pipes after pipe installation has been approved with permeable material to the depth indicated. Place in maximum loose lifts of 8 inches.
- D. Compact each lift with mechanical tampers or rammers. Compact bedding and backfill materials to 90% of ASTM D1557, Method D, maximum density. Place the remainder of the trench backfill as specified.

3.7 SPECIAL REQUIREMENTS FOR CONTROLLED DENSITY FILL (CDF)

- A. Applications of CDF include, but are not limited to: backfills, structural fills, insulating fills, road base, slab base, trench bedding, void and abandoned tank fills caisson and

pile fills, abandoned pipes and culverts.

- B. CDF shall be discharged from the mixer by any reasonable means into the area to be filled, including tremie methods or elephant trunk chutes. CDF shall be brought uniformly to the elevation as shown on the plans. Trench sections to be filled with CDF shall be contained at either end by bulkheads of earth fill.
- C. Permanent pavement may be placed directly upon the CDF as soon as it has sufficiently self-consolidated so that the surface will withstand the process of paving without displacement or disruption. If the placement of the CDF is not completed early enough to allow for permanent paving to be completed the same day, the contractor shall provide steel plates to span the trench and prevent traffic contact with the CDF overnight or until permanent paving can be placed.
- D. Compaction is not necessary when placing CDF.

3.8 FIELD QUALITY CONTROL

- A. The Engineer will inspect, test and approve trench backfill layers before further construction is permitted thereon. Number of tests required will be determined by the Engineer.
- B. If backfill has been placed, that is below the specified density, provide additional compaction with subsequent retesting until successful compaction is achieved.

3.9 DUST ALLEVIATION AND CONTROL

- A. Contractor shall be responsible for and shall provide pollution and dust abatement and control measures satisfactorily during the course of the work.
- B. The Contractor shall utilize reclaimed water, or dust palliatives, in compliance with the City's Water Conservation Ordinance.

3.10 FINISH OPERATIONS

- A. Pipes shall be laid to finished grades indicated on the plans.
- B. Dispose of all surplus material or material unsuitable for filling or grading off the site in a legal manner.
- C. Satisfactorily restore any existing improvements, paving, landscaping, and other utilities disturbed during the course of constructing the improvements.
- D. Existing traffic markings and control devices damaged or disturbed during construction shall be replaced or repaired to the satisfaction of the Engineer.

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SECTION 02206
ROCKSLOPE PROTECTION

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Clearing, grubbing and stripping work site.
- B. Grading and shaping of waterway or lagoon slopes.
- C. Placing borrow material for slope re-establishment.
- D. Placing rockslope protection on slopes.
- E. Dust alleviation and control.
- F. Cleanup and disposal of excess material.
- G. Supplying all labor, materials, equipment and apparatus not specifically mentioned herein or noted on the plans, but which are incidental and necessary to complete the work specified.

1.2 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specifications to the extent referenced. The publications are referred to in the text by the general designation only.
- B. American Society for Testing and Materials (ASTM) Publication:
 - D-1557 Moisture-Density Relations of Soils and Soil Aggregate Mixtures using 10-lb. (4.54 KG) Rammer and 18-in. (457mm) Drop.

1.3 QUALITY ASSURANCE

- A. Finish surface of the prepared rockslope subgrade shall not vary more than 0.15 feet from that called for on the plans or detail drawings when completed, and immediately prior to placement of the rockslope protection.
- B. Percentage of compaction specified shall be the minimum acceptable. The percentage represents the ratio of the dry density of the compacted material to the maximum dry density of the material as determined by the procedure set forth in ASTM Designation D1557.

1.4 JOB CONDITIONS

- A. Contractor shall accurately grade and prepare the rockslope section to the lines and grades called for on the plans and detail drawings.

- B. Fill required shall consist of suitable excavated material if available, and/or such imported borrow material as may be required for the work conforming to the requirements therefor.
- C. Contractor shall provide satisfactory dust alleviation and control measures continuously during the course of work.
- D. Surplus material including all waste, rubbish and construction debris shall be disposed of by the Contractor.

PART 2 - PRODUCTS

2.1 IMPORT MATERIAL FOR FILL

- A. Import material for fill shall conform to Section 02220, Grading and Earthwork.
- B. Materials not conforming to the above specifications and requirements shall remain the property of the Contractor and shall be removed from the job site as directed.

2.2 ROCK FOR ROCKSLOPE PROTECTION

- A. Rock shall be light grey in color and subject to approval by the Engineer.
- B. Size of aggregate shall conform to the following gradation:

Size (inches)	Percent Passing
9	100
8	98
7	78
6	50
5	30
4	6
3	2

- C. Aggregate shall be clean of dirt, clay and organic material.
- D. Rock shall have a minimum specific gravity of 2.50.
- E. Rock shall have a durability index of not less than 52 percent when tested in accordance with Test Method No. California 229.
- F. All the rock shall be supplied from the same source.

PART 3 - EXECUTION

3.1 PREPARATION

- A.** Prior to placing fill or rockslope protection, all areas shall have been stripped of all vegetation and other objectionable materials as directed.
- B.** The slope shall be graded to the elevations shown on the plans, and compacted as specified in Section 02220 of these Specifications.

3.2 PLACEMENT

- A.** Rock shall be placed at a nominal twelve (12) inch thickness measured perpendicular to the slope. The Contractor shall adjust spread rates to assure that this requirement is met.
- B.** Existing slopes shall be trimmed and graded as directed. In the event that erosion has taken place, regrade the slopes to the slope ratio shown on the plans, for a satisfactory rock placement.
- C.** Round boulders or cobbles shall not be allowed in the work. Angular shapes may be used. Flat or needle-shaped rocks will not be accepted unless the thickness of the individual pieces is greater than 1/3 the length.
- D.** Finished slope of the rock slope shall be as shown on the plans.
- E.** Rock shall not be stockpiled prior to placement higher than three (3) feet nor closer than fifteen (15) feet from the top of the bank.
- F.** Local surface irregularities of the slope protection shall not vary from the planned slopes by more than 6 inches measured at right angles to the slope.
- G.** Placing of rocks by dumping will not be permitted.

3.3 SITE DRAINAGE

- A.** Contractor shall be solely responsible for provision of adequate site drainage at all times during the course of the work.
- B.** All in-progress work within the construction area detrimentally affected by surface runoff shall be satisfactorily corrected to comply with Specification section 02133.

3.4 CLEANUP

- A.** Upon completion of rock slope protection operations, the Contractor shall thoroughly clean the rocks of all waste, rubbish and construction debris.
- B.** Surplus imported fill material remaining upon completion of rock slope protection operations shall be segregated as to type, and must be disposed of.

- C. Surplus rock slope material remaining upon completion of rock slope protection operations shall be transported off the site.

* * *

SECTION 02220

GRADING AND EARTHWORK

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Grading, earthwork and roadway excavation and/or fill.
- B. Subgrade preparation.
- C. Dust alleviation and control.
- D. Cleanup and disposal of excess material.
- E. Supplying all labor, materials, equipment and apparatus not specifically mentioned herein or noted on the plans, but which are incidental and necessary to complete the work specified.

1.2 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the general designation only.
- B. American Society for Testing and Materials (ASTM) Publications:
 - D 424 - Test Method for Plastic Limit and Plasticity index of Soils.
 - D 1556 - Test method for Density of Soil in place by Sand Cone Method.
 - D 1557 - Moisture-Density Relations of Soils and Soil Aggregate Mixtures Using 10lb (4.54 KG) Rammer and 18-in. (457mm) Drop.
 - D 2922 - Density of Soil and Soil Aggregate in Place by Nuclear Methods
 - D 2419 - Sand Equivalent Value of Soils and Fine Aggregate.

1.3 QUALITY ASSURANCE

- A. Finish surface of the graded and prepared subgrade shall not vary more than 0.10 feet from that called for on the plans or detail drawings when completed, and immediately prior to placement of the roadway structural section.
- B. Percentage of compaction specified shall be the minimum acceptable. The percentage represents the ratio of the dry density of the compacted material to the maximum dry density of the material as determined by the procedure set forth in ASTM Designation D1557.
- C. Submit test results on imported material to indicate conformance with these requirements.

1.4 JOB CONDITIONS

- A. Accurately grade and prepare the roadway subgrade section to the lines and grades called for on the plans and detail drawings with due provision for future surface improvements.
- B. Fill required shall consist of suitable excavated material if available, and/or such approved imported borrow material as may be required for the work conforming to these requirements.
- C. Provide dust alleviation and control measures satisfactory to the Engineer continuously during the course of the work.
- D. Surplus excavation material remaining upon completion of the grading and roadway subgrade preparation shall be segregated as to type, and must be transported and disposed off-site in a lawful manner.

PART 2 - PRODUCTS

2.1 SOIL AND AGGREGATE MATERIALS

- A. Site Fill and Backfill Materials - General:
 - 1. Provide various types of materials as specified herein and indicated on the Plans.
 - 2. In lieu of obtaining materials from on-site sources, approved import materials may be substituted or required.
 - 3. All fill and backfill materials shall be free of deleterious substances, large rocks, garbage, rubbish, wood or organic debris.
 - 4. All materials, regardless of source, are subject to approval prior to procurement or placement.
- B. Unclassified Locally Obtained or Imported Fill Beneath or Adjacent to Roadways and for Structural Backfill:
 - 1. Unless otherwise shown on the Plans, use suitable materials obtained from Contract excavation. Supplement with import materials, if required and authorized. Suitable materials shall be non-organic, native soil or soil-rock. Expansive silt and clay with L.L. greater than 50 is unsuitable fill material and shall not be used.
 - 2. No import materials for structural fill or embankment fill will be authorized until suitable materials from Contract excavation have been exhausted.

2.2 IMPORTED MATERIAL FOR FILL

- A. Material for fill shall consist of inert, granular soil and rock fragments supplied from previously tested and approved sources, and shall conform to the following specifications and requirements:
 - 1. All material shall be free of organic materials, trash and debris, expansive clays or any other deleterious materials, and shall be subject to the approval and acceptance of the Engineer.

2. The contractor shall designate his proposed import sources in advance and shall provide the source samples of material proposed to be furnished for evaluation.
3. Minimum "R" value shall be 25."R" values for acceptable import material shall be determined by the procedure set forth in Test Method No. California 301 of the State of California, Department of Transportation, and the material shall conform to the following gradation requirements:

Maximum particle size	4 inches
Percent passing 1-1/2" screen	50-100
Percent passing No. 4 screen	20-100
Percent passing No. 200 screen	10-30

4. Plasticity Index for acceptable import material shall be less than fifteen (15) when determined by the procedure set forth in ASTM Designation D424.
5. Sand Equivalent for acceptable import material shall be not less than twenty-five (25) when determined by the procedure set forth in ASTM Designation D2419.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Prior to placing fill, all areas shall be stripped of all vegetation and other objectionable materials to the satisfaction of the Engineer. Such areas shall then be scarified to a minimum depth of eight (8) inches, the scarified material conditioned to a moisture content that will permit compaction to the specified density, and compacted to a density of not less than ninety (90) percent of maximum dry density as determined by the procedure set forth in ASTM Designation D1557.
- B. Do not proceed with filling until the grade has been satisfactorily inspected.

3.2 PLACING AND COMPACTING FILL MATERIAL

- A. Control soil compaction during construction to provide the minimum percentage of density specified for each area as determined according to ASTM D-1556 or ASTM D-2922. All operations will be subject to the approval of the Engineer.
- B. Compact all fill material within one foot of finished grade by methods specified below, under paragraph "C," or by other methods, if approved by the City, so as to produce the specified minimum degree of compaction, as determined by ASTM D-1557. For a minimum depth of 8 inches below existing subgrade or fill placed under roadways or parking areas shall be compacted to 95 percent compaction. In landscaped areas, place and compact fill to 1" below the surface of adjacent curbs, walks and drives. Fill in landscape areas shall be compacted to 85 percent. Unless otherwise specified or indicated, all other fill shall be compacted to 90 percent.
- C. Spread fill material in uniform lifts not exceeding 8" in uncompacted thickness. Before

compaction begins, bring fill to a uniform water content within 1 to 3 percent of optimum by either: (1) aerating the material if it is too wet, or (2) spraying the material with water if it is too dry. Each lift shall be thoroughly mixed to ensure a uniform distribution of water content. If suitable compaction can be demonstrated, thickness of fill placement may be increased, subject to written approval of the Engineer.

- D. Remove and replace, or scarify and air dry soil material that is too wet to permit compacting to specified density. Soil material that has been removed because it is too wet to permit compacting may be temporarily stockpiled or spread and allowed to dry. Assist drying by discing, harrowing, or pulverizing, until moisture content is reduced to a satisfactory value as determined by moisture-density relation tests.
- E. Any fill that does not meet the specification requirements shall be removed and/or recompacted until the requirements are satisfied.

3.3 GENERAL GRADING & EARTHWORK

- A. Earthwork shall consist of excavating to the lines and grades called for on the plans and detail drawings.
- B. Materials shall be removed or placed to the lines and grades indicated for subgrade for roadway, curbs, gutters, driveways, walks or paths, and any other improvements called for on the plans and detail drawings. Materials shall be placed and compacted as specified above for fill material.

3.4 SUBGRADE PREPARATION UNDER PAVED AREAS

- A. After excavating to the subgrade elevation shown on the plans, and prior to installation of aggregate base, the entire work area shall be scarified to a minimum depth of eight (8) inches, wetted or dried to an appropriate moisture content, and compacted to the lines and grades called for on the plans and detail drawings at a density of not less than ninety five (95) percent of maximum dry density as determined by the procedure set forth in ASTM Designation D1557.
- B. The Contractor shall at all times maintain the subgrade surface in such condition as to readily drain effectively. Vehicular and equipment traffic shall be distributed across the prepared surface in such a manner as to prevent continual operation in one path. The Contractor shall repair any damage to the prepared subgrade.
- C. Storage or stockpiling of heavy loads on the roadway subgrade will not be permitted. Use only approved storage areas.
- D. The Contractor shall be responsible for any failure of the underlying native soils during the course of the work and shall repair any damage.
- E. Finished subgrade shall be subject to the approval of the Engineer and no select material or improvement shall be placed thereon until approval for same has been obtained.

3.5 FIELD QUALITY CONTROL

- A. The Engineer will inspect, test and approve subgrades and fill layers before further

construction is permitted thereon; and will conduct a sufficient number of tests chosen at Engineer's discretion to enable said Engineer to approve fill as it is placed. Areas to receive structural fills and all structural excavations shall be approved before covering or filling.

- B. If in the Engineer's opinion, based on the results of testing for subgrade or fills which have been placed and compacted below the specified density, the Contractor shall provide additional compaction testing at their costs until the affected subgrade or fill is approved.

3.6 DUST ALLEVIATION AND CONTROL

- A. The Contractor shall be responsible for and shall provide pollution and dust abatement and control measures continuously during the course of the work.
- B. The Contractor shall utilize reclaimed water, or dust palliatives, in compliance with the City's Water Conservation Ordinance.

3.7 DISPOSAL OF EXCESS MATERIAL

- A. Surplus materials and construction debris remaining upon completion of the work shall become the property of the Contractor unless otherwise specified herein or noted on the plans, and shall be removed from the work site by the Contractor and disposed of off-site in a lawful manner.

* * *

SECTION 02500

ASPHALT PAVING AND SURFACING

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Traffic control as required to divert vehicular and pedestrian traffic around construction.
- B. Spreading and compacting aggregate sub-base material.
- C. Spreading and compacting aggregate base material.
- D. Spreading and compacting asphalt concrete pavement and surfacing.
- E. Grinding existing pavement at conforms and for overlaying.
- F. Replacing asphalt concrete surfacing (Spot Reconstruction).
- G. Shoulder backing.
- H. Applying prime coat and tack coat.
- I. Dust alleviation and control.
- J. Cleanup and disposal of debris.
- K. Supplying all labor, materials, equipment and apparatus not specifically mentioned herein or noted on the plans, but which are incidental and necessary to complete the work specified.

1.2 APPLICABLE PUBLICATION

- A. The publications listed below form a part of this specification to the extent referenced. The publication is referred to in the text by the general designation only.
- B. American Society for Testing and Materials (ASTM) Publication: D-1557
Moisture-Density Relations of Soils and Soil
Aggregate Mixtures Using 10-lb. (4.54 KG) Rammer and 18-in.
(457mm) Drop.
- C. California Department of Transportation Testing Manual:
 - Test 304 Method of Preparation of Bituminous Mixtures for Testing
 - Test 375 Determining the In-Place Density and Relative Compaction of AC
Pavement

1.3 QUALITY ASSURANCE

A. Codes and Standards

1. Spreading and compacting of aggregate subbase material shall conform to the applicable provisions of Section 25 of the State Standard Specifications.
2. Spreading and compacting of aggregate base material shall conform to the applicable provisions of Section 26 of the State Standard Specifications.
3. Spreading and compacting of asphalt concrete shall conform to the applicable provisions of Section 39 of the State Standard Specifications.
4. Traffic Control shall conform to Section 01550 of these Specifications.

B. Allowable Tolerances

1. Finish surface of the aggregate base or aggregate subbase courses shall not vary more than 0.05 feet from the grade established by the Engineer.
2. Finish surface of asphalt concrete when measured with a twelve-foot straight edge shall not vary more than 0.01 feet in the longitudinal direction and 0.02 feet transversely below the lower edge of the straight-edge.
3. Percentage of compaction specified shall be the minimum acceptable. The percentage represents the ratio of the dry density of the compacted material to the maximum dry density of the material as determined by the procedure set forth in ASTM Designation D1557.

C. Submittals

1. For aggregate bases and sub-bases, the contractor shall arrange and provide for the following acceptance tests to be performed on samples taken at the job site, based on a frequency of one series of tests per 3000 tons of material placed or as directed by the Engineer:
 - a. "R" valve, per California Test Method 301;
 - b. Sieve Analysis, per California Test Method 202;
 - c. Sand equivalency, per California Test Method 217;
 - d. For aggregate bases, the durability index, per California Test Method 229.
2. Provide the Engineer daily with one (1) copy of a material certificate signed by material producer certifying that each material item complies with or exceeds the specified requirements for each type of material delivered.
3. Provide the Engineer with one (1) copy of certified plant load out slips for each load of material delivered showing net weight of aggregate base, subbase or asphalt concrete delivered to the job site, to be attached to the appropriate material certificate.
4. Submit a traffic detour plan and obtain approval prior to closing any traffic lane.

1.4 JOB CONDITIONS & MINIMUM TEMPERATURES

- A.** Aggregate base or subbase material shall not be placed until the subgrade has been approved.
- B.** Provide satisfactory dust alleviation and control measures continuously during the course of the work.

- C. Prime or tack coat materials shall not be applied unless the ambient temperature is above 50°F and has not been below 35°F during the twelve (12) hours immediately prior to application. Prime or tack coats shall not be applied when the surface to be coated is wet or contains an excess of moisture.
- D. Asphalt concrete shall not be applied unless the ambient temperature is above 50 degrees F and rising, the surface is dry, and upon specific approval by the Engineer.
- E. Temperature of asphalt concrete shall not be less than 250 degrees F during initial spreading.

PART 2 - PRODUCTS

2.1 AGGREGATE SUBBASE

- A. Materials for aggregate subbase shall conform to the requirements for Class 2 aggregate subbase contained in Section 25-1.02A of the State Standard Specification.

2.2 AGGREGATE BASE

- A. Materials for aggregate base shall conform to the requirements for Class 2 aggregate base contained in Section 26-1.02A of the State Standard Specifications.

2.3 ASPHALT CONCRETE

- A. Asphalt to be mixed with aggregate to form asphalt concrete shall be steam- refined paving asphalt, grade PG-64-10, conforming to the requirements of Section 92-1.02 and 1.03 of the State Standard Specifications.
- B. Aggregate for asphalt concrete shall be Type A conforming to the requirements of Section 39-2.02 of the State Standard Specifications with the following special provisions:
 - 1. Grading of combined aggregates for new asphalt concrete pavement, walkways, and overlays two (2) inches or more in thickness shall be three-quarter (3/4) inch maximum size, medium grading.
 - 2. Grading of combined aggregate for asphalt concrete pavement, walkways and overlays less than two (2) inches in thickness shall be one half (1/2) inch maximum size, medium grading.
- C. Liquid asphalt for prime coat shall be Grade SS-1 conforming to the requirements of Section 94 of the State Standard Specifications.
- D. Asphaltic emulsion for tack coat (paint binder) shall be emulsified asphalt, Type SS-1h conforming to the requirements of Section 94-1.01 through 1.05 of the State Standard Specifications.

- E. Suppliers' certification showing conformance to these specifications shall be delivered with each shipment of materials to the job site.

2.4 REINFORCING FABRIC

- A. Reinforcing fabric, if required by the plans, shall conform to Section 88 of the State Standard Specifications.
- B. At least one side of the reinforcing fabric shall be heat bonded, or heat set.

PART 3 - EXECUTION

3.1 AGGREGATE SUBBASE

- A. Subbase material shall be placed, spread and compacted in conformance with the requirements of Section 25-1.04 and 1.05 of the State Standard Specifications.
- B. Subbase material shall be compacted to a relative density of not less than 95% when tested in accordance with the requirements of ASTM 1557.

3.2 AGGREGATE BASE

- A. Base material shall be placed, spread and compacted in conformance with the applicable requirements of Section 26-1.035, 1.04 and 1.05 of the State Standard Specifications.
- B. Base material shall be compacted to a relative density of not less than 95% when tested in accordance with the requirements of ASTM 1557.

3.3 PRIME, TACK COATS, AND SURFACE PREPARATION

- A. Liquid asphalt prime coat shall then be applied to the aggregate base course in conformance with the requirements of Section 39-4.02 of the State Standard Specifications. Prime coat shall be applied at the rate of 0.25 gallons per square yard unless otherwise directed. After the liquid asphalt has penetrated the base course, any excess standing on the surface shall be absorbed to the satisfaction of the Engineer with a suitable coating of clean sand.
- B. Tack coat shall be applied to all vertical surfaces of existing pavement, curbs, gutters, catch basins, manhole frames, and construction joints in the surfacing to the horizontal surface of all existing pavements to be resurfaced and other surfaces designated. Asphaltic paint binder shall be provided in sufficient quantity to produce a thin, uniform black, glossy coat of asphalt. Pools in unevenly distributed material shall be spread out by squeegee, broom or other means so an even coverage is attained. Immediately in advance of placing HMA, apply additional tack coat to damaged areas or where loose or extraneous material is removed. Do not track tack coat onto pavement surfaces beyond the job site. Discontinue application of emulsion early enough to comply with lane closure specifications and daily work advancement. Do not track tack coat onto pavement surfaces beyond the job site.

- C. Distributed areas shall be redistributed by means of hand brooms. Tack coat shall be applied in conformance with the applicable requirements of Section 39- 4.02 of the State Standard Specifications.
- D. Prior to placing asphalt over existing pavement, sweep the pavement clean of loose dirt to the satisfaction of the Engineer.

3.4 ASPHALT CONCRETE

- A. Asphalt concrete shall be proportioned, mixed, placed, spread and compacted in conformance with the applicable requirements of Section 39-3 and 39-6 of the State Standard Specifications and the following requirements:
 - 1. Asphalt concrete shall be placed only upon specific approval of the Engineer. When, in the opinion of the Engineer, the surface is too wet, no asphalt concrete shall be placed. The Engineer will make the final decision as to whether conditions are satisfactory for paving.
 - 2. No asphalt concrete surface course shall be placed when the ambient temperature is less than 50° F. All compaction shall be completed before the temperature of the mixture drops below 200°F.
 - 3. All longitudinal joints shall be "hot" joints; cold joints are only allowed transversely at discontinuance of the day's run.
 - 4. Asphalt concrete for roadways shall be placed in layers when the total depth called for on the plans and detail drawings exceeds two (2) inches. The final layer shall not be less than one and one-half (1-1/2) inches in compacted thickness no more than two (2) inches. Where more than four and one-half (4-1/2) inches in total compacted thickness are specified, three (3) or more layers shall be required. The first lower layer shall not exceed two and one-half (2-1/2) inches in compacted thickness.
 - 5. All asphalt courses shall be placed by means of an approved self-propelled asphalt paving machine. Contractor may place lower courses and compact all courses with equipment conforming to the requirements of Section 39-5 of the State Standard Specification.
 - 6. The window/pick-up machine method for spreading asphalt may be used with the following restrictions:
 - a. The machine is self-supporting and may not transmit loads to the paving machine. The use of a track type machine is recommended.
 - b. The maximum window length in front of the paving machine shall be 200-feet, and shall not block intersections.
 - c. The Contractor shall furnish a "Dump Man" for the control of window distribution.
 - d. At the sole discretion of the Engineer, depending on ambient temperature and the length of haul, the loaded trucks must be covered with a tarp.
 - e. Any damages to the reinforcing fabric caused by the pick-up machine shall be repaired before the work is allowed to continue.
 - f. At the sole discretion of the Engineer, depending on traffic control operations, the use of double-bottom dump trucks may be prohibited.

7. Where asphalt paving is to be laid against concrete gutter, the first pass shall start at the gutter and successive passes work towards the center of the street, and the finish surface of the asphalt concrete wearing course shall be constructed to a height one-quarter (1/4) inch above the abutting edge of the gutter.
 8. Trucks, loaded or empty, shall not be allowed on the new surface until the asphalt concrete reaches ambient temperature.
- B. The final lift of asphalt paving shall not be placed until all other construction activity, including building construction and landscaping is completed.
 - C. When placing asphalt over existing pavement, repair large cracks, spalls, and chuck-holes, and clean the pavement surface to the satisfaction of the City Engineer.
 - D. Asphalt concrete shall be rolled such that compaction after rolling shall be 95% of the density obtained with the California Test 304. Field density tests may be conducted by the Engineer to confirm density using the California Test 375.
 - E. Failure to meet the specified density may require credits back to the City for non-conformance.

3.5 ADJUST MANHOLES, VALVES, AND MONUMENT COVERS

- A. Existing manholes, lampholes, valve and monument covers, or other such structures in the line of the work shall be adjusted to conform with the new grade after completion of paving operations.
- B. The box will be adjusted by removing the existing concrete pad and pouring a new pad of concrete.
- C. The concrete collar shall be circular and shall be covered with a minimum of two (2) inches of asphalt concrete to blend in with the adjacent surfacing.
- D. Extension rings will not be acceptable. Contractor shall be responsible for preserving the survey point in its original position.

3.6 ASPHALT PLANING

- A. The depth, width, and shape of the cut shall be as shown on the plans by a project-specific detail, or if there is no project-specific detail, as shown on City Standard Engineering Detail A-6.
- B. Asphalt planing operations shall provide a final cut resulting in a uniform surface conforming to the typical cross sections, and be performed without damage to the surfacing to remain in place.
- C. For overlay, plane as necessary to allow a minimum overlay of two (2) inch to new elevations.
- D. Where transverse joints are planed in the pavement at conform lines no drop-off shall remain between the existing pavement and the planed area when the pavement is opened to public traffic. If asphalt concrete has not been placed to the level of existing pavement before the pavement is to be opened to public traffic a temporary asphalt concrete taper shall be constructed. Asphalt concrete for

temporary tapers shall be placed to the level of the existing pavement and tapered on a slope of 1:30 (Vertical: Horizontal) or flatter to the level of the planed area.

- E. The contractor will be held responsible for any and all damage to trees, plants, and shrubs caused by the grinding operation and shall satisfactorily replace with new material or correct any damage.
- F. Ground asphalt concrete shall be removed from the job site and disposed of immediately following the grinding operation.
- G. Ground areas shall be overlaid within one week of grinding.

3.7 ASPHALT CONCRETE SPOT RECONSTRUCTION

- A. This work shall consist of removing existing asphalt concrete surfacing and underlying base material and replacing the removed surfacing and base material with new asphalt concrete as shown on the plans and specified in these technical specifications.
- B. The exact limits of asphalt concrete surfacing to be removed and replaced will be determined by the Engineer.
- C. Existing surfacing and underlying base material removed during a work period shall be replaced before the lane is to be opened.
- D. A four-foot wide grind is required as shown on the plans and directed by the Engineer.
- E. Surfacing and base material shall be removed without damage to surfacing that is to remain in place. Damage to pavement which is to remain in place shall be repaired to a condition satisfactory to the Engineer.
- F. The material remaining in place, after removing surfacing and base material to the required depth, shall be graded to a plane, watered, and compacted.
 - 1. The finished surface of the remaining material shall not extend above the grade established by the Engineer
 - 2. Areas of the base material which are low or beyond the area approved by the Engineer as a result of over excavation shall be filled, at the Contractor's expense, with asphalt concrete.

3.8 SHOULDER BACKING

- A. Shoulder backing shall be applied as shown on the plans, in conformance with the applicable provisions of sections 24 and 26, "Lime Stabilization" and "Aggregate Bases" of the State Standard Specifications, and these technical specifications.
- B. Work shall consist of placing a compacted layer of lime treated, Class 2 aggregate base on the shoulder of the roadway, in areas shown on the plans or as directed by the Engineer. Affected shoulder areas generally consist of previously disturbed aggregate and dirt adjacent to the paved roadway.

- C. Shoulder backing shall be four feet in width and two inches in height, unless otherwise shown on the plans or directed by the Engineer.

3.9 REINFORCEMENT FABRIC

- A. Reinforcing Fabric shall be installed in accordance with Section 39-4.03 of the State Standard Specifications.
- B. Fabric which may have become damaged by paving equipment shall be satisfactorily repaired prior to proceeding with the paving operation.
- C. Install fabric with bonded side up.
- D. At each utility cover which would be covered with fabric, the fabric shall be neatly cut around the cover to allow for raising of the cover to finish grade.

3.10 SPEED HUMPS/TABLES

- A. Install speed humps/tables where shown on the plans using hot mix asphalt concrete, 3/8" maximum size gradation.
- B. Apply tack coat to existing pavement prior to laying asphalt.
- C. Spread asphalt by hand using a template/screed approved by the Engineer to the dimensions shown.
- D. Compact the humps/tables using an 8-ton static roller.
- E. Multiple lifts may be required at the discretion of the Engineer, in order to accomplish the design tolerances. In which case, multiple templates or screeds may be required.
- F. The cross-section of the humps/tables shall not vary by more than 0.25" from the design height.

3.11 DUST ALLEVIATION AND CONTROL

- A. Contractor shall provide satisfactory pollution and dust abatement and control measures continuously during the course of the work.
- B. The Contractor shall utilize reclaimed water, or dust palliatives, in compliance with the City's Water Conservation Ordinance.

3.12 TRAFFIC CONTROL AND STRIPING

- A. Provide satisfactory traffic control measures and warning devices to safely detour traffic around construction activity in accordance with Section 01550 of these Specifications.
- B. If the street is to be opened for traffic, or as directed by the Engineer, temporary delineation shall be placed on new surfaces immediately after the asphalt concrete has been finished rolled. Temporary delineation shall conform to Section 02840 of these Specifications.

3.13 CLEANUP

- A.** Upon completion of asphalt paving and surfacing operations, the entire work site shall be cleaned of all waste, rubbish, and construction debris of any nature.

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SECTION 02544

CRACK TREATMENT

PART 1 – GENERAL

1.1 SCOPE

- A. This specification covers the materials, equipment, construction and procedures for treating cracks in asphalt concrete pavement including shoulders and parking areas

PART 2 – PRODUCTS

2.1 GENERAL

- A. Crack treatment shall be hot-applied and conform to the table in part 2.02

2.2 MATERIALS/MIX DESIGN/TESTING

Crack Treatment Material

Quality Characteristic	ASTM Test Method ^a	Type 2 Material
Softening point (min.)	D 36	96 °C
Cone penetration at 77°F (max.)	D 5329	40
Resilience at 77°F, unaged, %	D 5329	25-65
Flexibility ^b	D 3111	0 °C
Tensile adhesion, %, (min.)	D 5329	400
Specific gravity (max.)	D 70	1.25
Asphalt compatibility	D 5329	Pass
Sieve test (percent passing)	See note c	100

Notes:

- a. Except for viscosity, cure each specimen at a temperature of 23 °C ± 2 °C and relative humidity of 50 ± 10 percent for 24 ± 2 hours before testing.
- b. For flexibility test, the specimen size must be 6.4 ± 0.2 mm thick x 25 ± 0.2 mm wide x 150 ± 0.5 mm long. Test mandrel diameter must be 6.4 ± 0.2 mm. Bend arc must be 180 degrees. Bend rate must be 2 ± 1 seconds. At least 4 of 5 test specimens must pass at the specified test temperature without fracture, crazing, or cracking.
- c. For hot-applied crack treatment, dilute with toluene and sieve through a No. 8 sieve. If the manufacturer provides a statement that added components passed the No. 16 sieve before blending, this requirement is void.

If crack treatment material is delivered to the job site in containers, each container must be marked with the following information. If crack treatment material is not delivered in containers, the following information must accompany the delivery:

1. Manufacturer's name
2. Production location
3. Product brand or trade name
4. Product designation
5. Crack treatment trade name
6. Batch or lot number
7. Maximum heating temperature
8. Expiration date for cold application only

Hot-applied crack treatment must be delivered to the job site premixed in cardboard containers with meltable inclusion liners or in a fully meltable package.

PART 3 – EXECUTION

3.1 SURFACE PREPARATION

- A.** Treat cracks from 1/4 to 1 inch in width for the entire length of the crack. Fill or repair cracks wider than 1 inch as directed by the Engineer.
- B.** Cracks must be clean and dry before treating. Before treating, blast cracks with oil-free compressed air at a pressure of at least 90 psi.
- C.** If the pavement temperature is below 40 °F or if there is evidence of moisture in the crack, use a hot air lance immediately before applying crack treatment. The hot air lance must not apply flame directly on the pavement.

3.2 APPLICATION AND WORKMANSHIP

- A.** Heat hot-applied crack treatment material in compliance with the manufacturer's instructions. Comply with the manufacturer's application instructions.
- B.** Insert crack treatment with a nozzle inserted into the crack. Fill the crack so that it is recessed less than 1/4 inch.
- C.** Immediately remove crack treatment material spilled or deposited on the pavement surface.

* * *

SECTION 02550

CONCRETE IMPROVEMENTS

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Traffic control as required to divert vehicular and pedestrian traffic around the construction.
- B. Mixing and transporting Portland Cement Concrete.
- C. Forming concrete.
- D. Placing and finishing concrete.
- E. Curing concrete.
- F. Protecting concrete improvements.
- G. Steel Reinforcement.
- H. Dust alleviation and control.
- I. Cleanup and disposal of debris.
- J. Supplying all labor, materials and equipment not specifically mentioned herein or noted on the plans, but which are incidental and necessary to complete the work specified.

1.2 APPLICABLE PUBLICATION

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the general designation only.
- B. American Society for Testing and Materials (ASTM) Publication:
 - A - 82 Cold Drawn Steel Wire for Concrete Reinforcement.
 - A - 185 Steel Welded Wire Fabric, Plain, for Concrete Reinforcement.
 - A - 615 Deformed and Plain Billet Steel Bars for Concrete Reinforcement.
 - C - 94 Specification for Ready-mixed Concrete.
 - C - 114 Method for Chemical Analysis of Hydraulic Cement.
 - C - 150 Portland Cement.
 - C - 452 Test Methods for potential Expansion of Portland Cement Mortars exposed to Sulfate.
 - C - 618 Fly Ash and Raw or Calcined Natural Pozzolan for use as a Mineral Admixture in Portland Cement.
 - C - 1751 Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction. (Non- extruding and Resilient Bituminous Types)

1.3 QUALITY ASSURANCE

- A. Compressive strength and cement content for the class of Portland Cement Concrete herein designated shall be the minimum acceptable.
- B. No concrete for concrete improvements shall be placed until the subgrade, the forms, and reinforcement have been approved.
- C. Color and surface texture of decorative concrete paving or surfacing shall closely match the approved sample for the work.

D. Codes and Standards:

1. Proportioning of Portland Cement concrete shall conform to the applicable provisions of Section 90-5 of the State Standard Specifications.
2. Mixing and transporting of Portland Cement Concrete shall conform to the applicable provisions of Section 90-6 of the State Standard Specifications.
3. Curing of Portland Cement Concrete shall conform to the applicable provisions of Sections 90-7.03 and 90-8.02 of the State Standard Specifications.
4. Protection of Portland Cement Concrete shall be provided in conformance with the applicable provisions of Section 90-8 of the State Standard Specifications.
5. Forming of concrete for improvements shall conform to the provisions of Section 73-1.04 of the State Standard Specifications forming for cast-in- place structures shall conform to Section 51-1.05 of the State Standard Specifications.
6. Placing of concrete improvements shall conform to the provisions of Sections 73-1.05 and 73-1.05A, of the State Standard Specifications; placing of concrete for cast-in-place concrete structures shall conform to Section 51-1.09 of the State Standard Specifications.
7. Finishing of cast-in-place concrete structures shall conform to the provisions of Section 51-1.18 of the State Standard Specifications. Finishing of concrete improvements shall conform to Section 73 of the Standard Specifications. Unless otherwise called for on the plans, all buried surfaces shall have "Ordinary Surface Finish" all exposed surfaces shall have "Class 1 Surface Finish".
8. Placing of steel reinforcement shall conform to the requirements of Section 52-1.07 of the State Standard Specifications.
9. Splicing of steel reinforcement shall conform to the requirements of Section 52-1.08 of the State Standard Specifications.

E. Certifications

1. At the time of delivery provide certificates of compliance signed by both Contractor and Supplier containing the following statements:
 - a. Materials supplied comply with the specification in all respects.
 - b. Proportioning and mixing is in compliance with a design mix which has been field tested in accordance with the herein requirements and produces the required compressive strength under like conditions.

- c. Statement of type and amount of any admixtures.
 - d. All certificates shall include the Material and Supplier's mix design number.
2. At time of delivery provide certified delivery ticket stating volume of concrete delivered and time of mixing, or time of load-out in case of transit mixers.

1.4 JOB CONDITIONS

- A.** Admixtures shall not be used except upon the prior written permission of the Engineer and, if permitted, the concrete containing same will be subject to the same compliance testing as herein specified for the various classes of concrete.
- B.** Temperature of mixed concrete, immediately prior to placement, shall not be less than 50° F, nor more than 90°F. Aggregates and water shall be heated or cooled at the mixing plant by supplier as necessary to produce concrete within these limits. Neither aggregates nor mixing water shall be heated to exceed 150°F.
- C.** No additional mixing water shall be incorporated into the concrete during transport or after arrival at the work site unless such water is specifically authorized by the Engineer. If authorization to add mixing water is obtained and mixing water is added to the mix, the mixer drum shall then be revolved a minimum of thirty (30) revolutions.
- D.** Hand mixing of Portland Cement Concrete shall not be allowed except upon prior written approval.
- E.** Where a portion of existing concrete improvements is to be reconstructed, the section to be removed shall first be a cut with an approved concrete saw to a minimum depth of one-half the depth of the existing concrete at the first score line beyond the area to be replaced.
- F.** Where concrete removal is required, it shall be removed to the nearest score line of joints.
- G.** Prior to placing concrete for concrete structures, Contractor shall first secure approval of the forms and any required reinforcement.

PART 2- PRODUCTS

2.1 AGGREGATE FOR PORTLAND CEMENT CONCRETE

- A.** Aggregates for Portland Cement Concrete shall conform to the requirements of Section 90-2.02A and B of the State Standard Specification.
- B.** Unless otherwise specified or called for on the plans for the work, aggregate size and gradation for Portland Cement Concrete shall conform to the requirements of Section 90-3.04 of the State Standard Specifications for one inch (1") maximum combined aggregate.

2.2 WATER FOR PORTLAND CEMENT CONCRETE

- A.** Water for mixing and curing concrete and for washing aggregates shall conform to the requirements of Section 90-2.03 of the State Standard Specifications.

2.3 CEMENT FOR PORTLAND CEMENT CONCRETE

- A.** Cement for Portland Cement Concrete to be placed in roadway improvements such as curbs, gutters, walks, valley gutters, driveways, surface and subsurface pads or slabs shall be Type V or Type II (modified) cement conforming to the requirements of ASTM Designation C150, with the following modifications:

1. The cement shall not contain more than 0.60% by weight of alkalis, calculated as the percentage of Na_2O plus 0.658 times the percentage of K_2O when determined by either direct 4 intensity flame photometry or by the atomic absorption method. The instrument and procedure used shall be qualified as to precision and accuracy in accordance with the requirements of ASTM Designation C114.
2. The autoclave expansion shall not exceed 0.50%.
3. Mortar, containing the Portland Cement to be used and the sand, when tested in accordance with Test Method No. Calif 527, shall not expand in water more than 0.010% and shall have an air content less than 048%.
4. Allowable tri-calcium Aluminate (C_3A) by weight shall not exceed 5%. Allowable tetracalcium alumino ferrite plus twice the tricalcium aluminate ($\text{C}_4\text{AF}+2\text{C}_3\text{A}$) by weight shall not exceed 25%. The sulfate expansion test (ASTM C452) may be used in lieu of the above chemical requirements, provided the sulfate expansion does not exceed 0.040% at 14 days (max).
5. The Contractor may substitute pozzolan for Portland Cement in amounts up to 15% of the required mix unless high early strength concrete is specified. Pozzolan shall consist of Class F fly ash meeting the requirements of ASTM C618.

- B.** Cement for Portland Cement Concrete to be placed in surface improvements shall contain a coloring compound equivalent to 1/4 pound of lampblack per cubic yard, added to the concrete at the central mixing plant.

- C.** Liquiblack, as supplied by Concrete Corporation of Redwood City, California, may be used in lieu of lampblack. One pint of liquiblack shall be considered equal to one pound of lampblack.

2.4 CLASSIFICATION OF PORTLAND CEMENT CONCRETE

- A.** Portland Cement Concrete shall be classified Class "A" or according to the compressive strength requirements specified in Section 90 of the State Standard Specifications.
- B.** Portland Cement Concrete not conforming to the above classification or having required minimum compressive strengths other than those set forth above, shall conform to requirements to be set forth for same noted on the plans or detail drawings.

2.5 EXPANSION JOINT MATERIAL

- A.** Material for expansion joints in Portland cement concrete improvements shall be

premolded expansion joint fillers of the thickness called for on the plans and conforming to the requirements of ASTM Designation D1751. Expansion joint material shall be shaped to fit the cross section of the concrete prior to being placed. Suppliers certificates showing conformance with this specification shall be delivered with each shipment of materials delivered to the job site.

2.6 REINFORCEMENT AND DOWELS

- A.** Bar reinforcement for concrete improvements shall be deformed steel bars of the size or sizes called for on the plans conforming to the requirements of ASTM Designation A615 for Grade 60 bars. Size and shape for bar reinforcement shall conform to the details shown or called for on the plans.
- B.** Slip dowels, where noted or called for on the plans or detail drawings shall be smooth billet-steel bars as designated and conforming to the requirements of ASTM Designation A615 for Grade 60 bars. Ends of bars inserted in new work shall be covered with a cardboard tube sealed with cork; no grease or oil will be used.
- C.** Mesh for reinforcement for concrete improvements shall be cold drawn steel wire mesh of the size and spacing called for on the plans conforming to the requirements of ASTM Designation A82 for the material and ASTM Designation A185 for the mesh. Size and extent of mesh reinforcement shall conform to the details shown or called for on the plans.
- D.** Tie wire for reinforcement shall be eighteen (18) gauge or heavier black annealed conforming to the requirements of ASTM Designation A82.
- E.** Suppliers certificates showing conformance with this specification shall be delivered with each shipment of materials delivered to the job site.

2.7 COLOR AND PATTERN FOR DECORATIVE PAVEMENT

- A.** Colors for decorative pavement and surfacing shall be CHROMIX admixtures as manufactured by the L. M. Scofield Company, Schedule A-312.05 or approved equal. The specific color shall be as designated or called for on the plans.
- B.** Curing compound for color conditioned decorative pavement shall be LITHOCHROME colorwax as manufactured by the L. M. Scofield Company or approved equal.
- C.** Patterns for decorative pavement or surfacing shall be standard "Bomanite" patterns as copyrighted by the Bomanite Corporation of Palo Alto, California or equal. The specific pattern shall be as designated or called for on the plans.

2.8 ACCESSORY MATERIALS

- A.** Materials for water stops and other items required in the placement of Portland Cement Concrete shall conform to the applicable requirements of Section 51 of the State Standard Specifications unless otherwise specifically noted or called for on the plans or detail drawings.
- B.** Curing compound for use on exposed surfaces of Portland Cement Concrete shall be "Non-Pigmented Curing Compound - chlorinated Rubber Base-Clear" conforming to the

requirements contained in Section 90-7.01B of the State Standard Specifications.

2.9 MATERIAL FOR FORMS

- A. Material for forms for cast-in-place concrete shall conform to the requirements of Section 51-1.05 of the State Standard Specifications.

PART 3 - EXECUTION

3.1 STRUCTURAL EXCAVATION

- A. Structural excavation may be either by hand, or by machine and shall be neat to the line and dimension shown or called for on the plans. Excavation shall be sufficient width to provide adequate space for working therein, and comply with CAL-OSHA requirements.
- B. Where an excavation has been constructed below the design grade, the bottom of the excavation shall be backfilled to grade with approved material and compacted in place to 95% of the maximum dry density.
- C. Surplus excavation material remaining upon completion of the work shall be either removed from job site, or conditioned to optimum moisture content and compacted as fill at the site.

3.2 BRACING AND SHORING

- A. The Contractor shall furnish, place and maintain such bracing and shoring as may be required to support the sides of the excavations for the proper protection to workmen; to facilitate the work; to prevent damage to adjacent structures or facilities. Upon completion of the work, all bracing and shoring shall be removed, unless otherwise directed.
- B. The Contractor is solely responsible for all bracing and shoring and shall, if required, submit an application and supporting data for an effective shoring system to the Engineer. The Engineer may forward the application to the California Division of Industrial Safety for design, assumed soils conditions, and the estimation of forces to be resisted, together with plans and specifications of the materials and methods to be used. The application shall be prepared by a Civil Engineer registered in California. No excavation around cast-in-place concrete structures shall proceed until the Contractor has received the return of an approved application, if required.

3.3 FORMS FOR CONCRETE

- A. Concrete improvements shall be formed with a smooth and true upper edge and the side of the form shall be placed next to concrete with a smooth finish. Forms shall be constructed or made rigid enough to withstand the pressure of the fresh concrete to be placed without any distortion.
- B. All forms shall have been thoroughly cleaned prior to placement and shall be coated with an approved form oil sufficient to prevent adherence of concrete prior to placing.
- C. Forms shall be carefully set to the alignment and grade established and shall conform to

the required dimensions. Forms shall be rigidly held in place by stakes set at satisfactory intervals. Sufficient clamps, spreaders and braces shall be installed to insure the rigidity of the forms.

- D. Forms for back and face of curbs, lip of gutters and edge of walks, valley gutters or other surface slabs shall be equal to the full depth of the concrete as shown, noted or called for on the plans or detail drawings. Composite forms made up from benders or thin planks of sufficient ply to ensure rigidity of the form in the shape required may be used on curves and curb returns.

3.4 PLACING STEEL REINFORCEMENT

- A. Bars shall be free of mortar, oil, dirt, excessive mill scale and scabby rust and other coatings of any character that would destroy or reduce the bond. All bending shall be done cold, to the shapes shown on the plans. The length of lapped splices shall be as follows:

1. Reinforcing bars No. 8, or smaller, shall be lapped at least 45 bar diameters of the smaller bar joined, and reinforced bars Nos. 9, 10, and 11 shall be lapped at least 60 bar diameters of the smaller bars joined, except when otherwise shown on the plans.
2. Splice locations shall be made as indicated on the plans.

- B. Reinforcement shall be accurately placed as shown on the plans and shall be firmly and securely held in position by wiring at intersections and splices and by using precast mortar blocks or ferrous metal chairs, spacers, metal hangers, supporting wires, and other approved devices of sufficient strength to resist crushing under applied loads. Supports and ties shall be such as to permit walking on reinforcing without undue displacement.

- C. Reinforcing shall be placed so as to have the following minimum concrete cover:

Surfaces exposed to water	4"
Surfaces poured against earth	3"
Formed surfaces exposed to earth or weather	2"
Slabs, walls, not exposed to weather or earth	1"

- D. Minimum spacing, center of parallel bars shall be two and one half (2-1/2) times the diameter of the larger sized bar. All reinforcing shall be securely tied in place prior to pouring concrete. Placing of dowels or other reinforcing in the wet concrete is not permitted.

3.5 MIXING CONCRETE

- A. All concrete shall be transit mixed in accordance with the requirements of ASTM Designation C94. Transit mixed concrete shall be mixed for not less than ten (10) minutes total, of which not less than three (3) minutes shall be on the site just prior to pouring. Mixing shall be continuous with no interruptions from the time the truck is filled

until the time it is emptied. Concrete shall be placed within one hour of the time water is first added.

- B. Hand mixing of concrete for use in concrete structures will not be permitted.

3.6 PLACING CONCRETE

- A. Subgrade shall be thoroughly wetted prior to the placing of concrete for all concrete placed directly on soil. All standing water shall be removed prior to placing of concrete.
- B. No concrete shall be placed until the subgrade and the forms have been approved.
- C. Concrete shall be conveyed from mixer to final location as rapidly as possible by methods preventing separation of the ingredients. Deposit concrete as nearly as possible in final position to avoid re-handling.
- D. Concrete shall be placed and compacted in forms without segregation by means of mechanical vibration or by other means as approved by the Engineer. Vibration shall continue until the material is sufficiently consolidated and absent of all voids without causing segregation of material. The use of vibrators for extensive shifting of fresh concrete will not be permitted.
- E. All control and construction joints shall be as shown on the plans.
- F. Concrete in certain locations may be pumped into place upon prior approval. When this procedure requires redesign of the mix, such redesign shall be submitted for approval in the same manner as herein specified for approval of design mixes.

3.7 FORM REMOVAL

- A. Forms shall be removed without damage to concrete. All forms below the ground surface, together with all shores and braces, shall be removed before backfilling.
- B. Backfill against concrete shall not commence until the concrete has developed sufficient strength to prevent damage.
- C. Forms with cast-in-place walls shall remain in place at least 72 hours after pouring.
- D. Forms with suspended slabs shall remain in place at least 28 days after pouring.
- E. Edge forms shall remain in place at least 24 hours after pouring.

3.8 EXPANSION JOINTS

- A. Expansion joints incorporating premolded joint fillers shall be constructed at twenty (20) foot intervals in all concrete curbs, gutters and sidewalks, and at the ends of curb returns. At each expansion joint, one-half by twelve inch (1/2" x 12") smooth slip dowels shall be installed in the positions shown or noted on the detail drawings.
- B. Slip dowels shall be oriented at right angles to the expansion joint and shall be held firmly in place during the construction process by means of appropriate chairs.

- C. Expansion joints and slip dowels shall be constructed in valley gutters and driveway approaches in the positions indicated or called for on the detail drawings.

3.9 CONTROL JOINTS

- A. Control joints shall be constructed in concrete curbs, gutters, walkways and pavements between expansion joints at ten (10) foot intervals throughout, or as shown on the plans. Depth of joint score shall be a minimum of one-fourth (25%) the thickness of the concrete.

3.10 FINISHING

- A. Concrete curb and gutter shall be finished in conformance with the applicable requirements of Section 73-1.04 and 73-1.05A of the State Standard Specifications as modified herein.
- B. Where monolithic curb, gutter and sidewalk is specified, separate concrete pours will not be allowed.
- C. Horizontal surfaces shall receive a medium broom finish unless otherwise shown.

3.11 ROADWAY ACCESSORY CONSTRUCTION

- A. Concrete walkways, island paving, valley gutters and driveway approaches shall be formed, placed and finished in conformance with the applicable requirements of Section 73-1.04 and 73-1.06 of the State Standard Specifications as modified herein.
- B. Where new concrete curb and gutter is to be constructed against existing AC remove 12" of the AC to form new gutter lip. Patch pave after gutter form is removed.

3.12 CONNECTING TO EXISTING CONCRETE IMPROVEMENTS

- A. Whenever new curb, gutter, or sidewalk is to connect to existing improvements to remain, sawcut to existing sound concrete at the nearest score line or expansion joint. Drill and insert ½ " diameter by 12" long dowels at 24" on center into existing improvements. Install pre-molded expansion joint filler at the matching joint.
- B. A "cold" joint to the existing curb, gutter or sidewalk is not permitted.

3.13 DECORATIVE PAVEMENT CONSTRUCTION

- A. Decorative pavement for streets or roadways and decorative surfacing for median islands or other installations shall be formed and placed as a concrete slab conforming to the details therefor shown or noted on the drawings.

3.14 FIELD QUALITY CONTROL

- A. Finish subgrade for concrete improvements shall be subject to approval prior to placement of forms.

- B. No concrete shall be placed prior to approval of forms.
- C. Appearance and finish of all concrete improvements constructed shall not contain "bird baths" or pond water and shall be smooth and ridge free.
- D. Finish grade at top of curb, flow line of gutter, and the finish cross section of concrete improvements shall conform to the design grades and cross sections.
- E. Variation of concrete improvements from design grade and cross section as shown or called for on the plans shall not exceed the tolerances established in Sections 73-1.05 and/or 73-1.06 of the State Standard Specifications, as applicable.

3.15 RESTORATION OF EXISTING IMPROVEMENTS

- A. Existing pavement or other improvements removed or damaged due to the installation of concrete improvements shall be replaced in kind.
- B. Existing landscaping or planting removed, damaged or disturbed due to the installation of concrete improvements shall be replaced in kind.

3.16 CLEANUP

- A. Surplus material and debris remaining upon completion of the work shall be segregated as to type, and transported from the job site and disposed of in a legal manner.

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SECTION 02670

UTILITY POLYETHYLENE CONTAINMENT PIPE SYSTEMS

PART 1 – GENERAL

1.1 WORK INCLUDED

- A. Trenching and other excavation.
- B. Ground water control.
- C. Pipe bedding.
- D. Installation of containment pipe and appurtenances.
- E. Backfill and compaction of backfill.
- F. Dust alleviation and control.
- G. Cleanup and restoration of surface in improved areas.
- H. Supplying all labor, materials, equipment and apparatus not specifically mentioned herewith or noted on the plans, but which are incidental and necessary to complete the work specified.

1.2 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the general designation only.
- B. American Society for Testing and Materials (ASTM) Publications:
 - D-638 Standard Test Method for Tensile Properties of Plastics.
 - D-790 Standard Test Methods for Flexural Properties of unreinforced and reinforced Plastics and Electrical Insulating Materials.
 - D-1248 Specifications for Polyethylene Plastics Molding and Extrusion Materials.
 - D-1505 Test Methods for Density of Plastics by Density Gradient Technique.
 - D-1603 Test Method for Carbon Black in Olefin Plastics.
 - D-1693 Test Methods for Environmental Stress Cracking Ethylene Plastics.
 - D-2774 Standard Recommended Practice for Underground Installation of Thermoplastic Pipe
 - D-3015 Standard Practice for Microscopical Examination of Pigment Dispersion in Plastic Compounds.
 - D-3035 Standard Specification for Polyethylene (PE) Plastic Pipe (SDRPR) Based on Controlled Outside Diameter.
 - D-3261 Standard Specifications for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing.
 - D-3350 Specifications for Polyethylene Plastic Pipe and Fittings Materials.

1.3 QUALITY ASSURANCE

- A.** All Work shall be done to the satisfaction of the representative of the Geotechnical Consultant and shall meet the approval of the City Engineer.
- B.** Class of pipe requirements shown or called for on the plans shall be the minimum acceptable.
- C.** Submit manufacturer's data on the pipe material, fittings and service material.
- D.** The City Engineer may require manufacturer's certificates showing conformance with this specification with any shipment of materials to the job site.

1.4 JOB CONDITIONS

- A.** Note and conform with conditions and requirements indicated and specified under Section 02202 of these Specifications.
- B.** Contractor shall conduct operations and schedule cleanup in a manner to cause the least possible obstruction and inconvenience to traffic, pedestrians and to adjacent property owners or tenants.

PART 2 - PRODUCTS

2.1 PIPE MATERIALS

- A.** The polyethylene containment pipe shall be Plexco Polyethylene, or equal, conforming to ASTM D-1248 with a PE 3408 designation. The size of pipe, SDR and pressure rating shall be as designated on the plans.
- B.** The Contractor shall install pressure-sensitive tape noting the intended use for the inner carrier pipe. Adhesive-backed Pipe Labeling Tape shall be PVC Plastic tape manufactured specifically for direct placement onto pipe, cable or conduit for warning and identification. Tape shall be a minimum of 2.2 mils, an adhesive strength of 26 psi, and with tensile strength of 32 lb. per inch of width. Tape shall be of the type provided in rolls, color coded for the utility involved with warning and identification imprinted in bold letters continuously and repeatedly over entire tape length. Code and letter coloring shall be permanent, unaffected by moisture or other substances contained in trench material.
- C.** All pipe lengths shall be butt fused by means of a heat fusion process in accordance with ASTM D-3261.
- D.** All fittings shall be of the same material as the mainpipe and shall be joined to the main pipe by means of a heat fusion process in accordance with ASTM D- 3261.
- E.** The polyethylene containment pipe shall be supplied with "spider" supports sized with spacing as recommended by the pipe manufacturer for support of the carrier pipe.

2.2 LEAK DETECTION VAULTS

- A.** Leak detection vaults shall be precast reinforced concrete with poured in place reinforced concrete bottoms of the form and dimensions shown and detailed on the plans and shall conform to the requirements of ASTM Designation C478. Concrete used for leak detection vaults, bases and thrust blocks shall be Class "A" shall conform to Section 02550 of these Specifications.
- B.** Containment pipe connections to leak detection vaults shall be PE fusion welded flanged connections with rubber gaskets and 316 SS anchor bolts and nuts.
- C.** Frames and covers for leak detection vaults shall be gray iron castings of the form and dimensions shown and detailed on the plans and shall conform to the requirements of ASTM Designation A48 for Class 30B castings. Frames and covers shall be match marked in sets which have been machined after fabrication to provide a firm and continuous seat. All castings shall be thoroughly cleaned and coated with commercial quality asphaltic varnish prior to delivery.
- D.** Reinforcement for leak detection vaults and bases shall be deformed steel bars conforming to Section 02550 of these Specifications.
- E.** All exposed reinforcing bars required for thrust blocks and anchors shall be fusion epoxy coated conforming to Section 02661 of these Specifications, or stainless steel with equivalent load carrying capabilities as specified for deformed steel bars.
- F.** Mortar for precast leak detection and cone section joints shall consist of one (1) part Portland cement conforming to the requirements of Section 02550 of these Specifications, with two (2) parts of mortar sand by volume. Sand shall be well graded and of such size that all will pass a No. 8 sieve. Mortar materials shall be mixed to a consistency suitable for making joints on concrete pipe and all mortar shall be used within thirty (30) minutes after mixing water has been added. Admixtures shall not be added to mortar without the prior approval.

2.3 PIPE BEDDING AND BACKFILL MATERIAL

- A.** Shall conform to Section 02202 of these Specifications.

PART 3 - EXECUTION

3.1 TRENCHING, BACKFILL AND SHORING

- A.** Shall conform to Section 02202 of these Specifications.

3.2 CONTAINMENT PIPE INSTALLATION

- A.** Installation: Pipe and appurtenances shall be installed in accordance with the best practice, and in conformance with the applicable requirements of the manufacturer's handbooks. All pipes shall be laid on a bed prepared by handwork, dug true to line and grade, to furnish a true and firm bearing for the pipe throughout its entire length.

- B. Joints between plain ends of polyethylene pipe shall be made by butt fusion when possible. The pipe manufacturer's fusion procedures shall be followed at all times as well as the recommendations of the Fusion Machine Manufacturer. The wall thickness of the adjoining pipes shall have the same DR at the point of fusion.
- C. On each day butt fusions are to be made, the first fusion of the day shall be a trial fusion. The trial fusion shall be allowed to cool completely, then fusion test straps shall be cut out. The test strap shall be 12-inches or 30 times the wall thickness in length (minimum) an 1-inch or 1.5 times the wall thickness in width (minimum). Bend the test strap until the ends of the strap touch. If the fusion fails at the joint, a new trial fusion shall be made, cooled completely and tested. Butt fusion of pipe to be installed shall not commence until a trial fusion has passed the bent strap test.
- D. Socket fusions shall be tested by a bent strap test as described by the pipe manufacturer. The pipe manufacturer shall provide visual guidelines for inspecting the butt, saddle and socket fusion joints.
- E. Handling: Pipe shall be carefully handled during hauling, unloading, and placing operations, so as to avoid breakage or damage. Strap-type slings shall be used for lifting and placing; no chains or hooks will be permitted. Broken or damaged pipe or appurtenances will be rejected, and shall thereupon be removed from the work and replaced.
- F. Alignment: All pipe shall be accurately laid in conformity with the prescribed lines and grades as established by the City Engineer. Each length shall be jointed to the preceding section as specified, and after said jointing has been completed, there shall be no movement of the pipe in subsequent operations.
- G. Cleaning: Before each new length of pipe is placed, the interior of the preceding pipe shall be carefully cleaned of all dirt and debris. When pipe laying is not in progress, all open pipe ends shall be satisfactorily closed with watertight plugs.
- H. Bearing: Pipe in the trench shall have continuous uniform bearing along its bottom, except at bell holes. Before lowering pipe into the trench, the Contractor shall remove all stakes, debris, loose rock and other hard material from the bottom of the trench.
- I. Positioning: After the final positioning, pipe shall be held in place in the trench with backfill material placed equally on both sides of the pipe at as many locations as required to hold the pipe section in place. After joints are completed, the backfill material shall be redistributed and compacted as herein required.
- J. Closure: At the end of each day and when work is not in progress, all open ends of pipe installed in the line shall be satisfactorily closed with watertight plugs.

3.3 CONNECTIONS

- A. Unless separately listed on the bid schedule, Contractor shall make all required connections to existing facilities and improvements at no additional cost, and compensation for such work shall be deemed as included in the price bid for pipe installation.

3.4 STRUCTURES

- A.** Structures and appurtenances shall be installed at the location and to the lines and dimensions shown on the plans and detail drawings, and as established by the City Engineer. Structures shall be installed in conformance with the applicable requirements of Section 71-1.07 of the State Standard Specifications. Precast structures shall be accurately assembled with full mortar bed joints.
- B.** Frames for leak detection vaults in paved areas shall be accurately placed flush with and in the plane of the finish pavement. Tops of structures in unpaved areas shall be constructed to the grades shown or called for on the plans and established by the City Engineer. Leak detection vault frames in new roadway subgrade shall be brought to finish pavement plane and grade immediately after paving operations. All leak detection vault frames in paved areas shall be secured by means of concrete frame anchor slabs as shown and detailed on the plans and detail drawings.

3.5 CLEANUP

- A.** Upon completion of containment pipe construction operations, all lines, vaults, and other structures shall be thoroughly cleaned of dirt, rubbish, debris and obstructions of any kind to the satisfaction of the City Engineer, and the entire work site shall be cleaned of all waste, rubbish, and construction debris of any nature.

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SECTION 02720
STORM DRAINAGE

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Trenching and other excavation.
- B. Ground water control.
- C. Pipe bedding.
- D. Installation of storm drains and appurtenances.
- E. Installation of underdrains and appurtenances.
- F. Backfill and compaction of backfill.
- G. Dust alleviation and control.
- H. Cleanup and restoration of surface in improved areas.
- I. Supplying all labor, materials, equipment and apparatus not specifically mentioned herein or noted on the plans, but which are incidental and necessary to complete the work specified.

1.2 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text only by the general designation.
- B. American Society for Testing and Materials (ASTM) Publications:
 - A - 34 Structural Steel.
 - A - 48 Gray Iron Castings.
 - A - 123 Zinc Coatings, Rolled, Pressed Forged Mat.
 - A - 386 Zinc Coating (Hot-Dip) on Assembled Steel Products.
 - C - 76 Reinforced Concrete Culvert.
 - C - 443 Joints for Circular Concrete Sewer and Culvert Pipe, using Rubber Gaskets.
 - C - 478 Precast Reinforced Concrete Manhole Sections.
 - C - 497 Method of Testing Concrete Pipe, Sections, or Tile.
 - D - 1784 Rigid Poly Vinyl Chloride (PVC) Compounds and Chlorinated Poly Vinyl Chloride Compounds
 - D - 1785 Pipe, Poly Vinyl Chloride (PVC) Schedules 40, 80 and 120.

- D - 2564 Solvent Cements for Poly Vinyl Chloride (PVC) Plastic Pipe and Fittings.
- D - 3034 PVC Sewer Pipe and Fittings
- F - 477 Elastomeric Seals (Gaskets) for joining Plastic Pipe.
- F – 679 Standard Specifications for Poly Vinyl Chloride large Diameter Plastic gravity sewer pipe and fittings

1.3 QUALITY ASSURANCE

- A. Submit manufacturer's data on pipe, drainage structure and castings to be used.
- B. The Engineer may require manufacturer's or supplier's certificates showing conformance with this specification to be delivered with each shipment of material delivered to the job site.
- C. D-Load or class of pipe requirements shown or called for on the plans shall be the minimum acceptable.
- D. All pipes shall bear the manufacturer's label for the type, specification, and classification of the pipe.
- E. All storm drains shall be subject to passing a ball test.

1.4 JOB CONDITIONS

- A. Note and conform to conditions and requirements indicated and specified under Section 02202 of the Specifications.

PART 2 - PRODUCTS

2.1 REINFORCED CONCRETE PIPE

- A. Pipe 12 inches and larger shall be reinforced concrete, bell and spigot-type pipe, conforming to the requirements of ASTM Designation C76 except that all pipe shall have been manufactured using Portland Cement Concrete conforming to the requirements of Section 02550 of these Specifications.
- B. Pipe strength requirements shall be designated in terms of D-load as shown or called for on the plans. D-load as used herein is defined as the maximum load the pipe will sustain per foot of length per foot of internal diameter under the standard three-edge bearing test without the appearance of any crack one one-hundredth (0.01) inch in width exceeding twelve (12) inches in length when tested in accordance with the procedure set forth in ASTM Designation C497.
- C. Pipe wall thickness and bell and spigot mating surfaces shall be the same for each size and class or D-load of pipe delivered to the job site. The concrete cover over any reinforcement shall not be less than 1" for 12" RCP and 1-1/2" for 18" RCP.

- D. Pipe shall be cured by water curing, steam curing, or a combination of both as required to produce the D-load strengths shown, noted or called for on the plans.
- E. All reinforced concrete pipe shall have rubber gasket joints that are self-centering and so designed that after the joint is made up, the rubber gasket shall not be required to support the weight of the pipe. Spigot grooves shall be provided in all joints, and the joint and gasket shall conform to the requirements of ASTM Designation C443. All joints shall be watertight.
- F. Pipe lengths shall not exceed twelve (12) feet for all pipe except that short lengths of pipe (two (2) feet nominal) shall be furnished and installed at all connections to structures and appurtenances.
- G. Each section of pipe shall be clearly and legibly marked with waterproof paint to show the date of manufacture, the D-load classification of the pipe, and the type of cement used in the manufacture of the pipe.

2.2 POLY VINYL CHLORIDE PIPE

- A. PVC pipe for minor storm drains less than twelve (12) inches in diameter shall conform to the requirements of ASTM 3034 or ASTM F-679 and shall have a DR rating of 26. All pipe and fittings shall be made of PVC plastic having a minimum cell classification of 12454-B or 13364-B as defined in ASTM D-1784. Pipe barrel shall have the words "STORM DRAIN" marked along the longitudinal axis of the outside in 1-5/8" high block letters with permanent ink. The words shall be repeated at 2-foot spacing along the pipe length.
- B. The Contractor may substitute pressure-sensitive tape in lieu of stenciling. Adhesive-backed Pipe Labeling Tape shall be PVC Plastic tape manufactured specifically for direct placement onto pipe, cable or conduit for warning and identification. Tape shall be a minimum of 2.2 mils, an adhesive strength of 26 psi, and with tensile strength of 32 lb. per inch of width. Tape shall be of the type provided in rolls, color coded for the utility involved with warning and identification imprinted in bold letters continuously and repeatedly over entire tape length. Code and letter coloring shall be permanent, unaffected by moisture or other substances contained in trench material.
- C. Couplings and fittings for use with PVC non-pressure pipe shall be of the same materials and in compliance with the requirements specified for the pipe. Couplings and fittings shall be equipped with rubber rings which fit into individual grooves formed in the inner wall to the requirement of ASTM Designation F-477.

2.3 PVC UNDERDRAINS

- A. PVC underdrains shall consist of four (4) inch Schedule 40 perforated Poly Vinyl chloride (PVC) pipe conforming to the requirements of ASTM Designation D1785. B. Joints and fittings for PVC underdrains shall conform to the requirements of ASTM Designation D1785.
- B. Solvent cement for joining PVC underdrain pipe, couplings and fittings shall conform to the requirements of ASTM Designation D2564.

- C. Permeable material bedding and cover for subsurface drains shall be as specified in Section 02202 of these Specifications.
- D. Filter Fabric for underdrains shall conform to Section 88 of the Standard Specifications.

2.4 STORM DRAIN MANHOLES

- A. Barrel and cone sections for storm drain manholes shall be precast reinforced concrete of the form and dimensions shown and detailed on the plans and shall conform to the requirements of ASTM Designation C478. Concrete used for manhole barrel and cone sections shall conform to the requirements of Section 02550 of these Specifications.
- B. Frames and covers for manholes shall be gray iron castings of the form and dimensions shown and detailed on the plans and shall conform to the requirements of ASTM Designation A48 for Class 30B castings. Frames and covers shall be match marked in sets which have been machined after fabrication to provide a firm and continuous seat. Each cover shall have cast into it the raised letters "STORM DRAIN". All castings shall be thoroughly cleaned and coated with commercial quality asphaltic varnish prior to delivery.
- C. Steps for manholes and other storm structures shall be polypropylene to the form and dimensions shown and detailed on the plans.
- D. Concrete for manhole bases shall be Class "A" conforming to the requirements of Section 02550 of these Specifications.
- E. Reinforcement for manhole bases shall be deformed steel bars conforming to Section 02550 of these Specifications. Size and shape of reinforcement shall conform to the details shown on the plans.
- F. Mortar for precast manhole section joints shall consist of one (1) part Portland Cement conforming to the requirements of Section 02550 of these Specifications, with two (2) parts of sand by volume. Sand shall be well graded and of such size that all will pass a No. 8 sieve.
- G. Concrete for manhole frame anchor slabs shall be Class "A" conforming to the requirements of Section 02550 of these Specifications.

2.5 CONCRETE CURB INLETS

- A. Concrete curb inlets for storm drains shall be cast in place, reinforced concrete of the form and dimensions shown and detailed on the plans.
- B. Insert form for the curb inlet and other parts shall be as manufactured by Santa Rosa Cast Products, or approved equal. Concrete used in the construction of concrete curb inlets shall conform to the requirements for Class "A" concrete set forth in Section 02550 of these Specifications. Forming, placing and finishing shall conform to Section 02550 of these Specifications.
- C. Reinforcement used in the construction of precast curb inlets shall be deformed steel bars conforming to Section 02550 of these Specifications.

- D. Miscellaneous steel shapes used in construction of concrete curb inlets shall be structural quality carbon steel conforming to the requirements of ASTM
- E. Designation A36 and shall be hot-dip galvanized after fabrication in conformance with the requirements of ASTM Designation A123.
- F. Steps for curb inlets, where required, shall be polypropylene to the form and dimensions shown and detailed on the plans.

2.6 CAST-IN-PLACE DRAINAGE STRUCTURES

- A. All concrete structures are to be cast in place except where specifically noted on the plans and specifications.
- B. Concrete for cast-in-place drainage structures shall be Class "A" conforming to the requirements of Section 02550 of these Specifications.
- C. Forming, placing and finishing concrete, and reinforcement for cast-in-place drainage structures shall conform to Section 02550.
- D. Steel for frames and grates or covers for cast-in-place drainage structures shall be structural steel conforming to the requirements of ASTM Designation A36. Frames and grates or covers shall be fabricated to the form and dimensions shown and detailed on the plans and shall be hot-dip galvanized after complete fabrication in conformance with the requirements of ASTM Designation A386. Frames and grates or covers shall be match marked in sets which have been so constructed as to provide a firm and continuous seat.
- E. Welding for frames and grates shall conform to the requirements of the American Welding Society for Arc and Gas Welding in Building Construction.

2.7 PIPE BEDDING AND COVER MATERIAL

- A. Shall be as specified in Section 02202 of these Specifications.

PART 3 - EXECUTION

3.1 TRENCHING, BACKFILLING AND SHORING

- A. Shall conform to Section 02202 of these Specifications.

3.2 PIPE INSTALLATION

- A. Installation: Storm drain pipe, underdrains and appurtenances shall be installed in accordance with the best practice, and in conformance with the plans and these Specifications.
- B. Handling: Pipe shall be carefully handled during hauling, unloading, and placing operations, so as to avoid breakage or damage. Strap-type slings shall be used for lifting

and placing; no chains or hooks will be permitted. Broken or damaged pipe including chipped bells of spigots, will be rejected, and shall be removed from the work site.

- C. Alignment: All pipe shall be accurately laid in conformity with the prescribed lines and grades as established by the Engineer. Each length shall be joined to the preceding section as specified, and after said jointing has been completed, there shall be no movement of the pipe in subsequent operations.
- D. Pipe Deflections: The laying of pipe on curved alignment will be permitted only when necessary to conform with the alignment shown or called for on the plans. Joint deflections called for on the plans shall be permitted up to one half of the deflection recommended by the pipe manufacturer.
- E. Cleaning: Before each new length of pipe is placed, the interior of the preceding pipe shall be carefully cleaned of all dirt and debris. When pipe laying is not in progress, all open pipe ends shall be closed with plugs in a satisfactory manner to the Engineer.
- F. Bearing: Pipe in the trench shall have continuous uniform bearing along its bottom, except all bell holes. Before lowering pipe into the trench, the Contractor shall remove all stakes, debris, loose rock and other hard material from the bottom of the trench.
- G. Positioning: After the final positioning, pipe shall be held in place in the trench with cover materials placed equally on both sides of the pipe at as many locations as required to hold the pipe section in place. Position plastic pipe with "STORM DRAIN" markings facing up. After joints are completed, the cover material shall be redistributed and compacted as herein required.
- H. Closure: At the end of each day and when work is not in progress, the open ends of pipe installed in the line shall be closed with plugs and openings for appurtenances shall be suitably covered.

3.3 CONNECTIONS

- A. Unless separately listed on the bid schedule, make all required connections to existing facilities and improvements at no additional cost, and compensation for such work shall be deemed as included in the price bid for pipe installation.
- B. All connections to manholes shall be constructed with concrete channels directed toward outlet pipe as shown and detailed on the plans.
- C. Break-out holes in manholes for connecting new pipe shall be grouted all around to prevent ground water infiltration. Pipes shall be cut off flush with the inside surface of the manhole. Use PVC manhole adapters in break-out holes in manholes for connecting new PVC pipe and grout all around to prevent ground water infiltration. Pipes shall be cut off flush with the inside surface of the manhole.
- D. A 2-foot nominal length of pipe shall be used when entering and leaving all manholes and structures.

3.4 STRUCTURES

- A. Structures and appurtenances shall be installed at the location and to the lines and dimensions shown on the plans and detail drawings.
- B. Structures shall be constructed and/or installed in conformance with the applicable requirements of Section 51 of the State Standard Specifications. Unless otherwise noted on the plans or detail drawings, all exposed surfaces of poured in place structures and appurtenances shall have a Class 1 surface finish.
- C. Frames for manholes and tops of catch basins, inlets and other structures in paved areas shall be accurately placed flush with and in the plane of the finish pavement. All manhole frames in paved area shall be secured by means of concrete anchor slabs as shown and detailed on the plans and detail drawings.
- D. All joints and pipe openings on manhole sections, risers, and grade adjustment rings shall be grouted smooth and flush with the interior of the structure in a workmanlike manner.

3.5 STORM DRAIN PLUGS & CLEANING

- A. Where called for on the plans or directed, plugs shall be placed in open ends of storm drains. Plugs shall consist of a brick and mortar wall not less than eight (8) inches in thickness constructed in such a manner as to ensure a watertight seal. Mortar for plugs shall conform to the requirements of paragraph 2.04F hereof.
- B. Storm drain pipe and structures shall be cleaned of all dirt, debris, and form work.
- C. Pipes shall be balled with an approved rubber ball to insure cleanliness prior to acceptance.

3.6 UNDERDRAINS

- A. Trenches for underdrains shall be excavated in the location shown.
- B. Place filter fabric in the trench to protect the permeable material and pipe prior to backfilling.
- C. The pipe installed and the trench backfilled with permeable material according to the dimensions and details shown on the plans.
- D. Perforated pipe, fabric, and permeable material shall be installed in accordance with Section 68-1.03 of the Standard Specifications.

* * *

SECTION 02730
SANITARY SEWERS

PART 1 – GENERAL

1.1 WORK INCLUDED

- A. Trenching and other excavation.
- B. Ground water control.
- C. Pipe bedding.
- D. Installation of sanitary sewers and appurtenances.
- E. Backfill and compaction of backfill.
- F. Infiltration and leakage testing for gravity sewers.
- G. Hydrostatic and leakage testing for force mains.
- H. Dust alleviation and control.
- I. Cleanup and restoration of surface in improved areas.
- J. Supplying all labor, materials, equipment and apparatus not specifically mentioned herewith or noted on the plans, but which are incidental and necessary to complete the work specified.

1.2 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the general designation only.
- B. American Society for Testing and Materials (ASTM) Publications:
 - A - 48 Gray Iron Castings.
 - A - 276 Standard Specifications for Stainless and Heat-Resisting Steel Bars and Shapes.
 - C - 478 Precast Reinforced Concrete Manhole Sections.
 - D – 1784 Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
 - D - 3034 Type PSM Poly (Vinylchloride) (PVC) Sewer Pipe and Fittings.
 - F - 477 Elastomeric Seals (Gaskets) for joining Plastic Pipe.

F - 679 Standard Specification for Poly (Vinyl Chloride) (PVC) large Diameter Plastic Gravity Sewer Pipe and fittings.

C. American Water Works Association (AWWA) Publications:

C - 110 Gray-Iron and Ductile-Iron Fittings 3" through 48" for Water and other Liquids.

C - 111 Rubber Gasket Joints for Ductile-Iron and Gray Iron Pressure Pipe and Fittings.

C - 900 Polyvinyl Chloride (PVC) Pressure Pipe, 4" through 12", for Water.

1.3 QUALITY ASSURANCE

- A.** Sanitary sewer gravity mains shall be subject to a ball test, infiltration and leakage tests. Sanitary sewer force mains shall be subject to air testing, and hydrostatic and leakage tests.
- B.** Class of pipe requirements shown or called for on the plans shall be the minimum acceptable.
- C.** Submit manufacturer's data on the pipe material, fittings and service material.
- D.** Construction practices for PVC pipe shall comply with Uni-Bell's "Handbook of PVC Pipe".
- E.** The Engineer may require manufacturer's certificates showing conformance with this specification with any shipment of materials to the job site.

1.4 JOB CONDITIONS

- A.** Note and conform with conditions and requirements indicated and specified under Section 02202 of these Specifications.
- B.** Contractor shall conduct operations and schedule cleanup in a manner to cause the least possible obstruction and inconvenience to traffic, pedestrians and to adjacent property owners or tenants.

PART 2 - PRODUCTS

2.1 PIPE MATERIALS

- A.** All PVC pipe and fittings for sanitary sewers and laterals shall conform to the requirements of ASTM D-3034 or ASTM F – 679 with SDR rating of 26. All the pipe and fittings shall be made of PVC plastic having a minimum cell classification of 12454-B as defined in specification ASTM D – 1784. The size of pipe shall be as designated on the plans and the size indicated shall be the internal clear diameter of the pipe. Individual pipe lengths shall not exceed twenty (20) feet in length. All pipe shall be stenciled with

the words "SANITARY SEWER" in 1-5/8" high block lettering with permanent ink. The words shall be repeated at 2-foot spacing along the pipe length.

- B. The Contractor may substitute pressure-sensitive tape in lieu of stenciling. Adhesive-backed Pipe Labeling Tape shall be PVC Plastic tape manufactured specifically for direct placement onto pipe, cable or conduit for warning and identification. Tape shall be a minimum of 2.2 mils, an adhesive strength of 26 psi, and with tensile strength of 32 lb. per inch of width. Tape shall be of the type provided in rolls, color coded for the utility involved with warning and identification imprinted in bold letters continuously and repeatedly over entire tape length. Code and letter coloring shall be permanent, unaffected by moisture or other substances contained in trench material.
- C. Joints shall be with either a factory provided, rubber gasketed coupling, or integral bell; couplings or bells shall have a solid rubber ring conforming to ASTM F-477, factory assembled and locked into place to prevent displacement during installation, with continuous stainless steel shear rings supplied by Mission Rubber Company, or approved equal.
- D. Wye branches at the cleanout and the cleanout riser shall be PVC conforming to ASTM D-3034, DR 26.

2.2 ADDITIONAL REQUIREMENTS FOR FORCE MAINS

- A. Pipe for sanitary sewer force mains shall conform to the requirements of AWWA C-900, Class 150, DR 18 pipe.
- B. Fittings for PVC sanitary sewer force mains shall be ductile iron castings conforming to the requirements of AWWA Standard C153 for two hundred (250) psi working pressure. Fittings shall be furnished with either push-on joints for use with pressure pipe or flanged joints as designated on the plans. Both push-on and flanged joints shall conform to the requirements of AWWA Standard C111 for cast-iron pressure pipe.
- C. Bolts, nuts, and washers for flanged fittings shall be stainless steel, ASTM A- 276, Type 316.

2.3 SANITARY SEWER MANHOLES

- A. Barrel and cone sections for sanitary sewer manholes shall be precast reinforced concrete of the form and dimensions shown and detailed on the plans and shall conform to the requirements of ASTM Designation C478. Concrete used for manhole barrel and cone sections shall conform to Section 02550 of these Specifications.
- B. Frames and covers for manholes shall be gray iron castings of the form and dimensions shown and detailed on the plans and shall conform to the requirements of ASTM Designation A48 for Class 30B castings. Frames and covers shall be match marked in sets which have been machined after fabrication to provide a firm and continuous seat. Each cover shall have cast into it the raised letters "SANITARY SEWER." All castings shall be thoroughly cleaned and coated with commercial quality asphaltic varnish prior to delivery.

- C. Steps for manholes shall be polypropylene conforming to the form and dimensions shown and detailed on the plans.
- D. Concrete for manhole and cleanout bases shall be Class "A" conforming to the requirements of Section 02550 of these Specifications.
- E. Reinforcement for manhole and cleanout bases shall be deformed steel bars conforming to Section 02550 of these Specifications.
- F. Mortar for precast barrel and cone section joints shall consist of one (1) part Portland cement conforming to the requirements of Section 02550 of these Specifications, with two (2) parts of mortar sand by volume. Sand shall be well graded and of such size that all will pass a No. 8 sieve. Mortar materials shall be mixed to a consistency suitable for making joints on concrete pipe and all mortar shall be used within thirty (30) minutes after mixing water has been added. Admixtures shall not be added to mortar without the prior approval.
- G. PVC manhole adapters shall be as shown on the drawings.

2.4 SANITARY SEWER CLEANOUTS

- A. Install sanitary sewer cleanouts per project details and specifications
- B. Wye branches and risers for sanitary sewer cleanouts shall conform to the City's Standard Details.
- C. Cleanout box shall be Christy concrete type F08 Curb Valve Box with F08R lid marked "SEWER" when installed in location not subject to vehicular loading.
- D. When installed in location subject to vehicular loading, cleanout box shall be Christy concrete type G05T Traffic Valve Box with G05CT Traffic Lid marked "SEWER" and shall be provided with 8" concrete base

2.5 SANITARY SEWER LATERALS

- A. Contractor shall verify location and diameter of all active laterals which is paid under the appropriate bid item.
- B. Sanitary sewer lateral shall be installed to conform to City's Standard Details.
- C. Sanitary sewer lateral shall be installed perpendicular to the main sewer line or as directed in the field by City Inspector. Tracer wire shall be installed in lateral pipeline and conform to City Standard details.
- D. See Paragraph 3.05 of this Specification Section for more details regarding lateral installation.

2.6 CONCRETE FOR THRUST BLOCKING FOR FORCE MAINS

- A. Reinforcement for concrete thrust blocks shall conform to Section 02550 of these Specifications.

- B. Concrete for thrust blocks shall be Portland cement concrete conforming to the applicable requirements of Section 02550 of these Specifications.
- C. All exposed reinforcing bars required for thrust blocks and anchors shall be fusion epoxy coated conforming to Section 02661 of these Specifications, or stainless steel with equivalent load carrying capabilities as specified for deformed steel bars.

2.7 PIPE BEDDING AND COVER MATERIAL

- A. Shall conform to Section 02202 of these Specifications.

PART 3 - EXECUTION

3.1 TRENCHING, BACKFILL AND SHORING

- A. Shall conform to Section 02202 of these Specifications.

3.2 PIPE INSTALLATION

- A. Installation: Pipe and appurtenances shall be installed in accordance with the best practice, and in conformance with the applicable requirements of the manufacturer's handbooks. Pipe laying shall start at the low end of each section and proceed upgrade. All bell and spigot pipe shall be laid with the bell end upgrade. All pipes shall be laid on a bed prepared by handwork, dug true to line and grade, to furnish a true and firm bearing for the pipe throughout its entire length. Adjustment of pipes to the line and grade shall be made by scraping away or filling in and tamping material under the body of the pipe throughout its entire length and not by blocking or wedging. Unless otherwise indicated or directed by the Engineer, pipe shall be laid continuously through manhole locations and any connections therein made by means of appropriate fittings to provide a smooth and continuous channel. Bell holes shall be provided at the ends of each pipe length of sufficient size to permit making up the particular type of joint being used. Each length of pipe shall be rotated so that the stenciled or taped words "SANITARY SEWER" will be located on the top of the pipe.
- B. Handling: Pipe shall be carefully handled during hauling, unloading, and placing operations, so as to avoid breakage or damage. Strap-type slings shall be used for lifting and placing; no chains or hooks will be permitted. Broken or damaged pipe or appurtenances will be rejected, and shall thereupon be removed from the work and replaced.
- C. Alignment: All pipe shall be accurately laid in conformity with the prescribed lines and grades as established by the Engineer. Each length shall be jointed to the preceding section as specified, and after said jointing has been completed, there shall be no movement of the pipe in subsequent operations.
- D. Pipe Deflections: The laying of pipe on curved alignment by means of un-symmetrical closure of joints, will be permitted only when necessary to conform to the alignment shown on the plans. Grade breaks indicated on the plans shall be accomplished by un-symmetrical closure of pipe and NOT by means of fittings. Joint deflections called for on

the plans shall be permitted up to one-half of the deflections recommended by the pipe manufacturer.

- E. Cleaning: Before each new length of pipe is placed, the interior of the preceding pipe shall be carefully cleaned of all dirt and debris. When pipe laying is not in progress, all open pipe ends shall be satisfactorily closed with watertight plugs.
- F. Bearing: Pipe in the trench shall have continuous uniform bearing along its bottom, except at bell holes. Before lowering pipe into the trench, the Contractor shall remove all stakes, debris, loose rock and other hard material from the bottom of the trench.
- G. Positioning: After the final positioning, pipe shall be held in place in the trench with backfill material placed equally on both sides of the pipe at as many locations as required to hold the pipe section in place. After joints are completed, the backfill material shall be redistributed and compacted as herein required.
- H. Closure: At the end of each day and when work is not in progress, all open ends of pipe installed in the line shall be satisfactorily closed with watertight plugs.
- I. Thrust Blocking for Force Mains: Concrete thrust blocks of the form and dimensions shown or noted on the plans shall be provided at all changes in horizontal and vertical alignments and at such other points as may be called for on the plans. Thrust blocks shall be installed in strict conformance with the details shown or noted on the plans.

3.3 CONNECTIONS

- A. Unless separately listed on the bid schedule, Contractor shall make all required connections to existing facilities and improvements at no additional cost, and compensation for such work shall be deemed as included in the price bid for pipe installation.
- B. All connections in manholes shall be constructed with concrete channels directed toward the outlet pipe as shown and detailed on the plans.
- C. Use PVC manhole adapters in break-out holes in manholes for connecting new PVC pipe and grout all around to prevent ground water infiltration. Pipes shall be cut off flush with the inside surface of the manhole.
- D. Use 2-foot nominal lengths of pipe when entering and leaving manholes and structures.

3.4 STRUCTURES

- A. Structures and appurtenances shall be installed at the location and to the lines and dimensions shown on the plans and detail drawings, and as established by the Engineer. Structures shall be installed in conformance with the applicable requirements of Section 71-1.07 of the State Standard Specifications. Precast structures shall be accurately assembled with full mortar bed joints.
- B. Frames for manholes in paved areas shall be accurately placed flush with and in the plane of the finish pavement. Tops of structures in unpaved areas shall be constructed to the grades shown or called for on the plans and established by the Engineer. Manhole

frames in new roadway subgrade shall be brought to finish pavement plane and grade immediately after paving operations. All manhole frames in paved areas shall be secured by means of concrete frame anchor slabs as shown and detailed on the plans and detail drawings.

3.5 LATERALS

- A.** Unless otherwise noted on the plans, all sanitary sewer laterals shall terminate in a cleanout constructed to the form and dimensions shown and detailed on the plans and detail drawings. "Lateral sewer" means the portion of a sewer located within a public street connecting a building sewer to the main sewer, the ownership, and responsibility for all maintenance, repairs and replacement of which lies with the owner of the property it serves. (City Code Chapter 13.12.110).

3.6 CLEANING SANITARY SEWERS

- A.** Contractor shall flush and clean all sewer mains by means of pneumatic, sewer cleaning balls. The balls shall be of the appropriate size to fit the sewer pipe being cleaned. "Sewer Balling" operations shall be conducted by experienced personnel under the observation of the Engineer. The ball shall be introduced at the uppermost manhole and passed from manhole to manhole by means of a line with sufficient head of water to carry the ball along. The movement of the ball shall be controlled by a rope; care shall be exercised not to feed the ball too rapidly in order that all debris can be removed at each manhole.
- B.** Each section of the sewer line shall be thoroughly cleaned before proceeding to the next section. Where sewer balls will not pass, flexible sewer rods with approved spears or cutters may be used to clear the obstruction. Where obstructions cannot be cleared by sewer rodding, the obstructions shall be removed by excavation at the Contractor's expense. The Contractor shall remove all debris from sewer lines using approved methods.
- C.** Installation cost shall include cost for water for sanitary sewer flushing and cleaning operations.

3.7 TESTING SANITARY SEWERS

- A.** Sanitary sewer systems including laterals, and sanitary force mains shall be tested for tightness after completion of all backfilling and prior to request for final inspection. Contractor shall notify the Engineer at least two (2) working days in advance of proposed testing dates. Tests of gravity sewers shall be made from end or manhole to manhole unless grades are flat enough to permit testing two or more sections at one time. Sections which fail to pass the tests shall be repaired or replaced, and the section retested until it falls within specified allowances.
- B.** All water for sanitary sewer testing shall be provided and the tests performed by the Contractor in conformance with the following requirements:
 - 1. Mandrell Test
 - a. Pipes shall be tested for deflection by passing a mandrel through the pipe without

obstruction.

- b. The size of the mandrel shall be set at 92.5% of the base inside diameter of the pipe, as defined in ASTM 3034.

2. Water Leakage Test

- a. Preparation for Test: The sewer line to be tested shall be plugged at the downstream manhole. All openings in the upstream manhole shall be plugged except the downstream opening for the line to be tested. All branch sewers running from wye connections on the mains shall be plugged at their upper ends if the test head would cause them to overflow. The Test section shall then be filled with water and allowed to stand for at least thirty (30) minutes before test is started.
- b. Test Procedure: The water level in the upstream manhole or test tee shall be brought to a height approximately 4 feet above the crown of the open sewer at the upper end of the test section. The hydrostatic head in the test section shall be maintained so that no point in the section is the head less than four (4) feet or greater than 18 feet. In the case of a submerged section of line, the said head limitation shall be the difference between internal and external water levels. The test shall consist of measuring the loss of water during a one (1) hour period.
- c. Allowable Leakage: The allowable leakage in one (1) hours' time based on an average hydrostatic head of 4 feet for the entire test section, shall not exceed 0.4 gallons per inch of pipe diameter for each 500 feet of pipe.
- d. Manhole Leakage: Should an initial test show excessive leakage in a section of line, it is permissible to draw off the water and test the manhole that contained water. This test shall be made by plugging all openings in the manhole, filling same with water to the same elevation as used for the initial test, and checking the loss in a one-hour period. The leakage so determined may be deducted from the total leakage in the section of pipe initially tested. If, in the opinion of the Engineer, the manhole leakage thus determined is excessive, the Contractor shall waterproof interior of the manhole by applying a coating of grout or an approved water- proofing material.

3. Force Mains

- a. Preparation for Tests: The Contractor shall provide all necessary material and equipment, and shall perform all work required in connection with the testing of the force main system, as specified herein. Hydrostatic and leakage tests shall be made only after the trenches have been backfilled sufficiently to hold the pipe firmly in position. Hydrostatic tests for sewer force mains shall be made on all sections to a hydrostatic pressure of 150 psi. Excess pressure will not be permitted. Each section of pipe to be tested shall be slowly filled with water using care to expel all air. Water shall be allowed to stand in the pipe for 24 hours before test pressure is applied.
- b. Test Procedure: The required pressure as measured at the lowest elevation, shall be applied for not less than one hour. Any leakage discovered in consequence of the pressure test shall be corrected, and the test shall be repeated until satisfactorily completed. Any defective pipe, fittings, or valves,

shall be repaired or replaced.

- c. Allowable Leakage: No section of force main will be accepted until the leakage is less than 15 U.S. gallons per 24 hours per mile of pipe per inch of internal pipe diameter.
4. Air Leakage Test - The Contractor, at his option, may substitute an air pressure test in lieu of the hydrostatic test specified above for gravity sewers.
- a. The procedure shall be as described in Uni-Bell B-6-90, "Recommended Practice for Low Pressure Air Testing of Installed Sewer Pipe."
 - b. The procedure shall be to securely plug all openings in the section of the line to be tested, and apply an air pressure of approximately four (4) psi.
 - c. The elapsed time observed for a pressure drop of one (1) psi shall not be less than shown on Table I of Uni-Bell B-6.

3.8 SANITARY SEWER PLUGS

- A. All ends of sanitary sewers provided for future connection shall be plugged with material of the same joint characteristics as specified for the sanitary sewer main or lateral.

3.9 CLEANUP

- A. Upon completion of sanitary sewer construction operations, all lines, manholes, and other structures shall be thoroughly cleaned of dirt, rubbish, debris and obstructions of any kind to the satisfaction of the Engineer, and the entire work site shall be cleaned of all waste, rubbish, and construction debris of any nature.

* * *

SECTION 02732

CLEANING AND CLOSED CIRCUIT TELEVISION (CCTV) INSPECTION OF SEWER PIPE

PART 1 - GENERAL

1.1 WORK INCLUDED

- A.** This section covers the initial and final cleaning, and the initial and final closed circuit TV (video) inspection of sewer pipelines. The word "clean" in this section is defined as the removal of all accumulations including sludge, dirt, sand, rocks, grease, roots, and other solid or semisolid material in the pipe.
- B.** Supplying all labor, materials, equipment and apparatus not specifically mentioned herewith or noted on the plans, but which are incidental and necessary to complete the work specified.

1.2 APPLICABLE PUBLICATIONS

- A.** The publications listed below form a part of this specification:
- B.** Standard Specifications for Public Works Construction latest Edition, (refer as the Green Book herein) Section 500-1.1.4 - Cleaning and Preliminary Inspection.
- C.** Standard Specifications for Public Works Construction latest Edition (refer as the Green Book herein) Section 500-1.1.5 - Television Inspection.

1.3 JOB CONDITIONS

- A.** The Contractor shall conduct operations and schedule cleanup in a manner to cause the least possible obstruction and inconvenience to traffic, pedestrians and to adjacent property owners or tenants.

1.4 SUBMITTALS

- A.** The Contractor shall submit a plan for bypassing sewage around the work area and facilities where sewage flows must be interrupted to carry the work. The plan shall be reviewed by the engineer and shall be acknowledged as acceptable before any work is started.
- B.** For each of the initial and final inspection, Contractor shall submit to an external hard drive containing all the videos, images, and inspection reports in Wincan V8 inspection software format with audio of all sewer reaches inspected. Work will not be considered complete until the following items have been received and approved by the City.
 - 1. Initial and final video inspection shall be in digital format using Wincan Version 8 Inspection software recorded digitally to an external drive. At the beginning of

the inspection, the information of the inspection shall be displayed in the following PACP format:

- a. Surveyed by
- b. Street
- c. Locations Code
- d. Direction of inspection
- e. Pipe material
- f. Pipe diameter
- g. Length of reach to be televised
- h. Manhole number from which the camera is traveling
- i. Manhole number to which the camera is traveling
- j. Pipe ID
- k. Inspection Time/Date

In addition, each recording shall continuously display the following information:

- a. City
- b. Number of the manhole from which the camera is traveling
- c. Number of the manhole to which the camera is traveling
- d. Direction of flow (indicated by arrow)
- e. Date of recording
- f. Pipe diameter
- g. Pipe material
- h. Footage

2. The video shall be labeled with the Contractor's name, date televised, street name, identification of the sewer reach(es) inspected, and run number. The audio portion of the CCTV inspection shall be in English and intelligible in its entirety. If the CCTV inspection are of such poor quality that the Engineer is unable to evaluate the condition of the sewer, locate sewer service connections, or verify cleaning, the Contractor shall re-televiser the sanitary sewer and provide a new CCTV inspection of good quality at no cost to the City. No payment will be made for CCTV inspection that does not meet the requirements of these specifications.

PART 2 - PRODUCT - NOT APPLICABLE

PART 3 - EXECUTION

3.1 INITIAL AND FINAL CLEANING OF SEWER PIPE

- A.** The Contractor shall clean sewer pipe of any obstruction and debris including roots in accordance with the "Standard Specifications for Public Works Construction latest Edition," (refer as the Green Book herein) Section 500-1.1.4 - Cleaning and Preliminary Inspection - and the following additions and added subsections.
- B.** Add the following to paragraph (b) of Section 500-1.1.4 of the Green Book to read:

High velocity hydrocleaning equipment shall have the following:

1. A minimum of 700 feet of high pressure hose.
2. A 1,000-gallon minimum water tank, auxiliary engines and pumps, and a hydraulically driven hose reel.
3. Equipment operating controls located above ground.
4. Minimum working pressure of 1,000 pounds per square inch at a 50 gpm rate.

C. Add the following subsections to Section 500-1.1.4 of the Green Book to read:

1. Cleaning Precautions

During sewer cleaning operations, satisfactory precautions shall be taken in the use of cleaning equipment. When hydraulically propelled cleaning tools which depend upon water pressure to provide their cleaning force, or tools which retard the flow in the sewer line are used, precautions shall be taken to ensure that the water pressure created does not damage or cause flooding of public or private property being served by the sewer. Care shall be exercised to avoid pipe damage.

2. Root Removal

Videotapes and TV log of existing sewers, if available, will be provided upon request for general guidance only. The Contractor is responsible for all interpretations made from these logs. The omission of noting on the Drawings of the existence of roots within a sewer line shall not relieve the Contractor of the responsibility of removal of roots as part on the cleaning of the sewer at bid cost. Roots shall be removed where shown on Video Tape or revealed by the Contractor's television inspection. Special attention shall be used during the cleaning operations to assure removal of roots from the joints. Procedures may include the use of mechanical equipment such as rodding machines and bucket machines using root cutters and porcupines, and equipment such as high-velocity jet cleaners. Chemical root treatment shall not be used by the Contractor.

3. Material Removal

All sludge, dirt, sand, rocks, grease and other solid or semisolid material resulting from the cleaning operation shall be removed at the downstream manhole of the section being cleaned. Passing material from manhole section to manhole section which could cause line stoppages, accumulations of sand in wet wells, or damage pumping equipment, shall not be permitted.

4. Material Disposal

All solids or semisolids resulting from the cleaning operations shall be removed from the site and disposed of at a suitable sanitary landfill site as defined by the Titles 22 and 23 of the California Administrative Code. All Materials shall be removed from the site no less often than at the end of each workday. Under no circumstances will the Contractor be allowed to accumulate debris, etc, on the site of work beyond a single workday, except in totally enclosed containers and as

approved by the Engineer.

5. Sewer Flow Control

a. General

When depth of flow in the pipe upstream of the manhole section being worked is above the maximum allowable for television inspection, joint testing and/or sealing; or when necessary to accomplish the specified sewer line replacement; the flow shall be reduced to the required level by plugging or blocking of the flow, and by pumping the flow around the section being worked.

Depth of flow shall not exceed that shown below for the respective pipe sizes as measured in the manhole when performing television inspection, joint testing and/or sealing.

Maximum Depth of Flow in Inches

Pipe Sizes in Inches	Television Inspection	Joint Testing/ Sealing
6	1.20	1.50
8	1.60	2.00
10	2.00	2.50
12	3.00	3.00
15	3.75	4.50
18	4.50	5.40
21	5.25	6.30
24	6.00	7.20
27	8.10	9.45
30	9.00	10.50
33 and up	30% of Pipe Diameter	35% of Pipe Diameter

Amount of the flow allowed in sewer line shall be in accordance with the manufacturer's recommendations and as approved by the Engineer.

Plugging, Blocking, and Pumping

When sewer flow control is required, the Contractor shall furnish, install, and operate pumps, plugs, conduits, and other equipment to divert the flow of sewage around the pipeline reach in which work is to be performed. The plug shall be provided with a tag line. The pumping system shall be of sufficient capacity to handle existing flow plus additional flow that may occur during a rainstorm. If pumping is required on a 24-hour basis, engines shall be equipped in a manner to keep noise to a minimum. Standby pumps shall be provided as required. Pumping shall be done by the Contractor in such manner as will not damage public or private property or create a nuisance or health menace. The pumped sewage shall be in an enclosed hose or pipe and shall be reinserted into the

sanitary sewer system. Sewage shall not be allowed to free flow in gutters, streets or over sidewalks, etc. Nor shall any sewage be allowed to flow into the storm inlets or conduits. After the work has been completed, flow shall be restored to normal.

D. Additional Requirement for Final Cleaning of Sewer Pipe:

The Project is ready for cleaning when the following work has been completed:

- a. All sewer mains and laterals are rehabilitated/installed, backfilled, and compacted.
- b. All structures are in place, all channeling is complete, and pipelines are accessible from structures.
- c. All other underground facilities, utility piping, and conduits are installed.
- d. Placement of aggregate base has been completed.
- e. Final air test has been completed.

Acceptance of the cleaning shall be based upon the subsequent video inspection of the line.

3.2 INITIAL AND FINAL CLOSED CIRCUIT TELEVISION (CCTV) INSPECTION OF SEWER LINE

- A.** Prior to rehabilitation of each sewer section, the Contractor shall be required to conduct a manhole to manhole Closed Circuit Television (CCTV) survey of the lines to determine the general condition of the sewer, to determine defective pipe sections for point repairs, to log the location of all house laterals and to verify location of active house laterals.
- B.** The Contractor will abide by the requirements of the "Standard Specifications for Public Works Construction latest Edition," (refer as the Green Book herein) Section 500-1.1.5 - Television Inspection - and the following additions and added subsections.
- C.** Add the following to Section 500-1.1.5 of the Green Book to read:
 1. When sewer line depth of flow at the upstream manhole of the section being televised is above the maximum allowable for television inspection, the Contractor shall reduce the flow in accordance with Subsection 500 - 1.1.4 of the Sewer Line Cleaning Specification above to permit proceeding with the television inspection.
 2. Television inspection shall be done one sewer section at a time. The section being inspected shall be isolated from the remainder of the sewer with upstream sewage flow by-passed. The camera shall be moved through the sewer section in either direction at a uniformly slow rate of means of power cable winches at each manhole, stopping at each defect to allow adequate evaluation
 3. Should the camera get stuck in the sewer, the Contractor shall be responsible for all costs involved in extracting it. Costs related to difficulties encountered during internal television inspection are incidental to the Contract and claims, therefore, will not be considered.

D. Add the following subsections to Section 500-1.1.5 of the Green Book to read:

1. Initial CCTV Inspection

- a. The Contractor is required to clean the sewers and manholes per Section 500-1.1.4 and television inspect all proposed rehabilitative pipes shown on plans.
- b. No construction work shall be started on a particular sewer unless the Engineer has had five working days to review the inspection documentation for the sewer. The method of rehabilitation/replacement of each sewer will be re-evaluated by the Engineer on the basis of the television inspection information furnished by the Contractor and the replacement/rehabilitation method will be changed if it is determined necessary or advisable. Such changes in the method replacement/rehabilitation shall not be considered substantial changes in the character of the work.
- c. As directed by the Engineer and at locations where CCTV inspection or pipe installation work is hampered by an obstruction which cannot be removed by conventional sewer cleaning equipment or by other approved internal means, spot excavations shall be performed to expose and remove the obstruction. Spot excavations shall be performed as specified elsewhere in this contract document.

E. Additional Requirement for performing Closed Circuit Television (CCTV) inspection of sewer line.

1. Contractor shall take at least one picture of all mid-to-major defects in pipe that will be in JPEG format. Each JPEG file will be named in accordance with the line and footage. One photograph shall also be taken of each lateral connection looking up into the lateral.
2. Contractor shall setup at the upstream manhole whenever possible to video inspect with the flow. The camera will move at a uniform rate at a speed no greater than 30 feet per minute. Distance of the line will be measured and recorded from the center of manhole to the center of the next manhole. The distance will be accurate within 2 feet of every 1000 linear feet inspected. If more than one manhole reach is inspected in a single run, the footage counter shall be reset to zero at the center of all intermediate manholes. The camera shall pause for a sufficient amount of time to adequately document and provide accurate distance measurements of all defects in pipe and the connections observed in the line. The camera shall rotate and look directly at each defect and look into each connection to thoroughly document the conditions and determine if the lateral is in service. Contractor shall capture photos of any moderate and above damages or abnormal conditions.
3. The recording shall include an audio portion describing the condition of the lines with the video image. The audio portion will be sufficiently free of background noise to produce an oral report that clear and easily discernible. At the beginning of each inspection run, the audio shall identify Contractor's name, the crew member, date, time, street location, name of line, pipe size, pipe material, direction of inspection,

and the pipe numbers at the beginning and end of the reach. The audio shall note during the inspection the location and condition of the pipe defects, including all cracks, breaks, cracked or misaligned joints, root intrusion, infiltration, missing pieces of pipe, corrosion, deposits, obstructions, and any other items which reflect the condition of the sewer line. The audio shall also note the location of the connections, and whether the connection is in service. All observations shall be included on the inspection report.

4. Continuous digital recordings of the inspection view as it appears on the monitor shall be stored. A digital recording will be made of the entire inspection. The video will be recorded in MPEG 4 unless prior arrangements are made between the City and Contractor.
5. In case the camera cannot pass from upstream to downstream, a reverse setup shall be attempted. In case of this type of setup, a separate MPEG file will be stored. Inspection data shall be obtained using WinCan software. This shall include data tables, observations, pictures, and video. Contractor shall use standard observation codes consistent with PACP coding. Once all inspections are complete, Contractor shall give the City of Half Moon Bay a hard drive that details all of the captured information, and WinCan reader program that has full rights for viewing all videos, pictures, and observations.

F. Additional Requirement for Final CCTV Inspection of sewer line:

The project is ready for final video inspection when pipelines and structures have been cleaned a maximum of thirty (30) minutes before the inspection is to take place.

The following observations from television inspections shall be considered defects in the construction of new sewer pipelines and shall require correction prior to project completion:

- a. Sags greater than fifteen percent (15%) of the inside pipe diameter.
- b. Open or offset joints.
- c. Cracked or damaged pipe.
- d. Out of round pipe.
- e. Joint infiltration.
- f. Debris or other foreign objects.
- g. Other obvious deficiencies.

G. Traffic Control requirement in performing Closed Circuit TV (CCTV) inspection.

1. CONTRACTOR shall adhere to the WATCH Manual for traffic control. All Contractor's trucks shall have an arrow board and beacons as well as a full set of cones, candle sticks, and "Men at Work" signs and tripods that shall be used to provide safety for both employees and the general public.

* * *

SECTION 02733

POINT REPAIR

PART 1 - GENERAL

1.1 WORK INCLUDED

- A.** Point repairs (spot repairs) are work required to prepare defective sections of existing sewer lines for rehabilitation. Excavation from the surface is required to accomplish the necessary repairs. Generally, the work will require repair of existing sags, offset joints, cracks, protruding laterals, removal and replacement of short sections of damaged pipe, and any other defects deemed necessary after the initial and/or final video inspection.
- B.** Flow control, if required to accomplish the repair, shall be performed as described in Section 02732, Part 3, Subsection 3.01, Paragraph C.5.
- C.** The CONTRACTOR shall repair the point repairs after determining that it is necessary and approved by the Engineer. The work shall include verifying the location of the point repair, locating all interfering utilities, temporary flow bypassing, excavation, shoring, dewatering, pipe repairs or replacement, backfilling, and surface restoration.
- D.** All point repairs discovered through subsequent investigations, and/or directed by the Engineer, shall be completed prior to rehabilitating the pipe by grouting or lining or other method of repair. The exact location of the point repairs will be determined by the Contractor and approved by the Engineer after the pipe is exposed. All work to expose and correct the defects, and the materials and methods used shall conform to the applicable specifications, including excavation and backfill, surface restorations, pipe installation, and sewer flow control.
- E.** All point repairs shall be visually inspected and measured by the Engineer prior to backfilling.
- F.** Supplying all labor, materials, equipment and apparatus not specifically mentioned herewith or noted on the plans, but which are incidental and necessary to complete the work specified.

1.2 JOB CONDITIONS

- A.** The Contractor shall conduct operations and schedule cleanup in a manner to cause the least possible obstruction and inconvenience to traffic, pedestrians and to adjacent property owners or tenants.

1.3 SUBMITTALS

- A.** The Contractor shall submit to the Engineer for approval, a detailed plan including the location, method, and lineal footage or each location of spot repairs prior to the actual work.

- B. The Contractor shall submit a plan for bypassing sewage around the work area and facilities where sewage flows must be interrupted to carry the work. The plan shall be reviewed by the engineer and shall be acknowledged as acceptable before any work is started.

PART 2 - PRODUCT - NOT APPLICABLE

PART 3 - EXECUTION

3.1 Notification

- A. The Contractor shall notify the Engineer not less than 48 hours in advance of the time he plans to begin repair work at a particular location within the project.
- B. After the point repair is located and exposed, the Engineer will inspect the damaged pipe and confirm the required repair and methods proposed by the Contractor.

3.2 Repair Methods

- A. One or a combination of the following methods could be used. Method selected from below or recommended by the Contractor, shall be subject to approval by the Engineer prior to its installation.
 1. Repair Clamp: Install full circle repair clamps as recommended by the manufacturer and approved by the Engineer. All metallic hardware shall be 316 stainless steel.
 2. Heat-Shrink Sleeve: Install in accordance with manufacturer's recommendations.
 3. Remove and Replace Pipe and Fittings: Remove defective pipe or fittings to the nearest joint or by cutting perpendicular to the pipe axis to leave a plain end. Prepare a replacement section of like pipe material or as otherwise approved by the Engineer or shown on the drawings. Make connections using standard joints, repair clamps, couplings, or heat- shrink sleeves.

3.3 Backfill

1. Backfill, including pipe bedding, shall be placed and compacted as specified in Section 02202, "Trenching and Backfill", of this Specification.
2. Flow shall be returned into the repaired section prior to placement of backfill.
3. The Contractor shall correct any settlement of backfill which may occur within the guaranty period at no cost to the Agency.

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SECTION 02734

PIPE BURSTING

PART 1 – GENERAL

1.1 WORK INCLUDED

- A. Sewer renewal using the pipe bursting method has been developed to enable a range of relatively small sewer pipe to be replaced without open-cutting.
- B. The scope of work requires the Contractor to provide all materials, labor, equipment, and services necessary for bypass pumping, and/or diversion of sewage flows, rehabilitation of existing sanitary sewers by bursting the existing pipe and inserting a high density polyethylene pipe (HPDE), reconnection of active sewer lateral connections, anchoring new pipe, and initial and final cleaning & CCTV inspection and final testing of the pipe system.
- C. The sewer replacement work details include:
 - 1. Site Planning and Preparation
 - a. Perform Site Investigation.
 - b. Perform Initial Cleaning and Close Circuit TV Inspection.
 - c. Formulate and execute plans for launching pit excavation, layout for sewer by-pass pumping system, marking existing utilities, laterals, cleanout, etc.
 - 2. Pipe Installation
 - a. Excavate Launching Pit.
 - b. Install Sewer By-Pass Pumping System.
 - c. Excavate to Relieve Affects of Bursting to Existing Utilities.
 - d. Excavate to Expose All Active Laterals.
 - e. Temporary Disconnect / Plug All Active Laterals Connections.
 - f. Install New Sewer Pipe by Pipe Bursting Method.
 - g. Anchor Pipe and Seal Manholes.
 - h. Replace Existing Active Laterals, Cleanouts, and Lampholes.
 - i. Reconnect All Active Lateral Connections to New Sewer Main. Disconnect and plug all inactive laterals.
 - j. Perform Final Cleaning and Close Circuit TV Inspection.
 - k. Remove Sewage By-Pass System.
 - l. Backfill and Restore Excavations.
 - 3. Cleanup and Restore Existing Surface Condition and Structures.
 - 4. Repair Defective Work Per Engineer's Final Inspection.

- C. The Contractor is responsible for proper and accurate installation of the new sewer pipe regardless of the method described in this section and the following subsections. The Contractor shall ensure that the new pipe's vertical and horizontal alignment is as indicated on the plans and in accordance with these specifications.
- D. Supplying all labor, materials, equipment and apparatus not specifically mentioned herewith or noted on the plans, but which are incidental and necessary to complete the work specified.

1.2 APPLICABLE PUBLICATION

- A. Reference Specifications: This specification references American Society for Testing and Materials (ASTM) and American Welding Society (AWS) standard specifications, which are made a part hereof by such reference and shall be the latest edition and revision thereof. Conformance to the following shall be required.

ASTM D-1238 Measuring Flow Rates of Thermoplastics by Extrusion Plastometer

ASTM D-1248 Specification for Polyethylene Plastics Molding and Extrusion Materials

ASTM D-1505 Density of Plastics by the Density-Gradient Technique

ASTM D-1599 Test for Short Term Rupture Strength of Plastic Pipe, Tubing and Fittings

ASTM D-1693 Test for Environmental Stress-Cracking of Ethylene Plastics

ASTM D-1928 Preparation of Compression Molded Polyethylene Test Samples

ASTM D-2122 Determining Dimensions of Thermoplastic Pipe and Fittings

ASTM D-2321 Underground Installation of Thermoplastic Flexible Sewer Pipe

ASTM D-2657 Practice for Heat-Joining Polyolefin Pipe and Fittings

ASTM D-2837 Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials

ASTM D-3035 Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Controlled Outside Diameter (Up to 6" IPS)

ASTM D-3261 Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing

ASTM D-3350 Specification for Polyethylene Plastic Pipe and Fittings Material

ASTM F-585 Practice for Insertion of Flexible Polyethylene Pipe into Existing Sewers

ASTM F-714 Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter (3" IPS and larger)

AWS D1.1 AWS Standard Qualification Procedure

1.3 WARRANTY AND QUALITY ASSURANCE

- A. General Bid Requirements:

1. The bidder, or his/her Sub-contractor, shall be properly licensed and trained to perform pipe bursting, having at least 10,000 lineal feet of successful installation in the United States within the last 2 years, in pipelines ranging from 4 to 12 inches. Documentation of the licensing and experience and details of two years minimum

training of the on-site foreman and the installers who will perform the actual pipe bursting system, shall be provided with the bid.

- B.** The Contractor shall provide to the City a warranty to be in force and effect for a period of one (1) year from the date of acceptance by the City. The warranty is inclusive of the Contractor to repair or replace the pipe should failure result from faulty material or installation.
- C.** Correction of failed HDPE pipe deemed unacceptable, as a result of the post video inspection shall be the responsibility of the Contractor, at no extra cost to the City. Method of correction/repair shall be approved by the City.
- D.** The finished HDPE pipe shall be continuous over the entire length of run between the launching and receiving pits and shall be free from visual defects.
- E.** The Contractor shall carry out the operations in strict accordance with all applicable OSHA regulations.
- F.** Delivery, Storage and Handling
 - 1. Transport, handle, and store pipe and fittings as recommended by manufacturer.
 - 2. If pipe and fittings become damaged before or during installation, it shall be repaired as recommended by the manufacturer or replaced as required by the Engineer at the Contractor's expense, before proceeding further.
 - 3. Deliver, store, and handle other materials as required to prevent damage.
- G.** Only those tools designed for the aforementioned procedures, and approved by the pipe manufacturer or supplier and the ENGINEER, shall be used for assembly of pipe fittings to ensure proper installation. The heater plate shall be equipped with suitable means to measure the temperature of plate surfaces and to assure uniform heating such as thermometers or pyrometers.
- H.** The CONTRACTOR shall televise the installed pipe after existing services have been reconnected and manhole work has been completed. The original television inspection files in Wincan version 8 format shall be provided to the ENGINEER. The CONTRACTOR shall repair all damages found during the review of the final video inspection. The damages shall include but not limited to sags, leaks, cracks, unsecured joints, visual defects, and others which in the opinion of the ENGINEER are not acceptable and would impair the serviceability of the new piping system.

1.4 SUBMITTALS

- A.** Submit the following Contractor's Drawings:
 - 1. Shop drawings, catalog data and manufacturer's technical data showing complete information on material composition, physical properties, and dimension of pipe and fittings. Include manufacturer's recommendation for handling, storage, and repair of pipe and fittings if damaged.
 - 2. The Contractor shall prepare and submit for the Engineer's approval a detailed description of the Pipe Bursting Plan, including materials and equipment, lateral reconnection, bypass pumping system, plan of operation, schedule of work, etc. No work shall begin prior to approval by the Engineer of the Contractor's Pipe

Bursting plan. The followings should be included:

- a. Detail drawings and written description of the entire construction procedure to bypass sewage flow, install pipe, reconnection of sewer house connections.
 - b. Working drawings for showing excavation locations, dimensions, sheeting and shoring, method of dewatering, and other utilities that may be affected; width and length of working area, access pit, and portion of existing sewer to be removed to conduct the work; sewage flow by-pass; and maintenance of traffic.
 - c. Design of the sheeting and shoring for the excavations, and dewatering shall be the Contractor's responsibility.
- B.** Television inspection reports and video tapes made prior to and after pipe insertion. (See Section 02732 for details of submittals).
- C.** Grout and design mixes and grout testing reports.
- D.** Certification:
1. Certification by the manufacturer that all pipe and fittings furnished under this specification were manufactured, sampled, tested, and inspected in accordance with ASTM D3350 and ASTM F714. Certification shall be signed by an authorized agent of the manufacturer.
 2. The CONTRACTOR performing the pipe installation shall be certified by the pipe bursting system manufacturer that the CONTRACTOR is a licensed installer of the manufacturers' system.
 3. Polyethylene pipe jointing shall be performed by personnel trained in the use of joint fusion and stab joint equipment and recommended methods for pipe bursting connection. Personnel directly involved with installing the pipe shall receive training in the proper methods for handling, inserting, trimming, and finishing the pipe. The Contractor shall provide a certification of training and experience for each fusion and installing crew member.
 4. The Contractor shall perform trial fusion welds and submit samples to the owner for review prior to installation of the pipe. Full penetration welds shall provide homogenous material across the cross section of the weld. The fusion machine employed for the trial welds shall be the same machine to be utilized for the installation work.
 5. Fusion equipment shall be operated only by technicians who have been certified by the pipe manufacturer or supplier who have a minimum of two (2) years of experience fusion welding 4-inch or larger diameter pipelines. The technician's experience shall be documented in the HDPE pipe material.
- E.** The CONTRACTOR shall submit a sewage bypass pumping and/or diversion plan for review by the ENGINEER at least 10 days prior to pipe installation. The sewage bypass pumping and/or diversion plan shall include an emergency response plan to be followed in the event of a failure of the bypass pumping and/or diversion system. The CONTRACTOR shall notify the ENGINEER 24 hours prior to commencing the bypass pumping operation. The CONTRACTOR'S plan for sewage bypass pumping and/or diversion shall be satisfactory to the ENGINEER before the CONTRACTOR shall be allowed to commence sewage bypass pumping and/or diversion.

- F. **As-built drawings:** The CONTRACTOR shall indicate and draw, with clear and accurate dimensions, on plans the as-built locations of newly installed sewer mains, laterals and cleanouts.

1.5 JOB CONDITIONS

- A. Note and conform to conditions and requirements indicated and specified under Section 02202 of these Specifications.
- B. Contractor shall conduct operations and schedule cleanup in a manner to cause the least possible obstruction and inconvenience to traffic, pedestrians and to adjacent property owners or tenants.

PART 2 - PRODUCTS

2.1 GENERAL

- A. The CONTRACTOR shall provide polyethylene pipe as specified. The pipe shall be made to diameter and tolerances in accordance with ASTM D3035. The minimum ratio of orthogonal diameters prior to installation shall be 0.95. All pipe shall be made from virgin grade material. The pipe shall be of the diameter and class shown or specified and shall be furnished complete with all fabricated fittings, and other appurtenances as necessary for a complete and functional system.

2.2 HDPE PIPE, JOINTS AND FITTINGS

- A. Unless approved otherwise by the Engineer, pipe and fittings shall be **SDR 17**, Extra High Molecular Weight, High Density Polyethylene PE 4710, Cell Class PE445574C, per ASTM D3350. Pipe shall be co-extruded using a melt homogenizing/plasticating extruder and appropriate die.
- B. The pipe and fittings materials shall meet the requirements for Type III, Class C, Category 5, Grade P34 material as described in ASTM D1248. Pipe and fittings shall be made in conformance with ASTM F714 and ASTM D3261 as modified for the specified material. The pipe shall contain no recycled compound except that generated in the manufacturer's own plant from resin of the same specification from the same raw material pipe.

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1. Pipe, fittings, and joints shall meet or exceed the following physical properties:

<u>Property</u>	<u>ASTM Test Method</u>	<u>Nominal Value</u>
Density, gm/cc	D 1505	0.96
Melt Index, gm/10 min.	D 1238-E	0.10
High Load Melt Index, gm/10 min.	D 1238-F	12.0
Tensile Strength @ Break, psi	D 638	4,500
Tensile Strength @ Yield, psi	D 638	>3,400
Elongation, %	D 638	>700
Flexural Modulus, psi	D 790	136,000
Environmental Stress Cracking Resistance F20' Hours (100°C)	D 1693 (Cond. C)	>5,000
Brittleness Temperature, °	D 746	<-103
Melting Point, °F	D 789	261
Vicat Softening Temperature, °F	D 1525	255
Hardness, Shore D	D 2240	64
Volume Resistivity, ohm-cm	D 991	2.6X10(16 th)
ASTM D 1248 Classification:	Type III Class C P 34 445574C	Category 5 Grade
ASTM D 1248 Classification:		
RECOMMENDED HYDROSTATIC DESIGN STRESS:	800 psi @ 73.4°F 400 psi @ 140°F	

2. Pipe and Fittings Markings:

- a. Pipe shall be marked at 3-foot intervals or less with the manufacturer's name (or trade mark), the designation ASTM D3350 and ASTM 714, including the year of issue, the letters "PE" followed by the cell classification number of the raw material compound used and the polyethylene grade per ASTM D1248, and the Hydrostatic Design Basis in hundreds of psi; the nominal pipe size in inches, the dimensional ratio, and the manufacturer's code identifying the resin manufacturer, lot number, and date of manufacture.

- b. Fittings shall be marked with the manufacturer's name (or trade mark), the designation ASTM D3350 and ASTM 714, and the manufacturer's code identifying the resin manufacturer, lot number, lot number, and date of manufacture.
3. Pipe and Fittings shall be homogeneous throughout and free of:
- a. Serious abrasion, cutting, or gouging of the outside surface extending to more than 10 percent of the wall thickness in depth.
 - b. Cracks
 - c. Kinking (generally due to excessive or abrupt bending)
 - d. Flattening
 - e. Holes
 - f. Blisters
 - g. Other injurious defects
- C. They shall be uniform in color, opacity, density, and other physical properties. Any pipe and fittings not meeting these criteria shall be rejected.
- D. The average outside diameter and wall thickness of pipe and fittings shall conform to Table 1 when measured in accordance with ASTM D2122.

TABLE 1				
Nominal Size (inches)	Nominal OD (inches)	Minimum Wall Thickness SDR26 (inches)	Minimum Wall Thickness SDR17 (inches)	Minimum Wall Thickness SDR11 (inches)
3	3.5	0.135	0.206	0.318
4	4.5	0.173	0.265	0.409
5	5.563 5.375	0.214 0.207	0.327 0.316	0.506
6	6.625	0.255	0.390	0.602
7	7.125	0.274	0.419	0.648
8	8.625	0.332	0.507	0.784
10	10.75	0.413	0.632	0.977
12	12.75	0.490	0.750	1.159

- E. **Pipe and Fittings Color:** Pipe and fittings shall conform to the following:
- 1. Inside: The inner wall shall be white, light green, light red (vitrified clay color), or natural. Yellow, black, and light purple are not acceptable.
 - 2. Outside: The outer wall shall be black, white, light green, light red (vitrified clay color), or natural. Yellow and light purple are not acceptable.
 - 3. Both the inside and outside may be the same color.

F. Joints:

1. Pipe lengths shall be assembled in the field with butt-fused joints in accordance with ASTM D 2657 and the pipe manufacturer's written instructions shall apply. Butt-fused joints shall have internal bead projections of not more than 1/4 inch. Bead projections on the outside and inside of the pipe shall be removed. Joint strength shall be equal to or greater than the pipe and shall indicate a ductile rather than brittle fracture when tested.
2. Joint with Fusion Equipment: The fusion machine shall have hydraulic pressure control for fusing two pipe ends together and shall be equipped with gauges to monitor fusion pressures. The machine shall be equipped with an electric or gasoline engine powered facing unit to square and trim the pipe ends smooth and provide full surface contact with the heating plate. The heating plate on the fusion machine shall be electrically heated and thermostatically controlled with a temperature gauge and be capable of maintaining 500°F with a tolerance of 10°F. Fusion temperature shall be as recommended by the pipe manufacturer.

2.3 PVC PIPE, JOINTS AND FITTINGS

- A.** Shall conform to Section 02730 - Sanitary Sewers of these specifications

2.4 SANITARY SEWER LATERALS

- A.** Contractor shall verify location and diameter of all active laterals.
- B.** Sanitary sewer lateral shall be installed to conform to the City's Standard Details or modified herein as shown in the Contract Drawings. Connections to the HDPE main shall be performed using electrofusion wye saddles.
- C.** Heat fusion electrofusion wye saddles shall be made of polyethylene pipe compound that meets the requirements of ASTM D1248, Class C and suitable for fusion welding to polyethylene pipe. Fusion saddles shall be electrofusion wye saddle as manufactured by Central Plastics Company, Driscopipe, Miller, Dupont or approved equal.
- D.** Connections to the existing sewer house connection pipe shall be made using sleeved stainless steel flexible couplings. All flexible couplings shall conform to ASTM C425 and be manufactured by Fernco Joint Sealer Co., DFW Plastics, Inc. or approved equal.
- E.** For laterals shown to be constructed using open cut method, the Contractor shall conform to Specification Section 02730 Sanitary Sewers.

2.5 SANITARY SEWER CLEANOUTS

- A.** Install sanitary sewer cleanouts per project details and specifications.
- B.** Wye branches and risers for sanitary sewer cleanouts shall conform to the City's project details.
- C.** Cleanout box shall be Christy concrete type F08 Curb Valve Box with F08R lid marked "SEWER" when installed in location not subject to vehicular loading.

- D. When installed in location subject to vehicular loading, cleanout box shall be Christy concrete type G05T Traffic Valve Box with G05CT Traffic Lid marked "SEWER" and shall be provided with 8" concrete base.

2.6 GROUT

- A. The grout design mix shall meet or exceed 500 psi compressive strength at 28 days tested accordance with ASTM C495 or C109. Contractor may incorporate grout additives to improve its flow properties, provided the minimum compressive strength requirements are met.

2.7 EQUIPMENT

- A. External and Internal Bead removers shall be McElroy Manufacturing, Inc. or equal.
- B. Bursting head/mechanism must be capable of pipe bursting existing repair section of cast iron pipe with minimal damage to the immediate and above ground environment and structures.

PART 3 - EXECUTION

3.1 GENERAL

- A. This section is intended to provide the Contractor with general guidance on the methods to be used to install the sewer pipe using the pipe bursting method. Nothing contained herein shall relieve the Contractor from completing the pipe bursting operation in the most feasible, efficient and safe manner, using required materials to the lines and grades shown on the plans and to the requirements of these specifications.

3.2 SITE INVESTIGATION

- A. Prior to pipe bursting operation, the Contractor shall perform a careful site investigation to locate and record possible surface obstructions, locate and mark active and inactive sewer laterals; and formulate and submit plans to replace the pipe, to reconstruct all sewer laterals, and to restore all structures and plants that would be damaged by the project work.

3.3 PREPARATION

A. Preliminary Site Work

1. Excavation of launch areas, etc. shall be carried out according to the planned schedule submitted to the Engineer prior to commencement of work.
2. Installation of by-pass pumping equipment shall be complete and operational.
3. All buried utilities adjacent to the line of operation shall be reviewed and where necessary excavated to relive transient loading during the insertion operation.
4. Excavations for all active house connection laterals shall be completed before the insertion of the new pipe. Manhole positions along the line of insertion and lateral excavations will be used to check progress as the head passes these points.

5. Any heavy concrete reinforcement present along the line of insertion shall be broken out prior to the operation to allow steady and free passage of the expander.

B. By-Pass Sewage

1. The Contractor shall furnish, install, and operate pumps, plugs, conduits, and other equipment to divert the flow of sewage around the pipeline reach in which work is to be performed. The plug shall be provided with a tag line. The pumping system shall be of sufficient capacity to handle existing flow plus additional flow that may occur during a rainstorm. If pumping is required on a 24-hour basis, engines shall be equipped in a manner to keep noise to a minimum. Standby pumps shall be provided as required. Pumping shall be done by the Contractor in such manner as will not damage public or private property or create a nuisance or health menace. The pumped sewage shall be in an enclosed hose or pipe and shall be reinserted into the sanitary sewer system. Sewage shall not be allowed to free flow in gutters, streets or over sidewalks, etc. Nor shall any sewage be allowed to flow into the storm inlets or conduits. After the work has been completed, flow shall be restored to normal.
2. The Contractor shall be responsible for continuity of sanitary sewer service (i.e. building laterals) to each facility connected to the section of sewer during the execution of the work. **Building laterals shall not be disconnected or plugged overnight**; that is continuing service on the laterals should not be interrupted during the peak flow period from 5 P.M. the day before to 9 A.M. the next day.

C. Cleaning and Closed Circuit TV Inspection for Sewer Pipe

1. Prior to pipe bursting operation, the Contractor shall perform an initial sewer cleaning and closed circuit TV (CCTV) inspection according to Section 02732 of this Specification to determine the general condition of the sewer, to remove any obstruction and debris, to determine defective pipe sections for point repairs, to log the location of all house laterals and to verify location of active house laterals.

D. Excavation

1. Existing utilities shall be located and protected as required by utility owners.
2. Excavation, dewatering, sheeting, shoring, and bracing shall be in accordance with FED-OSHA 29 C.F.R., Part 1926 Sub-Part P. Sewer house connections shall be exposed prior to pipe installation operation.
3. Access excavations shall be provided as required to facilitate the pipe bursting insertion. When practicable, they shall be located where interference to vehicular traffic and inconvenience to the public is minimized. Access excavations shall coincide with sewer house connections, changes in the sewer line and grade and to provide access to the sewer in both directions. Excavations that have pull or push equipment installed shall have adequate support provided to prevent damage to adjacent areas.

E. Locating Existing Sewer Lateral Connection

1. Upon completion by the Contractor of CCTV inspection, the Contractor shall mark in the field the location of the existing sewer lateral connection.
2. The Contractor shall expose the existing sewer lateral connection and make arrangements with the resident to access all the plumbing fixtures in each house and perform dye tests when necessary or other means to determine if the exposed sewer lateral connection is active. If access to the house fixtures is denied by the resident, the exposed sewer lateral connection shall be assumed active unless otherwise directed by the Engineer and shall be reconnected in accordance with these specifications.
3. All inactive sewer laterals shall be plugged at the sewer main.

3.4 PIPE BURSTING AND PIPE INSTALLATION

A. Site Organization

1. Excavation of launch pits shall be situated to provide minimum inconvenience to residents, businesses or traffic. Launch excavation will be situated to give maximum possible advantage to the insertion operation but more importantly to give minimum inconvenience to traffic and pedestrian users. Launch pits shall not be located in the easement areas and private property without permission of the homeowner and the Engineer.
2. Dimensions will vary with depth of cover and size of pipe and also pipe wall thickness. These latter parameters, together with ambient temperature, control the pipe bend radius and the pipe manufacturer's recommendations must be used to obtain the slit trench length.
3. A sump hole in the base of the excavations should be provided to allow pumping of water from the excavation.
4. Layout of a temporary by-pass pumping system to isolate the working area should take into account the location of pumps and pipes, possible pump failure contingency and avoidance of blocking entrances to homes, drives, bus stops, etc. Equipment used should be selected to give minimum noise levels and emission of fumes. All costs for this time are included in the bid price per linear foot of replacement.
5. Where buried utilities are known to exist, surface marking should be carried out and where necessary local excavations made to relieve the possibility or transferred loading. This is especially important in the case of gas mains which should be at least one foot away from the line of work. If nearer than this, special arrangements must be made with the local gas utility to comply with codes of practice.
6. Existing manholes shall be utilized where-ever practical. Remove manhole inverts and bottoms to permit access for installation equipment.
7. Support equipment used to perform the work shall be located away from buildings

so as not to create a noise impact. Provide silencers or other devices to reduce machine noise as required to meet local requirements.

B. Pipe Installation

1. The Contractor shall remove internal bead.
2. Contact by radio shall be maintained between key positions at all times so that slowing down, stopping and starting can be effected when necessary.
3. The Contractor shall record the general progress, i.e. insertion rates in feet per minute, reasons for stoppages, signs of failure of equipment and road or other surface damage.
4. Particular care shall be exercised when passing buried utilities or when near building foundations.
5. At manholes or lateral excavations, the Contractor shall slow the rate of progress to examine the winch rope attachments on the head and the pipe retaining assembly at the rear of the head. Repairs and replacements in these positions are much easier than having to excavate to repair between positions.
6. Thread winch and associated lines through sewer section to be rehabilitated. Keep lines away from pedestrian and vehicular traffic.
7. For the method using sectional pipe, only existing manholes in the street may be used for launch and receiving access. Manholes in the easement area may be used only with the permission of the homeowner and the Engineer. Remove manhole invert and bottom as required.

3.5 ANCHORING PIPE AND SEALING MANHOLES

- A.** After the pipe has been installed in the entire length of the sewer section, anchor the pipe at manholes. The pipe shall protrude in the manholes for enough distance to allow sealing and trimming.
- B.** Sealing the pipe at manholes providing a flexible gasket connector in the manhole wall at the end of the pipe, centered in the existing manhole wall. Grout the flexible connector in the manhole wall filling all voids the full thickness of the manhole wall.
- C.** Restore manhole bottom and invert.

3.6 CLEANING SANITARY SEWERS

- A.** Contractor shall flush and clean all sewer mains by means of pneumatic, sewer cleaning balls. The balls shall be of the appropriate size to fit the sewer pipe being cleaned. "Sewer Balling" operations shall be conducted by experienced personnel under the observation of the Engineer. The ball shall be introduced at the uppermost manhole and passed from manhole to manhole by means of a line with sufficient head of water to carry the ball along. The movement of the ball shall be controlled by a rope; care shall be exercised not to feed the ball too rapidly in order that all debris can be removed at each manhole.

- B. Each section of the sewer line shall be thoroughly cleaned before proceeding to the next section. Where sewer balls will not pass, flexible sewer rods with approved spears or cutters may be used to clear the obstruction. Where obstructions cannot be cleared by sewer rodding, the obstructions shall be removed by excavation at the Contractor's expense. The Contractor shall remove all debris from sewer lines using approved methods.
- C. Installation cost shall include cost for water for sanitary sewer flushing and cleaning operations.

3.7 TESTING SANITARY SEWERS

- A. Sanitary sewer systems including laterals, and sanitary sewer mains shall be tested for tightness after completion of all backfilling and prior to request for final inspection. Contractor shall notify the Engineer at least two (2) working days in advance of proposed testing dates. Tests of gravity sewers shall be made from end or manhole to manhole unless grades are flat enough to permit testing two or more sections at one time. Sections which fail to pass the tests shall be repaired or replaced, and the section retested until it falls within specified allowances.
- B. All water for sanitary sewer testing shall be provided and the tests performed by the Contractor in conformance with the following requirements:
 - 1. Mandrell Test
 - a. Pipes shall be tested for deflection by passing a mandrel through the pipe without obstruction.
 - b. The size of the mandrel shall be set at 92.5% of the base inside diameter of the pipe, as defined in ASTM 3034.
- C. Leakage Tests shall be performed per City Standard Specification Section 02730, "Sanitary Sewer" - Subsection 3.07, "Testing Sanitary Sewer".

3.8 MANHOLE INSPECTION

- A. Manholes will be inspected after completion and within the guarantee period. Leakage and other defects that were a result of the Contractor's work shall be eliminated and repaired by the Contractor as required by the Engineer, at the Contractor's expense.

3.08 FINAL CLEANING AND CLOSE CIRCUIT TELEVISION INSPECTION (CCTV) REQUIREMENTS

- B. Prior to final acceptance and final inspection of the pipe, the contractor shall flush and clean all parts of the newly installed HDPE pipes by removing all accumulated construction debris, rocks, gravel, sand and other foreign material from the pipe.
- C. Perform final CCTV inspection per specification Section 02732 and Section 02737 after existing sewer mains and laterals are completely replaced/rehabilitated.

* * *

SECTION 02737

CURED-IN-PLACE PIPE (CIPP)

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Scope

1. This section covers the work necessary to furnish and install, complete in place, a cured-in-place pipe (CIPP) for rehabilitation of existing sanitary sewers as specified herein. The Contractor shall provide all materials, labor, equipment, and services necessary for bypass pumping of sewage flows in mains and services, cleaning and pre-television inspection of sewer to be lined, complete installation, inversion, and curing process of cured-in-place pipe, re-connection of service laterals, pipe sealing at manholes, and final television inspection and testing of the lined pipe sewer system. Cured-in- place pipe shall be as specified herein and installed at the locations shown on the Drawings.

B. Process Description

1. The rehabilitation of existing sanitary sewer lines by Cured-In-Place process includes reconstruction of the existing lines by forming a new pipe within the existing, structurally deteriorated pipe which has generally maintained its original shape. Installation of the Cured-In-Place Pipe shall be accomplished by the use of an inversion process or a winched-in application. The reconstruction of the existing line shall be accomplished by installing a flexible tube which is first impregnated with a thermosetting resin. The tube is either inverted into the pipeline by using hydrostatic head (water pressure), compressed air pressure or some other approved inversion method, or pulled into the pipeline from manhole to manhole using mechanical equipment (winch). After full insertion, the tube is cured by circulating hot water or introducing controlled air or steam throughout the length of the tube to cure it into a hard, impermeable pipe. This "pipe" shall extend the full length of the original sewer, and shall provide a structurally sound, joint less, tight-fitting, water-tight pipe within a pipe.
2. Cleanup and Restore Existing Surface Condition and structures.
3. Repair Defective Work per Engineer's Final Inspection.
4. The Contractor is responsible for proper and accurate installation of the new sewer pipe regardless of the method described in this section and the following subsections. The Contractor shall ensure that the new pipe's vertical and horizontal alignment is as indicated on the plans and in accordance with these specifications.
5. Supplying all labor, materials, equipment and apparatus not specifically mentioned herewith or noted on the plans, but which are incidental and necessary to complete the work specified.

1.2 APPLICABLE PUBLICATION

- A. The following documents form a part of these specifications to the extent stated herein and shall be the latest edition thereof. Where differences exist between codes and standards, the one affording the greatest protection shall apply.

American Society for Testing and Materials (ASTM):

ASTM D 256	Standard Test Methods for Impact Resistance of Plastics and Electrical Insulating Materials.
ASTM D 543	Resistance of Plastics to Chemical Reagents.
ASTM D 638	Tensile Properties of Plastics
ASTM D 732	Standard Test Method for Shear Strength of Plastics by Punch Tool.
ASTM D 790	Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
ASTM F 1216	Standard Practice for Rehabilitation of Existing Pipelines and Conduits by the Inversion and Curing of Resin-Impregnated Tube (1991 Revision).
ASTM D 2990	Tensile, Compressive, and Flexural Creep and Creep-Rupture of Plastics.

Federal Water Pollution Control Act of 1972 (FWPCA): As Amended.

National Association of Sewer Service Companies (NASSCO): Recommended Specifications for Sewer Collection System Rehabilitation.

1.3 WARRANTY AND QUALITY ASSURANCE

- A. General Bid Requirements:

1. The curing and installation methods of the liner shall be described and included with the Bid. The Contractor shall demonstrate that the method is applicable and that his/her experience in using the method is proven.
2. The bidder, or his/her Sub-contractor, shall be properly licensed and trained to a cured-in-place pipe lining process having at least thirty (30,000) lineal feet of successful installation in the United States within the last 2 years, in pipelines ranging from 4 to 48 inches. Documentation of the licensing and details of two years minimum training of the on-site foreman of the Contractor, or his/her CIPP Sub-contractor, who will perform the actual lining process, shall be provided.

- B. The Contractor shall provide to the City a warranty to be in force and effect for a period of ONE (1) year from the date of acceptance by the City. The warranty shall

cause the Contractor to repair or remove and replace the liner should failure result from faulty materials or installation.

- C. Correction of failed liner or liner pipe deemed unacceptable, as a result of the post video inspection and/or test reports for structural values, thickness, chemical resistance, etc., shall always be the responsibility of the Contractor, at no extra cost to the City. Method of correction/repair shall be approved by the City with prior field demonstration, if required. It shall be understood that minimum criteria of the specification shall not be lowered to compromise with lower than the required test values, unless approved in writing.
- D. The finished liner shall be continuous over the entire length of run between two manholes and shall be free from visual defects. The finished liner shall meet or exceed the requirements of Section 2.01-D.2 of this specification, "Finished and Cured Liner Properties."
- E. Wrinkles in the finished liner pipe which exceed 5% of the pipe diameter are unacceptable; Contractor shall remove either the liner or the wrinkled segments which exceed 5% of the pipe diameter. Repair of the removed sections shall be proposed by the Contractor and approved by the Engineer.
- F. The Contractor shall carry out the operations in strict accordance with all applicable OSHA regulations. Particular attention is called to those safety requirements involving work on an elevated platform and entry into a confined space.
- G. Delivery, Storage and Handling
 1. Transport, handle, and store pipe and fittings as recommended by manufacturer.
 2. If pipe and fittings become damaged before or during installation, it shall be repaired as recommended by the manufacturer or replaced as required by the Engineer at the Contractor's expense, before proceeding further.
 3. Deliver, store, and handle other materials as required to prevent damage.
- H. Only those tools designed for the aforementioned procedures, and approved by the pipe manufacturer or supplier and the ENGINEER, shall be used for assembly of pipe fittings to ensure proper installation.
- I. The CONTRACTOR shall televise the installed pipe after existing services have been reconnected and manhole work has been completed. The original television inspection video tape shall be provided to the ENGINEER. The CONTRACTOR shall repair all damages found during the reviewing of these final TV inspection video tapes. The damages shall include but not limited to sags, leaks, cracks, unsecure joints, visual defects, and others which in the opinion of the ENGINEER are not acceptable and would impair the serviceability of the new piping system.

1.4 SUBMITTALS

- A. The Contractor shall submit for approval by the Engineer the following information:
- B. Certification by the manufacturer that all pipe and fittings furnished under this specification were manufactured, sampled, tested, and inspected in accordance with ASTM F1216-91. Certification shall be signed by an authorized agent of the

manufacturer. Verification of product conformance with the chemical resistance and physical testing requirements of the latest edition of Green Book, Section 210-2.3.3 AND 500-1.4.2 - ASTM test methods D638, D790 and D2990) shall also be provided to the Engineer for approval a minimum of 15 days prior to the commencement of the scheduled work. A report of test results shall be furnished for the Engineer's review. The date the pipe was manufactured shall be included in the Certification.

- C. Manufacturer's recommendations for the installation of the CIPP including resin application, curing process details (including temperature control), storage procedures, service connection methods, trimming and finishing, and quality control measures to be used for cured-in-place pipe lining of main-lines and services.
- D. Certification from the Manufacturer(s) that the installer is licensed to perform the work.
- E. Certification from the manufacturer(s) that the resin material complies with the required application, meets the intended service condition, and that the resin will meet the physical requirements set forth in this specification. Information from the resin manufacturer shall include specifications, characteristics and properties of the resin, methods of application, curing temperatures, and duration of temperature (step cooking temperatures/hours at each and final stages).
- F. Grout and design mixes and grout testing reports.
- G. Recommended grout and equipment to seal any open area in the reconnected (cut) service laterals AND the annular space between the cured-in-place pipe and the existing pipe at the manholes.
- H. Television inspection reports and video tapes made prior to and after pipe insertion. (See Section 02732 for details of submittals).
- I. The CONTRACTOR shall submit a sewage bypass pumping and/or diversion plan for review by the ENGINEER at least 10 days prior to pipe installation. The sewage bypass pumping and/or diversion plan shall include an emergency response plan to be followed in the event of a failure of the bypass pumping and/or diversion system. The CONTRACTOR shall notify the ENGINEER 24 hours prior to commencing the bypass pumping operation. The CONTRACTOR'S plan for sewage bypass pumping and/or diversion shall be satisfactory to the ENGINEER before the CONTRACTOR shall be allowed to commence sewage bypass pumping and/or diversion.
- J. The Contractor shall submit to the Engineer a detailed plan of construction including the installation procedures, equipment set-up, and the locations of the proposed access points for approval. The Contractor shall have an approved plan of construction prior to commencing any construction.

1.5 JOB CONDITIONS

- A. Note and conform to conditions and requirements indicated and specified under Section 02202 of these Specifications.
- B. Contractor shall conduct operations and schedule cleanup in a manner to cause the least possible obstruction and inconvenience to traffic, pedestrians and to adjacent property owners or tenants.

PART 2 - PRODUCTS

2.1 MATERIALS

A. The liner pipe material shall be designed for use in gravity sanitary sewers and shall be in strict conformance with all applicable sections of ASTM F1216 specifications. All materials and procedures used in the cured-in-place pipe rehabilitation process shall be equal to or exceed the manufacturer's standards.

B. **Tube:** The liner tube shall be fabricated to meet performance requirements as specified in section 1.03.04, Finished and Cured Liner Properties, of this specification. Two different types of systems shall be considered for cured-in-place pipe rehabilitation:

1. Fiber Felt Tube System:

- a. The felt tube shall be a thermoplastic polyester or acrylic tube consisting of one or more layers of flexible needled felt or an equivalent woven and/or non-woven material capable of carrying resin, and with sufficient needling and cross lapping and strength to withstand the installation pressures and curing temperatures. The felt tube to be furnished shall be compatible with the resin and catalyst systems to be utilized.
- b. The tube shall be free of tears, holes cuts, foreign materials and other defects and will be subject to inspection by the City.
- c. The finished lining shall consist of inner polyurethane and outer polyester felt layer (or layers) impregnated with a thermosetting resin and fabricated to fit tight against the existing pipe wall. An allowance shall be made for circumferential stretching during inversion.
- d. Contractor shall determine the minimum tube length necessary to effectively span the designated run between manholes, unless otherwise specified. Contractor shall field verify the lengths in the field prior to impregnation of the tube with resin, to insure that the tube will have sufficient length to extend the entire length of run.

OR

2. Fiberglass Mat System:

- a. The tube shall be composed of a high strength, fiberglass mat system capable of retaining resin, contained within a system of polyethylene film. The tube shall have sufficient needling and cross lapping to yield a minimum burst strength of 800 pounds per square inch in transverse directions (hoop stress), and strength to withstand the installation pressures and curing temperatures. The tube shall be free from tears, holes cuts, foreign materials and other defects, and will be subject to inspection by the City.

C. Resin/Catalyst

1. The resin used shall be compatible with the rehabilitation process used, and

designed for a wastewater environment. The resin shall be able to cure in the presence or absence of water, and the initiation temperature for cure shall be as recommended by the resin manufacturer and approved by the Engineer. The resin shall have sufficient thixotropic properties to obtain non-draining characteristics when impregnated into the fiber fabric.

2. Unless otherwise specified or approved by the Engineer, the resin shall be an epoxy vinylester system and shall be able to meet the service conditions specified for the tube system.
3. The Engineer shall also be informed in advance, for verification and inspection of the resin material at the "wet out" of the tube. The inspection shall be at the discretion of the Engineer, which shall not relieve the Contractor of his responsibilities. The wet-out procedure shall utilize the resin and catalyst in sufficient quantities to ensure complete impregnation of the liner and provide the properties specified in Section, Finished and Cured Liner Properties.
4. The catalyst system shall be compatible with the resin and other materials to be utilized in the rehabilitation process. Quantity and type of catalyst shall be selected based on the curing conditions and recommendations of the resin manufacturer.

D. Liner Design Criteria

1. The Cured-In-Place Pipe thickness shall be calculated and designed upon the following physical conditions of the existing pipe to be rehabilitated:
 - a. All pipes shall be considered fully deteriorated.
 - b. All pipes shall be subjected to a soil load of 120 lbs./cu. Ft., with applicable live load, and water table two (2) feet below the top of the ground.
 - c. Pipes in good condition shall have a minimum of 2% ovality in the circumference. A higher value of ovality shall be used if the pipe is deteriorated.
 - d. Factor of safety (N) of 2.0 shall be used for calculations.
 - e. The Contractor shall measure the inside diameter of the existing pipe in the field so that the liner can be lined in a tight fitted condition.
 - f. Conditions (a) and/or (b) above may change after the initial TV report, if approved by the Engineer. The Engineer shall have the right to modify/change the required liner thickness, depending upon field conditions evident from the video tape(s).
 - g. **The minimum material wall thickness derived using design criteria for the City shall be equivalent to SDR-34.** The calculated wall thickness derived using the above design criteria shall be compared to the specified (bidded) pipe thickness (SDR-34). The Engineer then has the right to either keep the specified pipe thickness (SDR-34) or change to the calculated pipe thickness for installation. Material cost shall be adjusted accordingly.

2. Finished and Cured Liner Properties

- a. The finished cured-in-place pipe liner shall fit tightly and neatly against the existing pipe walls. The liner shall be fabricated from materials which, when cured, will be suitable for continuous service in sewerage environments containing hydrogen sulfide, carbon monoxide, carbon dioxide, methane, dilute (10%) sulfuric acid at an average wastewater temperature of 80°F, dilute (10%) phosphoric acid, petroleum hydrocarbons, gasoline, vegetable oil, tap water (pH 6.5 - 9), up to 1 hour per day exposure to 5 percent sodium hydroxide up to a pH of 11, moisture saturation, and external exposure to soil bacteria and chemical attack which may be due to materials in the surrounding ground or sewage within.

The cured-in-place pipe system shall conform to and comply with the requirements above and with the minimum standard physical properties as follows:

STRUCTURAL/ MECHANICAL PROPERTY	ASTM TEST METHOD	ASTM MINIMUM SHORT TERM VALUE	ASTM MINIMUM LONG TERM VALUE
Tensile Strength (@ yield)	D-638	4,000 psi.	
Tensile Modulus	D-638	250,000 psi.	125,000 psi.
Flexural Strength	D-790	5,000 psi.	
Flexural Modulus	D-790	300,000 psi.	150,000 psi.
Shear Strength	D-732	55,000 psi.	
Impact Strength	D-256	1.9 in. -lb.	

The initial stiffness factor shall conform to the following table:

Nominal ID of Original Pipe (inches)	Stiffness Factor (EI) ¹ (in ³ - lbf/in ²)	Maximum Allowable Depth of Groundwater Above Invert ² (Feet)
6	328	238
8	328	96
10	328	48
12	328	27
12	1109	96
15	1109	48
18	1109	27
18	2628	67

Stiffness factor shall be determined in accordance with ASTM D2412.

- E. Liner pipe material shall be homogeneous throughout and free of:
1. Serious abrasion, cutting, or gouging of the outside surface extending to more than 10 percent of the wall thickness in depth.
 2. Cracks
 3. Kinking (generally due to excessive or abrupt bending)
 4. Flattening
 5. Holes
 6. Blisters
 7. Other injurious defects

They shall be uniform in color, opacity, density, and other physical properties. Any pipe and fittings not meeting these criteria shall be rejected.

2.2 SANITARY SEWER LATERALS

- A. Contractor shall verify location and diameter of all active laterals.
- B. Sanitary sewer lateral shall be installed to conform to the City's Standard Details or modified herein as shown in the Contract. Drawings. Lateral to main connections shall be performed using strap-on wye rubber saddles.
- C. Lateral to main connection shall be backfilled with controlled density fill to provide concrete support to strap-on wye rubber saddle.
- D. Connections to the existing sewer house connection pipe shall be made using sleeved stainless steel flexible couplings. All flexible couplings shall conform to ASTM C425 and be manufactured by Fernco Joint Sealer Co., DFW Plastics, Inc. or approved equal.
- E. The sewer lateral connection shall have a slope equal to the existing or a minimum of two-percent.
- F. For laterals shown to be constructed using pipe bursting method, the Contractor shall conform to details specified under Section 02734, Pipe Bursting. For laterals shown to be constructed using open cut method, the Contractor shall conform to Specification Section 02730 Sanitary Sewers.

2.3 SANITARY SEWER CLEANOUTS

- A. Install sanitary sewer cleanouts per project details and specifications.
- B. Wye branches and risers for sanitary sewer cleanouts shall conform to the City's project details.
- C. Cleanout box shall be Christy concrete type F08 Curb Valve Box with F08R lid marked "SEWER" when installed in location not subject to vehicular loading.
- D. When installed in location subject to vehicular loading, cleanout box shall be Christy concrete type G05T Traffic Valve Box with G05CT Traffic Lid marked "SEWER" and shall be provided with 8" concrete base.

PART 3 - EXECUTION

3.1 GENERAL

- A.** This section is intended to provide the Contractor with general guidance on the methods to be used to install the sewer pipe using cured in place pipe lining rehabilitation method. Nothing contained herein shall relieve the Contractor from completing the pipe rehabilitation in the most feasible, efficient and safe manner, using required materials to the lines and grades shown on the plans and to the requirements of these specifications.

3.2 SITE INVESTIGATION

- A.** Prior to pipe rehabilitation, the Contractor shall perform a careful site investigation to locate and record possible surface obstructions, locate and mark active and inactive sewer laterals; and formulate and submit plans to replace the pipe, to reconnect all sewer laterals, and to restore all structures and plants that would be damaged by the project work.

3.3 PREPARATION

A. Preliminary Site Work

1. Installation of by-pass pumping equipment shall be complete and operational. Layout of a temporary by-pass pumping system to isolate the working area should take into account the location of pumps and pipes, possible pump failure contingency and avoidance of blocking entrances to homes, driveways, bus stops, etc. Equipment used should be selected to give minimum noise levels and emission of fumes. All costs for this time are included in the bid price per linear foot of replacement.
2. Verification of all active and in-active house connection laterals shall be completed before the insertion of the new pipe. Manhole positions along the line of insertion shall be used to check progress as the liner passes these points.
3. Any heavy concrete reinforcement present along the line of insertion shall be broken out prior to the operation to allow steady and free passage of the liner.
4. Support equipment used to perform the work shall be located away from buildings so as not to create a noise impact. Provide silencers or other devices to reduce machine noise as required to meet local requirements.

B. By-Pass Sewage

1. The Contractor shall furnish, install, and operate pumps, plugs, conduits, and other equipment to divert the flow of sewage around the pipeline reach in which work is to be performed. The plug shall be provided with a tag line. The pumping system shall be of sufficient capacity to handle existing flow plus additional flow that may occur during a rainstorm. If pumping is required on a 24-hour basis, engines shall be equipped in a manner to keep noise to a minimum. Standby pumps shall be

provided as required. Pumping shall be done by the Contractor in such manner as will not damage public or private property or create a nuisance or health menace. The pumped sewage shall be in an enclosed hose or pipe and shall be reinserted into the sanitary sewer system. Sewage shall not be allowed to free flow in gutters, streets or over sidewalks, etc. Nor shall any sewage be allowed to flow into the storm inlets or conduits. After the work has been completed, flow shall be restored to normal.

2. The Contractor shall be responsible for continuity of sanitary sewer service (i.e. building laterals) to each facility connected to the section of sewer during the execution of the work. **Building laterals shall not be disconnected or plugged overnight**; that is continuing service on the laterals should not be interrupted during the peak flow period from 5 P.M. the day before to 9 A.M. the next day. **Plugging of laterals is therefore allowed only from 9 A.M. to 5 P.M. of the same day.**

C. Cleaning and Closed Circuit TV Inspection for Sewer Pipe

1. Prior to pipe rehabilitation, the Contractor shall perform an initial sewer cleaning and closed circuit television (CCTV) inspection according to Section 02732 of this Specification to determine the general condition of the sewer, to remove any obstruction and debris, to determine defective pipe sections for point repairs, to log the location of all house laterals and to verify location of active house laterals.

D. Point Repairs

1. Point repairs are work required to prepare defective sections of existing sewer lines for rehabilitation.
2. Work shall be performed per Section 02733 of this Specification. The work shall include verifying the location of the point repair, locating all interfering utilities, temporary flow bypassing, traffic control, excavation, shoring, dewatering, pipe repairs or replacement, backfilling, and surface restoration.

3.4 INSTALLATION

- A.** The Contractor's shall retain the services of a licensed installer of the manufacturer of the cured-in-place pipe rehabilitation system to assist the Contractor during preparation and installation of the system to certify that the work has been performed in accordance with the manufacturer's recommendations. The Contractor shall obtain detailed installation instruction and procedures from the manufacturer for the actual installation of the cured-in- place liner system.
- B.** The host pipeline shall be cleaned and televised in accordance with Section 02732. The outside diameter of the tube being inserted shall be properly sized to allow for expansion so that the CIPP liner can fit tightly against the host pipe.
- C.** The tube shall be installed through the existing manholes, in accordance with the manufacturer's recommendations and procedures. The finished pipe on mainline reaches shall be continuous over the entire length between manholes. A seal, recommended by the installer, shall be installed at the entrance to each manhole between the tube and the existing pipe.

- D. During the curing process, the Contractor shall keep logs, charts and/or graphs of the liner temperatures at the upstream and downstream manholes to insure that proper temperatures and cure times have been achieved. These documents may be required by the Engineer at any time during and after the curing process.
- E. Immediately after curing of the cured-in-place pipe and after testing, within the same working day, the Contractor shall reinstate all existing active service connection per City standard details. Rough edges, string or other pipe defects that would prevent solids from free flowing shall be removed.
- F. The Contractor shall also have a remote control cutting and grouting device on site to reinstate house lateral connections. There will be no initial relief hole; all cut shall be finish cut to the approximate original size and shape of the service lateral. Rough edges, strings or other pipe defects that would prevent solids from free flowing shall be removed. The Contractor shall have a back-up remote control cutting device on site in case of malfunction.
- G. Any evidence of infiltration between the service connection and the existing pipe shall be corrected by the Contractor. The method of correction shall be submitted and approved by the Engineer.
- H. The beginning and end of the cured-in-place pipe shall be cut flush at the inlet and outlet points in the manhole by using a rotary cutter, and the ends shall be sealed to the rehabilitated pipeline. The sealing material shall be compatible with the cured-in-place liner pipe and shall provide a watertight seal.

3.5 SEALING AT MANHOLES

- A. The cured-in-place CIPP shall make a tight seal at the manhole opening with no annular gaps. Under all circumstances, the liner shall be sealed to the manhole and host pipe with appropriate type of sealant. The sealing material shall be compatible with the cured-in-place liner pipe and shall provide a watertight seal.

3.6 SEWER HOUSE CONNECTIONS

- A. All active laterals shall be verified. Sanitary sewer lateral shall be installed to conform to the City's Standard Details. See specifications Section 02730 and 02734 for more details regarding lateral installation.

3.7 FIELD TESTING

- A. Sanitary sewer systems including laterals, and sanitary sewer mains shall be tested for tightness after completion of all backfilling and prior to request for final inspection. Contractor shall notify the Engineer at least two (2) working days in advance of proposed testing dates. Tests of gravity sewers shall be made from end or manhole to manhole unless grades are flat enough to permit testing two or more sections at one time. Sections which fail to pass the tests shall be repaired or replaced, and the section retested until it falls within specified allowances.
- B. All water for sanitary sewer testing shall be provided and the tests performed by the Contractor in conformance with the following requirements:
 1. Mandrell Test

- a. Pipes shall be tested for deflection by passing a mandrel through the pipe without obstruction.
 - b. The size of the mandrel shall be set at 92.5% of the base inside diameter of the pipe, as defined in ASTM 3034.
- C. Air Leakage Tests shall be performed per City Standard Specification Section 02730, "Sanitary Sewers" - Subsection 3.07, "Testing Sanitary Sewer".

3.8 FIELD SAMPLING, LABORATORY TESTING and ACCEPTANCE TESTING

- A. The physical properties of the installed CIPP shall be verified through field sampling and laboratory testing, as approved by the Engineer. Following the curing and cooling of the installed pipe, the Contractor with or without the aid of the independent lab field personnel hired by the City, shall remove pipe samples at locations determined by the Engineer and/or City inspector. The samples shall be clearly labeled with the date, time of day, duration of curing, and location of the sample. The sample shall be tested by an independent third party testing laboratory hired by the City for the following parameters:

Average Outside Diameter - ASTM D 2122

Average Inside Diameter - ASTM D 2122

Minimum Wall Thickness - ASTM D 2122

Pipe Stiffness at 5% - ASTM D 2412

Tensile Strength at Yield - ASTM D 638

Tensile Modulus - ASTM D 638

Flexural Strength - ASTM D 790

Flexural Modulus - ASTM D 790

Impact Strength - ASTM D 256

The Lab shall provide the Engineer for approval, with certified test results of the short term properties of the CIPP pipe liner material from the actual installed liner at a minimum of two samples taken at a random locations, and with no more than three (3) samples, per each project area of lining set-up. Locations of sample shall be as directed by the Engineer.

CIPP liner pipe samples shall be submitted to a certified laboratory which has been approved by the Engineer and tested to confirm that the liner pipe conforms to the requirements of the latest edition of Green Book, Section 500-1.4.2, 210-2 and ASTM F1216.

- B. Field sample preparation for Cured-In-Place lining method shall be according to ASTM F-1216, item 8.1.1.

- C. The testing costs are to be paid by the City and therefore, should not be included in the bid. However, if the work should fail to pass the tests, it is the Contractor's responsibility to correct the work and re-test at the Contractor's expense. The City shall not pay for these re-installations and re-tests.
- D. If within the warranty period, any section of the sewer system is not acceptable due to subsequent excessive leakage or any other defects, although originally accepted, the Contractor shall repair or replace the affected portion at no cost to the Agency. It is understood that if the Contractor fails to do such work as required, the Surety shall be liable for said costs of repair or replacement.

3.9 MANHOLE INSPECTION

- A. Manholes will be inspected after completion and within the guarantee period. Leakage and other defects that were a result of the Contractor's work shall be eliminated and repaired by the Contractor as required by the Engineer, at the Contractor's expense.

3.10 FINAL CLEANING AND CLOSE CIRCUIT TELEVISION INSPECTION (CCTV) REQUIREMENTS

- A. Upon completion of the cured-in place sewer lining operations, all lines, manholes, and other structures shall be thoroughly cleaned of dirt, rubbish, debris and obstructions of any kind to the satisfaction of the Engineer, and the entire work site shall be cleaned of all waste, rubbish, and construction debris of any nature.
- B. Prior to acceptance of any rehabilitated sanitary sewer line, a closed circuit television (CCTV) inspection shall be performed using Wincan Version 8 inspection software recorded digitally to an external drive.
- C. Defects such as high and low spots, joint separations, offset joints, chipped ends, cracked or damaged pipe, infiltration points and debris in lines shall be corrected to the satisfaction of the Engineer. For joint separations, low spots and chipped ends, the following maximum acceptable limits will apply for 6-10 inch pipes:

Joint separations	1/2 inch
Low spots	1 inch maximum depth
Chipped ends	1/4 inch

- D. For pipe larger than 10 inch, maximum limits will be specified by the Engineer for each project.
- E. The complete job is ready for television inspection when the following work has been completed:
 1. All sewers pipelines are installed and backfilled.
 2. All structures are in place, all channeling is complete and pipelines are accessible from structures.
 3. All other underground facilities, utility piping and conduits are installed.
 4. Final street grading is complete and ready for asphaltic concrete surfacing.
 5. Pipelines to be inspected have been preliminarily balled and flushed or cleaned by a high pressure cleaner.

6. Final leakage test has been completed and approved.
 7. Flood and drain the sewer system just prior to video inspection.
- E.** When the above work is completed, the Contractor shall arrange with the Engineer for close circuit television (CCTV) inspection.
 - F.** The Contractor shall repair or replace failed sections as required by the Engineer.
 - G.** Those portions of the pipeline system that have been corrected must be re- televised.
 - H.** Refer to specification Section 02732 for additional details regarding close circuit television video (CCTV) inspection.

* * *

SECTION 02738

MANHOLE REHABILITATION

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Scope:

1. This section covers repair, structural restoration and rehabilitation of existing manholes as required to eliminate leakage into the structures and provide protection against biogenic corrosion by providing a structural, monolithic liner on the manhole inside walls.
2. Construction Photographs: The Contractor shall provide the City with preconstruction and post construction digital photo files of the manholes indicated for rehabilitation. Provide a list correlating the photo file number with manhole's approximate location. All photographs shall have sufficient detail of the interior of each manhole to reveal conditions of existing defects and rehabilitated features.

B. Process Description:

1. Manhole structural restoration is achieved by spraying the manhole walls and bench surfaces with cementitious materials (mortar) to create a monolithic wall with no joints. This process provides a uniform minimum thickness of ½" in depth, forming an impervious, monolithic liner with physical properties that exceed those of the existing structure. The system consists of three primary components; (1) materials consisting of pre-blended, fiber-reinforced mortar, (2) specialized equipment designed to mix and convey the material, and (3) proper application techniques.
2. The mortar must be designed for this particular use and shall have:
 - A minimum tensile strength of 500 psi (ASTM C 496)
 - A minimum 28 days flexural strength of 600 psi (ASTM C78)
 - A minimum 28 days compressive strength of 5000 psi (ASTM C109)
 - A minimum 28 days bond strength of 2300 psi (ASTM C 882)
3. The equipment must be specially designed to mix, pump and spray the wet mortar in a uniform controlled manner.
4. The applicator, approved and trained by the manufacturer, shall furnish all labor and equipment and materials for applying a corrosive resistant cementitious material to form the structural liner. All aspects of the installation shall be in accordance with the manufacturer's recommendation and per the following specifications which includes:
 - a. The removal of any loose and unsound substrate.
 - b. Cleaning of the area to be sprayed with high pressure water.

- c. The repair and filling of voids.
 - d. The repair and sealing on the inverts and benches.
 - e. The elimination of active infiltration prior to making the application.
 - f. Finally, the spay application of an acid resistant cementitious material to form a structurally enhanced corrosion resistant monolithic liner.
- C. Supplying all labor, materials, equipment and apparatus not specifically mentioned herewith or noted on the plans, but which are incidental and necessary to complete the work specified.

1.2 JOB CONDITIONS

- A. The Contractor shall conduct operations and schedule cleanup in a manner to cause the least possible obstruction and inconvenience to traffic, pedestrians and to adjacent property owners or tenants.

1.3 SUBMITTALS

- B. A list of locations and references for other projects in which the products was used shall be furnished to the Engineer prior to commencing work.
- C. The Contractor shall submit the manufacturer documents containing product (mortar and water-stop patching compound) technical information, ASTM test results and certification, application procedures and specifications for approval.
- D. The Contractor shall submit a plan for bypassing sewage around the work area and facilities where sewage flows must be interrupted to carry the work. The plan shall be reviewed by the engineer and shall be acknowledged as acceptable before any work is started.

1.4 REQUIREMENTS

- A. The installer, whether the Contractor or a subcontractor, shall be a certified installer of the lining system. The installer's personnel shall be adequately trained in maintenance and operation of the required installation equipment, as certified by the lining manufacturer. A letter from the manufacturer of the lining system, verifying the certification of the installer required to be on-site during installation, shall be submitted to the City.
- B. Prior to the installation of the lining system, the host structure shall be prepared to produce a concrete surface suitable for application and adhesion of the specified lining system. Cleaning and surface preparation shall include the inspection of the host structure for any damage or leaks, and the removal of any protrusions on the surface of the host structure that could interfere with the installation of the lining system. Any damage or leaks shall be reported to the Engineer. Cleaning methods may include high pressure water cleaning at a minimum of 34.5MPa (5,000 psi), abrasive blast, or a method recommended by the manufacturer of the lining system, or another cleaning method submitted to the Engineer for approval. The Contractor shall protect the host structure from damage by the cleaning equipment, water and air pressure. Flow bypassing, if required by the lining system, shall be as specified under Section 02740.

- C. Debris from the cleaning operation shall not be allowed to enter the sewer system. The Contractor shall furnish, install and remove any necessary debris containment devices while maintaining sewer flow. The Contractor shall remove and dispose of all debris collected from the cleaning operation. If reinforcing steel is exposed, either before or after removing deteriorated concrete, it shall be thoroughly cleaned to remove all contamination and rust particles. Immediately after the cleaned reinforcing steel is inspected and accepted by the Engineer, the Contractor shall place a protective coating on the exposed reinforcing steel. The protective coating shall be approved by the Engineer in accordance with the manufacturers' specifications.

PART 2 - PRODUCT

2.1 MATERIALS

- A. Cementitious material (i.e. spray-able mortar) shall be SewperCoat as manufactured by Kerneos Aluminate Technologies or SP15 Spray Mortar as manufactured by ThoRoc or Strong-Seal MS-2A as manufactured by Strong-Seal Systems Group or Drycon - SM as manufactured by IPA Systems Inc. or approved equal. Polyurethane coating material shall be Utilithane 1600 Polyurethane Coating as manufactured by Prime Coatings Incorporated or SprayShield by Sprayroq or approved equal. Epoxy coating material shall be Raven 405 manufactured by Raven Lining Systems or approved equal. The minimum liner shall be 3mm (125 mils) thick.

	Polyurethane	Epoxy Primer
Tensile Strength ASTM D 638, Type IV, MPa (psi) (min)	13.8 (2,000)	41.4 (6,000)
Elongation at Break, % ASTM D 638, Type IV	40	5
Wear Resistance, mg. wt. Loss Taber abrasion, ASTM D4060	60 ¹	100 ¹
Hardness, Shore D, Durometer ASTM D 2240	55	75
Tear Resistance, kg/mm (ppi) ASTM D 624	2.7 (150)	N/A
Peel Strength, Concrete, g/mm (pli) ASTM D 903	125 (7) ²	125 (7) ²
Weight Change ³	±1.5%	±1.5%

- B. Other applicable crack repair materials such as patching material, infiltration control material, and grouting material shall be obtained from the same manufacturer of the mortar for consistency in material used.

2.2 EQUIPMENTS

- A. Progressive cavity pumps are preferred because of their ability to provide a consistent volume of material to the spray head. High-pressure cleaning system and water storage tank are also required. A water metering system should be provided on the equipment to allow the application to properly control the volume of water added.

PART 3 - EXECUTION

3.1 SANITARY SEWER MANHOLE WALL REPAIR

- A. Comply with all relevant provisions of the Safety and Health Regulations for

Construction, promulgated by the Secretary of Labor, as set forth in Title 29 C.F.R., and with all provisions of the California Occupational Safety and Health Act of 1973.

- B.** Specific attention is directed to OSHA safety rules, regulations and precautions to be taken by the Contractor before entering sanitary sewer manholes, and sanitation structures with respect to physical and chemical hazards which may be present.
- C.** Manhole walls shall be sealed where shown or specified, or as directed by the Engineer. Rehabilitation of the manhole walls shall be accomplished by applying a structural, spray-able repair mortar coating to the original surface plane or a minimum of 0.5 inch. The manufacturer's recommendations shall be strictly followed for the entire operation including cleaning and preparing the manhole walls, storing and preparing the products, and sealing the manholes. The product must be specifically formulated for use in the sewer system and bear the manufacturer's certification that it will fulfill the requirement described herein when applied in accordance with the manufacturer's recommendations.
- D.** Prior to the sealing operation, the manhole walls shall be thoroughly cleaned using a high pressure water blast with a minimum nozzle pressure of 2,500 psi or higher as required to remove all surface debris and loose materials. All cracks, openings, active water infiltration, and deteriorated joints in the manhole walls shall then be repaired in accordance with the sealing product manufacturer's recommendations.
- E.** Where occur, seal crack openings greater than 1/8 inch on inside of existing manholes by chipping out a minimum depth and width of 3/4" to provide mechanical key for mortar.
- F.** Where occur, remove any loose bricks or pieces of brick, mortar or concrete and fill all voids and joints with mortar.
- G.** Where occur, seal all active water infiltration using rapid setting, water stop patching compound manufactured for this purpose.
- H.** Sealing manhole walls shall mean that the entire wall surface and the base are sealed with the new mortar coating. The manhole wall seal shall extend from the top of the cone to the base. This seal will include the area where the walls join the base and the location where the pipes enter and exit the manhole, even if through the manhole base.
- I.** Solid debris resulting from required preparatory operations shall be prevented from entering the sewer pipe and shall be removed from the manhole prior to sealing.
- J.** Polyurethane Liner Installation and Curing: Lining material shall be applied to all prepared surfaces from 25mm (1 inch) below the low-flow water level to the base of the ring and cover unless otherwise specified. All termination points of the lining material to the existing subsurface shall be keyed into the subsurface by mechanically scoring a minimum 6mm x 6mm (1/4 inch x 1/4 inch) keyway. Prior to application of the polyurethane, the subsurface shall be primed with the epoxy primer to a thickness of 7.6µm (3 mils) minimum to 12.7µm (5 mils) maximum. Polyurethane shall be applied to a thickness of 3.2mm (125 mils) immediately prior to the epoxy primer becoming tack-free. Lining material shall be uniform in color, fully cured, free of holidays, surface

imperfections, blisters and sags and adequately adhered to the subsurface.

- K. **Epoxy Liner Installation and Curing:** Lining material shall be applied to all prepared surfaces from 25mm (1 inch) below the low-flow water level to the base of the ring and cover unless otherwise specified. Termination points of the lining to the existing subsurface shall be keyed into the subsurface by mechanically scoring a minimum 6mm x 6mm (1/4 inch x 1/4 inch) keyway. Epoxy shall be applied to a thickness of 3.2 mm (125 mils). Lining material shall be uniform in color, fully cured, free of holidays, surface imperfections, blisters and sags and adequately adhered to the subsurface.

3.2 SANITARY SEWER MANHOLE INVERT AND BENCH REPAIR

- A. The existing bench and trough area shall be thoroughly cleaned. Remove loose and unsound materials such as mortar, brick, clay pipe and concrete. Care shall be taken to avoid damage to other parts of the manhole structure. Loose materials shall be prevented from entering into the sewer lines and shall be properly disposed by the Contractor.
- B. Repair manhole inverts and rebuild benches that have visible damage or infiltration present.
- C. Trowel mix uniformly onto damaged invert and bench at a minimum thickness of ½ inch, extending out onto base of manhole sufficiently.
- D. Finished invert and bench surfaces shall be smooth and free of ridges.

3.3 FIELD SAMPLE AND FINAL ACCEPTANCE

- A. The Contractor shall provide the Engineer for approval, with certified test results of the short term properties of the structural grout material from the actual installed grout liner at a minimum of 4 samples taken at random from different batch of material.
- B. Grout samples shall be submitted to a certified laboratory hired by the Engineer and tested to confirm that the liner pipe conforms to the minimum ASTM requirements stated in Section 1.01-B.2. Final payment for project shall be withheld pending receipt and approval of results of tests.
- C. Visually verify the absence of leaks. Manholes will also be inspected after completion and within the guarantee period. Leakage and other defects that were a result of the Contractor's work shall be eliminated and repaired by the Contractor as required by the Engineer, at the Contractor's expense.

3.4 TESTING AND REPAIR

- A. The testing costs are to be paid by the City and therefore, should not be included in the bid. However, if the work should fail to pass the tests, it is the Contractor's responsibility to correct the work and re-test at the Contractor's expense. The City shall not pay for these re-installations and re-tests.
- B. **Spark Test:** The cured lining system shall be spark tested for holidays with the high voltage holiday detector instrument specified by the coating manufacturer or as specified in the Special Provisions. The voltage shall be set at a minimum of 15,000 volts. For thicknesses greater than 3.81mm (150 mils), the voltage shall be set at 100

volts per 25.4µm (1 mil) of thickness of the applied lining material. Identified holidays shall be marked without contaminating the lining surface and repaired.

- C. **Mil Gauge Test:** During installation, a mil gauge shall be used to verify that the minimum thickness of the lining meets and/or exceeds the minimum thickness as specified herein.
- D. **Adhesion Testing:** Adhesion testing shall be performed on a minimum of 1 structure or 15 percent of all rehabilitated structures, whichever is greater. Adhesion testing shall be conducted after the liner system has cured in accordance with the manufacturer's specifications. Adhesion testing shall be in accordance with ASTM D4541.
- E. **Liner Repairs:** Holidays, uncured lining material, blisters, surface imperfections and damage to the liner resulting from the adhesion test shall be repaired to a point 25mm (1 inch) minimum beyond the limits of the damaged area. The repair shall be 3mm (125 mils) thick. Holidays shall be primed and recoated with the same lining system to a minimum additional thickness of 30 mils unless otherwise specified by the liner manufacturer or approved by the Engineer. Blisters, uncured lining and surface imperfections shall be completely removed and the areas recoated with appropriate lining material to 25 mm (1 inch) minimum beyond the repair areas at a minimum thickness of 100 mils. Additional spark testing shall be performed after repairs are completed.

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SECTION 02840

ROADWAY MARKING ACCESSORIES

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Cleaning and sweeping of streets before application of markings.
- B. Application of temporary and permanent stripes and pavement markings.
- C. Application of raised pavement markers.
- D. Application of roadway markers and delineators.
- E. Installation of traffic control signs.
- F. Restoration of existing improvements.
- G. Cleanup and removal of debris.
- H. Supplying all labor, materials, equipment and apparatus not specifically mentioned herein or noted on the plans, but which are incidental and necessary to complete the work specified.

1.2 QUALITY ASSURANCE

- A. Manufacturer's certificates showing conformance with this specification shall be delivered with each shipment of materials and equipment delivered to the job site.
- B. Only City inspected and approved material may be used for roadway delineation.
- C. Codes and Standards
 - 1. The standards, recommended methods and tests contained in the publications cited below shall determine the standards for the work to be done hereunder unless otherwise specifically designated on the plans:
 - a. The *California Manual on Uniform Traffic Control Devices (California MUTCD)*, latest edition.
 - b. The regulations, standards, and tests of the State of California Department of Transportation Materials and Research Division.
 - c. The *State of California Standard Plans and Standard Specifications*, and applicable related *Standard Special Provisions*.

2. Traffic signs, roadway markers and delineators, traffic stripes, pavement markings, and pavement markers shall be placed in the locations shown on the plans and shall conform to the applicable sections of the California MUTCD and the State of California Highway Design Manual.
3. Reference by manufacturers, brands or models is to establish type and quality of materials desired. Substitutions of materials of equal quality will be permitted upon the prior written approval.

1.3 JOB CONDITIONS

- A. No striping, markings, or markers shall be applied until pavement surfaces have been approved.
- B. Concrete shall be thoroughly cured before application of striping, markings, or markers thereon.

PART 2 - PRODUCTS

2.1 TEMPORARY PAVEMENT MARKERS

- A. Short term, temporary pavement markers shall be day/night retroreflective raised pavement markers conforming to the requirements of Section 12 of the State Standard Specifications and Part 6 of the California MUTCD.

2.2 THERMOPLASTIC STRIPES AND MARKING

- A. Traffic stripes and pavement markings shall be thermoplastic material, unless otherwise noted on plans. Thermoplastic stripes and markings shall be extruded thermoplastic conforming to Section 84-1 and 84-2 of the *State Standard Specifications*.
- B. Thermoplastic stripes and markings shall have a minimum skid friction value of BPN = 35.
- C. Glass beads applied to molten thermoplastic material, or paint must comply with State Specification 8010-004.
- D. Submit certificates of compliance showing conformance with this specification for each load of material delivered to the job site.

2.3 PERMANENT PAVEMENT MARKERS AND ADHESIVES

- A. Pavement markers shall be the type and description shown, noted or called for on the plans and detail drawings, and shall conform to the requirements of Section 85 of the State Standard Specifications and the State Standard Plans.
- B. Adhesive for pavement markers shall be either epoxy or hot melt bituminous adhesive conforming to the requirements of Section 85 of the State Standard Specifications.

- C. Submit certificates of compliance showing conformance with these specifications for each load of pavement markers delivered to the job site. Pavement markers must be on Caltrans' Authorized Material List of signing and delineation materials.

2.4 REFLECTORIZED MARKERS AND POSTS

- A. Retroreflective markers and delineators shall be of the size, type and description shown, noted, or called for on the plans and detail drawings and shall conform to the requirements of Section 82 of the State Standard Specifications, and the *California MUTCD*.
- B. Posts for retroreflective markers shall be of the type shown, noted, or called for on the plans and detail drawings and shall conform to the requirements of Section 82-1.02 of the *State Standard Specifications*.
- C. Target plates for markers shall be of the type shown, noted, or called for on the plans and detail drawings and shall conform to the requirements of Section 82-1.02E of the *State Standard Specifications*.
- D. Reflectors for markers and delineators must consist of Type III or higher grade retroreflective sheeting on the State Authorized Material List for signing and delineation materials, and shall comply with requirements in the *California MUTCD*.
- E. Mounting hardware shall conform to the requirements of Section 82-1.02H of the *State Standard Specifications*.

2.5 TRAFFIC CONTROL SIGNS

- A. Traffic control sign panels shall be of the type, size, shape, and pattern designated or called for on the plans and detail drawings. Where sign sizes are not specified in the plans, the designated Standard size sign in accordance with the *California MUTCD* shall be used.
- B. Signs shall conform to the requirements of Section 56-4 of the *State Standard Specifications*.
- C. Signs must comply with the *California Sign Specifications* and the *Federal Standard Highway Signs and Markings Book*.
- D. Submit a certificate of compliance for:
 - 1. Aluminum sheeting
 - 2. Retroreflective sheeting
 - 3. Screened-process colors
 - 4. Nonreflective, opaque, black film
- E. Sign panels shall be constructed of aluminum, unless otherwise specified on plans. Aluminum panels shall conform to the requirements in Section 56- 2.01B(5), 56-2.02, and 56-2.05B of the *State Standard Specifications*, and the *State Standard Plans*.
- F. Retroreflective sign sheeting shall conform to the requirements in Section 56- 2.01B(6) of the *State Standard Specifications* and Part 2 of the *California MUTCD*.

- G. Sign information must be imprinted in 1/4-inch upper case letters and numerals. Locate this information on the back, lower right of each sign panel. Sign information must include:
 - 1. Month and year of fabrication
 - 2. Type of retroreflective sheeting
 - 3. Sheeting manufacturer's identification and lot number for the retroreflective sheeting
- H. Posts for traffic control signs, unless designated to be mounted on traffic signal or electrolier standards, shall be as designated and detailed on the plans.
- I. Mounting hardware for traffic control signs shall conform to the details shown or called for on the plans. Mounting hardware for signal or electrolier standards or metal posts shall conform to the applicable requirements and specifications shown and noted on *Plan RS4 of State Standard Plans* and Section 56-4.02E of the *State Standard Specifications*.
- J. Concrete bases for traffic control sign posts shall be Portland cement concrete of the shape and dimensions shown or called for on the plans and detail drawings, and shall conform to the requirements of Section 02550 of these specifications and Section 90-2 of the *State Standard Specifications*.

2.6 PROTECTION

- A. The Contractor shall protect the newly installed pavement markers and stripes from damage until the material has cured.
- B. Replace any markers broken, misaligned or otherwise disturbed prior to opening roadway to traffic.

PART 3 - EXECUTION

3.1 TEMPORARY PAVEMENT MARKERS

- A. Temporary pavement markers shall be installed and replaced as directed.
- B. If permanent pavement markers cannot be installed immediately, short term, temporary pavement markers shall be installed on new roadways before the street will be opened for traffic.
- C. Temporary pavement markers, at a minimum, shall be placed at 24 feet on centers in the appropriate colors to delineate centerlines and travel lanes on multi-lane roadways except that edge lines shall not be simulated with raised pavement markers.

3.2 THERMOPLASTIC STRIPES AND MARKINGS

- A. Thermoplastic stripes and markings shall be applied hot in conformance with the manufacturer's recommended instructions and the applicable requirements of Section 84-2.03 of the *State Standard Specifications*.

- B. Use mechanical wire brushing to remove dirt, contaminants, and loose material from the pavement surface that is to receive the traffic stripe or pavement marking. Use abrasive blast cleaning to remove laitance and curing compound from the surface of new concrete pavement that is to receive the traffic stripe or pavement marking.
- C. Apply a traffic stripe or a pavement marking to a dry surface during a period of favorable weather when the pavement surface is above 50 degrees F.
- D. Apply extruded thermoplastic at a temperature from 400 to 425 degrees F, unless a different temperature is instructed by the manufacturer.
- E. Apply glass beads to the surface of the molten thermoplastic at a rate of at least 8 lb/100 sq ft. Glass beads must be embedded in the coat or thermoplastic to a depth of 1/2 their diameters.
- F. Apply extruded thermoplastic for a traffic stripe at a rate of at least 0.20 lb/ft of 4- inch wide solid stripe. The applied thermoplastic traffic stripe must be at least 0.06 inch thick. An applied thermoplastic pavement marking must be 0.10 to 0.15 inch thick.

3.3 PAVEMENT MARKERS

- A. Pavement markers shall be installed in conformance with the requirements of Section 85-1.03 of the *State Standard Specifications*.
- B. Remove undesirable material from the pavement surface. Clean the pavement surface by abrasive blast cleaning when directed by the Engineer.
- C. Markers shall be installed accurately to the line established by the Engineer. No markers shall be installed until the surface and layout have been approved by the Engineer.

3.4 REFLECTORIZED MARKERS

- A. ReflectORIZED markers shall be installed in conformance with the requirements of Section 82-1.03 of the *State Standard Specifications*, except that the metal marker posts shall not be driven in place without prior approval of the Engineer.
- B. ReflectORIZED markers shall be installed accurately at the locations called for on the plans and in the positions specified on the detail drawings.

3.5 TRAFFIC CONTROL SIGNS

- A. Traffic control signs shall be installed in conformance with the requirements of the *California MUTCD*, and Section 56 of the *State Standard Specifications*.
- B. After erection, damage to traffic sign faces shall be repaired as required.

3.6 RESTORATION OF EXISTING IMPROVEMENTS

- A. Existing signs or other markings removed or damaged due to the installation of roadway markers or traffic control signs shall be replaced in kind.

- B. Existing landscaping or planting removed, damaged or disturbed due to the installation of roadway markers or traffic control signs shall be replaced in kind.

3.7 CLEANUP

- A. Upon completion of the installation of Roadway Markings and Accessories, Contractor shall thoroughly clean the work site of all waste, rubbish and construction debris of any nature.
- B. Upon removal of temporary signs, patch holes in walkway or roadway with Portland Cement concrete conforming to Section 02550 of these Specifications.

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SECTION 02900

LANDSCAPING

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Clearing and grubbing.
- B. Site grading to subgrade for topsoil.
- C. Leaching of subgrade soils.
- D. Placing topsoil and prepared soil backfill.
- E. Planting.
- F. Watering.
- G. Staking and guying of trees and shrubs.
- H. Maintenance of planted material, including application of pre and post emergent herbicides for weed control.
- I. Cleanup and restoration of disturbed surfaces.
- J. Supplying all labor, materials, equipment, and apparatus not specifically mentioned herein or noted on the plans, but which are incidental and necessary to complete the Work specified.

1.2 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the general designation only.
- B. American society for Testing and Materials (ASTM) Publications:
 - D - 1557 Moisture-Density Relations of Soils and Soil Aggregate Mixtures using 10-lb. (4.54 KG) Rammer and 18-in. (457 mm) Drop.

1.3 QUALITY ASSURANCE

- A. Percentage of compaction specified shall present the ratio of the dry density of the compacted backfill material to the maximum dry density of the material as determined by the procedure set forth in ASTM Designation D1557.
- B. Plant material as indicated on the "Plant List" and delivered to the job site shall be subject to the approval of the Engineer prior to planting. Any plant material as indicated

on the "Plant List" which is rejected by the Engineer shall be removed from the site immediately and replaced by the Contractor.

- C. Submit list of plant materials and source location 30 days in advance of planting date, to allow the City an opportunity to inspect and tag plant material at the source before delivery to site.

1.4 JOB CONDITIONS

- A. Contractor shall accurately grade and prepare the landscape subgrade to six (6) inches below the adjacent top of curbs within median areas and as shown on the plans outside of median areas.
- B. Contractor shall provide dust alleviation and control measures during the course of the work at no additional expense to the Contract.
- C. Substitutions for plant materials called for on the "Plant List" shall not be allowed except with prior written consent of the Engineer. All substitute plant materials shall conform to the requirements of these specifications.
- D. Contractor shall be solely responsible for the maintenance of landscape areas until acceptance of the work including weed and pest control.
- E. All irrigation work shall be inspected and approved by the Engineer before landscape work may begin.
- F. Prior to excavation for planting or placing of stakes, Contractor shall locate all electric cables, conduits, sprinkler valve control wires, and all utility lines so that proper precautions may be taken not to damage such improvements. Any damage occurring during planting shall promptly be satisfactorily repaired by Contractor.

PART 2 - PRODUCTS

2.1 IMPORT MATERIAL FOR SITE GRADING

- A. Import material for site fill shall conform to Section 02220 of these Specifications.
- B. Materials not conforming to the above specifications and requirements shall remain the property of the Contractor and shall be removed from the job site.

2.2 PLANT MATERIALS

- A. Plant materials shall be as indicated on the plans. Plant names on the "Plant List" shall be listed by both nursery name and technical name.
- B. Sizes of plants shall be as stated on the "Plant List". Contractor stock (1 gallon, 5 gallon, and 15 gallon) shall have been grown in containers for at least one (1) year, but not over two (2) years.
- C. Plants shall be symmetrical, typical for variety and species, sound, healthy, vigorous, free from plant disease, insect pests, and other eggs, and have healthy, normal root

systems, well filling their containers, but not to the point of being root bound. Plants shall not be pruned prior to delivery and in no case shall trees be topped before delivery.

- D. The height and spread of all plant material shall be measured with branches in their normal position, and shall be as indicated on the plans. The caliper of all trees shall be measured 4'-0" above the surface of the ground. Where caliper or other dimensions of any plant materials are omitted from the "Plant List", it shall be understood that these plant materials shall be normal stock for type listed.

2.3 SEEDED LAWN MATERIALS

- A. Grass seed shall be fresh, clean, new crop seed composed of the following varieties, or approved equal, mixed in proportions and testing minimum percentages of purity and germination as indicated below:

NAME	BY WEIGHT	PURITY	GERMINATION	MAXIMUM WEED CONTENT
*Warren's A-34 Bluegrass	25%	95%	90%	0.25%
Creeping Red Fescue	25%	96.89%	94%	0.20%
Penn Fine Ryegrass	50%	95%	90%	0.25%

* (Fylking Bluegrass may be substituted if sufficient quantities of Warren's A-34 Bluegrass are not available, upon prior approval by the Engineer.)

2.4 SODDED LAWN MATERIALS

- A. Sod shall be well-established, disease-free, and in a healthy and vigorous growing condition at time of placement and shall be as grown by "Cal-Turf" or approved equal. Sod in all areas, except as noted for shade on the plans, shall be a mixture consisting of thirty percent (30%) Fylking Bluegrass and seventy percent (70%) Manhattan Ryegrass. Sod in shade areas shall be Warren's A-34 (100% weed free) or approved equal.

2.5 TOPSOIL AND PREPARED SOIL BACKFILL

- A. Topsoil shall consist of a fertile friable soil sandy loam conforming to the U.S. Bureau of Soils triangular distribution chart. Laboratory certification of the conformance of the topsoil material to these requirements shall be delivered with each batch of topsoil delivered to the site, and approved by the Engineer.
- B. To the topsoil, add six (6) cubic yards of nitrogen stabilized Fir or Redwood and thirty-five (35) pounds of "Agriform" C.R.F. Controlled Release Fertilizer in the formulation 16-7-12 + Iron, or approved equal per 1,000 square feet (500 cubic feet) of topsoil.
- C. Topsoil shall be free of any refuse, heavy or stiff clay, hard clods, stones larger than one inch, roots larger than one-half inch in diameter, noxious weeds, Bermuda grass, nut grass, and other deleterious materials. Topsoil shall be free from toxic amounts of either acid or alkaline chemicals and shall be capable of sustaining plant life.

- D. Prepared soil mix for backfill in holes for trees, vines and shrubs shall consist of one-half (1/2) cubic yard of sandy loam topsoil and one-half (1/2) cubic yard of nitrogen stabilized fir or redwood per cubic yard of mix. One "Agriform" plant tablet (21 gram), or approved equal, shall also be placed for each twelve (12) inches of root ball circumference of the tree or shrub being planted.

2.6 FERTILIZERS AND ADDITIVES

- A. Fertilizer shall be "Agriform" C.R.F. Controlled Release Fertilizer in the formulation 16-7-12 + Iron, or approved equal. It shall be uniform in composition, dry and free flowing, and shall be delivered to the site in the original unopened containers. Any fertilizer which becomes caked or otherwise damaged shall be replaced.
- B. Fertilizer tablets shall be "Agriform" Planting Tablets as manufacture-by Agriform International Chemicals, Inc., or approved equal, with formulation 20-10-5 (21 gram).
- C. Nitrogen stabilized fir or redwood shall be bulk treated with a reactive form of nitrogen (NH₃) as manufactured under one of the following trade names "Tillo", "Redwood Soil Conditioner", "Ceda-Soil", "Turf and Tee".
- D. Mulch shall be "Walk on Bark", as manufactured by Sequoia Forest Products, or approved equal.
- E. Weed Control Material shall be pre-emergent herbicide, Trifluralin (Treflan R) or Diphenamid (Dymid R or Enide R) or approved equal.

2.7 STAKING AND GUYING MATERIALS

- A. Stakes for trees and shrubs shall be lodge pole pine as supplied by "B.V.C." or approved equal. Stakes shall be either two (2) inches or three (3) inches in diameter as shown on the plans and shall have been pressure treated with copper-chromate-arsenate or approved equal. The length of stakes shall be as indicated on the plans and all stakes shall be pointed at one end.
- B. Tree ties shall be corded rubber tree straps as manufactured by "Gro-Strait" or approved equal. Ties shall be located as indicated on the plans.

2.8 ROOT BARRIER

- A. Root Barriers shall be Deep Root Panels DR-128, or acceptable equivalent.

PART 3 - EXECUTION

3.1 CLEARING AND GRUBBING

- A. All weeds and grasses shall be dug out by the roots and disposed of off the site, except those weeds and grasses that are not the perennial type, are less than 2- 1/2 inches high and are not bearing seeds. The aforementioned weeds may be turned under.

3.2 SITE FILL AND GRADING

- A.** Areas to receive fill to landscape subgrade shall be scarified to a minimum depth of six (6) inches, conditioned to a moisture content that will permit compaction to the specified density, and compacted to a density of not less than ninety (90) percent of maximum dry density as determined by the procedure set forth in ASTM Designation D1557.
- B.** Import material for fill to landscape subgrade shall be placed in uniform horizontal layers not exceeding eight (8) inches in loose thickness and shall be compacted to a density of not less than ninety (90) percent of maximum dry density as determined by the procedure set forth in ASTM Designation D1557.
- C.** Subgrade for landscape shall be finished at six (6) inches below the adjacent top of curb grades shown or called for on the plans to the satisfaction of the Engineer prior to installation of irrigation and/or leaching systems, if any are required, and prior to leaching.

3.3 LEACHING

- A.** Fifteen (15) days prior to planting and prior to placing topsoil, subgrade for all planting areas shall be irrigated with automatic controller in operation at the maximum rate of one (1) inch per hour with a total of twenty-four (24) inches of water in a twenty-four (24) hour period.
- B.** Leaching operations shall be conducted in such a manner that said operation will not interfere with construction work by others. Surface runoff will not be permitted.

3.4 PLACING TOPSOIL AND SOIL MIX BACKFILL

- A.** Placing topsoil shall begin only after leaching operations have been completed to the satisfaction of the Engineer.
- B.** All areas to be planted shall have topsoil placed to a depth, that when compacted to a density of not less than eighty-five (85) percent of maximum dry density, shall conform to the lines, grades and elevations shown on the plans. Topsoil shall not be worked when the moisture content is so great that excessive compaction will occur, nor when it is so dry that a dust will form in the air or that clods will not break readily. Water shall be applied, as necessary, to provide ideal moisture content for planting. Prepared soil mix shall be used for backfill in all holes for trees, vines and shrubs.

3.5 MULCHING

- A.** In designated ground areas mulch shall be applied to a uniform depth of two (2) inches.

3.6 METHOD OF PLANTING

- A.** No planting shall be done until all grading and irrigation system operations have been completed, finish grades have been established, the planting areas have been properly prepared as herein specified, and the work has been approved by the Engineer.

- B. All plants shall be set so that, when settled, they bear the same relation to the required grade as they bore to the natural grade before being transplanted. Each plant shall be planted in the center of the hold and backfilled, unless otherwise specified, with prepared soil mix backfill. No backfill in muddy condition shall be used. No filling will be permitted above crown. All broken or frayed roots shall be properly cut off. All backfill shall be properly tamped.
- C. Any plant material furnished as indicated on the "Plant List" which is not in compliance with the requirements of these specifications shall be removed immediately and replaced.

3.7 PLANTING OF TREES

- A. Positions of all trees shall be marked and approved in the field prior to planting.
- B. Holes for trees shall be excavated two times the diameter of root ball and a minimum of nine (9) inches below the bottom of root ball around a platform to support the tree at proper depth. Soil at sides and bottoms shall be loosened by scarifying or other approved method. Holes shall be backfilled with prepared soil mix to the bottom of the root ball depth. After the root ball has been set to the required grade, backfill to half the root ball depth, and place "Agriform" plant tablets equally spaced around root ball. The number of tablets shall be equal to the circumference of the root ball in inches divided by twelve (12). Fill the remaining portion with prepared soil mix and thoroughly tamp the backfill.
- C. Remove any previous nursery staking and ties. Set plants in center of the hole, in a vertical position without staking.
- D. Trees shall be planted so that the root crown is 2 inches above surrounding soil, and at least one inch above surrounding soil after settling. All plants shall be thoroughly "watered-in" within one hour after planting.
- E. Root barriers shall be installed at the time of planting as shown on plans, or as designated by the Engineer.
- F. Each tree shall be supported by two round treated stakes, per City Details. Tying shall be done with two (2) ties per tree, one from each stake. Ties shall be tied at the lowest height the trunk can be supported allowing the crown or top to stand upright. Use "Figure 8" method to attach ties. Stakes must be set in ground a minimum of two feet (2'). Stakes shall parallel sidewalk or curb. Stakes shall be located in the soil outside the rootball. Stakes shall be cut off above the tie-point to a height so as not to rub or contact branches.
- G. Trees shall be pruned to remove broken, crossing, rubbing branches or to lightly thin branches. A dominant central leader should be established. Prune girdling or curling roots.
- H. Turf shall be maintained a distance of 12" from tree trunk.

3.8 PLANTING OF SHRUBS AND VINES

- A.** Shrubs and vines shall be planted in holes of at least twelve (12) inches greater in diameter than their ball of earth and at least six (6) inches below the bottom of the ball. Compacted soil at the bottom of the hole shall be loosened and the hole filled with prepared soil mix to the bottom of the ball. When the plant has been properly set, the hole shall be half filled and "Agriform" plant tablets placed. The number of tablets to be placed shall equal the circumference of their ball of earth divided by twelve (12). The remainder shall be filled to the required grade with prepared soil mix and then thoroughly settled by tamping and watering. All vines shall be removed from stakes, untied, and securely fastened in an approved manner to wall, fence, or other surface next to which they are planted and/or as shown on the plans.
- B.** Prepare depressed water basin as wide as plant balls at each plant. Water thoroughly, backfilling any voids with additional prepared planting mix followed by tamping. Do not basin flat sized plants.

3.9 PLANTING OF GROUND COVERS

- A.** Directly after planting, ground cover areas shall have applied a pre-emergent herbicide acceptable to the Engineer in accordance with the manufacturer's rates and procedures followed by an application of commercial fertilizer 6-20-20 applied at the rate of 35 lbs./1,000 sq. ft. A mulch top dressing shall then be placed over the fertilizer.
- B.** Plant spacing for flat sized plants shall be as specified on the plans. Ground cover areas are to be moistened prior to planting. No flat plants are to be planted in dry soil.
- C.** Set plants in the center of holes so that the crown of plants will be level with finished grade after settling of the soil, then backfill and water.
- D.** Plants shall not be allowed to dry out before, or while being planted. Keep exposed roots moist by means of wet sawdust, peat moss, or burlap at all times during planting operations. Do not expose roots of plants to the air except while being placed in the ground.

3.10 WATERING BASINS

- A.** Watering basins shall consist of a depression in the soil around each tree and plant at the outside edge and following the shape of the planting hole area. Area shall be firmly compacted. Depressions for trees and for shrubs from five-gallon or larger containers, shall be at least four (4) inches deep. Depressions for all other shrubs, vines or plants not otherwise specified shall be at least two (2) inches deep, and thoroughly tamped.
- B.** Watering shall be done so as not to expose the crown by washing away the mound in the center. However, if any settling occurs, the mound shall be satisfactorily replaced.

3.11 LAWNS

- A.** Seeded or Sodded Lawn
 - 1. Prior to planting lawn, the topsoil shall have been raked to a smooth, firm surface

and then rolled with a 200-pound water ballast roller.

2. All lawn areas whether seeded or sodded shall be thoroughly watered. Lawns are to be kept continuously moist by watering as deemed necessary to insure germination or maintain healthy growth as the case may be.
3. Any lawn areas that do not show a prompt catch of grass shall be re-seeded or re-sodded to the original specification at ten (10) day intervals until an acceptable stand of grass is produced.

B. Seeded Lawn

1. Seed shall be sown in two directions at the rate of 3 lbs./1,000 sq. ft. in each direction for a combined rate of 6 lbs./1,000 sq. ft.
2. After seeding operation is complete, top dress entire seed bed area using Nitrolized fir or redwood shavings at the rate of 1 cu. yd./1,000 sq. ft. of lawn.
3. After top dressing, roll entire seed bed area with a 200-pound water ballast roller to press seed firmly into seed bed.
4. After lawn planting is complete, fertilizer shall be applied as follows: 16-6-8

Polycoated Fertilizer at the rate of 7 lbs./1000 sq. ft. of lawn.

C. Sodded Lawn

1. Quantities of sod delivered to site shall not remain unplanted longer than one (1) day. Sod remaining unplanted longer than 24 hours shall be removed from the work and replaced.
2. All sod shall be set tight without gaps between pieces and shall be rolled with a 200-pound water ballast immediately after first watering.
3. All sodded areas shall be thoroughly watered. Lawns are to be kept continuously moist by watering as often as required to maintain vigorous growth.

3.12 WATERING

- A.** Immediately after planting, water shall be applied to each tree and shrub by means of a hose. The water shall be applied in a moderate stream in the planting holes and until the material around the roots is completely saturated from the bottom of the hole to the top of the ground.
- B.** Following the planting of ground cover plants, furnished in flats, each plant shall be immediately and thoroughly watered by means of a hose and a slow running stream of water.
- C.** Water shall be applied in sufficient quantities, and as often as seasonal conditions require, to keep the ground wet at all times, well below the root system of grass and planting until acceptance of the entire work.

3.13 ROOT BARRIER INSTALLATION

- A.** An approved root barrier shall be placed in the trench created alongside the new, or

existing sidewalk or curb as directed by the Engineer.

- B. The barrier shall be a continuous length and shall extend from finished grade downwards to a minimum depth of 18".

3.14 MAINTENANCE

- A. As a Contract requirement, Contractor shall maintain all landscaping for a period of at least sixty (60) calendar days after the date of written preliminary acceptance of landscape areas by the Engineer.
- B. The Contract maintenance period may begin prior to completion of the total work, but in no case shall the Contract maintenance period end prior to the final acceptance of the work by the City Council. If completion of the work is delayed for whatever reason, Contractor shall maintain all landscaping until final acceptance of the work. The project shall not be accepted until the end of the 60-day maintenance period.
- C. Plants, shrubs, trees, lawn or other landscaping which are replaced during the original Contract maintenance period shall be maintained for an additional maintenance period of sixty (60) calendar days beginning from the time of replacement.
- D. Contract maintenance work shall consist of applying water (except initial watering of plants), weeding, caring for plants, edging and mowing of lawns and the following additional maintenance requirements:
 - 1. Water lawn until final acceptance of work by the City. Seeded lawn shall be maintained 60 calendar days after germination of all grass species in seed mix. Immediately following the first mowing, apply commercial fertilizer 16-6-8 at a rate of 7 pounds per 1,000 sq. ft. Maintain a fertility level sufficient to insure a rapid, vigorous, healthy stand of grass.
 - 2. During the maintenance period, all plants and planted areas shall be kept well watered and weed free at all times. Weeds, Dallas and Johnson grass and Bermuda grass shall be removed. Grass shall be mowed before it exceeds two (2) inches in height. Grass clippings shall be collected during mowing operations and removed from the site. The entire project shall be cared for and maintained in a neat and clean condition.
 - 3. After each lawn cutting, the edge of the grass shall be trimmed to a neat and uniform line. Lawn and lawn edges are to be maintained in a neat and orderly condition until the final acceptance of work.
 - 4. Workmen shall not be allowed to work on lawn areas before, during or after planting. Damaged or compacted lawn areas shall be recultivated and re-planted.
 - 5. After initial mowing, lawn shall be mowed a minimum of twice every **seven (7) calendar days** and a final mowing shall occur one (1) day prior to the end of the maintenance period.
 - 6. Any damage to landscape areas including depressions caused by vehicles, bicycles, foot traffic or damage incurred by gophers or moles shall be satisfactorily replaced.

3.15 WARRANTY PERIOD

- A. Dead or dying trees and shrubs shall be replaced at the contractor's expense prior to the end of the warranty period.

3.16 DUST ALLEVIATION AND CONTROL

- A. Contractor shall be responsible for and shall provide pollution and dust abatement and control measures during the course of the work, including street sweepers and/or watering truck fully manned and operable as required.

3.17 RESTORATION OF EXISTING IMPROVEMENTS

- A. Existing paving and other improvements removed or damaged due to the installation of landscaping shall be replaced in kind.

3.18 CLEANUP

- A. Surplus materials and construction debris remaining upon the completion of the work shall become the property of the Contractor unless otherwise specified herein or noted on the plans, and shall be removed from the work site promptly by the Contractor and disposed of in a lawful manner.

* * *

SECTION 02910

IRRIGATION

PART 1 - GENERAL

1.1 WORK INCLUDED

- A.** Trenching and other excavation.
- B.** Irrigation lines, valve control circuits and appurtenances.
- C.** Irrigation controllers and remote control valves.
- D.** Electrical service and service installation if required.
- E.** Testing.
- F.** Backfill and compaction of backfill.
- G.** Dust alleviation and control.
- H.** Cleanup and disposal.
- I.** Supplying all labor, materials, equipment, and apparatus not specifically mentioned herein or noted on the plans, but which are incidental and necessary to complete the work specified.

1.2 APPLICABLE PUBLICATIONS

- A.** The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the general designation only.
- B.** American Society for Testing and Materials (ASTM) Publications:
 - D - 1785 Pipe, Polyvinyl Chloride (PVC) Plastic Schedules 40, 80 and 120.

1.3 QUALITY ASSURANCE

- A.** Irrigation mains, lines and appurtenances shall be subject to successfully passing a leakage test as prescribed herein.
- B.** Irrigation lines shall be installed after satisfactory completion of roadway or landscape subgrade.
- C.** Submit catalogue cuts of irrigation valves, controllers, and associated equipment for approval.

1.4 JOB CONDITIONS

- A.** Contractor shall conduct operations and schedule cleanup in a manner to cause the least possible obstruction and inconvenience to traffic, pedestrians, and any adjacent property owners or tenants.
- B.** Locations for proposed irrigation controllers and/or electrical service points shown on the plans are approximate only and the exact locations for such shall be as established in the field by the Engineer.
- C.** Damage resulting from movement of the sides or bottom of trenches or other excavation which is attributable to the Contractor's acts or omissions, whether sides are braced or not, and any portions of the area and work affected by such movement, shall be satisfactorily repaired or restored.
- D.** Contractor shall supply and deliver the following equipment and information prior to acceptance of the work:
 - 1. Three (3) each (if applicable) quick coupler valve keys and hose swivel ells.
 - 2. Two (2) sets of various special wrenches or tools that may be required for adjustment of sprinkler heads or equipment.
 - 3. Three (3) (if applicable) keys or wheel handles required to operate hose bibs.
 - 4. Two (2) copies of the instruction manual for each irrigation controller.
- E.** Comply and conform with conditions and requirements indicated under Section 02202, Trenching and Backfill, of these Specifications.

PART 2 - PRODUCTS

2.1 PIPE AND FITTINGS FOR IRRIGATION MAINS

- A.** Pressure mains and non-pressure mains shall be polyvinyl chloride (PVC) Schedule 40 conforming to the requirements of ASTM Designation D1785 and shall be provided with solvent weld joints and fittings.
- B.** All plastic fittings shall be Schedule 40 polyvinyl chloride (PVC) conforming to the requirements of ASTM Designation D1785 and shall be specifically made for the type of pipe used.
- C.** All nipples and fittings for risers shall be Schedule 80 polyvinyl-chloride (PVC) conforming to the requirements of ASTM Designation D1785. Nipples, fittings and risers shall be same size as sprinkler head inlets.
- D.** All polyvinyl chloride (PVC) pipe and fittings shall be free from imperfections.
- E.** Metallic nipples and fittings for above-ground installation of backflow preventer systems shall be Schedule 40 brass nipples and class 125# bronze fittings. All brass nipples and bronze fittings shall be factory threaded.

2.2 JOINTS FOR POLYVINYL CHLORIDE (PVC) PIPE

- A.** Rubber ring seal joints shall be made in accordance with the manufacturer's instructions and as indicated on the plans.
- B.** Solvent weld joints shall be made using P-70 primer as manufactured by "Weld-On" or approved equal and "Weld-On" 710 joint cement or approved equal.
- C.** All threaded joints shall be factory formed. Field threading of pipe or fittings will not be permitted. Threaded joint connections shall be made with virgin teflon tape, or approved equal.

2.3 VALVES AND VALVE BOXES

- A.** Gate valves, where required on the plans, shall be the same size as the main line and shall be "Stockham", or approved equal. Size and type of valve shall be as indicated on the plans.
- B.** Quick coupling valves shall be as manufactured by "Rainbird", brass or bronze one piece body designed for a working pressure of 125 psi and equipped with metal covers, or approved equal. Contractor shall provide the Engineer with three (3) for each quick coupler keys and double lug hose swivel ells. Type and model of valve shall be as indicated on the plans.
- C.** Remote control valves shall be as shown on plans, normally closed, diaphragm actuated, electrically operated from remote location by means of 18/24V, 50/60H, 7.5VA coil, with brass bleed plug for manual operation. Substitutions for irrigation controllers and/or remote control valves shall be at the sole option of the Engineer and shall require prior written consent. Remote control valve sizes shall be the same as the supply runs on which they are to be installed.
- D.** Valve boxes for gate valves and remote control valves in turf, shrub and ground cover areas shall be fiberglass reinforced plastic, color green, as manufactured by "Ametek", "Carson" or approved equal.
 - 1. Gate Valves Box Covers to be factory marked "Irrigation Control Valve" and shall have a valve number permanently stenciled on it with white exterior paint.
 - 2. Remote Control Valve Boxes shall be rectangular with a minimum dimension of 10-1/2" x 17-1/4" at the base. Cover to be factory marked "RCV" and shall have a station number permanently stenciled on it with white exterior paint.
 - 3. Valves shall be individually housed. Manifolding of valves in a single valve box shall not be permitted.

2.4 SPRINKLER HEADS

- A.** All bubblers and stationary shrub sprays on risers, pop-up spray heads and gear-driven stream rotors for ground cover, shrubs and turf shall be as manufactured by "Toro" or approved equal. Type and model of such heads shall be as indicated on the plans.
- B.** All pop-up spray heads and gear-driven stream rotors for ground cover, shrubs and turf

shall be as manufactured by "Hunter" or by "Toro", or approved equal. Type and model of such heads shall be as indicated on the plans.

2.5 IRRIGATION LINE INSTALLATION

- A.** Controllers for irrigation systems shall be solid state type controllers as manufactured by either Irritrol, Rainmaster or as shown. Controller installations shall consist of the following models to provide the required number of control valve stations to a maximum of twenty-four (24) stations per controller installation:
 - 1. Irritrol Model MCXX
 - 2. Rainmaster Model SA6-MR8XX/RHG/PMR-CAC/FSAV-150P+200MV

Note: XX shall be substituted by the number of stations.

- B.** Substitution for irrigation controllers on an "or equal" basis shall be at the sole option of, and shall require the prior written consent from the Engineer.
- C.** Remote final strength shall be verified by the contractor in presence of the project inspector prior to final installation to determine the need of a high gain antenna assembly.
- D.** Irrigation controllers shall be mounted as specified in the Detail Drawings.
- E.** Controllers shall be 120V from a metered power supply, unless solar or battery operated systems are specified.
- F.** All electrical wires and cables, shall be placed in conduits (1" minimum diameter).
- G.** Controller enclosures shall be furnished with acceptable keyed locking mechanisms and furnished with keys.

2.6 BACKFLOW PREVENTION DEVICE

- A.** Backflow prevention devices shall be as required by Section 1003 of the Uniform Plumbing Code, and as approved by the County Public Health Department. Model and details of such devices shall be as indicated on the plans.

2.7 CONTROL VALVE CIRCUITS

- A.** Wire for valve control circuits shall be UL-approved for direct burial in ground, size #14-I. Common ground wire shall have white insulating jacket. Control wire shall have jacket of color other than white and the jacket color for any circuit shall be continuous between controller and valve. A circuit color code schedule shall be posted inside each controller enclosure.
- B.** Splices shall be made with #2006-S "Buchanon" splice caps and 3M #3576 "Scotchloc" seal packs or approved equal.

2.8 THRUST BLOCKS FOR RUBBER RING SEAL JOINTS

- A.** Thrust blocks shall be provided where necessary to resist pressure on rubber ring seal joints. Concrete for thrust blocking shall conform to the requirements of Section 02550 of these specifications.

2.9 PIPE COVER MATERIAL

- A.** Shall be in conformance to Section 02202, Trenching and Backfill, of these Specifications.

PART 3 - EXECUTION

3.1 TRENCHING, BACKFILLING AND COMPACTION

- A.** Shall be in conformance to Section 02202, Trenching and Backfill, of these Specifications.

3.2 IRRIGATION LINE INSTALLATION

- A.** Pipe, valves, fittings, and appurtenances shall be installed as accurately as possible in accordance with the locations shown on the plans. All polyvinyl chloride (PVC) pipe shall be installed with identification markings facing upward, visible from the top of the trench. Cap or plug openings as pipeline is assembled to prevent entrance of dirt or obstructions. Remove caps or plugs only when necessary to continue assembly. Where pipes pass through sleeves, provide removable non-decaying plug at ends to prevent entrance of earth. No irrigation lines shall be constructed before subgrade for roadway and median areas have been satisfactorily completed.
- B.** Depth of cover for pressure mains shall be twenty-four (24) inches below subgrade in areas to be paved and in landscape areas. Depth of cover for non- pressure lines shall be eighteen (18) inches below sub-grade in areas to be paved, eighteen (18) inches below subgrade for topsoil for mainlines and twelve (12) inches below subgrade for topsoil for lateral lines in landscape areas.
- C.** Pipe, valves and fittings shall be carefully handled during hauling, unloading, and placing operations, so as to avoid breakage or damage. All polyvinylchloride (PVC) pipe shall be stored carefully, and protected from prolonged sunlight. Broken or damaged pipe or appurtenances will be rejected and shall be replaced.
- D.** Irrigation lines shall be installed as accurately as possible in accordance with the locations shown on the plans. The plans are diagrammatic only, and where irrigation lines on the plans are shown under paved areas but running parallel and adjacent to planted areas, the intent is to install the irrigation lines in the planted area. Irrigation lines shall have a minimum horizontal clearance of four (4) inches from each other, and a minimum horizontal clearance of twelve (12) inches from other underground lines (this requirement does not apply to any lines crossing at angles from 45 to 90 degrees with each other). A minimum of two (2) inches vertical clearance shall be maintained between lines which cross between these angles. No irrigation line shall be installed parallel to and directly over another line. Intermediate high spot along the irrigation line

shall not be allowed.

- E. All pipes shall be assembled free from dirt, shall be reamed and all burrs shall be removed. When pipe laying is not in progress, all open pipe ends shall be closed with watertight plugs in a manner satisfactory to the Engineer. Before installation of irrigation lines, the Contractor shall remove all stakes, debris, loose rock and other hard material from the bottom of the trench.
- F. After the final positioning, the pipe shall be held in place in the trench with backfill material placed equally on both sides of the pipe at as many locations as are required to hold the pipe section in place. After joints are completed, the backfill material shall be redistributed and compacted as herein required.
- G. At the end of each day and when work is not in progress, the open ends of pipe installed in the line shall be closed with watertight plugs, and openings for valves and other appurtenances shall be suitably covered.
- H. Concrete thrust blocks of the form and dimensions shown or noted on the plans shall be provided as indicated on the plans. Form thrust blocks in such a manner to prevent any concrete from coming in contact with the pipe. Thrust blocks shall be constructed to completely fill the void between solid soil and the fitting, and shall be installed in strict conformance with the applicable details shown or noted on the plans.

3.3 JOINT AND FITTING INSTALLATION

A. Rubber Ring Seal Joints

1. Use factory made male ends or prepared field cut male end joints to exact specifications of factory made ends. Join lengths of pipe by means of integrally formed bell end on pipe using rubber ring seal. Carefully clean bell or coupling and insert rubber ring without lubricant. Position ring carefully according to manufacturer's instructions.
2. Lubricate male end according to manufacturer's instructions and insert male end to specified depth. Use hands only when inserting PVC pipe.
3. Thrust blocks shall be provided where necessary to resist system pressure on joints or fittings made with rubber ring seal joint pipe in accordance with the details shown on the plans.

B. Solvent Weld Joints

1. Prepare joint by first making sure the pipe end is square, then deburring the pipe end and cleaning pipe of dirt, dust and moisture.
2. Dry-insert pipe into fitting to check for proper sizing. Pipe should enter fitting 1/3 to 2/3 depth of socket.
3. Coat the inside socket surface of the fitting and the external surface of the male end of the pipe with 711 primer manufactured by "Weld-On" or approved equal. Then, without delay, apply "Weld-On" 710 joint cement or approved equal liberally to the inside of the socket. At this time, apply a second coat of cement to the pipe end.
4. Insert pipe immediately into fitting and turn 1/4 turn to distribute cement and

remove air bubbles. The pipe must seat to the bottom of the socket and fitting. The fitting shall be properly aligned without strain.

5. Hold joint still for approximately thirty (30) seconds and then wipe the excess cement from the pipe and fitting.
6. Cure joint a minimum of thirty (30) minutes before handling and at least six (6) hours before allowing water in the pipe.

C. Threaded Joints

1. Field threading of plastic pipe or fittings is not permitted. Only factory formed threads and factory fabricated nipples or risers shall be permitted.
2. When assembling threaded plastic joints, take up joint no more than one full turn beyond hand tight.
3. Threaded joint connections shall be made up with virgin teflon tape, or approved equal.

3.4 VALVE AND VALVE BOX INSTALLATION

- A.** Valve boxes shall be grouped and located in shrub and ground cover areas wherever possible. Valves shall be installed no farther than twelve (12) inches from the main line and no closer than twelve (12) inches from walk edges, buildings and walls.
- B.** Thoroughly flush main line before installation. Valves shall be installed as indicated on the details shown on the plans.
- C.** All control valves shall be three (3) inches minimum and eight (8) inches maximum below finish grade to the top of the flow control stem.
- D.** Quick coupling valves shall be located as called for on the plans and installed as indicated on the details shown on the plans.
- E.** Valve boxes shall be set flush with finish grade in lawn areas and one and one-half (1-1/2) inches above grade in shrub areas.

3.5 SPRINKLER HEAD INSTALLATION

- A.** Lawn heads shall be located with a minimum of one (1) inch, a maximum of two (2) inches, clear from adjacent paving or headers, and flush with them where a potential hazard may occur. Other lawn heads shall be installed as indicated on the details shown on the plans.
- B.** Pop-up heads of approved design shall be installed at edges of landscaped areas adjoining paved areas as indicated on the details shown on the plans. Interior shrub heads shall be either pop-up heads set level with finish grade or fixed heads set six (6) inches above finish grade.
- C.** Individual heads shall be adjusted as required to obtain uniform coverage without overthrow onto buildings, paving, main walks, or other structures.
- D.** Each section of lateral pipe shall be thoroughly flushed out before the sprinkler heads

are attached.

- E. Sprinkler heads shall be located and installed as shown on the plans.

3.6 IRRIGATION CONTROLLER INSTALLATION

- A. Controller enclosures shall be located, and irrigation controllers and enclosures shall be installed, as shown on the plans. The sprinkler controller chart shall be a photostatic reproduction of the sprinkler or irrigation plan, provided and installed by the Contractor. It shall be laminated permanently in plastic and securely attached to the inside lid of the controller cabinet and shall correctly relate each section to its respective system.

3.7 CONTROL WIRE INSTALLATION

- A. Connection of control lines to controller shall be in sequential arrangement according to assigned identification number of valve. Connections shall be made by crimping bare wires with brass connectors and sealing with epoxy resin sealer packs. Control lines shall be labeled at the controller with permanent non-fading labels indicating identification number of valve controlled.
- B. All control wiring shall be laid to minimum depth of eighteen (18) inches in common trenches with mainline piping wherever possible. Where control lines do not parallel mains, wires shall be strapped at intervals of at least ten (10) feet to the underside of two by four redwood boards.
- C. Where control lines pass under paving, they shall pass through Schedule 40 PVC conduit sleeves. Where control wires pass through sleeves, Contractor shall provide removable non-decaying plug at ends of the sleeve to prevent entrance of earth.
- D. Contractor shall loop a minimum of three (3) feet of extra wire in each valve box; both control wire and ground wire. All splices shall be made at a valve box only.

3.8 ELECTRICAL SERVICE INSTALLATION

- A. Make all electrical connections to 120 Volt service at each controller location. Install a disconnect switch inside the pedestal of the controller cabinet. All electrical work and materials shall comply with these specifications and any further requirements of the permit issued for the electrical service connection by the serving utility.

3.9 TESTING

- A. Hydrostatic and leakage tests shall be made only after the trenches have been backfilled sufficiently to hold the pipe firmly in position with no fittings being backfilled.
- B. All welded plastic pipe joints shall have cured for at least 24 hours. Provide all water necessary for filling and flushing at no additional expense to the Contract.
- C. Pressure irrigation mains shall be subjected to a hydrostatic test of 125 psi. Each section being tested shall be slowly filled with water, care being taken to expel all air from the pipe by such means as are necessary. The pipes must be flushed before testing to remove any foreign material. The test pressure shall be applied for not less

than four (4) hours. Any leakage discovered in consequence of the pressure test shall be corrected and the test shall be repeated until satisfactory results are obtained. Any defective pipe, fittings, valves, or joints shall be repaired or replaced.

- D. Contractor shall provide water as necessary for hydrostatic testing.

* * *

SECTION 16500

SIGNALS, LIGHTING AND ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Installation of electroliers and appurtenances.
- B. Installation of traffic signal standards, posts, cabinets, and foundations.
- C. Traffic signal heads, push button assemblies, luminaries, hardware and appurtenances.
- D. Conduit, circuits, and appurtenances.
- E. Trenching for conduits and appurtenances, and backfill.
- F. Traffic Signal controller assembly.
- G. Installation of electrical service, service cabinet, circuits and connections to existing circuits.
- H. Battery Backup System.
- I. Dust alleviation and control.
- J. Cleanup and restoration of surface in improved areas, including pavement markings and signage.
- K. Supplying all labor, materials, equipment and apparatus not specifically mentioned herein or noted on the plans, but which are incidental and necessary to complete the work specified.

1.2 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the general designation only.
 - 1. The State of California, Department of Transportation Standard Specifications, Standard Plans, and Manual on Uniform Traffic Control Devices (MUTCD).
 - 2. NEC – The National Electric Code.
 - 3. California Division of Industrial Safety Electrical Orders (Title 8).
 - 4. I.E.S. – Illumination Engineering Society of Standards.
 - 5. NEMA – National Electrical Manufacturers Association Standards.

6. IMSA – International Municipal Signal Standards and Specifications.
7. SPUC Electrical Safety Orders (i.e., General Order No. 95)
8. American Society for Testing and Materials (ASTM) Publications:
 - A – 123 Zinc Coatings, Rolled, Pressed Forged Mat.
 - A - 307 Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.
 - B - 3 Specification for Soft or Annealed Copper Wire.
 - B - 8 Cubic Conduit Hard Medium Soft.
 - D – 1785 Pipe, Poly Vinyl Chloride (PVC) Plastic, Schedules 40, 80 &120.

1.3 SUBMITTALS

- A. Contractor shall submit shop drawings on all electroliers, fixtures, and signal system equipment components, and catalogue cuts of conduits, conductors, pull boxes, and other equipment for approval prior to ordering material and equipment.
- B. Traffic Control Plan: When work will occur on or adjacent to the right-of-way, submit a Traffic Control Plan in accordance with Section 01550 72 hours in advance for approval prior to starting work.

1.4 QUALITY ASSURANCE

- A. All work shall be done under the supervision of, and to the satisfaction of the City Engineer.
- B. Installation shall be in conformance with the NEC.
- C. All material for signals and safety lighting shall require the Underwriters' Laboratories label, except material for which U. L. does not provide label service listing.
- D. All material shall be new, packed in original containers, installed or turned over to the City free of rust, corrosion, or any other defects.
- E. To the extent possible, all equipment or materials for any one system shall be furnished by the same manufacturer. Such items as conduit, conduit fittings and appurtenances supplied for any one system shall be the same throughout the project.
- F. Compaction, Compression, and Tests:
 1. The percentage of compaction or the compressive strength specified shall be the minimum allowable.
 2. Compressive strength of concrete shall be determined utilizing test cylinders taken during the pour at such times and frequencies as designated by the City Engineer. Sampling shall be in accordance with the requirements of ASTM C172 and the specimens shall be made and cured in accordance with the requirements of ASTM C31. Compression testing shall conform to the requirements of ASTM C39.

G. Certification of Materials:

1. Portland Cement Concrete: When requested, provide City Engineer with two (2) copies of mill test reports of aggregate, cement, and reinforcement supplied, showing compliance with the respective Specifications.
2. Provide City Engineer with copies of certified plant load-out slips showing volume of concrete delivered and time of mixing for each load.

1.5 JOB CONDITIONS

- A.** Contractor shall conduct operations and schedule cleanup in a manner to cause the least possible obstruction and inconvenience to traffic, pedestrians and any adjacent property owners and tenants.
- B.** Contractor shall protect open excavations and trenches with covers, railings and fences as required, together with signs, lights and other warning devices sufficient to protect and maintain safe pedestrian, bicycle, and vehicular traffic through the work area to the satisfaction of the City Engineer.
- C.** Contractor shall conduct operations in such a manner that existing facilities and utilities which are to remain in place will not be damaged. Excavation, trenching, and other work under or adjacent to existing pipelines, conduit runs, or structures of any kind, shall be protected in such a manner as not to interfere with the safe operation and use of such facilities. Should any damage be incurred to existing facilities or structures during the operations, the Contractor shall immediately notify the proper owners or authorities, and shall arrange for the immediate repair of the facilities at the Contractor's expense.
- D.** The location of proposed signal and electrical standards, pull boxes, conduits, cabinets, and other equipment shown on the plans is approximate only and the exact location of such shall be as established in the field by the City Engineer.
- E.** Construction area shall be left in a clean, neat, and workmanlike condition. All construction waste, rubbish, and debris remaining upon completion of the work shall become the property of the Contractor unless otherwise specified herein or noted on the plans and shall be removed from the work-site by the Contractor and disposed of off-site in a lawful manner to the satisfaction of the City Engineer.
- F.** Comply and conform to conditions and requirements indicated herein and specified under all other sections of these Specifications.

1.6 MAINTAINING EXISTING AND TEMPORARY ELECTRICAL SYSTEMS

- A.** Traffic signal and street lighting system shutdowns shall be limited to periods between the hours of 9:00 AM and 3:00 PM.
- B.** Existing street lighting and signal communication systems shall be maintained during construction operations. Maintain existing safety lighting on streets to the minimum required by the Special Provisions, or as required by the City Engineer. Maintenance of existing street light and traffic signal systems shall be considered as included in the

contract lump sum prices for the work item involved and no additional compensation will be allowed therefore.

- C. The contractor shall place "Stop Ahead" and "Stop" signs to direct vehicle and pedestrian traffic through the intersection during traffic signal system shutdown. Temporary "Stop Ahead" and "Stop" signs shall be either covered or removed when the system is turned on.
- D. "Stop Ahead" and "Stop" signs shall be furnished by the contractor and shall conform to the provisions in the California MUTCD and Section 12-3.06, "Construction Area Signs", of the Standard Specifications, except that the base material for the signs shall not be plywood.
- E. One "Stop Ahead" sign and two "Stop" signs shall be placed for each direction of traffic. Location of the signs shall be as directed by the City Engineer.
- F. Full compensation for furnishing, installing, maintaining and removing temporary "Stop Ahead" and "Stop" signs and for covering signs not in use shall be considered as included in the contract lump sum price paid for the work item involved and no additional compensation will be allowed therefore.

PART 2 - PRODUCTS

2.1 PORTLAND CEMENT CONCRETE

- A. Concrete shall be Class "A" conforming to the requirements of Section 02550 of these Specifications.
- B. Portland Cement Concrete for foundations shall conform to Section 90-10, "Minor Concrete", of the Standard Specifications and shall contain not less than 470 pounds of cement per cubic yard, except concrete for reinforced pile foundations shall contain not less than 564 pounds of cement per cubic yard.
- C. Hand mixing of concrete shall not be permitted.

2.2 PAINTING

- A. Painting shall conform to the provisions of Section 86-2.16 "Painting" of the Standard Specifications, and these provisions.
- B. All electroliers, standards, pedestals, posts, cabinets, and luminaire housings shall be coated with two part recoatable epoxy primer and two coats of Hi-solids polyurethane paint, Sherman Williams color RWC 6687 or approved equal:

Epoxy primer:	Part A: B67R5
	Part B: B67V5
Hi-solids polyurethane:	B65T304
Hardener:	B60V30

- C. All signal head mountings, brackets, fittings, outside of vehicle signal heads, and pedestrian signal head housings shall be finished with two coats of enamel, low-luster Pervo paint #2836, Oxford Brown or approved equal.

- D. Front of backplates and inside of visors of traffic signal heads shall be painted lusterless black.
- E. Contractor shall submit color chips for approval by City Engineer.
- F. Painting shall be considered to be included in the contract lump sum price for the work item involved and no additional compensation will be allowed therefore.
- G. Touch-up painting shall be provided where required by the City Engineer.
- H. Poles in downtown shall be black. See Precise Plan.

2.3 FOUNDATIONS

- A. Foundations shall consist of Portland Cement Concrete conforming to the requirements of Section 2.01 of these specifications and be constructed to conform to the details shown or called for on the plans.
- B. Anchor bolts, nuts and washers shall be fabricated from steel conforming to the requirements of ASTM Designation A307. Size and shape of anchor bolts shall conform to the details shown on the plans. Bolts, nut and washers shall be galvanized after fabrication in conformance with the requirements of ASTM Designation A123. All bolts and threads shall be lightly greased prior to acceptance.
- C. Reinforcement for foundations shall be deformed steel bars conforming to the requirements of Section 02550 of the Specifications. Size and shape for bar reinforcement shall conform to the details shown or called for on the plans.

2.4 ELECTROLIERS

- A. Electrolier masts, arms, fixtures, luminaires and appurtenances shall conform to the details shown on the plans.

2.5 CONTROLLER ASSEMBLIES

- A. Controller assemblies shall be a Type 90 NEMA Controller Assembly compatible with the City's designated controller system, conforming to Section 86-3.02 "Type 90 Controller Assemblies" of the Standard Specifications including controller unit, completely wired controller cabinet, inductive loop sensor units, conflict monitor, and load switches.
- B. Cabinets shall be Type P as shown on Standard Plan ES-3A. Cabinet shall be prime coated and finished in accordance with Section 2.02 "Painting". A graffiti coating acceptable to the City shall then be applied.
- C. Contractor shall furnish and install battery backup systems in conformance with paragraph 2.21 these Specifications.

2.6 PULL BOXES

- A.** Pull boxes shall be precast reinforced concrete of the size noted or called for on the plans and shall conform to the applicable provisions of Section 86-2.06 "Pull Boxes" of the State Standard Specifications with the following exceptions:
 - 1. Grout in the bottom of pull boxes will not be permitted, Contractor shall use drain rock at box sump.
 - 2. Covers of pull boxes shall be Christy "Fibrelyte" secured by means of either stainless steel bolts and nuts, or studs and nuts conforming to the requirements of said Section 86-2.06A of the State Standard Specifications.
 - 3. All ferrous metal parts shall be galvanized after fabrication in conformance with the requirements of Section 75-1.05 "Galvanizing" of the Standard Specifications.
 - 4. Covers for lighting pull boxes shall be marked "Street Lighting" in conformance with the requirements of Section 86-2.06B "Cover Marking" of the Standard Specifications.

2.7 CONDUIT

- A.** Conduit shall conform to the provisions in Section 86-2.05 "Conduit" of the Standard Specifications.
- B.** Conduit for underground electrical circuits shall be Poly Vinyl Chloride (PVC) type 1120, Schedule 40 with solvent weld joints, conforming to ASTM D-1785 and the requirements in the UL Standard for Rigid Non-Metallic Conduit (Publication UL 651). Minimum size conduit shall be 2" diameter.
- B.** Fittings and couplings for underground electrical conduit shall be Poly Vinyl Chloride (PVC), Schedule 40 specifically manufactured for the conduit used.
- C.** Conduit joints shall be solvent weld made by means of "Weld-On" P-70 primer and "Weld-On" cement, or approved equal.
- D.** All empty conduit or conduit for future circuits shall be installed with a 3/16 inch diameter nylon pull rope for future conductor extensions.

2.8 CONDUCTORS

- A.** Conductors shall conform to the provisions in Section 86-2.08 "Conductors" of the Standard Specifications and these provisions.
- B.** Conductors shall be copper of the type and size shown or called for on the plans. Copper wire shall conform to the applicable provisions of ASTM Designations B3 and B8.
- C.** Minimum conductor size is No. 8 AWG and shall be stranded. Wire size shall be based on American Wire Gage (AWG) and conductor diameter shall not be less than 98 percent of the specified AWG diameter.

- D. Conductors shall be UL listed and rated for 600 volt operation.
- E. Conductors shall be spliced by the use of "C" shaped compression connectors as shown on the Standard Plans.
- F. Traffic Signal Cable, 12 Conductor No. 14 AWG stranded (600 volt class) and meeting IMSA Specification 20-1-1984, may be used in lieu of individual wires.
- G. Insulation for conductors shall be one of the following:
 - 1. Type RHH or RHW cross-linked polyethylene.
 - 2. Type THW OR THWN Poly Vinyl chloride.
 - 3. At any point, the minimum thickness of any Type THWN insulation shall be 13 mils for conductor sizes No. 14 and No. 12, 18 mils for conductor size No. 10, 27 mils for conductor sizes No. 8 and No. 6, and 36 mils for conductor sizes No. 4 and No. 2. At any point, the minimum thickness of the nylon jacket shall be 4 mils for conductor sizes No. 14 to No. 10, inclusive, 5 mils for conductor sizes No. 8 and No. 6, and 6 mils for conductor sizes No. 4 and No. 2.

2.9 LUMINAIRES AND BALLASTS

- A. Luminaires shall be high pressure sodium vapor luminaries of the voltage, type and wattage shown on the plans, and shall be in conformance with all requirements in Section 86-6.01 "High-Pressure Sodium Luminaries" of the Standard Specifications, and these provisions.
- B. Ballasts shall conform to all of the provisions in Section 86-6.01 "High-Pressure Sodium Lamp Ballasts", of the Standard Specifications, and these provisions.
- C. Hardware shall be stainless steel or cadmium plated. Machine screws or bolts shall be used to secure removable components. Sheet metal screws shall not be used.
- D. The lamp socket shall be of high temperature, flame retardant thermoset material with self-wiping contacts or may be of other equally durable material. The socket shall be rated for 660 watts and 1,000 volts.
- E. Ballasts for luminaries to be mounted on mast arms, brackets or lowering assemblies shall be located within the luminaire housing. The ballast for each horizontally mounted luminaire shall consist of components mounted on the luminaire housing, components mounted on a metal plate secured to the house, or components mounted on a down opening door. The door shall be hinged and secured to the luminaire housing separately from the refractor of flat lens frame. The door shall be easily removable and replaceable. The door shall be secured to the housing in a manner to prevent its accidental opening when the refractor of flat lens frame is opened.
- F. Ballasts for luminaries to be mounted on mast arms, brackets, or lowering assemblies shall be the regulator, non-regulating reactor, autotransformer, or high reactance type.
- G. Section 86-6.01A (1), "Regular Type Ballasts", shall be lag-type regulator type ballasts.
- H. The 12th paragraph in Section 86-6.10, "High-Intensity-Discharge Lamp Ballasts" of

the Standard Specifications is amended to read:

"Ballasts for luminaires shall be located within the luminaire housing. The ballast for each vertically mounted luminaire shall consist of components mounted in the luminaire housing and components mounted on a metal plate secured to the pole."

- I. Luminaires shall be the semi-cutoff type with a Type IV distribution.
- J. Fused splice connectors shall conform to the provisions in Section 86-2.095 "Fused Splice Connectors" of the Standard Specifications, and these provisions.
- K. Each street light shall have an individual spliced fused connector located in the pull box adjacent to the pole.
- L. All fixture housings shall be painted in accordance with section 2.02 "Painting" of these specifications.
- M. The terminal strips shall have protective barriers between each terminal. The terminal screws shall be captive and equipped with wire grips for wire up to No. 8. All components shall be pre-wired to a single strip assuring that field connections are made to clearly identified line terminals.
- N. Prior to energizing luminaires, the lamp socket should be checked to assure that it is set in the proper location for the required light distribution in accordance with the manufacturer's instructions, and the luminaires shall be tilted five degrees (5°) above the horizontal.
- O. The supplier shall submit copies of certified tests to substantiate the satisfactory performance of the luminaires under 100 mph winds.
- P. A fused disconnect shall be furnished inside the luminaires so that when the door is opened the ballast primary circuit is broken, thereby allowing the fixture to be serviced without shock hazard.
- Q. Door frame shall be extruded aluminum construction hinged with stainless steel pins and be removable by means of quick release safety latch.
- R. Lens shall be of clear, thermal, and impact tempered glass of 0.156" minimum thickness, sealed with a gasket of heat resistant polypropylene.
- S. Ballast shall be open core-coil capacitor and starter type, high power factor type, suitable for starting lamp to -20°F.
- T. Ballast shall be mounted within the luminaires on a separate extruded aluminum panel having fins for heat dissipation with quick-release fasteners so that ballast assembly may be removed and replaced as a unit.
- U. Lamp holder shall be the mogul base ceramic type 5 KV pulse rated, having nickel-plated screw shell and contacts, reflector seal shall be airtight.

- V. All electrical components shall be rated for 240 volt single-phase two wire with insulation rated at 600 volts.

2.10 STANDARDS, STEEL PEDESTALS AND POSTS

- A. Standards for traffic signals and lighting, and steel pedestals for cabinets and other similar equipment shall be located as shown on the plans, and shall conform to the provisions of Section 86-2.04 "Standards, Steel Pedestals, and Posts" of the Standard Specifications and these specifications.
- B. Reference is made to Section 86-7 "Removing, Reinstalling or Salvaging Electrical Equipment" of the Standard Specifications. Salvaged material not reused shall be delivered to the City of Half Moon Bay Corporation Yard at 880 Stone Pine Road. The cost of this shall be considered in the lump sum of the work item involved and no addition compensation will be allowed therefore.
- C. All anchor bolts shall be galvanized steel and lightly greased prior to installation of the pole.
- D. All required drilling of poles shall be done in the field after the pole is mounted.
- E. Where the plans refer to the side tenon detail at the end of the signal mast arm, the applicable tip tenon detail may be substituted.
- F. The contractor shall either install a 3/16 inch or larger brass bolt on each existing standard for bonding, or preferably to be provided by pole manufacturer on the side of pole adjacent to hand-hole. The bolt shall be installed on the outside of the shaft near the baseplate where it is to be covered by the bolt cover. The shaft of the standard shall be drilled for no larger than a 1/4 inch hole near the baseplate to provide passage for the bonding conductor.

2.11 SERVICE PEDESTALS

- A. Type III CF service equipment enclosures shall be fabricated from aluminum and shall conform to the fabrication requirements in Section 86-2.11, "Service", of the Standard Specifications except as follows:
 - 1. All exterior seams for enclosure and doors shall be continuously welded by the gas tungsten arc (TIG) process.
 - 2. Sealing of the anodic coating shall be in a five (5) percent aqueous solution of nickel acetate (PH 5.0 to 6.5) for 15 minutes at 210°F.
- B. The anchor bolts for Type III CF service equipment cabinets shall be 5/8 inch diameter, minimum.
- C. One (1) each Type III CF service equipment cabinets shall have one 200-amp meter socket. See the construction plans for wiring schematic.
- D. Cabinets shall be prime coated and finished in accordance with Section 2.02 "Painting". A graffiti coating acceptable to the City shall then be applied.

- E. Circuit breakers used as service disconnect equipment shall have a minimum interrupting capacity of 42,000 amperes, RMS, for 120/240-volt services and 30,000 amperes, RMS, for 480-volt services.
- F. Minimum amperage for sub-circuit breakers shall be as shown on plans.
- G. Circuit breakers shall be mounted on non-energized clips. All circuit breakers shall be mounted vertically with the up position of the handle being the "ON" position.
- H. Dead front panel or panels, and corresponding exterior door, shall be hinged on one side and shall be able to open without the use of tools.

2.12 HEAT SHRINK TUBING

- A. Heat shrink tubing shall be dual wall, irradiated polyefin tubing containing an adhesive inner wall. When heated, the inner wall shall melt and fill all crevices and interstices of the object being covered while the outer wall shrinks. Each end of the heat shrink tube or the open end of the open end of the end clamp of heat shrink material shall, after contraction, overlap the conductor insulation at least 1-1/2 inches.
- B. All heat shrink tubing shall also meet the following requirements:
 1. Shrinkage Ratio: 33 percent, maximum, of supplied diameter when heated to 125°C. and allowed to cool to 25°C.
 2. Dielectric Strength: 350 kilovolts per inch, minimum.
 3. Resistivity: 1014 ohms per centimeter, minimum.
 4. Tensile Strength: 2,500 lbs. per square inch, minimum.
 5. Operating Temperature: -5 °C. to 135°C.
 6. Water Absorption: 0.5 percent, maximum.

2.13 DUCT SEAL

- A. Sealant for duct seal shall consist of "Duct Seal Compound" as manufactured by Johns-Mansville Industries, Appleton Electric Company and Killark Products, or approved equal.

2.14 PHOTOELECTRIC CONTROLS

- A. Photoelectric controls shall conform to the provisions in section 86-6.07 "Photoelectric Controls" of the Standard Specifications and these specifications.
- B. Unmetered street lights or lighting circuits shall use Type IV photoelectric controls. Each luminaire shall be equipped with an individual photoelectric unit conforming to Section 86-6.07B(1) of the State Standard Specifications with the following additional requirement:
 1. The photoelectric unit receptacle shall be adjustable to allow for positioning to the satisfaction of the City Engineer.

- C. Metered street lighting circuits serviced from an electrical service equipment enclosure shall use Type V photoelectric controls. Each Type III-BF or Type III- CF service equipment enclosure shall be equipped with a central photoelectric unit capable of switching multiple lighting circuits. Each luminaire shall be supplied with a shorting cap when a Type V photoelectric control is used.

2.15 SIGNAL INTERCONNECT CABLE

- A. Signal Interconnect Cable (SIC) shall be six-pair No. 19, AWG solid bare copper conductors. Conductors shall be in twisted pairs. Color coding shall distinguish each pair. SIC cable shall conform to IMSA Specification 20-2-1984.
- B. The cable jacket shall be IMSA 20-2 black, high-density polyethylene, rated for a minimum of 600 volts and shall have a nominal wall thickness of 60 mils, minimum. The cable jacket or the moisture resistant tape directly under the outer jacket shall be marked with the manufacturer's name, insulation type designation, number of conductors and conductor size and voltage and temperature rating.
- C. No splices shall be allowed. Connections will be at the designated terminals in controller cabinets. A minimum of three (3) feet of slack shall be provided at each pull box and six (6) feet at each controller cabinet.
- D. Cable shall be provided with an overall copper shield which shall be grounded at each end.

2.16 VEHICULAR TRAFFIC SIGNAL ASSEMBLIES

- A. Vehicular Traffic Signal Assemblies shall conform to the provisions of Section 86-4 "Traffic Signal Faces and Fittings" of the Standard Specifications and these specifications.
- B. Painting shall be in conformance with paragraph 2.02 "Painting" of these specifications.
- C. All vehicular traffic signal assemblies shall include a backplate. Backplates for traffic signal heads mounted on mast-arms shall be louvered.
- D. All signal sections shall be 12-inch units.
- E. The first paragraph of Section 86-4.08 "Signal Mounting Assemblies" of the Standard Specifications is amended to read:

"Signal mounting assemblies shall consist of 1-1/2 inch standard steel pipe or galvanized conduit, necessary fittings, slip-fittings and terminal compartments. Pipe fittings shall be ductile iron, galvanized steel, copper, brass, or bronze. Mast arm slip-fittings shall be cast bronze or hot-dip galvanized ductile iron. Post top slip-fittings and terminal compartments shall be cast bronze, Type-356-T6 aluminum or hot-dip galvanized ductile iron."
- F. All signals shall be tightened and aligned properly at time of mounting to the satisfaction of the City Engineer.

- G. After installation, all signal lenses must be covered until signal turn-on for final inspection, and then recovered until acceptance of the work by the City at which time the Contractor shall uncover all lenses.

2.17 LIGHT EMITTING DIODE SIGNAL MODULE

- A. Light Emitting Diode (LED) Signal Modules shall conform to the provisions in Section 86-4.02, "Light Emitting Diode Signal Module" in the Standard Specifications and to the provisions in Standard Special Provision 86-385 "Light Emitting Diode Signal Modules."
- B. References contained in these Specifications and Provisions to "State," "Department," or similar references meant to refer to the Department of Transportation shall be amended to refer to the City or the City Engineer as appropriate.

2.18 PEDESTRIAN PUSH-BUTTONS

- A. All pedestrian push-buttons shall be "accessible" type push buttons, and shall conform to the requirements in Section 86-5.02 "Pedestrian Push Button Assemblies" of the Standard Specifications and to Sections 4E.08 "Pedestrian Detectors" and 4E.09, "Accessible Pedestrian Signal Detectors" in the California Manual on Uniform Traffic Control Devices, latest edition.
- B. All pedestrian push buttons shall be the Navigator Accessible Pedestrian Signal type, by Polara Engineering Inc., or approved equal.
- C. Push button system shall be installed per the manufacturer specifications and details. Contractor shall be responsible for all required system components, including but not limited to, push button assemblies, control units, wiring circuits, and configuration devices.
- D. Accessible Pedestrian Signals shall include the following custom and sound options:
 1. Custom Locate Sound – Plays a sound at a selectable interval to assist a blind pedestrian in locating the Push Button Station.
 2. Custom Location Message(s) – Typically message states street being crossed and cross street names, and other vital information to help pedestrian with location and direction.
 3. Custom Walk Message(s) – Typically alerts pedestrians that the walk interval has begun and name of street being crossed.
 4. Custom Clearance Sounds/Countdown – Plays a sound to let pedestrians know they should clear intersection crosswalk. This option tone typically would sound similar to the locate tone but is played at a faster rate or counts down the number of seconds in the clearance phase.

2.19 PEDESTRIAN SIGNALS

- A. Pedestrian signals shall be the Light Emitting Diode (LED) type pedestrian signal,

conforming to the provisions of Standard Special Provision 86-405 "Light Emitting Diode Pedestrian Signal Modules" and Section 4E of the California Manual on Uniform Traffic Control Devices.

- B. Pedestrian signals shall be the "Countdown" type pedestrian signals conforming to the provisions in Section 4E.07, "Countdown Pedestrian Signals" of the California Manual on Uniform Traffic Control Devices, latest edition.
- C. Pedestrian Signal Faces shall be a single section with the "Upraised Hand" and "Walking Person" overlain on the left of the pedestrian signal face, and the "Countdown" on the right of the pedestrian signal face.

2.20 BATTERY BACK-UP SYSTEM FOR TRAFFIC SIGNALS

- A. Battery Back-up Systems for Traffic Signals shall be in conformance with "Specification for Battery Back-up System For Traffic Signals Utilizing Light Emitting Diodes (LED) Traffic Signal Modules" by the Department of Transportation dated July 2004, as amended below:
 - 1. References to "State," "Department," or similar references meant to refer to the Department of Transportation shall be amended to refer to the City or the City Engineer as appropriate.
 - 2. References to Caltrans Model 332A Cabinets, Model 170E Controllers, and Model 2070 Controllers shall be amended to refer to Caltrans Type P Cabinets and NEMA Type 90 Controllers as appropriate.
 - 3. The following sections, paragraphs and figures are deleted in their entirety:
 - a. Paragraph 2.1.1 & 2.1.2;
 - b. Paragraph 2.1.5 & 2.1.6;
 - c. Section 2.2;
 - d. Paragraph 2.3.5 through paragraph 2.3.7;
 - e. Paragraph 2.3.14 through paragraph 2.3.16;
 - f. Section 5.6;
 - g. Figure 2.
 - 4. The following sections and paragraphs are amended as follows:
 - a. Paragraph 2.1.7 – delete option (1) Internal Mounted Option;
 - b. Paragraph 2.3.3 line 3 shall read – "The specific finish of the external cabinet shall be in conformance with Section 2.02 "Painting" of these Specifications. A graffiti coating acceptable to the City shall then be applied."
 - 5. The following paragraph is added to Section 5:
 - a. Paragraph 5.0: The Contractor shall provide a Certificate of Compliance to the City Engineer certifying that the battery back-up system meets or exceeds these specifications.

2.21 LUBRICATING COMPOUND

- A. Contractor shall apply high-pressure, high-temperature anti-seize and lubricating

compound on all threaded nuts and bolts, including anchor bolts and components of signal mounting hardware assemblies.

- B. Contractor shall use THREADEASE of approved equal.

PART 3 - EXECUTION

3.1 TRENCHING, BACKFILL AND SHORING

- A. Trenching shall conform to Section 02202 of these Specifications.
- B. Depth of trenches for conduit or conductors in areas to be covered by street paving shall be such as to provide thirty (30) inches of cover for conduits or conductors. Trench depth under sidewalks shall be such as to provide eighteen (18) inches of cover over the conduit or conductor to the paving subgrade, or as indicated on the plans.

3.2 CONDUIT JACKING

- A. Placement of conduit beneath existing pavement and sidewalk may be by jacking methods when approved by the City Engineer.
- B. Where conduit is to be installed by jacking or drilling longitudinally along the curb line, installation shall conform to the provisions in Section 86-2.05C, "Installation" of the Standard Specifications.
- C. Pavement shall not be disturbed without written permission of the City Engineer.
- D. Jacking pits shall be kept two (2) feet clear of the edge of any type of pavement.
- E. Excessive use of water, such that pavement might be undermined or subgrade softened, will not be permitted.

3.3 FOUNDATIONS

- A. Concrete for foundations of standards and cabinets shall be installed in conformance with section 2.01, "Portland Cement Concrete," of these specifications.
- B. Top of foundations for electroliers shall be (2) inches above the surrounding finish grade in unpaved areas or shall be flush with top of curb when adjacent to curbs. The top two (2) inches of foundations for street electroliers shall be placed after the electrolier is in proper position.
- C. Top of foundations for service pedestals shall be to the dimension or elevation shown or noted on the plans.
- D. Excavation for electrolier foundations shall be done with an auger to the diameter called for on the plans and the top portion of the foundation above the surrounding subgrade shall be formed.
- E. Foundations for electroliers adjacent to curbs shall be set to provide a minimum of twenty-four (24) inches clear from face of curb to center of electrolier mast.

- F. Controller cabinet foundation shall be constructed to extend 5-1/2" above the surrounding grade, and shall be installed with a cast in ground rod.
- G. In unpaved areas, a four (4) inch thick Portland Cement Concrete pad shall be constructed in front of cabinets. Pad dimension shall be as directed by the City Engineer.
- H. The fifth paragraph in Section 86-2.03, "Foundations," of the Standard Specifications is amended to read:

Cast-in-drilled hole concrete pile foundations for traffic signal and lighting standards shall conform to the provisions in Section 49, "Piling," with the added requirements that standards shall not be erected until seven days have elapsed after placing the concrete, and except that material resulting from drilled holes shall be disposed as provided in Section 86-2.01, "Excavating and Backfilling," of the Standard Specifications.

3.4 CONDUIT

- A. Install conduits in the locations shown on the plans. Additional conduit not shown on the plans, but required to serve signal system shown on plans, shall be installed as directed by the City Engineer.
- B. After conductors have been installed, the ends of conduits terminating in controller cabinets and pull boxes shall be sealed with an approved type of sealing compound.
- C. All empty conduits shall be installed with 3/16" diameter nylon pull rope for future use.

3.5 PULL BOXES

- A. Pull boxes of the size and type specified shall be installed at the locations shown on the plans. Additional pull boxes required for construction and not shown on the plans shall be installed by the Contractor at the direction of the City Engineer.
- B. Top of pull boxes shall be set flush with surrounding finish grade and in curbed areas shall be set flush with top of curb.
- C. Where the sump of an existing pull box is disturbed by the Contractor's operations, the sump shall be reconstructed.

3.6 CONDUCTORS

- A. Conductors shall be pulled through rigid non-metallic conduit by hand only using nylon or polypropylene pull rope with a minimum tensile strength of 500 pounds. Nylon or polypropylene pull rope shall be installed in all conduits which are to receive future conductors.
- B. All splices of conductors shall use Type "C" shaped compression connectors and shall be insulated by means of Method "B" as set forth in Section 86-2.09E "Splice Insulation" of the State Standard Specifications.

- C. Splices shall be made in pull boxes, or terminal compartments only. All signal conductors may be spliced, in pull boxes, where circuits branch except where duplicate parallel conductors are shown in the conductor schedule.
- D. All splices for connection to electroliers shall have fused disconnect splice connectors installed in the pull box adjacent to the electrolier. Fused splice connectors shall be installed in conformance with the requirements of Section 86-2.095 "Fused Splice Connectors" of the State Standard Specifications.
- E. Provide at least three (3) feet of slack within each pull box.
- F. After conductors have been installed, the end of conduits terminating in service cabinets, standards, electroliers and pull boxes shall be sealed with Duct Seal Compound.
- G. Cables shall be permanently identified as to circuit or phase. Identification shall be placed on each cable in each pull box and near the end of terminated cable.
- H. When three or more conductors are to be enclosed within a single splice using heat shrink material, mastic shall be placed around each conductor prior to being placed inside the heat shrink material. The mastic shall be the type recommended by the manufacturer of the heat shrink material.

3.7 SERVICE

- A. Electrical services for street and safety lighting shall be installed in conformance with the applicable requirements of Section 86-2.11 "Service" of the State Standard Specifications and shall meet the requirements of the serving utility.
- B. The twelfth paragraph in Section 86-2.11 "Service" of the Standard Specifications is amended to read:

Except for power for the contractor's operations, upon written request by the contractor, the City Engineer will arrange with the serving utility to complete service connections for both temporary and permanent installations and the City will pay all costs and fees required by the utility. Such request shall be submitted not less than 15 days before service connections are required.

- C. Service conduit and pull boxes shall be installed as soon as possible to enable the utility company to schedule work well in advance of completion of the project.
- D. To facilitate the utility company in providing underground service connections, a conduit with conductors shall be run to the service point designated on the plans. Two No. 5 pull boxes shall be installed adjacent to the service point and an elbow to the face of the utility pole. The utility company shall then install the conductors through the elbow from the pull box.

3.8 LUMINAIRES

- A. Prior to energizing a luminaire, the lamp socket shall be set in the proper location for the required light distribution in accordance with the manufacturer's instructions for the

type of distribution called for on the plans.

- B. Set fixtures level and flush with the roadway surface.

3.9 PHOTOELECTRIC CONTROLS

- A. Photoelectric controls shall be installed as per the detail shown on the plans, and adjusted to point in the north direction.

3.10 STANDARDS AND PEDESTALS

- A. All poles shall be installed as shown, leveled and cleared of all concrete.
- B. Salvaged material not reused shall be delivered to the City of Half Moon Bay Corporation Yard at 880 Stone Pine Road. The cost of this shall be considered in the contract price paid under the work item involved and no additional compensation will be allowed therefore.
- C. All required drilling on poles, masts, mast arms and fixtures shall be done in the field after the pole (mast) has been satisfactorily installed, plumbed and cleaned.
- D. For bonding existing intersectional street lighting standards the contractor shall either install a 3/16 inch or larger brass bolt, or preferably a means to be provided by pole manufacturer on side of pole adjacent to hand-hole. The bolt shall be installed on the outside of the shaft near the base plate where it will be covered by the bolt cover. The shaft of the standard shall be drilled for no larger than a 1/4 inch hole near the base plate to provide passage for the bonding conductor.
- E. Payment for modifications for touch-up painting and bonding of existing standards shall be considered as included in the contract lump sum price paid for street lighting.

3.11 BONDING AND GROUNDING

- A. Bonding and grounding shall conform to the provisions in Section 86-2.10 "Bonding and Grounding" of the Standard Specifications, these special provisions, the latest issue of the National Electric Code, Section 250-91(c), and to Sections 2395.91(b) and (c)I of the State of California Low Voltage Electrical Safety Orders, Title 8.
- B. Grounding jumper shall be attached by means provided by pole manufacturer, if possible. If not, contractor shall provide a 3/16 inch or larger brass bolt in the standard or pedestal and shall be run through conduit to the ground rod or bonding wire in adjacent pull box.
- C. Grounding jumper shall be visible after cap has been poured on foundation.

3.12 REMOVING, REINSTALLING OR SALVAGING ELECTRICAL EQUIPMENT

- A. Salvaged electrical materials shall be hauled to the City of Half Moon Bay Corporation Yard at 880 Stone Pine Road, and stockpiled.
- B. Full compensation for hauling and stockpiling electrical materials shall be considered

as included in the contract price paid for the item requiring the material to be salvaged and no additional compensation will be allowed therefore.

3.13 EXCAVATION AND BACKFILLING

- A.** Excavation and backfilling for trenches, foundations and other appurtenance shall conform to the provisions in Section 86-2.01, "Excavating and Backfilling" of the State Standard Specifications and Section 02202 of the Specifications.

3.14 DISPOSAL OF LOW SODIUM LAMPS

- A.** All unserviceable sodium lamps recovered from the existing street lights shall be disposed of per local, State and Federal regulations. The contractor shall confirm the location of the disposal with the Public Works Services.
- B.** Sodium can generate a high degree of heat when exposed to small amounts of water; therefore the following precautions must be taken while handling the lamps.
 - 1. Prevent the bulb from being scratched.
 - 2. Be sure the power supply is off before installing or removing the lamp.
 - 3. In case the outer bulb is broken, avoid making contact with metal parts to prevent electrical shock.

3.15 INDUCTIVE LOOP DETECTORS

- A.** Loop detectors shall conform to the provisions in Section 86-5.01A "Inductive Loop Detectors" of the Standard Specifications, details and notes shown on the Standard Plans, and these specifications.
- B.** Loop detector sensor units and asphaltic emulsion sealant for inductive detector loop installation shall be furnished by the contractor.
- C.** Loop detectors to be installed in an area that is to receive new asphalt concrete shall be installed prior to the final overlay of asphalt concrete.
- D.** Where the inductive loop detector conductors are to be installed in an area that is to be resurfaced with asphalt concrete, the loop detector conductor shall be placed in slots cut in the existing pavement. The conductors shall be installed as shown on the plans in the existing pavement.
- E.** Loops shall be centered within traffic lanes unless otherwise specified.
- F.** Contractor shall position loops so that no portion of any loop lies over conduit.
- G.** Contractor shall make tentative layouts of all loops as shown on plans, then arrange for confirmation of layouts by the City Engineer prior to sawcutting.
- H.** All loops shall be brought to pull box individually through a chase and conductors shall have two turns of twist per foot and spliced in pull box.

- I. Wire shall be installed in a slot sawcut in the pavement. Residue resulting from slot cutting operations shall not be permitted to flow across shoulders or lanes occupied by public traffic and shall be removed from the pavement surface by vacuuming or other approved method before any residue flows off of the pavement surface. Residue from sawcutting operations shall be disposed of outside the highway right of way in conformance with the provisions in Section 7-1.13 of the Standard Specifications.
- J. Slots cut in the pavement shall be smooth, washed clean, blown out and thoroughly dried before installing conductors.
- K. Loop wire shall be Type 1, Type RHW-USE neoprene-jacketed or Type USE cross-linked polyethylene insulated, No. 12, stranded copper wire, the minimum insulation thickness at any point shall be 40 mils, in accordance with Section 86-5.01 A of the Standard Specifications. One continuous, unbroken length shall be used to form a loop of the number of turns required and the lead-in from loop to junction box.
- L. The lead-ins from the detector shall be Type B, lead-in cable shall be insulated with 20 mils of high-density polyethylene. The conductors shall be twisted together with at least 2 turns per foot and the twisted pair shall be protected with a copper or aluminum polyester shield. A No. 20, minimum, copper drain wire shall be provided and connected to the equipment ground within the cabinet. The cable shall be provided with a high-density polyethylene or high-density polypropylene outer jacket with a nominal thickness of 32 mils. An amorphous interior moisture penetration barrier of nonhydroscopic polyethylene or polypropylene fillers shall be provided in accordance with Section 86-5.01A. The lead-in shall be spliced, soldered and taped to the loop at the junction box. The shield shall be connected to the controller cabinet ground bus. Where spade terminals are used to secure the lead-in wire to field terminal blocks, the spade terminals shall be soldered as well as crimped to the UF wire. All detector lead-in cable shall be continuous - no splicing is permitted.
- M. After the loop conductors are installed in the pavement, the slots shall be filled to within 1/8" of the pavement surface with the appropriate sealant. All excess shall be removed.
- N. Detector loop lead-ins shall be installed in conduit from the gutter to the splice box. After installation of loop wires, gutter end of conduit is to be sealed with duct seal and excavation is to be filled with sand to within 1-1/2" of road surface and capped with asphalt.
- O. All splices shall be soldered to ensure constant low resistance and must be insulated in such a manner that the installation maintains resistance to ground of not less than 100 megohms. To ensure that the loop installation is correct, a continuity check of the loop wiring and a resistance check of this loop-to-ground shall be performed using a "megger" or other suitable insulation tester, with a representative of the City Engineer present. Loop readings that decrease below 20 megohms during the guarantee period shall be considered below minimum limits and shall require replacement.
- P. The contractor shall test the detectors with a motor-driven cycle, as defined in the California Vehicle Code that is licensed for street use by the Department of Motor Vehicles of the State of California. The unladen weight of the vehicle shall not exceed 200 pounds and the engine displacement shall not exceed 100 cubic centimeters. Special features, components or vehicles designed to activate the detector will not be

permitted. The contractor shall provide an operator who shall drive the motor-driven cycle through the response or detection area of the detector at not less than three (3) miles per hour nor more than seven (7) miles per hour. The detector shall provide an indication in response to this test.

- Q.** Chevron asphalt loop sealant or equal shall be used.
- R.** Adjacent loops shall be tied to the same four-channel detector.
- S.** The number of lead-in-cable required to achieve the specified detection shall be installed.
- T.** Where Type "A" loops are indicated on the plans, except for speed monitoring installation, a six-foot diameter circular loop may be installed in lieu of the shape shown on the plans. The sides of the slot shall be vertical and the minimum radius of the slot entering and leaving the circular part of the loop shall be 1-1/2 inches.
- U.** If any part of the loop conductor, including the portion leading to the adjacent pull box, is damaged by the contractor's operations, the entire detector loop shall be replaced. If any adjacent loop is damaged during such replacement, that loop shall also be replaced.

3.16 RESTORATION OF EXISTING IMPROVEMENTS

- A.** Existing pavement or other improvements removed or damaged due to the installation of work items shall be replaced in kind to the satisfaction of the City Engineer, at the Contractor's expense.
- B.** Existing landscaping, irrigations, or plantings removed, damaged or disturbed due to the work items shall be replaced in kind to the satisfaction of the City Engineer, at the Contractor's expense.
- C.** All construction areas shall be left in a clean, neat and workmanlike condition. All construction waste, rubbish and debris remaining upon completion of the work shall become the property of the contractor unless otherwise specified herein or noted on the plans and shall be removed from the worksite by contractor and disposed of off-site in a lawful manner to the satisfaction of the City Engineer.

3.17 ACCEPTANCE TEST AND TURN ON

- A.** The work item will not be considered acceptable until it has been energized and visually inspected by the City Engineer. Prior to acceptance testing, all equipment as shown on the Plans shall be installed and operable, including but not limited to, pedestrian signals, pedestrian push buttons, vehicle detectors, lighting, signs, and pavement delineation.
- B.** All louvers, visors, and signal faces shall be directed to provide maximum visibility.
- C.** Contractor shall pay all energy costs until the street light system has successfully passed the acceptance test and initial turn on.
- D.** Initial turn on of signal systems shall be made between 9 a.m. and 2 p.m., unless

specified otherwise.

- E.** Contractor shall notify the City Engineer seven (7) days prior to intended date of initial turn on. City will arrange for presence of the Police Department at the time of initial turn-on.
- F.** Turn-on procedures must be approved by the City Engineer. Contractor shall be responsible for all required traffic control measures required for the turn-on, to the satisfaction of the City Engineer.

* * *

VOLUME II

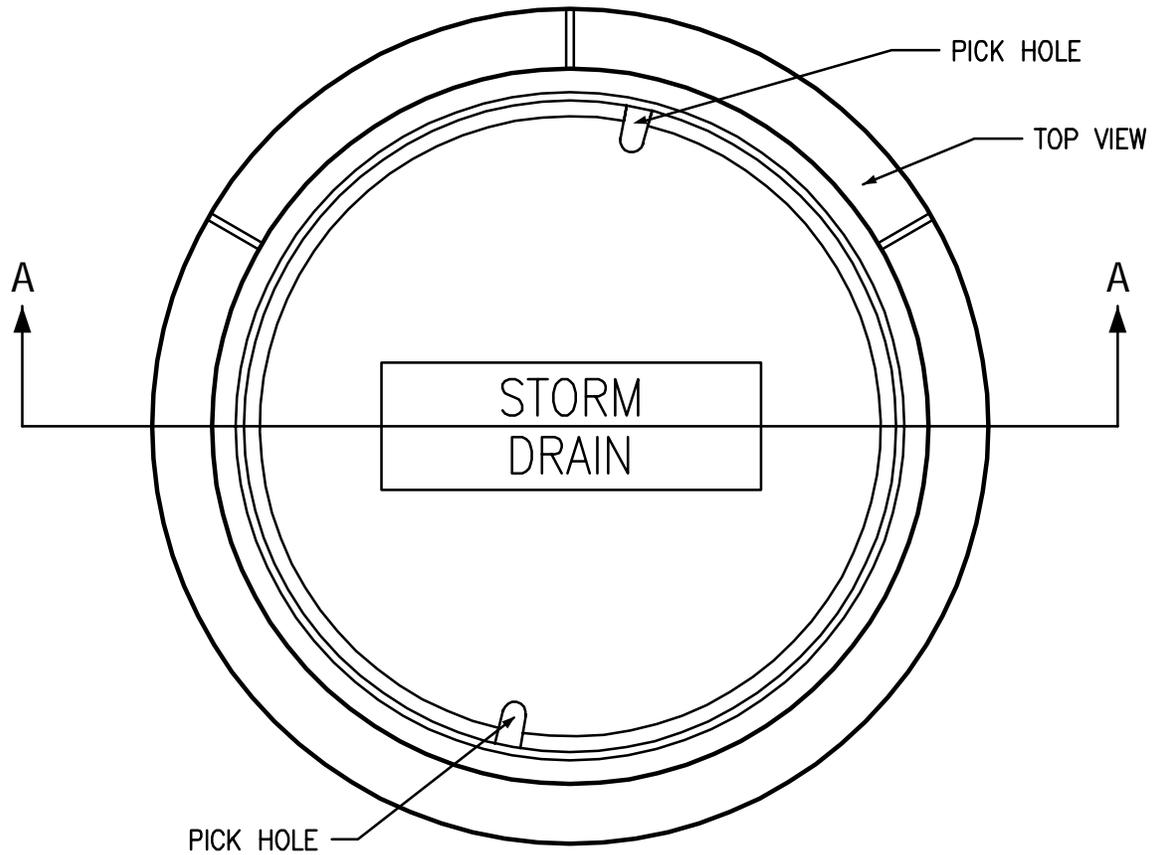
STANDARD DETAILS

CITY OF HALF MOON BAY, CALIFORNIA
LIST OF STANDARD DETAILS

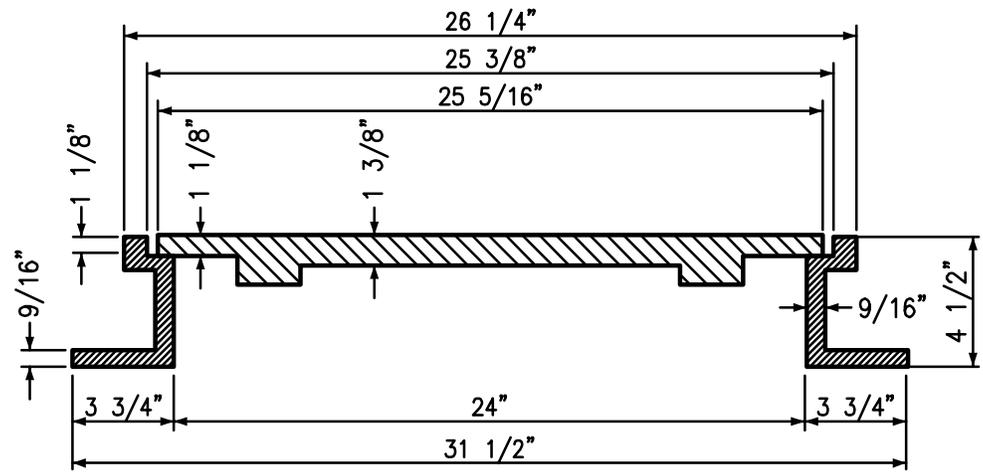
No.	DWG No.	Title/Description	Last Revision
STORM DRAIN			
1	SD-1	STANDARD 24" MANHOLE FRAME AND COVER	7/19/2016
2	SD-2	PIPE COVER REQUIREMENTS CP, RCP, ACP, VCP & CAST-IN-PLACE	7/19/2016
3	SD-3	NO DUMPING PUBLIC NOTICE DETAIL	7/19/2016
IMPROVEMENT PLAN LAYOUT			
4	SDG-1	STANDARD CITY TITLE BLOCK	7/19/2016
STREET IMPROVEMENTS			
5	SI-1	VALLEY OR CROSS GUTTER	7/19/2016
6	SI-2	CURBS AND GUTTERS	1/29/2021
7	SI-3	SIDEWALK DETAIL (MONOLITHIC)	1/29/2021
8	SI-3A	SIDEWALK DETAIL (PARKWAY)	7/19/2016
9	SI-4	COMMERCIAL DRIVEWAY APPROACH	7/19/2016
10	SI-5	RESIDENTIAL DRIVEWAY APPROACH WITH CURB	1/29/2021
11	SI-5A	RESIDENTIAL DRIVEWAY APPROACH WITH CURB	7/19/2016
12	SI-6	CURB RAMP DETAILS	7/19/2016
13	SI-7	TYPICAL SECTIONS RESIDENTIAL STREETS	1/29/2021
14	SI-8	TYPICAL SECTIONS COLLECTOR STREETS	7/19/2016
15	SI-8A	LIMITED R/W STREETS	7/19/2016
16	SI-9	STANDARD STREET SECTIONS	7/19/2016
17	SI-10	TRAFFIC CONTROL SIGN	7/19/2016
18	SI-10A	STREET NAME SIGN	7/19/2016
19	SI-10B	SIGN INSTALLATION PLANS	7/19/2016
20	SI-11	RED CURB PAINTING	7/19/2016
21	SI-12	CUL-DE-SAC DETAILS	7/19/2016
22	SI-13	FRONTAGE AND DRIVEWAY REGULATIONS	7/19/2016
23	SI-14	DRIVEWAY DESIGN ILLUSTRATIONS FIRE APPARTUS - PUMPER	7/19/2016
24	SI-15	BOXED SURVEY MONUMENT	7/19/2016
25	SI-16	GENERAL NOTES FOR STREET PLANS	7/19/2016
26	SI-16A	GENERAL NOTES FOR STREET PLANS (CONTINUED)	7/19/2016
27	SI-17	ASPHALT PLANING	7/19/2016
28	SI-18	SPECIAL - CURB AND GUTTER RECONSTRUCTION	7/19/2016
29	SI-19	MINIMUM CLEAR SIGHT TRIANGLES	7/19/2016
30	SI-20	INTERSECTION SIGHT DISTANCE	7/19/2016
31	SI-20A	INTERSECTION SIGHT DISTANCE (NOTES)	7/19/2016
32	SI-21	TREE PLANTING DETAILS	7/19/2016
33	SI-21A	TREE WELL DETAIL 1	7/19/2016
34	SI-21B	TREE WELL DETAIL 2	7/19/2016
35	SI-22	End of Road Barricade	7/19/2016

**CITY OF HALF MOON BAY, CALIFORNIA
LIST OF STANDARD DETAILS**

No.	DWG No.	Title/Description	Last Revision
SANITARY SEWER			
35	SS-1	INSIDE DROP CONNECTION DETAIL	7/19/2016
36	SS-2	SEWER MANHOLE COVER	7/19/2016
37	SS-3	TYPE I MANHOLE (PIPES 6" TO 21" DIAMETER)	7/19/2016
38	SS-4	TYPE II MANHOLE (24" - 48" DIAMETER PIPE)	7/19/2016
39	SS-5	TYPE III MANHOLE (PIPES LARGER THAN 48" DIAMETER)	7/19/2016
40	SS-6	SADDLE MANHOLE	7/19/2016
41	SS-7	STANDARD SEWER LATERAL AND CLEANOUT	1/29/2021
42	SS-7A	LATERAL CONNECTION TO EXISTING VCP MAIN	1/29/2021
43	SS-8	ABS OR PVC CLEANOUT TO GRADE (SEWER CONNECTED TO RISER)	7/19/2016
44	SS-9	CONCRETE ENCASMENT DETAIL	7/19/2016
45	SS-10A	SANITARY SEWER & WATER MAIN SEPERATION DETAILS (PARALLEL)	7/19/2016
46	SS-10B	SANITARY SEWER & WATER MAIN SEPERATION DETAILS (CROSSING)	7/19/2016
47	SS-11	SEWER TEE DETAIL	7/19/2016
48	SS-12	BACKWATER CHECK VALVE SYSTEM DETAIL	7/19/2016
49	SS-13	RAISING AND LOWERING MANHOLE DETAIL IN STREET (FOR RESURFACING)	7/19/2016
50	SS-13B	RAISING AND LOWERING MANHOLE NOTES (CONTINUED)	7/19/2016
51	SS-14	GENERAL NOTES FOR SANITARY SEWER PLANS	7/19/2016
UTILITY TRENCH			
51	UT-1	UTILITY TRENCH DETAIL	11/15/2017



PLAN



SECTION A-A

NOTES:

1. ALL MATERIAL USED IN MANUFACTURING SHALL CONFORM TO A.S.T.M. A48, CLASS 30.
2. ALL CASTINGS TO BE COMPLETELY CLEANED AND PAINTED WITH ASPHALTIC VARNISH, AFTER MANUFACTURE.
3. USE PHOENIX P-1090, D&L SUPPLY A-1024, OR EQUAL.

NO SCALE



CITY OF HALF MOON BAY, CALIFORNIA STANDARD DETAIL

APPROVED BY:
 PEYKAN ABBASSI, P.E.
 CITY ENGINEER
 DATE: JULY 19, 2016

**STANDARD 24" MANHOLE
 FRAME AND COVER**

STD. DETAIL No.
SD-1

MAXIMUM TRENCH DEPTH MEASURED SURFACE TO BOTTOM OF TRENCH IN FEET												
DIAMETER	C-14 CONC. PIPE -CLASS-			REINFORCED CONCRETE PIPE -CLASS-					VCP E.S.	CAST IN PLACE		
	1	2	3	I	II	III	IV	V				
10	12	17	29	NOT PERMITTED				NO LIMIT	NO LIMIT	NO LIMIT		
12	12	17	21		8	12	30					
15	12	17	20		10	15	35					
18	11	17	19		11	16	38					
21	11	17	19		12	17	39					
24	11	16	19		12	18	39					
27	11	16	18		13	19	39					
30	11	15	17		14	19	38					
33	11	15	16		14	20	38					
36	10	13	14		13	17	27				69	25
42	NOT PERMITTED				14	18	29				62	APPROVED ON DESIGN BASIS
48					15	19	30				60	
54					16	20	31				58	
60				14	16	21	31	57				
66	NOT PERMITTED			15	17	22	32	56	45			
72				15	18	23	33	56	35			
									30			

MINIMUM TRENCH DEPTH MEASURED SURFACE TO TOP OF TRENCH IN INCHES			
TYPE	CLASS	MIN. COVER	
		STREET	OFF ST.
C-14 CONC. PIPE	1	30	12
	2	27	12
	3	24	12
REIN. CONCRETE AND ASBESTOS CEMENT	I	27	12
	II	24	12
	III	12	12
	IV	12	12
	V	24	12
VCP	ES.		
CAST IN PLACE CONCRETE PIPE	—	12	12

NOTES:

- ALL DEPTHS SHOWN FOR FLEXIBLE PAVEMENT AND TRENCH WIDTH EQUAL TO O.D. OF PIPE PLUS 16" FOR PIPE 33" AND SMALLER INSIDE DIAMETER. TRENCH WIDTH EQUALS O.D. OF PIPE PLUS 24" FOR PIPE 36" AND LARGER IN INSIDE DIAMETER. TRENCH WIDTH MEASURED AT TOP OF PIPE.
- THIS DETAIL SHALL BE A GUIDE ONLY. THE CITY REQUIRES THAT A NCPI LOAD CALCULATION BE RUN ON ALL PIPES FOR TRENCH LOAD DESIGN.



CITY OF HALF MOON BAY, CALIFORNIA STANDARD DETAIL

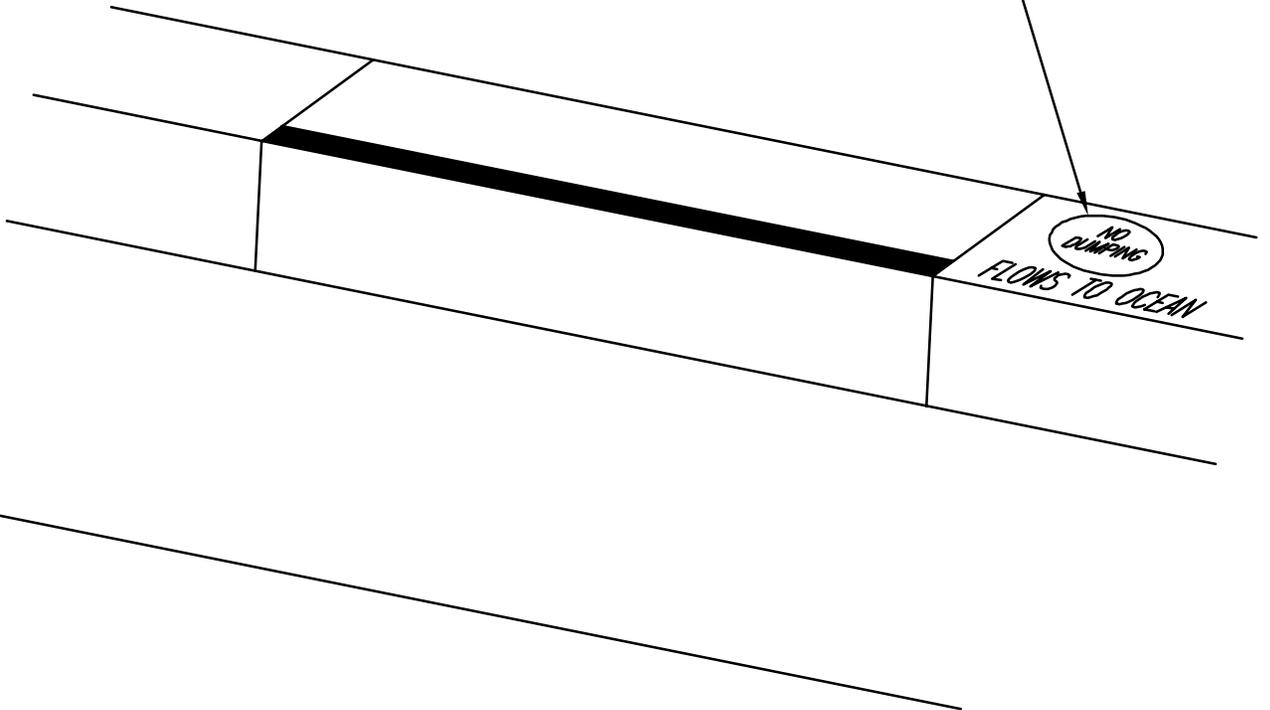
APPROVED BY:
 PEYKAN ABBASSI, P.E.
 CITY ENGINEER
 DATE: JULY 19, 2016

**PIPE COVER REQUIREMENTS
 CP, RCP, ACP, VCP & CAST-IN-PLACE**

STD. DETAIL No.
SD-2

A PUBLIC NOTICE SHALL BE PLACED ADJACENT TO ALL DRAIN INLETS
IN ACCORDANCE WITH THE DETAIL BELOW.

PLACE PHENOLIC "NO DUMPING—FLOWS TO OCEAN" SYMBOL



NOTES:

1. MESSAGE AND SYMBOL SHALL BE PERMANENTLY FLANGED WITH THE USE OF EPOXY OR ANOTHER METHOD RECOMMENDED BY THE MANUFACTURER APPROVED BY THE CITY OF HALF MOON BAY PRIOR TO THE CONSTRUCTION OF THE CURB AND GUTTER.
2. COLORS SHALL BE BLUE LETTERING AND GRAPHIC WITH WHITE BACKGROUND.
3. FOR AREA DRAIN INLETS, NOTICE WILL BE PLACED ADJACENT AND PARALLEL TO THE LONG AXIS OF THE DRAIN

NO SCALE



CITY OF HALF MOON BAY, CALIFORNIA STANDARD DETAIL

APPROVED BY:
PEYKAN ABBASSI, P.E.
CITY ENGINEER
DATE: JULY 19, 2016

**NO DUMPING
PUBLIC NOTICE DETAIL**

STD. DETAIL No.
SD-3

IMPROVEMENT PLAN LAYOUT

NOTES:

1. AFFIX REGISTRATION STAMP AND SIGNATURE OF ENGINEER, INCLUDING EXPIRATION DATE. A REGISTERED ENGINEER MUST SIGN THE FIRST SHEET OF PLANS; STRUCTURAL ENGINEERS MUST SIGN STRUCTURAL PLANS, ETC.
2. ADD ENGINEER'S LOGO, IF APPROPRIATE.
3. THE SHEET TITLE, FOLLOWED "PLANS FOR THE IMPROVEMENTS OF", FOLLOWED BY THE PROJECT/SUBDIVISION NAME.
4. APPROVAL BLOCKS SHALL APPEAR ON EACH SHEET AND WILL BE SIGNED BY THE CITY OF HALF MOON BAY.
5. FILL IN THE INITIALS OF THE DESIGNER, DELINEATOR, AND CHECKER, WITH DATES.
6. REVISION BLOCKS SHALL NOT BE USED UNTIL THE PLANS ARE APPROVED.
7. FOR REVISED PLANS, PUT THE REVISION NUMBER IN A TRIANGLE,  , BRIEFLY DESCRIBE THE REVISION AND ADD THE DATE. CITY WILL INITIAL THE ORIGINAL. ON PLAN, PUT A "CLOUD"  IN RED PENCIL AROUND THE ITEMS REVISED, WITH A CLEARLY IDENTIFIED SUBSCRIPT  TO CORRESPOND WITH THE REVISION BLOCK.
8. THE CITY WILL ASSIGN A FILE NUMBER TO EACH SHEET OF DRAWINGS.

ENG
Exp.

SEE NOTE 1&2

SEE NOTE 3

SEE NOTE 4

SEE NOTE 5

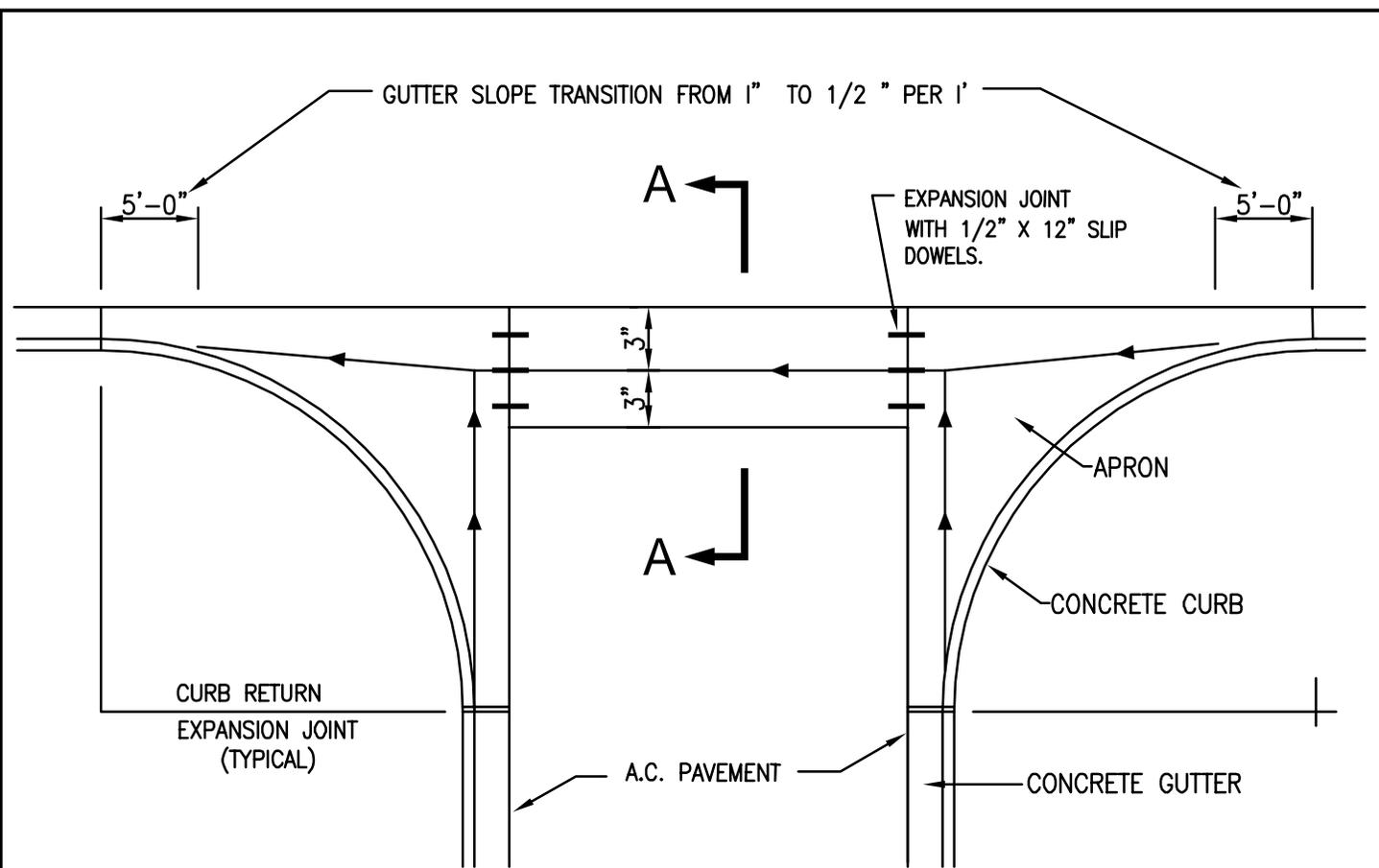
SEE NOTE 6&7

1 OF	
TITLE SHEET	PLANS FOR IMPROVEMENT OF
CITY OF HALF MOON BAY CALIFORNIA COMMUNITY DEVELOPMENT DEPARTMENT ENGINEERING	
APPROVED	City Engineer
APPROVED	
By	App
Revisions	
No.	
Date	

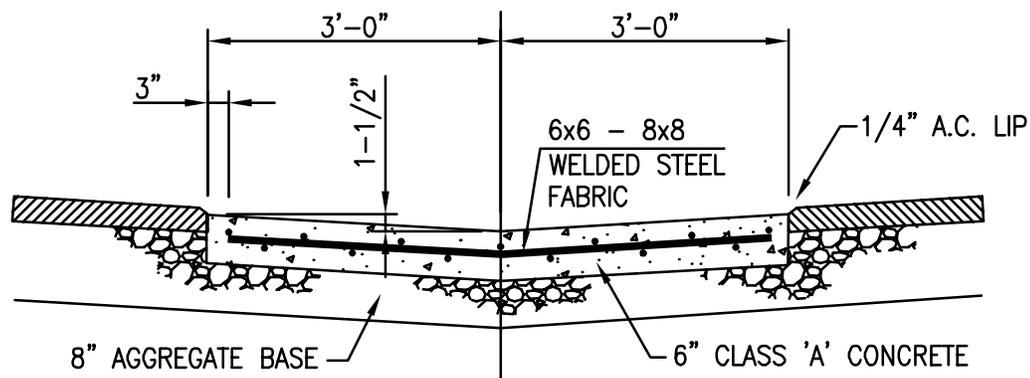


CITY OF HALF MOON BAY, CALIFORNIA STANDARD DETAIL

APPROVED BY: <u>PEYKAN ABBASSI, P.E.</u> CITY ENGINEER DATE: <u>JULY 19, 2016</u>	STANDARD CITY TITLE BLOCK	STD. DETAIL No. SDG-1
--	----------------------------------	---------------------------------



PLAN



SECTION A-A

NOTES:

1. APRON TO BE 6" THICK, CLASS 'A' CONCRETE AND POURED MONOLITHIC WITH ADJACENT CURB AND GUTTER.
2. VALLEY GUTTER TO BE POURED SEPARATE FROM APRONS.

NO SCALE

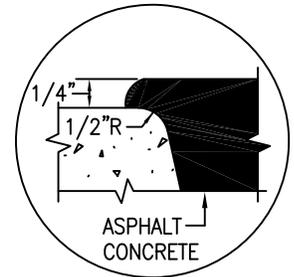
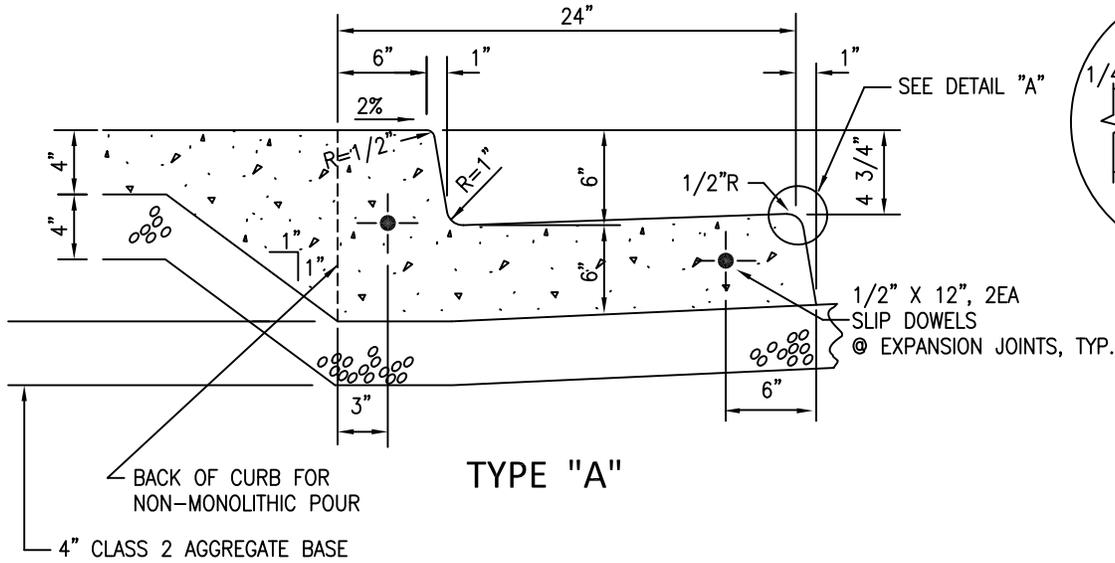


CITY OF HALF MOON BAY, CALIFORNIA STANDARD DETAIL

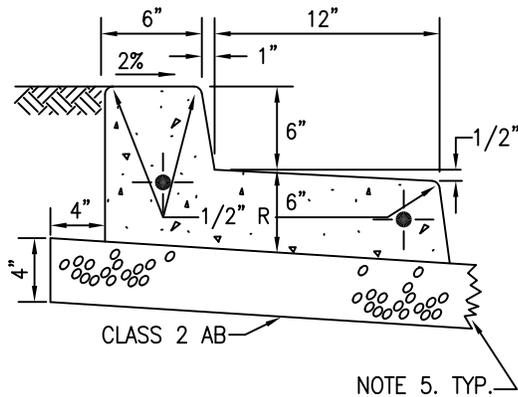
APPROVED BY:
 PEYKAN ABBASSI, P.E.
 CITY ENGINEER
 DATE: JULY 19, 2016

VALLEY OR CROSS GUTTER

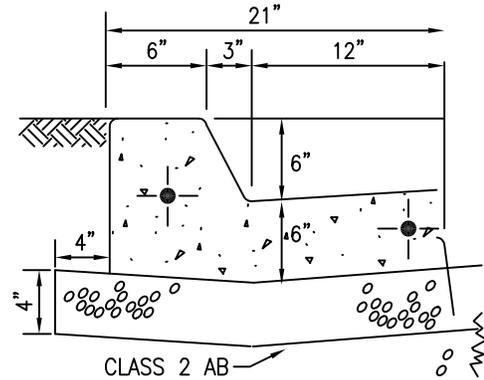
STD. DETAIL No.
SI-1



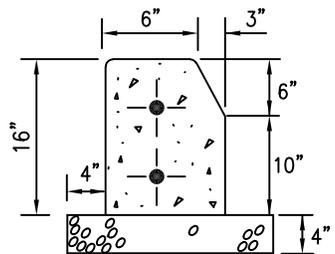
DETAIL "A"



TYPE "B"



TYPE "C"



TYPE "C"
VERTICAL CURB ONLY

NOTES:

1. EXPANSION JOINTS WITH DOWELS TO BE PLACED EACH 20' EXCEPT AT RETURNS.
2. PAVING AT GUTTER LIP SHALL CONFORM TO DETAIL "A" IN ALL CASES, EXCEPT WHERE STREET SLOPES AWAY FROM GUTTER, IN WHICH CASE PAVEMENT SURFACE SHALL MATCH GUTTER LIP.
3. CONCRETE TO BE CLASS "A".
4. THE RELATIVE COMPACTION OF MATERIAL BELOW ALL CURB, GUTTER & SIDEWALK SHALL NOT BE LESS THAN 95%.
5. BASEROCK TO BE EXTENDED A MINIMUM OF 2' BEYOND LIP OF GUTTER PRIOR TO POURING CONCRETE.
6. WHERE NEW CURB AND GUTTER IS TO BE PLACED IN EXISTING STREETS REMOVE A 12" WIDE SECTION OF ASPHALT AND REPLACE WITH A MIN. OF 4" DEEP LIFT ASPHALT.
7. ADD 3/4 LBS PER CUBIC YARD OF LAMP BLACK.

NO SCALE



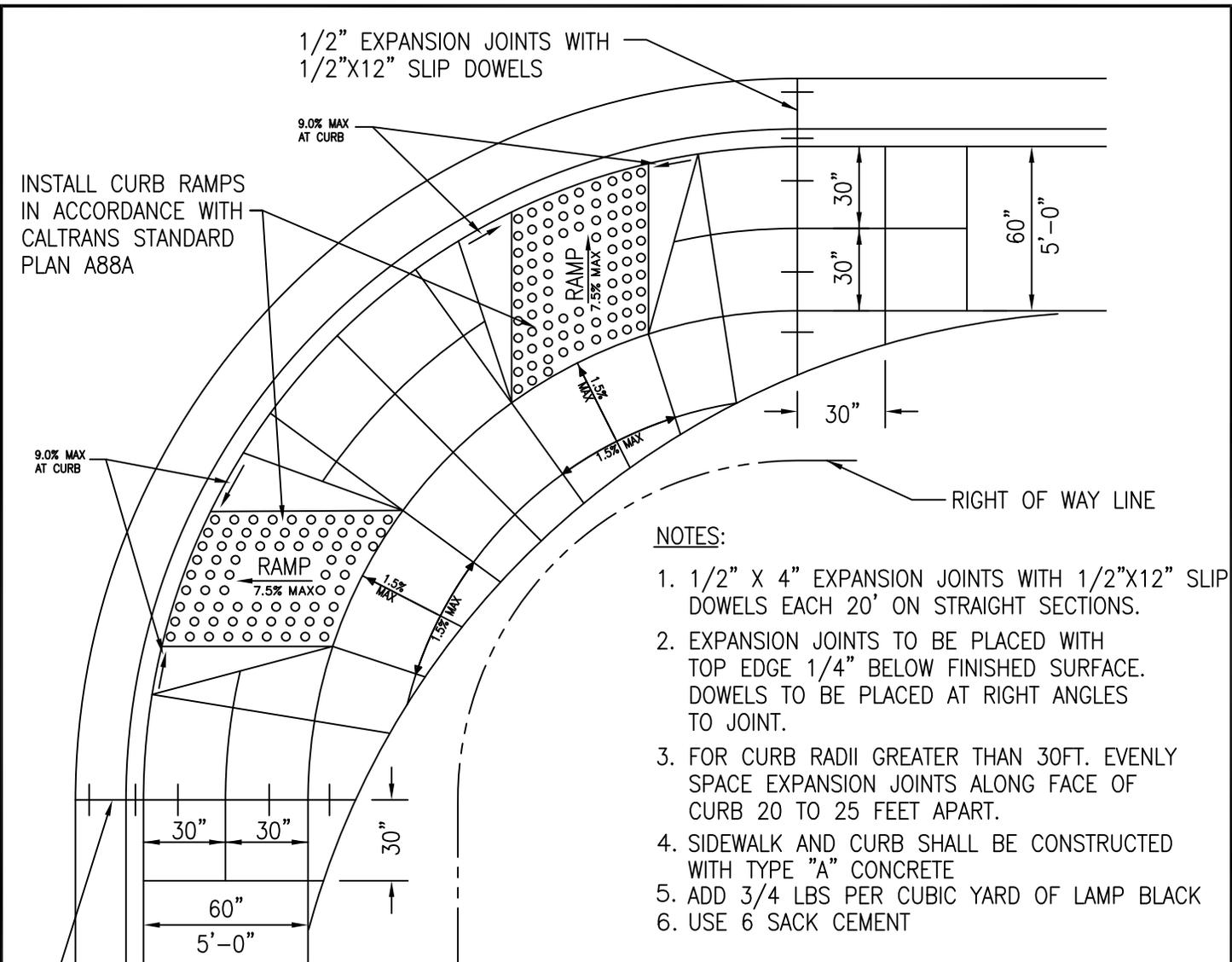
CITY OF HALF MOON BAY, CALIFORNIA STANDARD DETAIL

APPROVED BY:
MAZIAR BOZORGINIA, P.E.
CITY ENGINEER
DATE: JANUARY 29, 2021

CURBS AND GUTTERS

STD. DETAIL No.

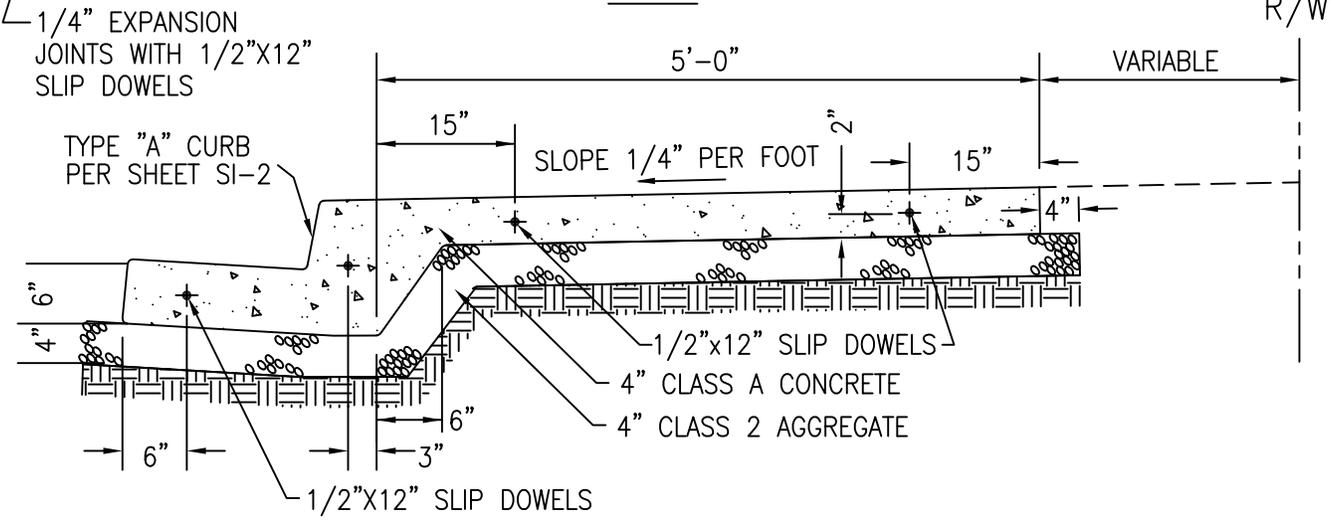
SI-2



NOTES:

1. 1/2" X 4" EXPANSION JOINTS WITH 1/2"x12" SLIP DOWELS EACH 20' ON STRAIGHT SECTIONS.
2. EXPANSION JOINTS TO BE PLACED WITH TOP EDGE 1/4" BELOW FINISHED SURFACE. DOWELS TO BE PLACED AT RIGHT ANGLES TO JOINT.
3. FOR CURB RADII GREATER THAN 30FT. EVENLY SPACE EXPANSION JOINTS ALONG FACE OF CURB 20 TO 25 FEET APART.
4. SIDEWALK AND CURB SHALL BE CONSTRUCTED WITH TYPE "A" CONCRETE
5. ADD 3/4 LBS PER CUBIC YARD OF LAMP BLACK
6. USE 6 SACK CEMENT

PLAN



CROSS SECTION

NO SCALE



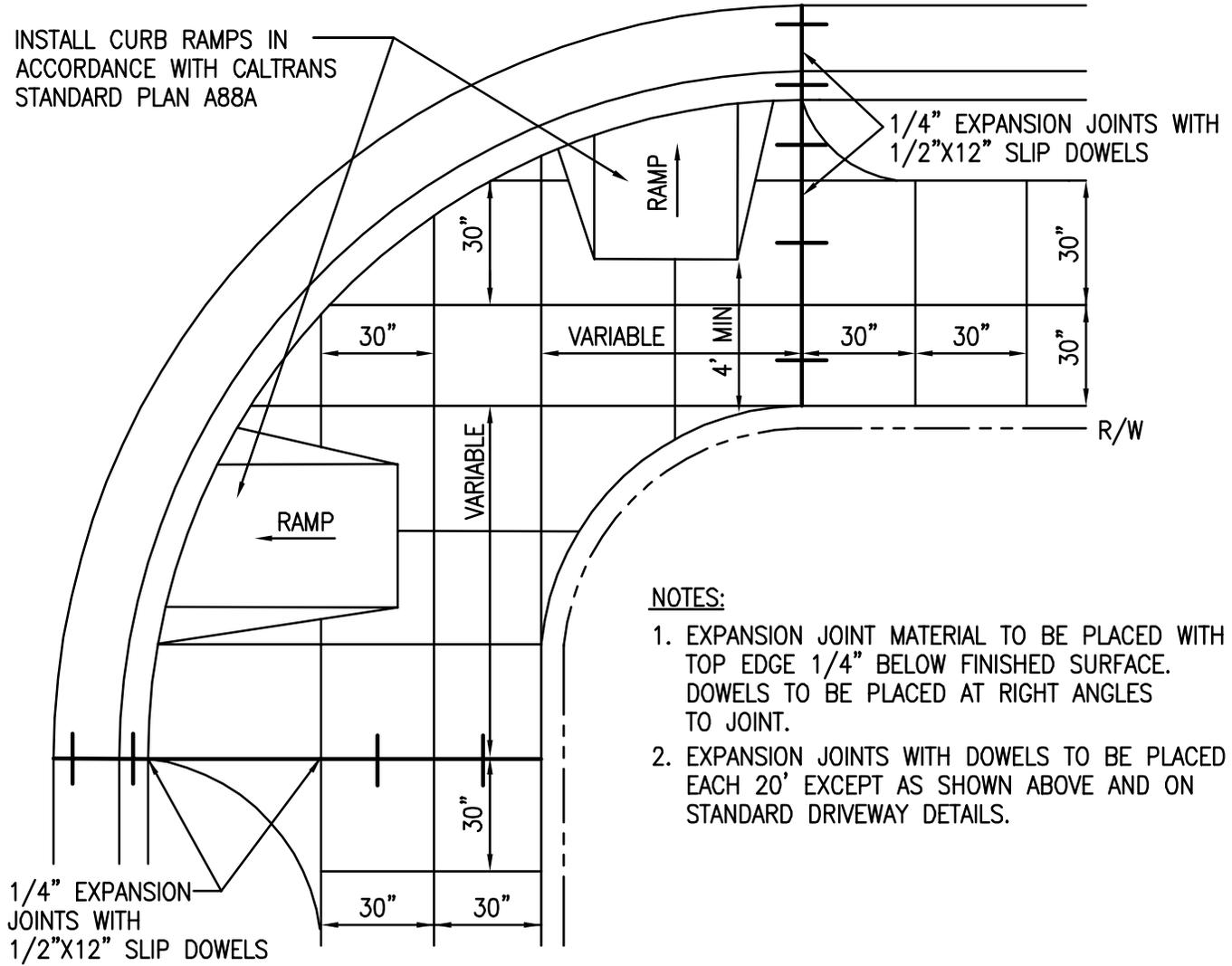
CITY OF HALF MOON BAY, CALIFORNIA STANDARD DETAIL

APPROVED BY:
 MAZIAR BOZORGINIA, P.E.
 CITY ENGINEER
 DATE: JANUARY 29, 2021

**SIDEWALK DETAIL
 (TYPICAL SW--MONOLITHIC)**

STD. DETAIL No.
SI-3

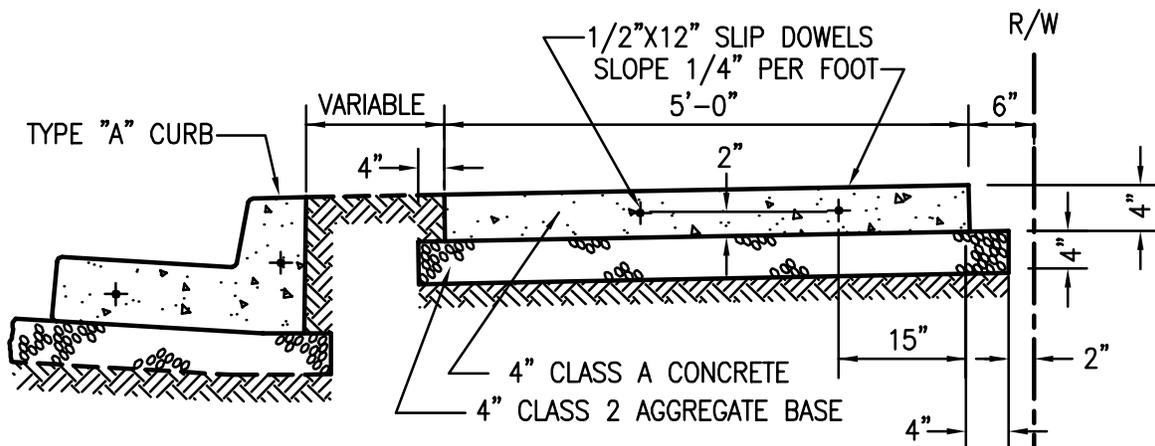
INSTALL CURB RAMP IN ACCORDANCE WITH CALTRANS STANDARD PLAN A88A



NOTES:

1. EXPANSION JOINT MATERIAL TO BE PLACED WITH TOP EDGE 1/4" BELOW FINISHED SURFACE. DOWELS TO BE PLACED AT RIGHT ANGLES TO JOINT.
2. EXPANSION JOINTS WITH DOWELS TO BE PLACED EACH 20' EXCEPT AS SHOWN ABOVE AND ON STANDARD DRIVEWAY DETAILS.

PLAN



CROSS SECTION

NO SCALE

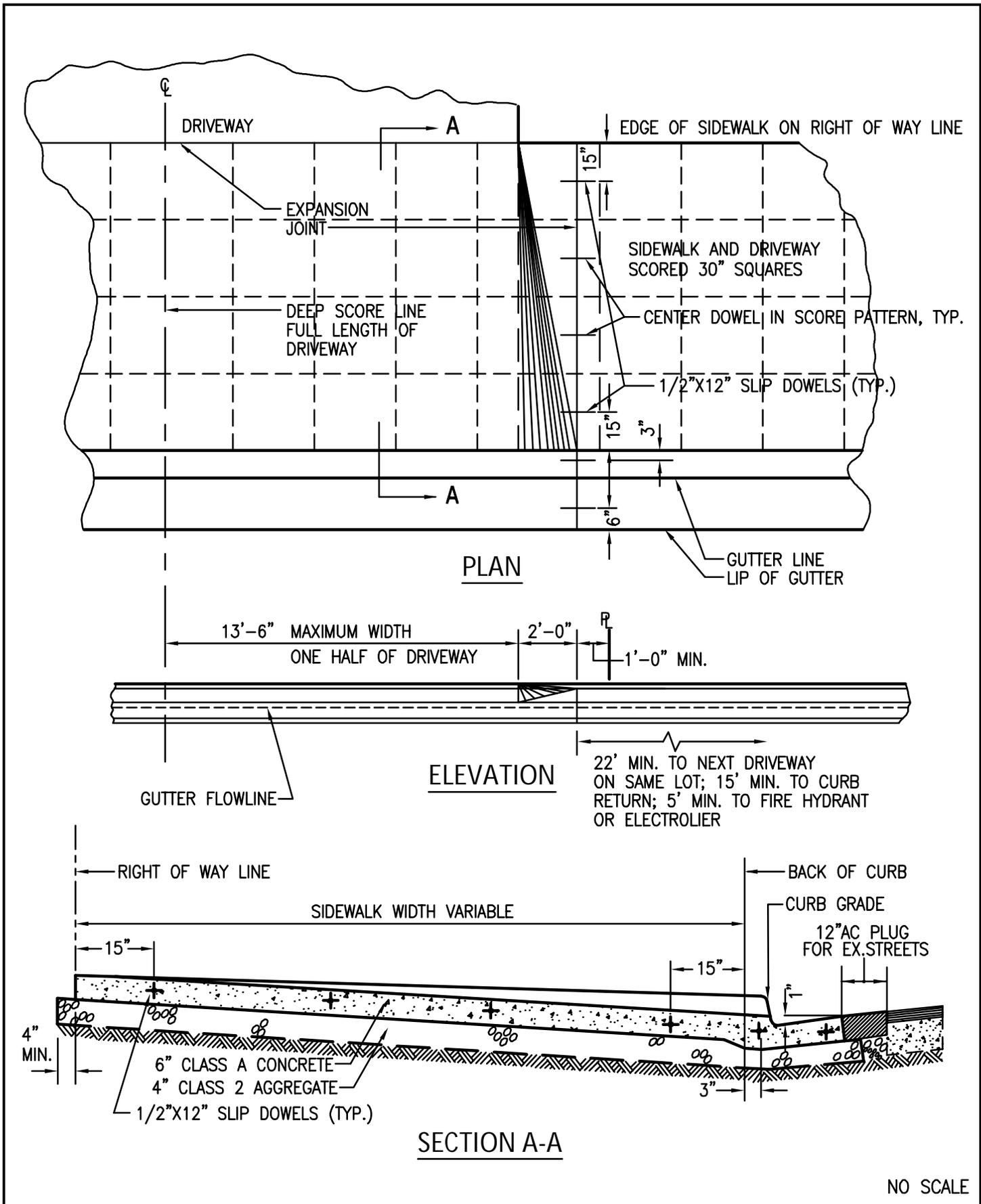


CITY OF HALF MOON BAY, CALIFORNIA STANDARD DETAIL

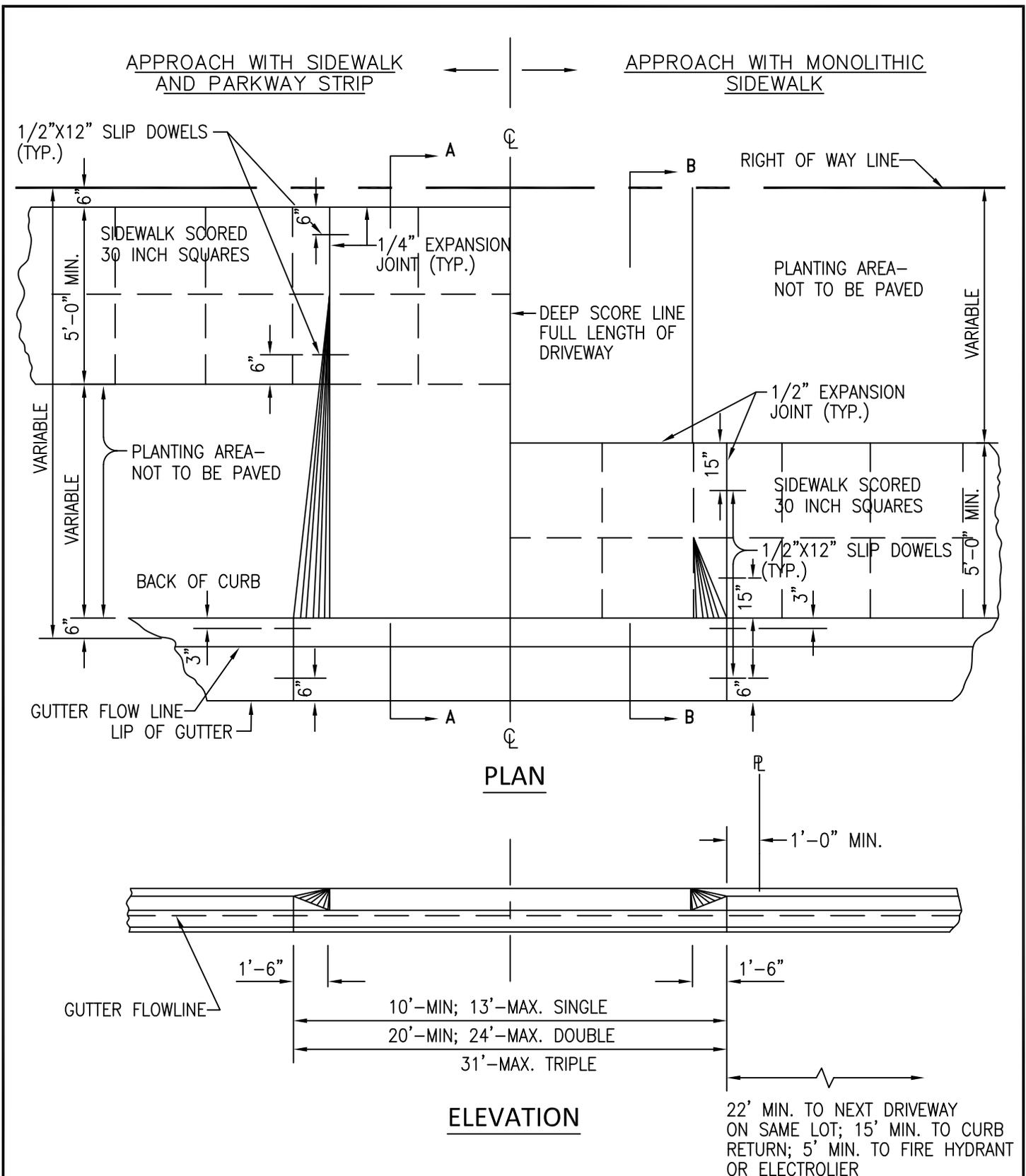
APPROVED BY:
 PEYKAN ABBASSI, P.E.
 CITY ENGINEER
 DATE: JULY 19, 2016

**SIDEWALK DETAIL
 (PARKWAY)**

STD. DETAIL No.
SI-3A



CITY OF HALF MOON BAY, CALIFORNIA STANDARD DETAIL		
APPROVED BY: PEYKAN ABBASSI, P.E. CITY ENGINEER	COMMERCIAL DRIVEWAY APPROACH	STD. DETAIL No. SI-4
DATE: JULY 19, 2016		



NOTE: SIDEWALKS SHALL BE ADA COMPLIANT IN ACCORDANCE WITH THE LATEST CALTRANS STANDARD PLANS

NO SCALE



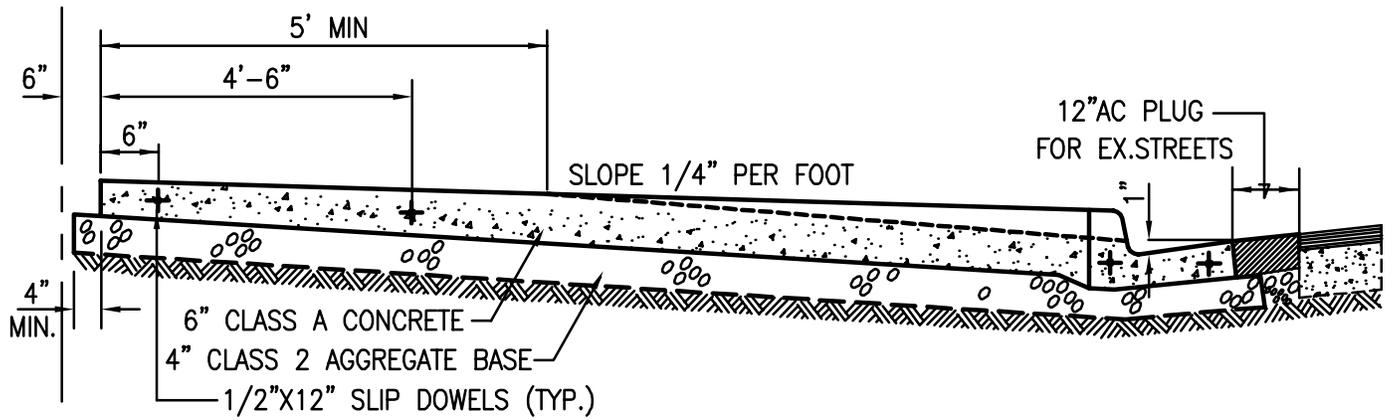
CITY OF HALF MOON BAY, CALIFORNIA STANDARD DETAIL

APPROVED BY:
 MAZIAR BOZORGINIA, P.E.
 CITY ENGINEER
 DATE: JANUARY 29, 2021

**RESIDENTIAL DRIVEWAY
 APPROACH WITH CURB**

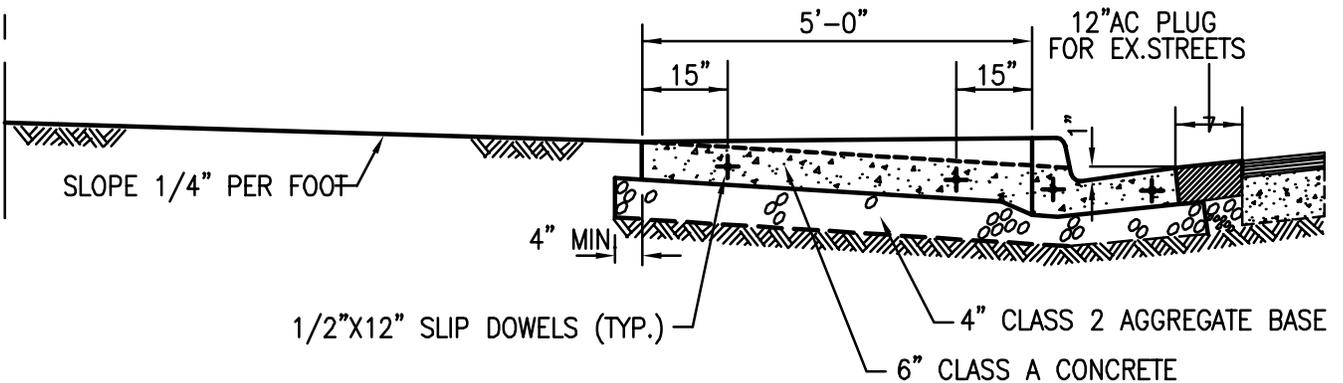
STD. DETAIL No.

SI-5



SECTION A-A

RIGHT OF WAY LINE



SECTION B-B

NOTES:

1. WHEN INSTALLING A DRIVEWAY IN AN EXISTING SIDEWALK, REMOVE EXISTING CURB, GUTTER AND SIDEWALK TO THE NEAREST CONTROL JOINT ON EITHER SIDE OF THE DRIVEWAY. REMOVE AND REPLACE A 12" WIDE STRIP OF ASPHALT PAVEMENT ACROSS THE WIDTH OF THE DRIVEWAY TO FORM NEW GUTTER.

NO SCALE

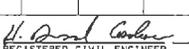


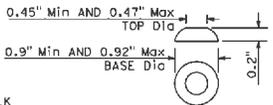
CITY OF HALF MOON BAY, CALIFORNIA STANDARD DETAIL

APPROVED BY:
 PEYKAN ABBASSI, P.E.
 CITY ENGINEER
 DATE: JULY 19, 2016

**RESIDENTIAL DRIVEWAY
 APPROACH WITH CURB**

STD. DETAIL No.
SI-5A

0161	COUNTY	ROUTE	POST MILES	SHEET TOTAL
			TOTAL PROJECT	NO. SHEETS
 REGISTERED CIVIL ENGINEER No. C41957 Exp. 3-31-18 CIVIL STATE OF CALIFORNIA				
July 15, 2016 PLANS APPROVAL DATE				
THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.				

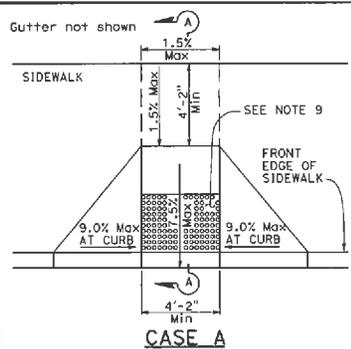


RAISED TRUNCATED DOME

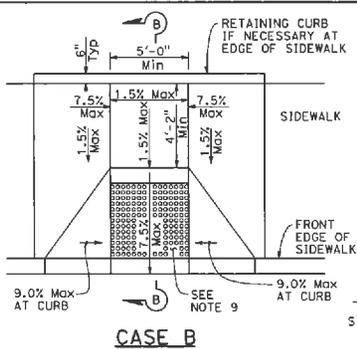
TO ACCOMPANY PLANS DATED _____

NOTES:

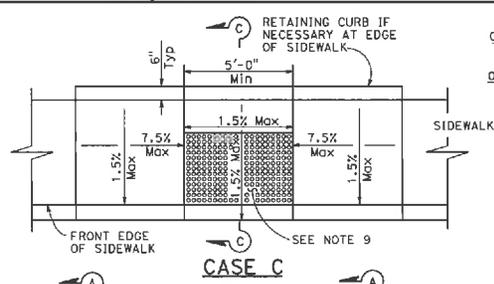
- As site conditions dictate, Case A through Case G curb ramps may be used for corner installations similar to those shown in Detail A and Detail B. The case of curb ramps used in Detail A do not have to be the same. Case A through Case G curb ramps also may be used at mid block locations, as site conditions dictate.
- If distance from curb to back of sidewalk (landing) as shown in Case A, the sidewalk may be depressed longitudinally as in Case B, or C or may be widened as in Case D.
- When ramp is located in center of curb return, crosswalk configuration must be similar to that shown for Detail B.
- As site conditions dictate, the retaining curb side and the flared side of the Case G ramp shall be constructed in reversed position.
- If located on a curve, the sides of the ramp need not be parallel, but the minimum width of the ramp shall be 4'-2".
- Side slope of ramp flares vary uniformly from a maximum of 9.0% at curb to conform with longitudinal sidewalk slope adjacent to top of the ramp, except in Case C and Case F.
- The adjacent surfaces at transitions at curb ramps to walks, gutters, and streets shall be at the same level.
- Counter slopes of adjoining gutters and road surfaces immediately adjacent to and within 24 inches of the curb ramp shall not be steeper than 1:20 (5.0%). Gutter pan slope shall not exceed 1" of depth for each 2'-0" of width.
- Curb ramps shall have a detectable warning surface that extends the full width and 3'-0" depth of the ramp. A 4'-0" wide detectable warning surface may be used on a 4'-2" wide curb ramp. Detectable Warning Surfaces shall conform to the requirements in the Standard Specifications.
- Sidewalk and ramp thickness, "T", shall be 3/2" minimum.
- Utility pull boxes, manholes, vaults and all other utility facilities within the boundaries of the curb ramp will be relocated or adjusted to grade by the owner prior to, or in conjunction with, curb ramp construction.
- Detectable warning surface may be cut to allow removal of utility covers while maintaining full detectable warning width and depth.



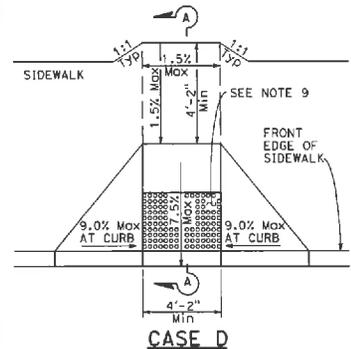
CASE A



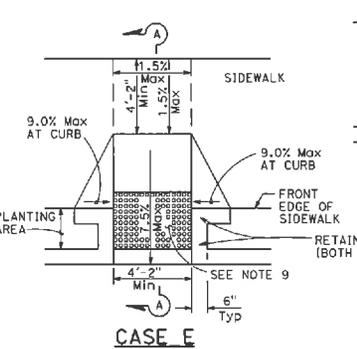
CASE B



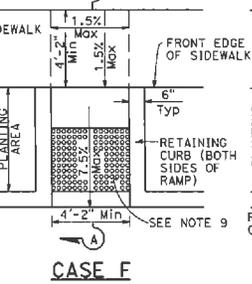
CASE C



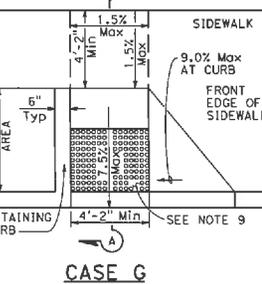
CASE D



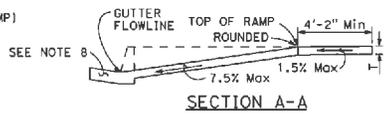
CASE E



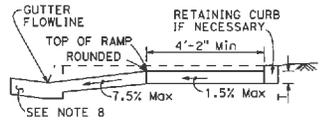
CASE F



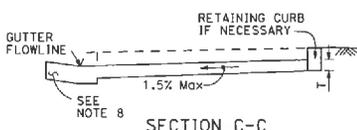
CASE G



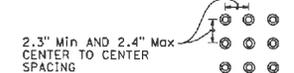
SECTION A-A



SECTION B-B

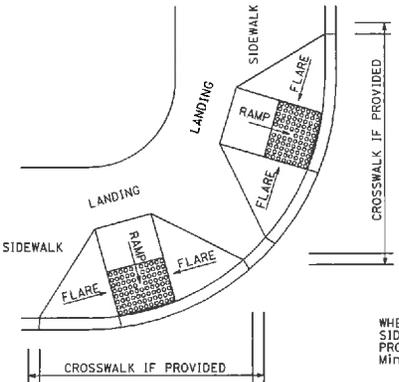


SECTION C-C



RAISED TRUNCATED DOME PATTERN (IN-LINE)
DETECTABLE WARNING SURFACE

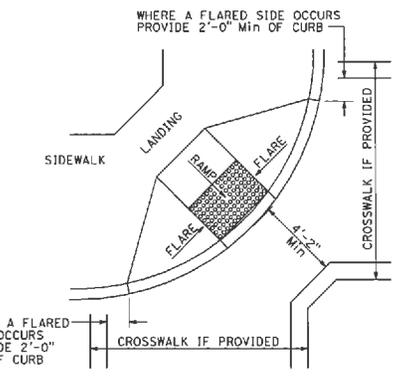
See Note 9



DETAIL A

TYPICAL TWO-RAMP CORNER INSTALLATION

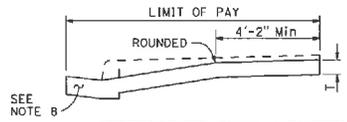
See Note 1



DETAIL B

TYPICAL ONE-RAMP CORNER INSTALLATION

See Notes 1 and 3



RETROFIT PAY LIMITS

Existing curb and sidewalk

2010 REVISED STANDARD PLAN RSP A88A

STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION
CURB RAMP DETAILS
NO SCALE
RSP A88A DATED JULY 15, 2016 SUPERSEDES RSP A88A DATED JULY 3, 2015,
RSP A88A DATED MARCH 21, 2014 AND RSP A88A DATED JULY 19, 2013 AND
STANDARD PLAN A88A DATED MAY 20, 2011
PAGE 121 OF THE STANDARD PLANS BOOK DATED 2010.

SEE CALTRANS
STANDARD PLAN
RNSP A88A & A88B
FOR CURB RAMP DETAILS

USE LATEST
CALTRANS APPROVED
DETAILS



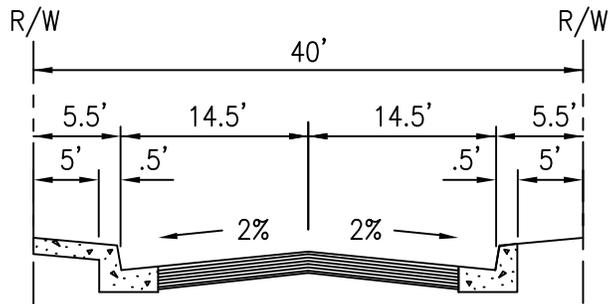
CITY OF HALF MOON BAY, CALIFORNIA STANDARD DETAIL

APPROVED BY:
PEYKAN ABBASSI, P.E.
CITY ENGINEER
DATE: JULY 19, 2016

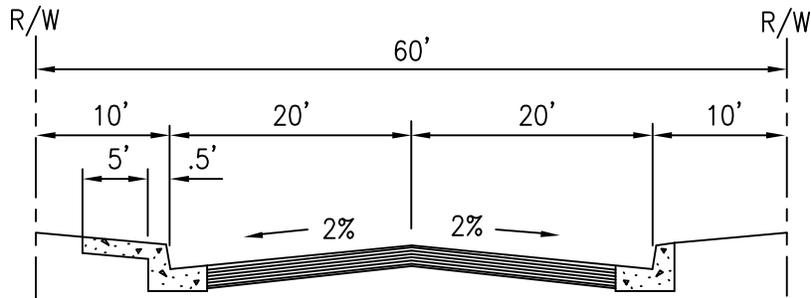
CURB RAMP DETAILS

STD. DETAIL No.

SI-6



RESIDENTIAL STREET: 2 - LANES
40' LIMITED R/W



RESIDENTIAL STREET: 2 - LANES
60' R/W

NOTES:

1. INCREASED WIDTHS MAY BE REQUIRED WHERE STREETS ARE TO SERVE COMMERCIAL OR INDUSTRIAL PROPERTY, OR WHERE PRESENT OR ANTICIPATED TRAFFIC CONDITIONS WARRANT SUCH INCREASE.
2. SEE STANDARD DRAWINGS FOR REQUIREMENTS OF PRIVATE STREETS.
3. CURBS AND GUTTER SHALL CONFORM TO STANDARD DETAIL SI-2 OR SI-3.
4. SIDEWALK SHALL CONFORM TO STANDARD DETAIL SI-3.

NO SCALE



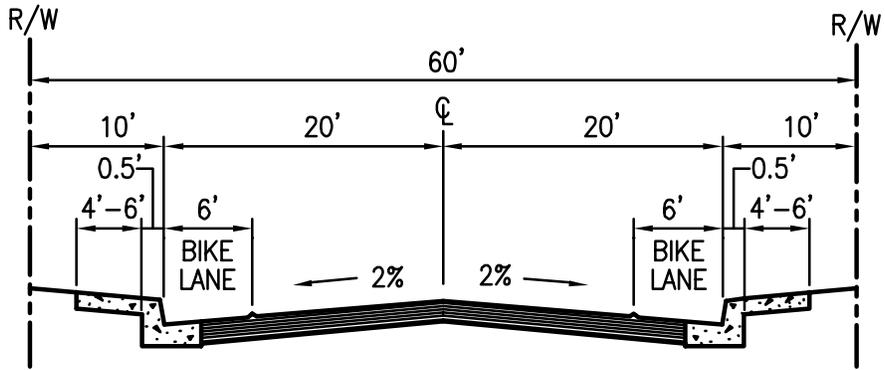
CITY OF HALF MOON BAY, CALIFORNIA STANDARD DETAIL

APPROVED BY:
 MAZIAR BOZORGINIA, P.E.
 CITY ENGINEER
 DATE: JANUARY 29, 2021

**TYPICAL SECTIONS
 RESIDENTIAL STREETS**

STD. DETAIL No.

SI-7



COLLECTOR: 2 - LANES

NO SCALE



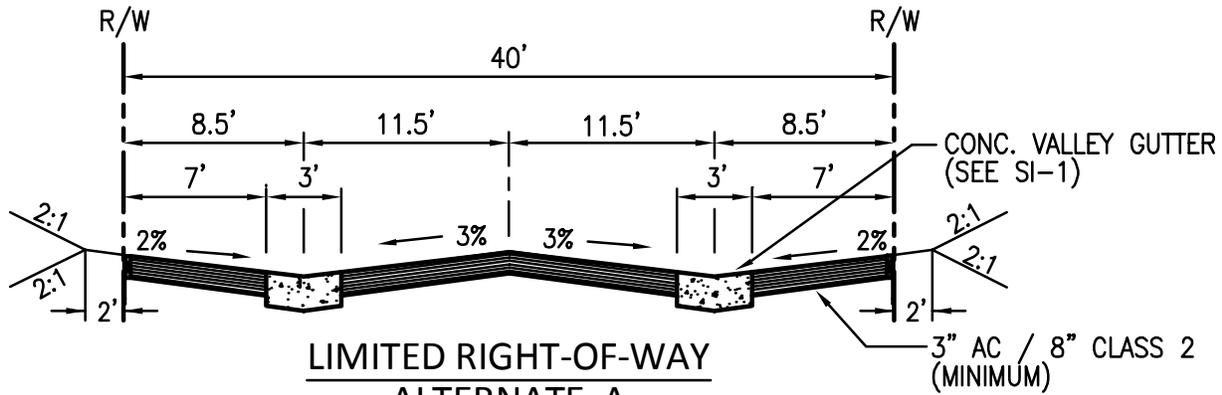
CITY OF HALF MOON BAY, CALIFORNIA STANDARD DETAIL

APPROVED BY:
 PEYKAN ABBASSI, P.E.
 CITY ENGINEER
 DATE: JULY 19, 2016

**TYPICAL SECTIONS
 COLLECTOR STREETS**

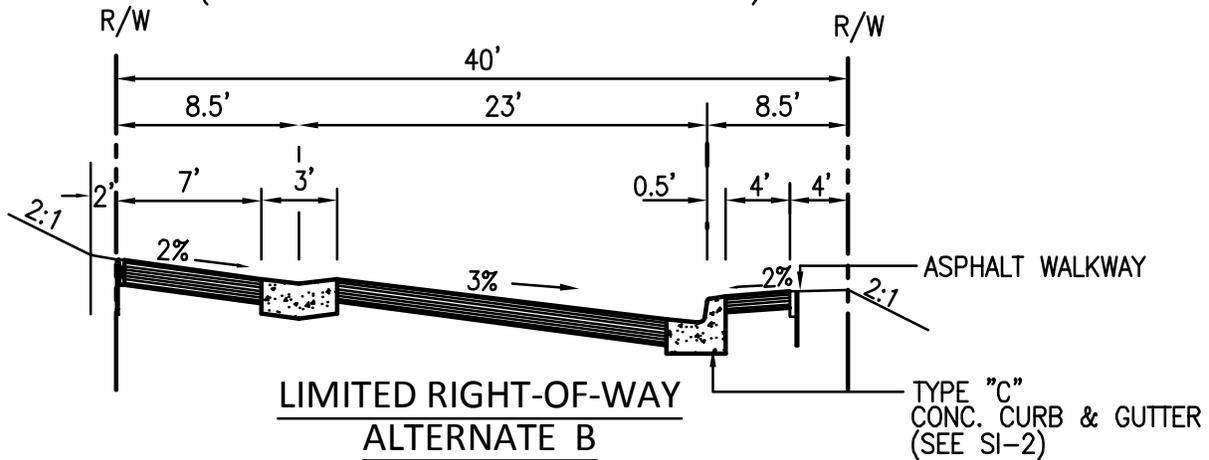
STD. DETAIL No.

SI-8



**LIMITED RIGHT-OF-WAY
ALTERNATE A**

(WHERE DRAINAGE CONTROL IS NOT CRITICAL)

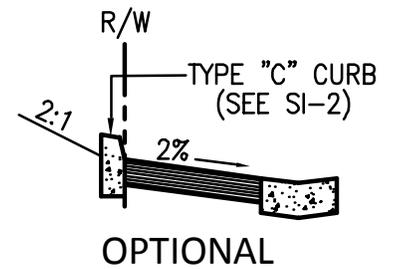


**LIMITED RIGHT-OF-WAY
ALTERNATE B**

(WHERE DRAINAGE CONTROL IS CRITICAL)

NOTES:

1. OPTIONAL CURB TREATMENT SHALL BE LIMITED TO UPHILL SLOPES 6' VERTICAL FEET IN HEIGHT OR LESS, AS APPROVED.
2. AT THE DISCRETION OF A REPRESENTATIVE OF THE CITY, THE TOP SLOPE ON THE DOWNHILL SIDE MAY BEGIN 18" FROM THE EDGE OF THE WALKWAY.
3. SLOPE CONTROL EASEMENTS SHALL BE GRANTED TO THE CITY AS NECESSARY.
4. EDGE OF ASPHALT SHALL BE PROTECTED WITH REDWOOD HEADER BOARD.
5. FOR ALTERNATE B, PARKING BAYS MAY BE REQUIRED.
6. PARKING SHALL BE LIMITED TO AREAS CONTAINING THE 7 FOOT WALKWAY WITH VALLEY GUTTERS OR PARKING BAYS. "NO PARKING" SIGNS SHALL BE POSTED TO PREVENT PARKING ON THE SIDE CONTAINING A CURB AND GUTTER.
7. PAVEMENT SECTION OF 4" A.C. OVER 8" A.B. IS THE MINIMUM REQUIRED.
8. GEOTECHNICAL CONSULTANT TO DETERMINE ACTUAL PAVEMENT SECTION BASED ON FIELD TEST DATA.
9. THE TRANSITION LENGTH REQUIRED TO GO FROM VALLEY GUTTER TO VERTICAL CURB SHALL BE 3'.
10. INSTALL 2" x 8" ROUGH REDWOOD HEADER, STAKED AT 24" O.C.



NO SCALE

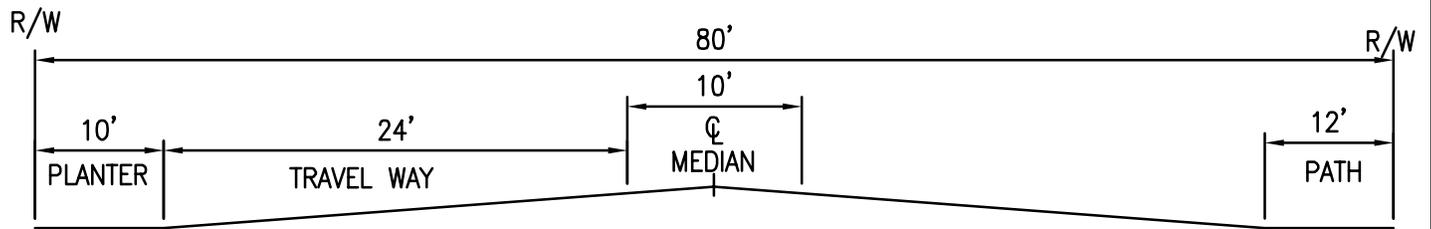


CITY OF HALF MOON BAY, CALIFORNIA STANDARD DETAIL

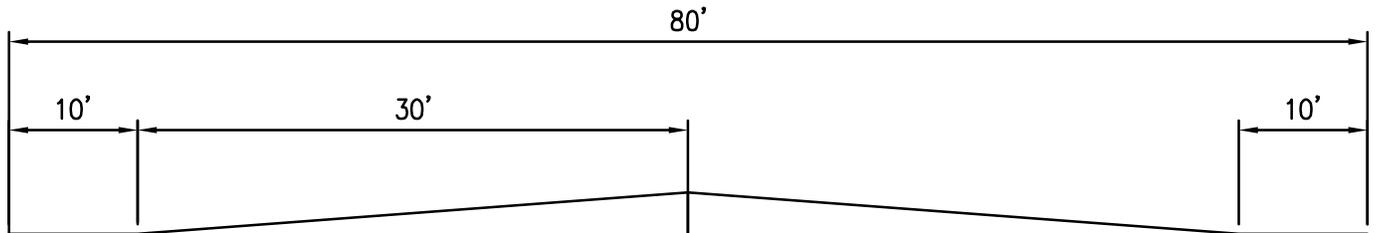
APPROVED BY:
 PEYKAN ABBASSI, P.E.
 CITY ENGINEER
 DATE: JULY 19, 2016

LIMITED R/W STREETS

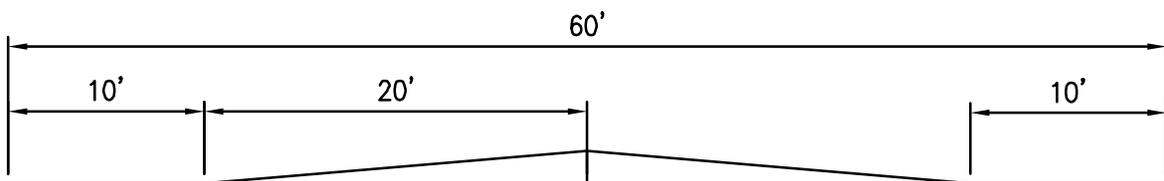
STD. DETAIL No.
SI-8A



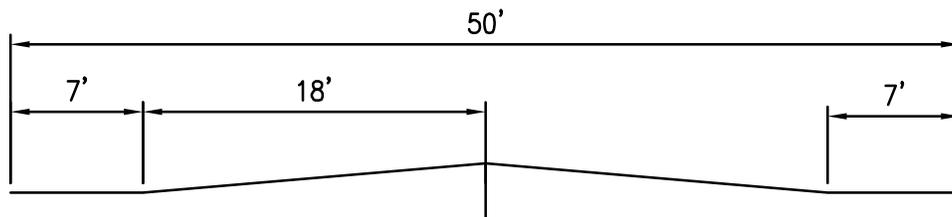
MAJOR ARTERIAL



SECONDARY ARTERIAL



COLLECTOR



RESIDENTIAL

MAJOR ARTERIAL – NO PARKING, NO DRIVEWAY ACCESS, LIMITED CONTROLLED INTERSECTION.

SECONDARY ARTERIAL – CONTROLLED PARKING AND ACCESS.

COLLECTOR – PARKING, LIMITED DRIVEWAY ACCESS, CONTROLLED INTERSECTIONS.

MINOR – PARKING, DRIVEWAY ACCESS, CONTROLLED INTERSECTION.

NO SCALE



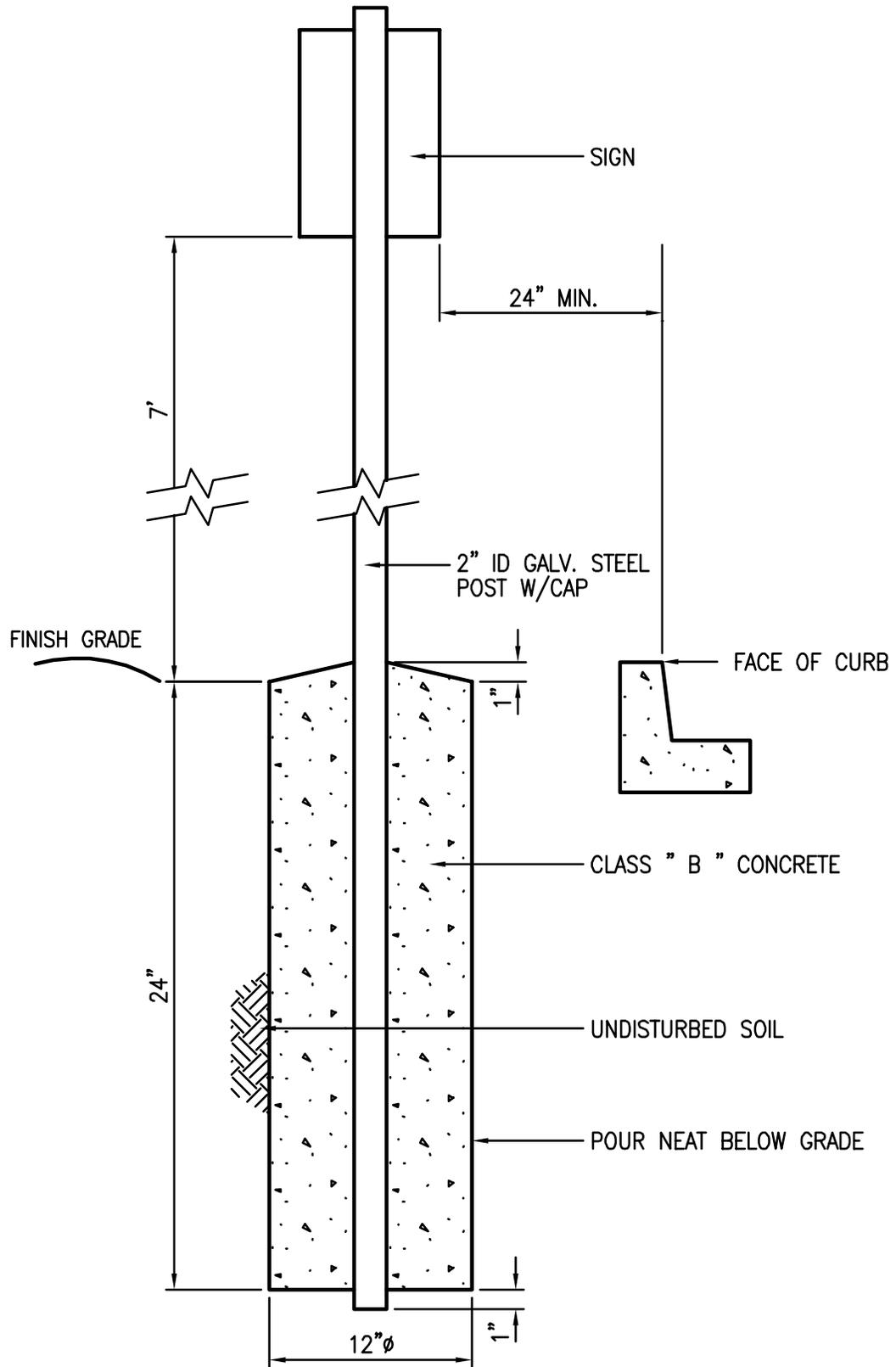
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 DATE: JULY 19, 2016

STANDARD STREET SECTIONS

STD. DETAIL No.

SI-9



NO SCALE



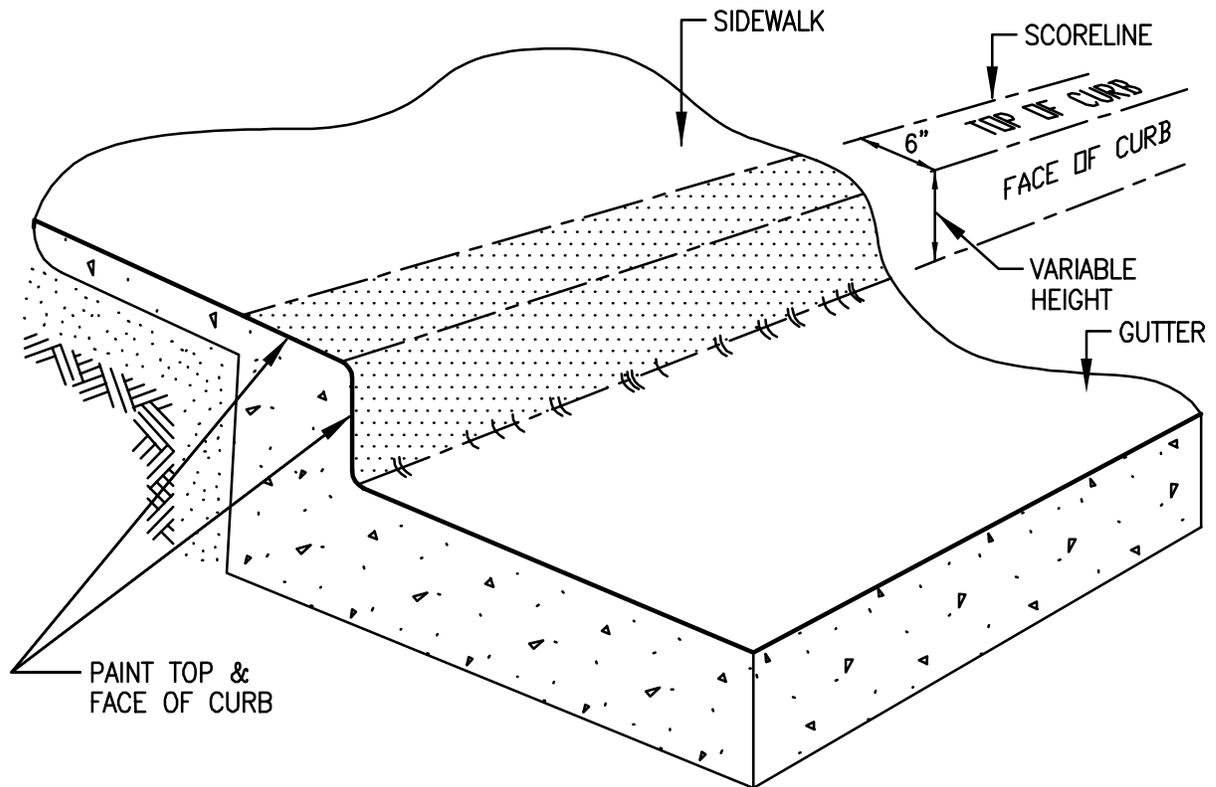
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 DATE: JULY 19, 2016

TRAFFIC CONTROL SIGN

STD. DETAIL No.

SI-10



PERSPECTIVE VIEW

NOTES:

1. RED CURB PAINT SHALL BE J.E.BAUER, ZONE LAC CURB PAINT NO. 2052A9, RED LATEX BASE OR EQUAL.
2. TEMPERATURE DURING APPLICATION SHALL NOT BE LESS THAN 50°
3. CURB SHALL BE DRY TWO DAYS PRIOR TO APPLICATION.
4. ALL RED CURBING REMOVED SHALL BE REPLACED. NEW CONSTRUCTION WHICH RESULTS IN ADDITIONAL RED CURBING SHALL BE INSTALLED ONLY AT THE DIRECTION OF THE CITY ENGINEER.

NO SCALE



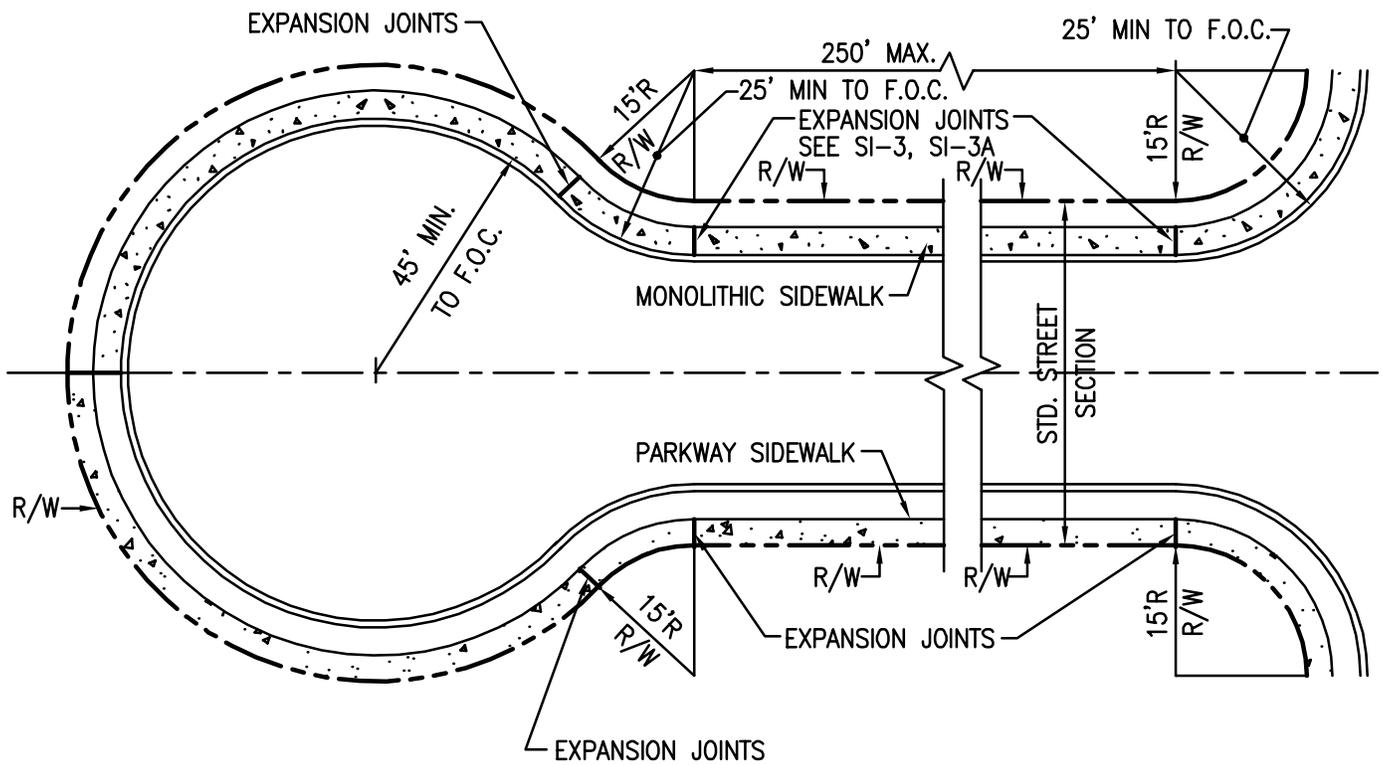
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 DATE: JULY 19, 2016

RED CURB PAINTING

STD. DETAIL No.

SI-11



CUL-DE-SAC

NO SCALE

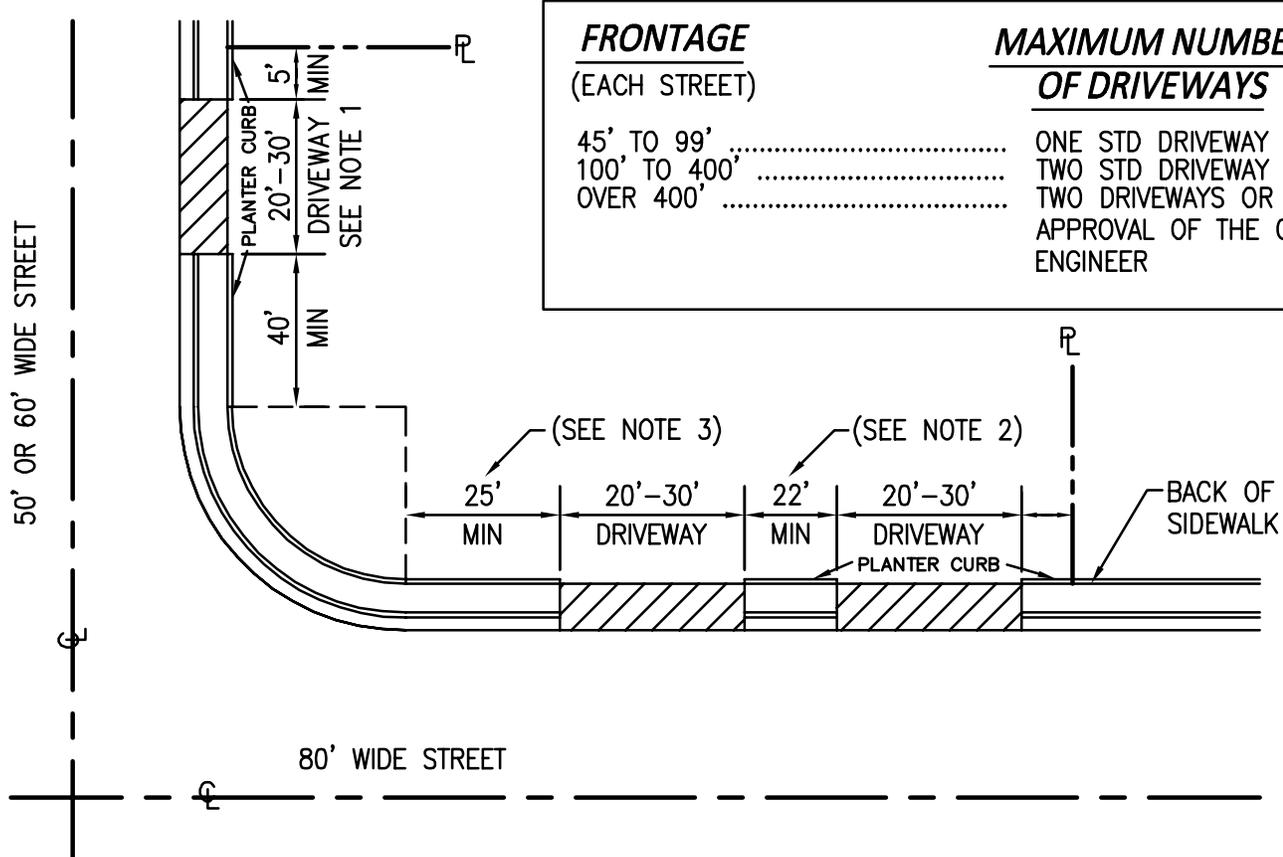


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 DATE: JULY 19, 2016

CUL-DE-SAC DETAILS

STD. DETAIL No.
SI-12



NOTES:

1. 20' TO 30' WIDTH DRIVEWAYS MAY BE APPROVED ON 50 OR 80 FOOT STREET FRONTAGES.
2. 22' MINIMUM ALLOWABLE DISTANCE BETWEEN DRIVEWAYS FOR LESS THAN 100' FRONTAGE. FRONTAGE EXCEEDING 100' SHALL BE CONSIDERED SEPARATE FRONTAGES.
3. ALL EXCEPTIONS TO THIS STANDARD MUST BE APPROVED BY THE CITY ENGINEER.
4. COMMERCIAL DRIVEWAYS DEPENDENT UPON PROJECT

NO SCALE

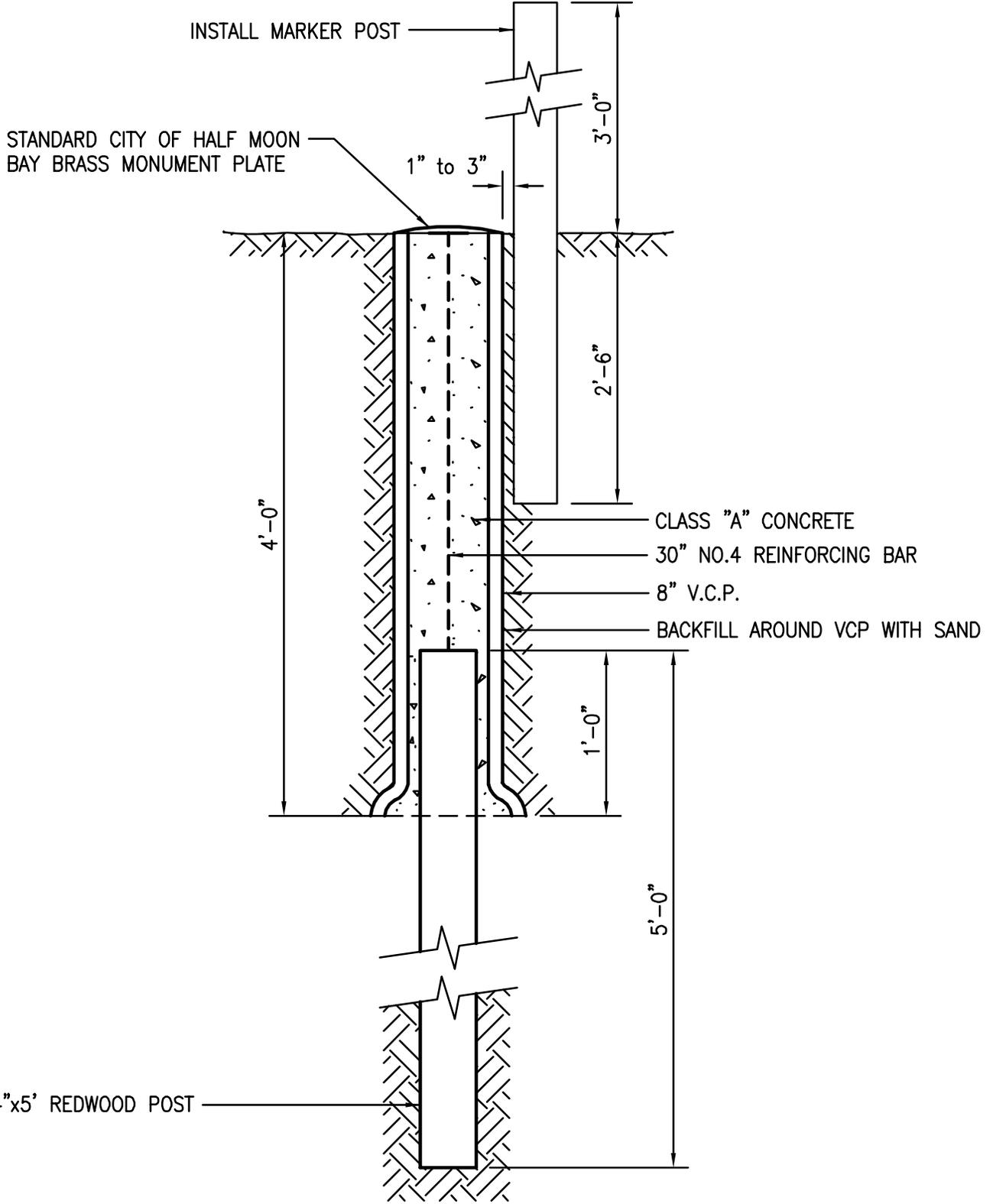


CITY OF HALF MOON BAY, CALIFORNIA STANDARD DETAIL

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 CITY ENGINEER
 DATE: JULY 19, 2016

FRONTAGE AND DRIVEWAY REGULATIONS

STD. DETAIL No.
SI-13



NO SCALE



CITY OF HALF MOON BAY, CALIFORNIA STANDARD DETAIL

APPROVED BY:
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 CITY ENGINEER
 DATE: JULY 19, 2016

BOXED SURVEY MONUMENT

STD. DETAIL No.
SI-15

GENERAL NOTES FOR STREET PLANS:

1. ALL WORK SHALL BE DONE IN ACCORDANCE WITH THESE PLANS, CITY STANDARDS PLANS, THE STATE OF CALIFORNIA "STANDARD SPECIFICATIONS", LATEST EDITION, AND THE STANDARD DRAWING OF THE COUNTY OF SAN MATEO
2. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO FAMILIARIZE HIMSELF/HERSELF WITH THE JOB SITE AND THE LOCATION OF ALL UNDERGROUND FACILITIES SHOWN OR NOT SHOWN ON THESE PLANS. NEITHER THE CITY OF HALF MOON BAY NOR THE ENGINEER WILL BE RESPONSIBLE FOR ANY DAMAGES TO UNDERGROUND FACILITIES.
3. IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO OBTAIN ALL NECESSARY PERMITS.
4. IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO CALL THE CITY OFFICE AT (650)726-8285 FOR INSPECTION 24 HOURS PRIOR TO PERFORMING ANY WORK. WORK PERFORMED WITHOUT CALLING FOR INSPECTION SHALL BE REJECTED AND SHALL BE REMOVED SOLELY AT THE CONTRACTOR'S EXPENSE.
5. UTILITY CONTRACTORS SHALL BE RESPONSIBLE FOR OBTAINING COMPACTION TESTS OF ALL TRENCH BACKFILL AND STREET SUBGRADES AND SUBMITTING THEM TO THE CITY ENGINEER FOR APPROVAL. NOTIFY CITY OFFICE AT (650)726-8285.
6. THE STREET STRUCTURAL SECTIONS SHOWN ON THESE PLANS ARE TENTATIVE. AT THE COMPLETION OF ROUGH GRADING, A MATERIAL REPORT AND THE PROPOSED STRUCTURAL SECTION SHALL BE SUBMITTED BY THE TRACT ENGINEER TO THE CITY ENGINEER FOR REVIEW AND EVALUATION; APPROVAL WILL BE GIVEN WHEN ALL STRUCTURAL SECTION REQUIREMENTS HAVE BEEN MET. THE MINIMUM PAVEMENT SECTION SHOWN ON THESE PLANS SHALL BE USED TO CONSTRUCT THE ROADWAY STRUCTURAL SECTION IN-LIEU OF COMPLETION OF THE MATERIAL REPORT (INCLUDING REQUIRED R-VALUE TESTS) FOR THE ROADWAY SUBGRADE AND EMBANKMENT IN ORDER TO OBTAIN A FINAL RECOMMENDED STRUCTURAL SECTION FOR THE STREET. ANY DEVIATION FROM THE MINIMUM PAVEMENT SECTION SHOWN ON THE PLANS MUST RECEIVE WRITTEN APPROVAL FROM THE CITY ENGINEER.
7. CUT SHEETS SHALL BE PREPARED BY THE DEVELOPER'S ENGINEER AND SUBMITTED TO THE CITY ENGINEER. NO CONSTRUCTION SHALL BE ALLOWED PRIOR TO THE CITY ENGINEER'S APPROVAL OF THE CUT SHEETS.
8. LOCATIONS OF DRIVEWAY APPROACHES SHALL BE ADDED TO THE PRECISE GRADING PLAN IF NOT ON ORIGINAL STREET PLANS. ANY WATER OR SEWER LATERALS CONSTRUCTED AT THE DRIVEWAY APPROACH LOCATIONS SHALL BE RELOCATED AT THE CONTRACTOR'S EXPENSE.
9. THE CONTRACTOR SHALL SATISFY HIMSELF/HERSELF THAT ESTIMATED QUANTITIES SHOWN ARE CORRECT BEFORE BIDDING ON ANY ITEM.
10. THE CONTRACTOR SHALL MAINTAIN DUST CONTROL AT ALL TIMES. WORK SITE AND EXTERIOR STREETS SHALL BE IN A NEAT, CLEAN, HAZARD-FREE, AND ORDERLY STATE THROUGHOUT CONSTRUCTION. SITE SHALL BE CLEANED UPON REQUEST OF THE INSPECTOR.
11. ALL EXISTING PAVEMENT TO BE REMOVED SHALL BE SAW CUT AND REMOVED TO CLEAN STRAIGHT LINES. HEADER CUTS MAY BE PROVIDED ADJACENT TO SAWCUTS.

(CONTINUED ON SI-16A)



CITY OF HALF MOON BAY, CALIFORNIA STANDARD DETAIL

APPROVED BY:
PEYKAN ABBASSI, P.E.
CITY ENGINEER
DATE: JULY 19, 2016

**GENERAL NOTES FOR
STREET PLANS**

STD. DETAIL No.
SI-16

GENERAL NOTES FOR STREET PLANS (CONTINUED):

12. AT ALL LOCATIONS WHERE NEW PAVEMENT JOINS EXISTING, THE EXISTING PAVEMENT SHALL BE COATED WITH AN ASPHALTIC EMULSION.
13. THE CONTRACTOR RESPONSIBLE FOR THE PROTECTION OF ALL UTILITY VALVES, BOXES AND COVERS, AND ADJUSTING OF ALL WATER VALVE BOXES AND COVERS TO FINISH GRADES.
14. THE CONTRACTOR SHALL RESET MANHOLE RINGS IN ACCORDANCE WITH CITY OF HALF MOON BAY STANDARDS.
15. THE PRIVATE ENGINEER SIGNING THESE PLANS IS RESPONSIBLE FOR THE ACCURACY AND ACCEPTABILITY OF THE WORK HERON. IN THE EVENT OF DISCREPANCIES ARISING DURING CONSTRUCTION, THE PRIVATE ENGINEER SHALL BE RESPONSIBLE FOR DETERMINING AN ACCEPTABLE SOLUTION AND REVISING THE PLANS FOR APPROVAL OF THE CITY ENGINEER.
16. THE CONTRACTOR SHALL CALL IN A LOCATION REQUEST TO UNDERGROUND SERVICE ALERT (USA), PHONE NUMBER 811 IN NOR CAL, TWO (2) WORKING DAYS BEFORE DIGGING. NO INSPECTION WILL BE PROVIDED BY THE CITY ENGINEER'S OFFICE, AND NO CONSTRUCTION PERMIT ISSUED INVOLVING EXCAVATION FOR UNDERGROUND FACILITIES WILL BE VALID, UNLESS THE APPLICANT HAS BEEN PROVIDED AN INQUIRY IDENTIFICATION NUMBER BY USA.
17. ALL IRRIGATION LINES ENCOUNTERED DURING CONSTRUCTION SHALL BE REPLACED WITH 12-GUAGE DIPPED AND WRAPPED-WELDED STEEL PIPE.
18. CITY APPROVAL OF PLANS DOES NOT RELIEVE THE DEVELOPER FROM THE RESPONSIBILITY FOR THE CORRECTION OF ERROR AND OMISSION DISCOVERED DURING CONSTRUCTION. UPON REQUEST, THE REQUIRED PLAN REVISIONS SHALL BE PROMPTLY SUBMITTED TO THE CITY ENGINEER FOR APPROVAL.
19. WHEN IMPROVEMENTS ARE TO BE PLACED ON NATIVE SOIL THAT CONSISTS OF A ROCKY MATERIAL, THE SUBGRADE SHALL BE PREPARED BY REMOVING ALL ROCKS WHICH PROTRUDE ABOVE THE SUB-GRADE AND ALL VOIDS OR DEPRESSIONS SHALL BE FILLED WITH A FINE GRADE MATERIAL OF A QUALITY BETTER THAN THE NATIVE MATERIAL.
20. IF THE ASPHALT CONCRETE IS TO BE PLACED ON SUB-GRADE, A SOILS STERILANT REGISTERED BY THE E.P.A. FOR USE UNDER A.C. AND P.C.C. SHALL BE UNIFORMLY APPLIED AT THE MANUFACTURER'S RECOMMENDED RATE FOR THE FULL PAVEMENT WIDTH PRIOR TO PAVING.
21. NO WORK SHALL COMMENCE WITH PUBLIC RIGHT-OF-WAY WITHOUT OBTAINING A PUBLIC WORKS PERMIT AND NOTIFYING THE CITY INSPECTOR TO SCHEDULE A PRE-CONSTRUCTION MEETING 24 HOURS PRIOR TO START OF WORK.
22. ALL QUANTITIES SHALL BE SHOWN ON THE PLANS INCLUDING EARTHWORK, REMEDIAL GRADING, REMOVALS, ETC.

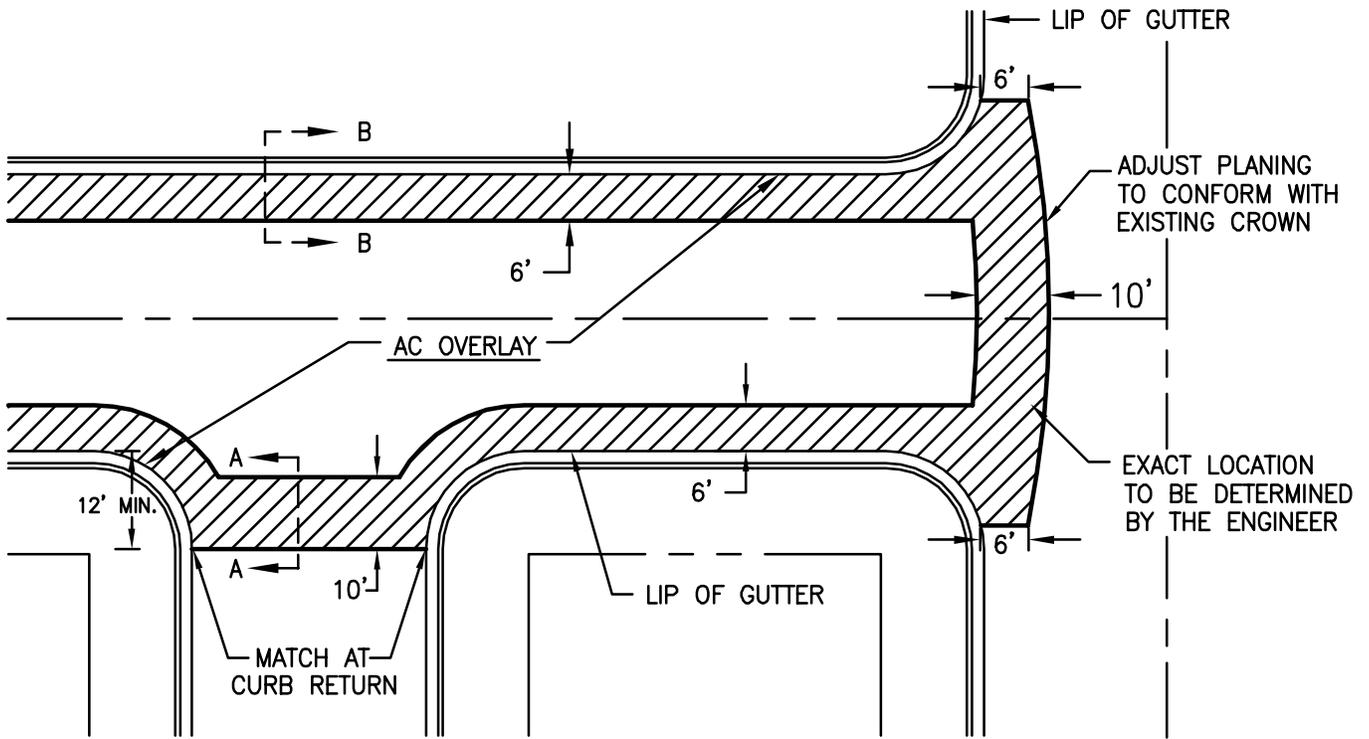


CITY OF HALF MOON BAY, CALIFORNIA STANDARD DETAIL

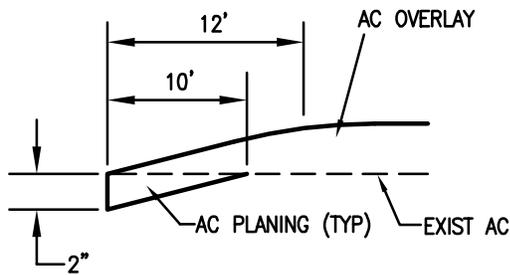
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CITY ENGINEER
DATE: JULY 19, 2016

**GENERAL NOTES FOR
STREET PLANS (CONTINUED)**

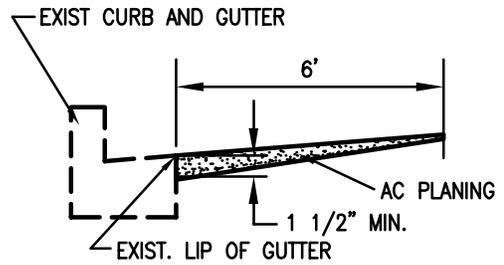
STD. DETAIL No.
SI-16A



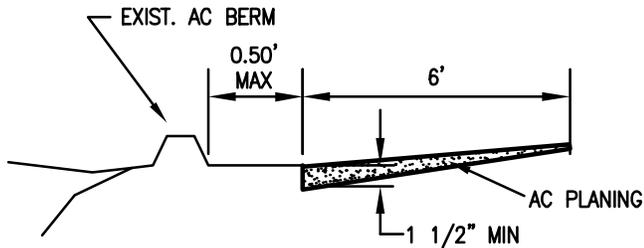
**INTERSECTION
PLANING DETAILS**



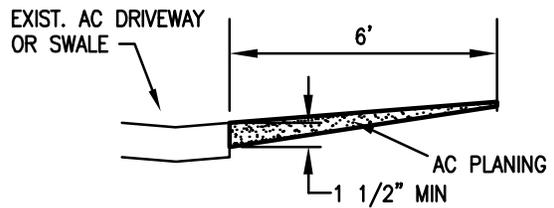
SECTION A-A



**SECTION B-B
PARKING LANE
PLANING DETAILS**



**SECTION C-C
ASPHALT BERM
PLANING DETAILS**



**SECTION D-D
DRIVEWAY OR SWALE
PLANING DETAILS**

NO SCALE

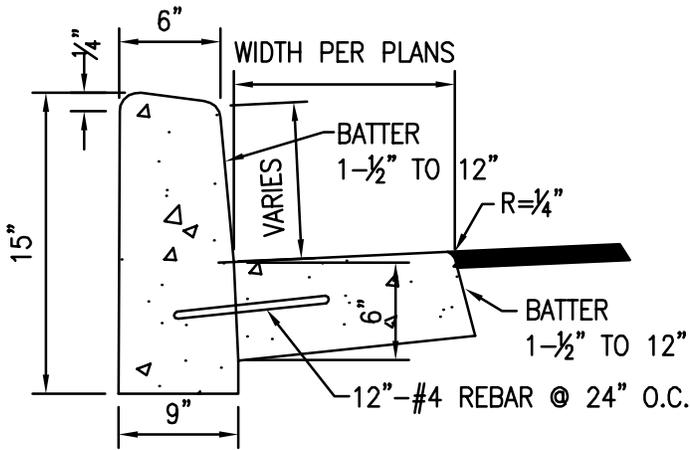


CITY OF HALF MOON BAY, CALIFORNIA STANDARD DETAIL

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 DATE: JULY 19, 2016

ASPHALT PLANING

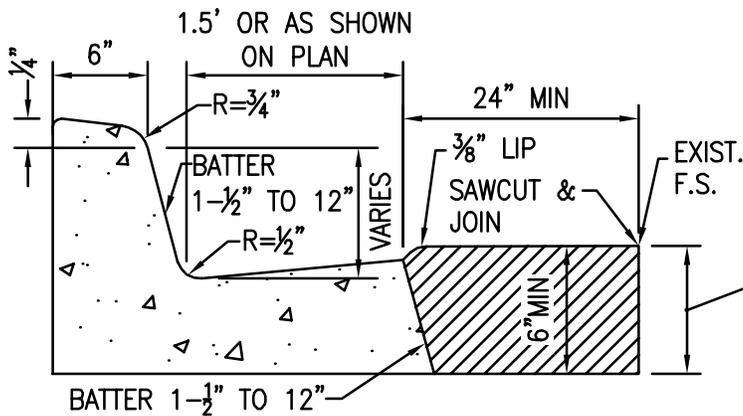
STD. DETAIL No.
SI-17



SEPARATE CURB AND GUTTER SECTION

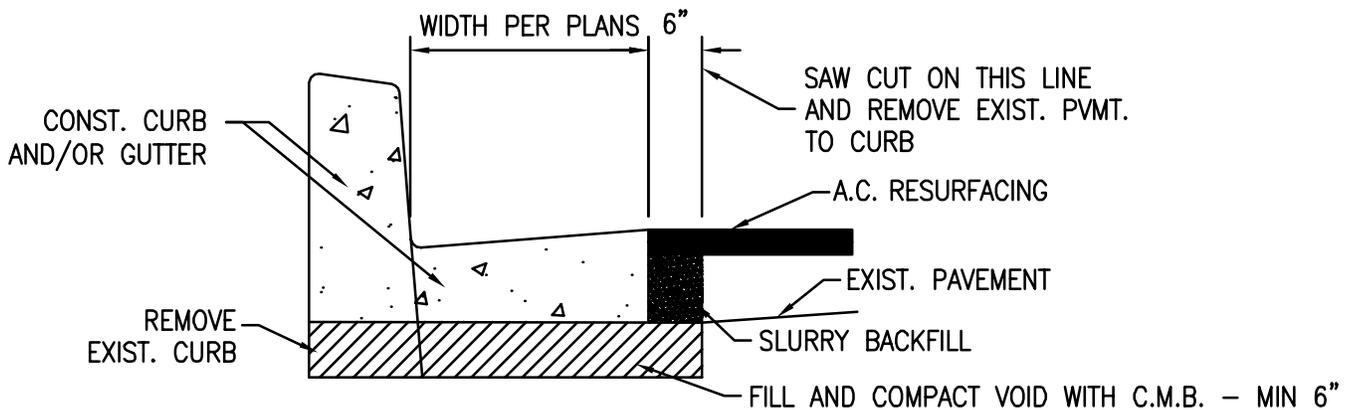
NOTES:

1. USE OF THESE SPECIAL CURB AND GUTTER RECONSTRUCTION DETAILS SHALL ONLY OCCUR WHEN STANDARD CURB AND GUTTER CONSTRUCTION IS PREVENTED BY EXISTING SITE CONDITIONS OR WHEN REMOVING AND REPLACING CURB AND GUTTER AT THE SAME ELEVATION.
2. IF THE EXISTING ASPHALT PAVEMENT THICKNESS IS GREATER THAN 6 INCHES, THE FULL THICKNESS OF EXISTING ASPHALT SHALL BE REMOVED AND REPLACED WITH FULL DEPTH ASPHALT CONCRETE PAVEMENT.
3. IF THE EXISTING AGGREGATE BASE IS ENCOUNTERED AT THE LEVEL OF THE BOTTOM OF THE CURB, IT SHALL BE LEFT IN PLACE AND RECOMPACTED PRIOR TO ASPHALT PLACEMENT.
4. FOR PAVEOUTS WIDER THAN 24 INCHES, THE APPROPRIATE ASPHALT CONCRETE PAVEMENT OVER CRUSHED AGGREGATE STRUCTURAL SECTION SHALL BE CONSTRUCTED FOR THE FULL WIDTH OF THE PAVEMENT.



EXCAVATE LEVEL OF BOTTOM OF CURB GUTTER, COMPACT SURFACE, AND REPLACE WITH FULL DEPTH ASPHALT CONCRETE (SEE NOTE 2 & 3)

REMOVAL & REPLACEMENT OF INTEGRAL CURB & GUTTER WITHOUT ADDITIONAL OVERLAY



REMOVAL & REPLACEMENT FOR CURB AND GUTTER CONSTRUCTION WITH ASPHALT OVERLAYS ON STREET



CITY OF HALF MOON BAY, CALIFORNIA STANDARD DETAIL

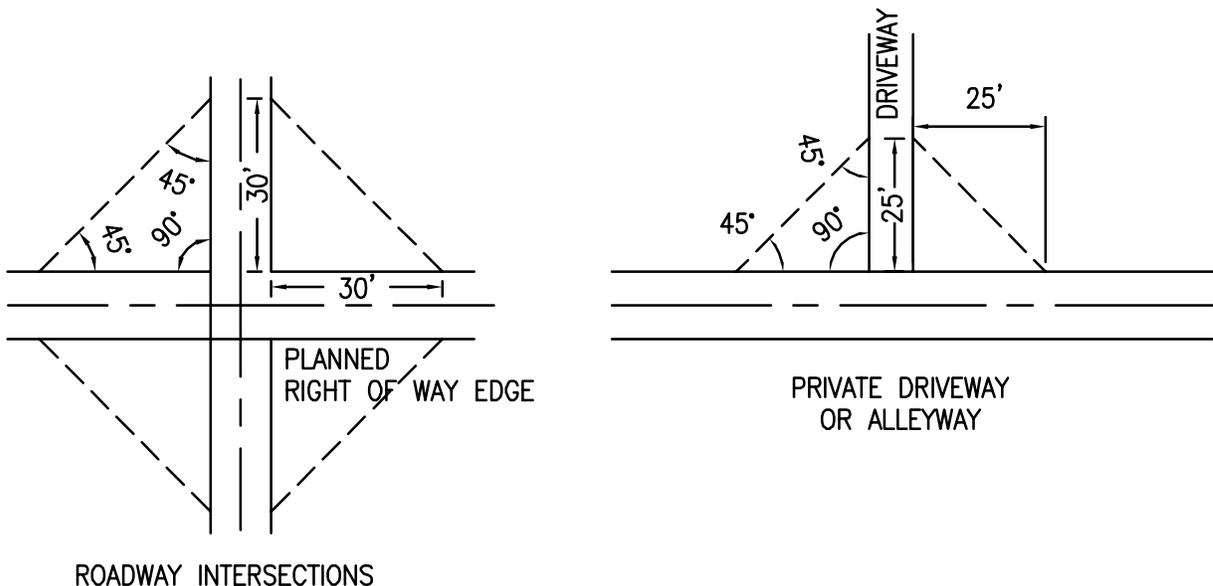
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 CITY ENGINEER
 DATE: JULY 19, 2016

SPECIAL - CURB AND GUTTER RECONSTRUCTION

STD. DETAIL No.
SI-18

NOTES:

1. ADEQUATE VISIBILITY FOR VEHICULAR AND PEDESTRIAN TRAFFIC SHALL BE PROVIDED AT CLEAR SIGHT TRIANGLES AT ALL INTERSECTIONS OF PUBLIC RIGHTS-OF-WAY AND PRIVATE STREETS AND DRIVEWAYS, THROUGH THE FOLLOWING MEASURES.
 - A. THERE SHALL BE NO MAN-MADE VISUAL OBSTRUCTION IN CLEAR SIGHT TRIANGLES EXCEPT BY NO MORE THAN TWO POSTS OR COLUMNS, EACH WITH A WIDTH NO GREATER THAN TWELVE INCHES.
 - B. THERE SHALL BE NO MONUMENT SIGNS, WALLS, OR FENCES ALLOWED WITHIN A CLEAR SIGHT TRIANGLE.
 - C. THE MAXIMUM HEIGHT OF LANDSCAPING SHALL BE LIMITED TO 18 INCHES.
2. CLEAR SIGHT TRIANGLES ARE RIGHT TRIANGLES WHICH ARE MEASURED AS FOLLOWS:
 - A. THE ANGLE IS FORMED BY THE INTERSECTION OF EITHER:
 - (i) THE INTERSECTION OF THE EDGES OF TWO ROADWAYS (PUBLIC AND PRIVATE) AS MEASURED AT THE EDGE OF THEIR ULTIMATE PLANNED RIGHT-OF-WAY; OR
 - (ii) THE INTERSECTION OF THE EDGE OF A PRIVATE DRIVEWAY OR ALLEY AND THE EDGE OF THE ULTIMATE PLANNED RIGHT-OF-WAY OF AN INTERSECTION ROADWAY.
 - B. THE TWO ANGLES OF A CLEAR SIGHT TRIANGLE SHALL EACH BE LOCATED AS FOLLOWS:
 - (i) ROADWAY INTERSECTIONS: 30 FEET FROM THE ROADWAY INTERSECTION
 - (ii) PRIVATE DRIVEWAY OR ALLEYWAY: 25 FEET FROM THE INTERSECTION
 - (iii) THE CLEAR SIGHT TRIANGLES SHALL APPLY FOR 90 DEGREE AND SKEWED STREET INTERSECTIONS, AND DRIVEWAYS AND ALLEYS.

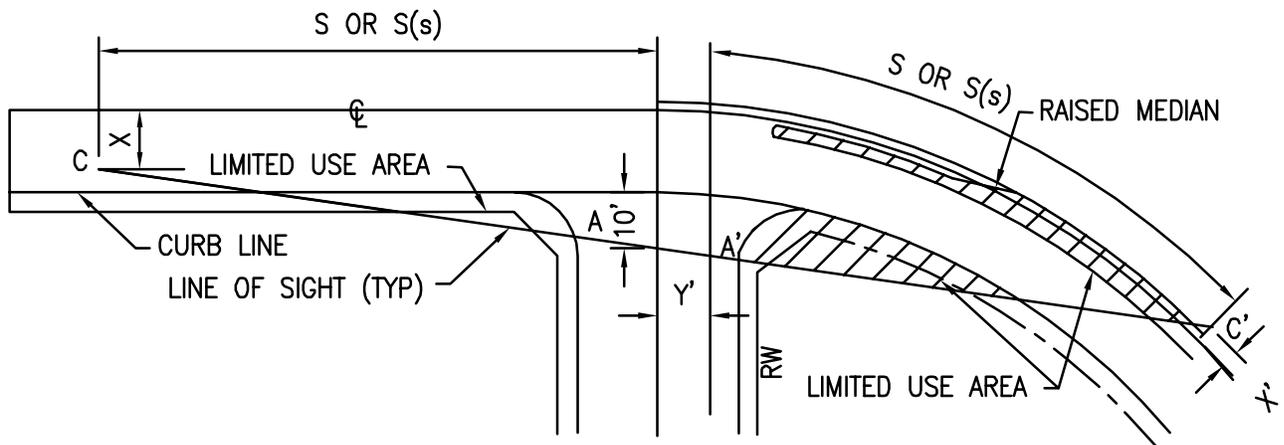


CITY OF HALF MOON BAY, CALIFORNIA STANDARD DETAIL

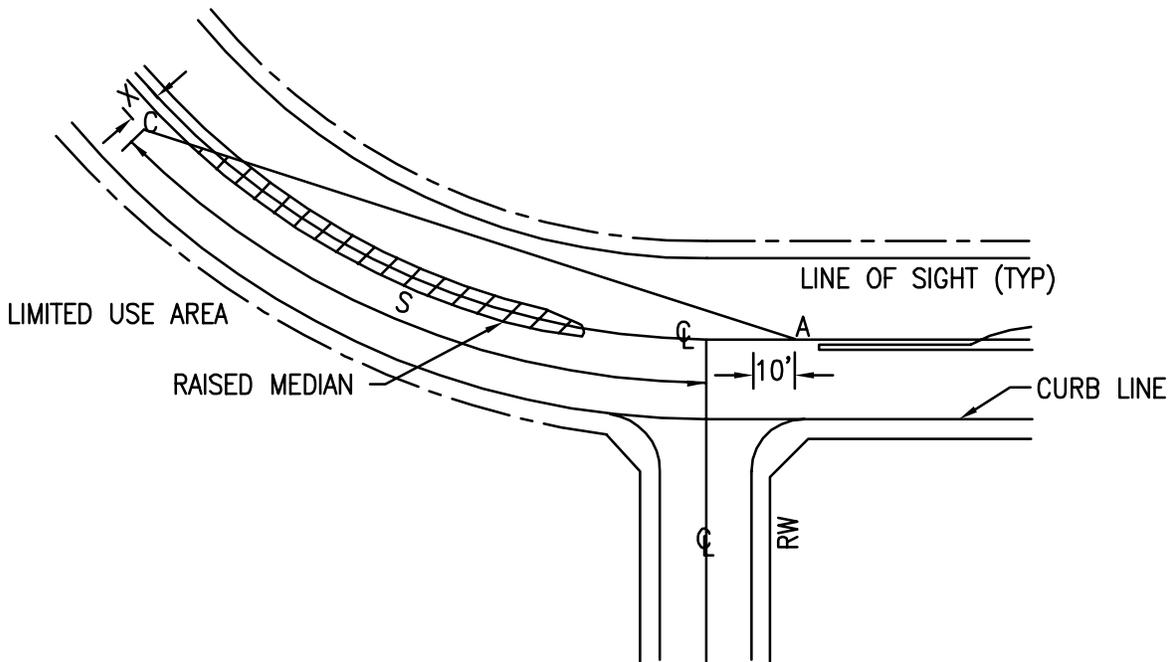
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DATE: JULY 19, 2016

**MINIMUM CLEAR SIGHT
TRIANGLES**

STD. DETAIL No.
SI-19



**LEFT AND RIGHT TURNOUT AND ACROSS TRAFFIC
SIGHT DISTANCE**



LEFT TURN SIGHT DISTANCE

	S	S(s)	Y'	X	X'
MAJOR	660	580	37	37	13
PRIMARY	610	500	25	25	13
SECONDARY	550	430	18	18	6
COMMUTER	500	360	0	0	0
COLLECTOR	390	250	0	0	0
LOCAL	280	150	0	0	0

NOTES:

1. X AND X' ARE BASED ON A STANDARD 14' MEDIAN FOR MAJOR AND PRIMARY HIGHWAYS.
2. USE S VALUES FOR UNSIGNALIZED INTERSECTIONS AND S(s) VALUES FOR SIGNALIZED INTERSECTIONS. (SEE SI-20A FOR ADDITIONAL NOTES)

NO SCALE



CITY OF HALF MOON BAY, CALIFORNIA STANDARD DETAIL

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INTERSECTION SIGHT DISTANCE

STD. DETAIL No.

SI-20

NOTES:

1. THE DISTANCE S REPRESENTS THE CORNER SIGHT DISTANCE MEASURED ALONG THE CENTERLINE OF THE ROAD. THE CORNER SIGHT DISTANCE IS THE DISTANCE REQUIRED TO ALLOW $7\frac{1}{2}$ SECONDS FOR THE DRIVER ON THE CROSS ROAD (OR LEFT TURN POCKET) TO SAFELY CROSS THE MAIN ROADWAY OR TURN LEFT WHILE THE APPROACH VEHICLE TRAVELS AT THE ASSUMED DESIGN SPEED OF THE MAIN ROADWAY.
2. THE DISTANCE S SHOULD BE INCREASED BY 20% FROM THE AMOUNT SHOWN ON THE TABLE ON SUSTAINED DOWNGRADES STEEPER THAN 3% AND LONGER THAN ONE MILE.
3. POINTS A AND A' ARE THE LOCATIONS OF A DRIVER'S LINE OF SIGHT (3.5 FOOT EYE HEIGHT) TO ONCOMING VEHICLES (4.25 FOOT OBJECT HEIGHT) LOCATED AT POINTS C AND C' WHILE IN A VEHICLE AT AN INTERSECTION 10 FEET BACK FROM THE PROJECTION OF THE CURB LINE. IN NO CASE SHALL POINTS A OR A' BE LESS THAN FIFTEEN FEET FROM THE EDGE OF THE TRAVELED WAY.
4. THE DISTANCE Y' IS THE DISTANCE MEASURED FROM THE CENTERLINE OF THE MAIN ROAD TO THE FAR RIGHT THROUGH TRAVEL LANE. THE DISTANCE Y' IS EQUAL TO ZERO FOR T-INTERSECTIONS. THE DISTANCE X IS THE DISTANCE MEASURED FROM THE CENTERLINE OF THE MAIN ROAD TO THE CENTER OF THE FAR RIGHT THROUGH TRAVEL LANE. THE DISTANCE X' IS THE DISTANCE MEASURED FROM THE CENTERLINE OF THE MAIN ROAD TO THE CENTER OF THE TRAVEL LANE NEAREST THE CENTERLINE OF THE ROAD.
5. THE LIMITED USE AREA IS DETERMINED BY THE GRAPHICAL METHOD USING THE APPROPRIATE DISTANCES GIVEN IN THE ABOVE TABLE. IT SHALL BE USED FOR THE PURPOSE OF PROHIBITING OR CLEARING OBSTRUCTIONS IN ORDER TO MAINTAIN ADEQUATE SIGHT DISTANCE AT INTERSECTIONS.
6. THE LINE OF SIGHT LINE SHALL BE SHOWN AT INTERSECTIONS ON ALL LANDSCAPING PLANS, GRADING PLANS AND TENTATIVE TRACT PLANS WHERE A SAFE SIGHT DISTANCE IS QUESTIONABLE. IN CASES WHERE AN INTERSECTIONS IS LOCATED ON A VERTICAL CURVE, A PROFILE AT THE LINE OF SIGHT MAY BE REQUIRED.
7. OBSTRUCTIONS SUCH AS BUS SHELTER, WALLS OR LANDSCAPING WITHIN THE LIMITED USE AREA WHICH COULD RESTRICT THE LINE OF SIGHT SHALL NOT BE PERMITTED.
 - A. PLANTS AND SHRUBS WITHIN THE LIMITED USE AREA SHALL BE OF THE TYPE THAT WILL GROW NO HIGHER THAN 12 INCHES ABOVE THE GROUND AND SHALL BE MAINTAINED AT A MAXIMUM HEIGHT OF 12 INCHES ABOVE THE GROUND. MAINTENANCE AT A LOWER HEIGHT MAY BE REQUIRED ON CREST VERTICAL CURVES PER NOTE 6 ABOVE.
 - B. A PROFILE OF THE LINE OF SIGHT MAY BE REQUIRED TO VERIFY 12" MINIMUM VERTICAL CLEARANCE ABOVE HEIGHT OBSTRUCTIONS SUCH AS SLOPE LANDSCAPING, PLANTS AND SHRUBS.
 - C. THE TOE OF SLOPE MAY ENCROACH INTO THE LIMITED USE AREA PROVIDED THAT THE REQUIREMENTS OF (B) ABOVE ARE SATISFIED.
 - D. IN LIEU OF PROVIDING A PROFILE OF THE LINE OF SIGHT, THE TOE OF SLOPE SHALL NOT ENCROACH INTO THE LIMITED USE AREA, AND THE LIMITED USE AREA SHALL SLOPE AT 2% MAXIMUM TO THE ROADWAY.
8. TREES SHALL NOT BE PERMITTED WITHIN ANY PORTION OF THE LIMITED USE AREA.
9. MEDIAN AREAS LESS THAN SIX (6) FEET IN WIDTH SHALL BE PAVED WITH CONCRETE.
10. RESIDENTIAL DRIVEWAYS SERVING FOUR OR MORE UNITS AND COMMERCIAL DRIVEWAYS SHALL BE TREATED AS LOCAL STREET INTERSECTIONS.

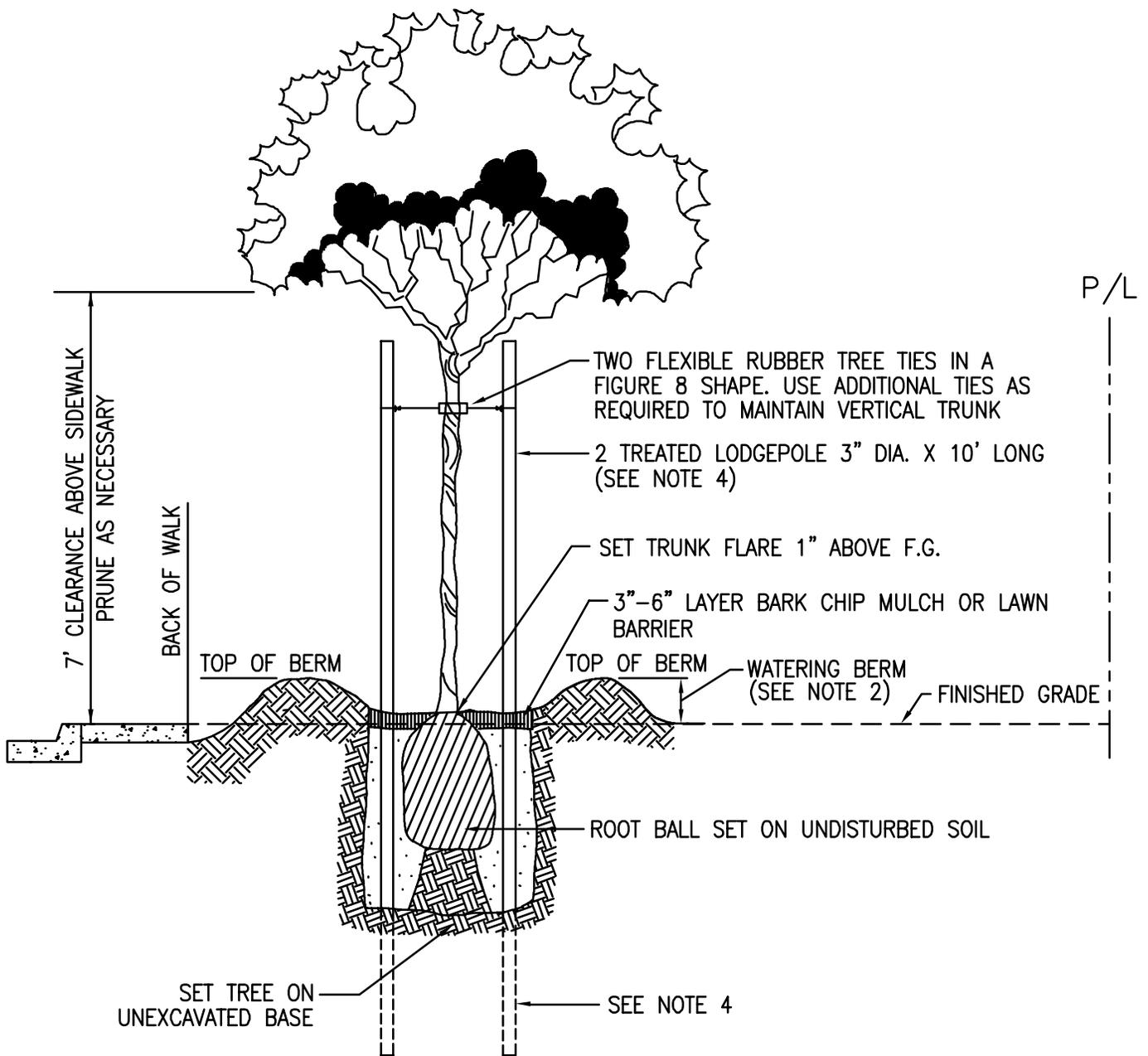


CITY OF HALF MOON BAY, CALIFORNIA STANDARD DETAIL

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PEYKAN ABBASSI, P.E.
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**INTERSECTION SIGHT
DISTANCE (NOTES)**

STD. DETAIL No.
SI-20A



P/L

NOTES:

1. PLANT PIT TO BE MIN. 2 TIMES THE DIAMETER OF THE ROOTBALL AND NO DEEPER THAN ORIGINAL LOCATION.
2. IN LAWN AREAS, EDGE OF SOD/SEED TO BE OUTSIDE OF WATERING BERM (2' MIN. DIAMETER).
3. PLANT TREES NO CLOSER THAN 5' FROM WATER SERVICES, 5' FROM SEWER LATERALS, 3' FROM WALKWAYS, 5' FROM DRIVEWAYS AND NEAREST UTILITY.
4. STAKES SHALL BE POUNDED 24" MINIMUM INTO UNDISTURBED SOIL.
5. STAKES SHALL BE INSTALLED TO PROTECT FROM PREVAILING WIND. ONE STAKE MAY BE REQUIRED AND LOCATED UPWIND OF TREE.

NO SCALE

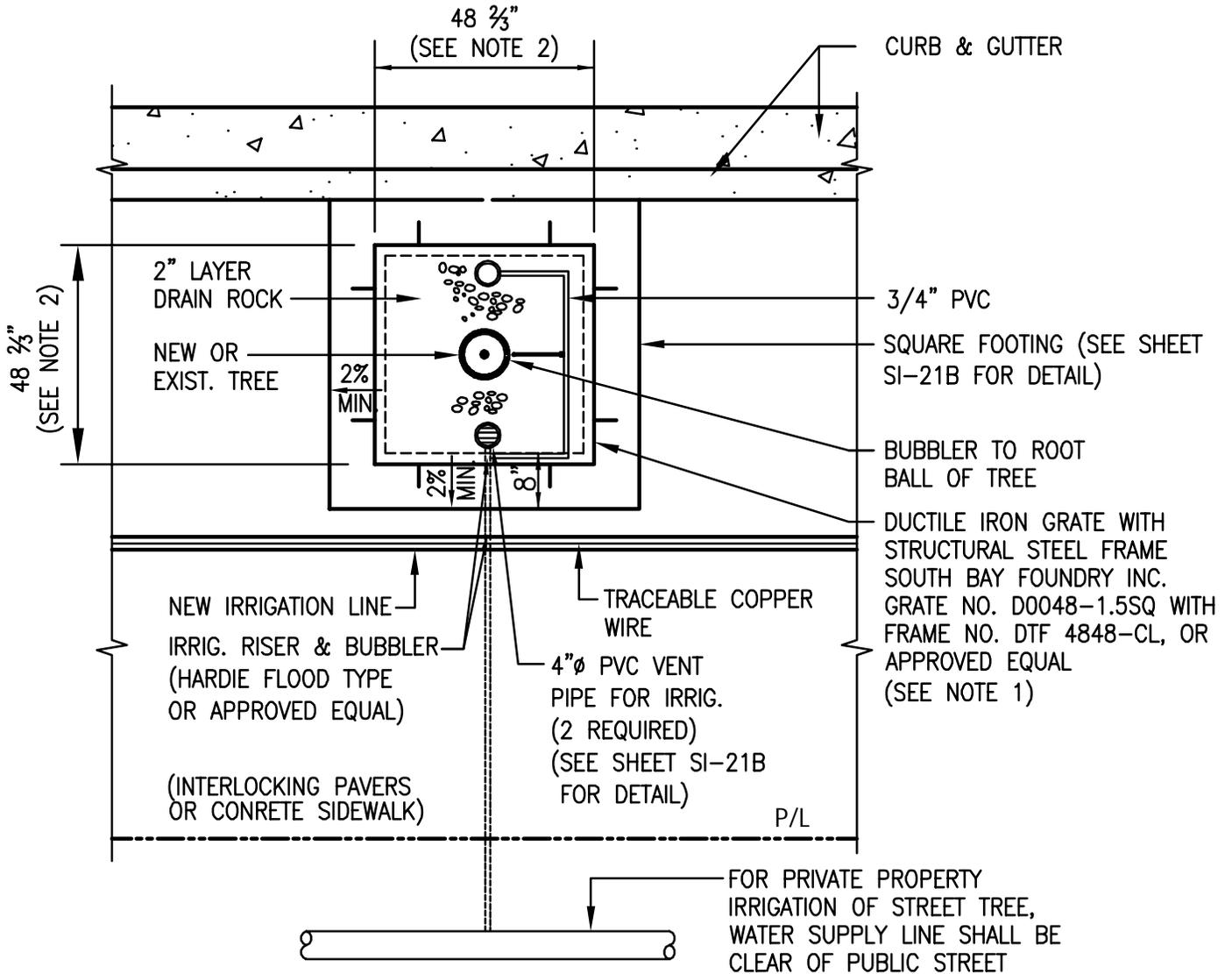


CITY OF HALF MOON BAY, CALIFORNIA STANDARD DETAIL

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TREE PLANTING DETAIL

STD. DETAIL No.
SI-21



TREE WELL WITH IRON GRATE AND STEEL FRAME ASSEMBLY

NOTES:

1. SOUTH BAY FOUNDRY INC. CAN BE REACHED AT 1-(209) 367-1940.
2. LARGER SQUARE GRATES MAY BE APPROVED BY THE CITY LANDSCAPE ARCHITECT.

NO SCALE

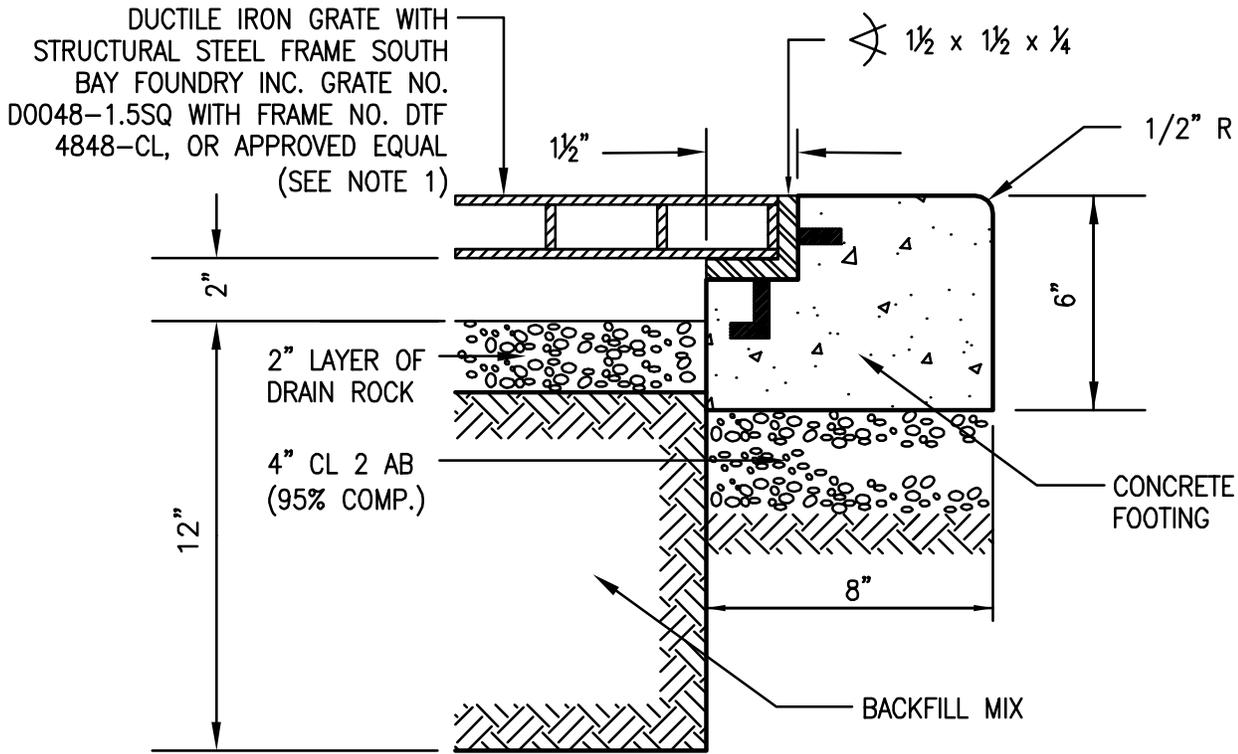


CITY OF HALF MOON BAY, CALIFORNIA STANDARD DETAIL

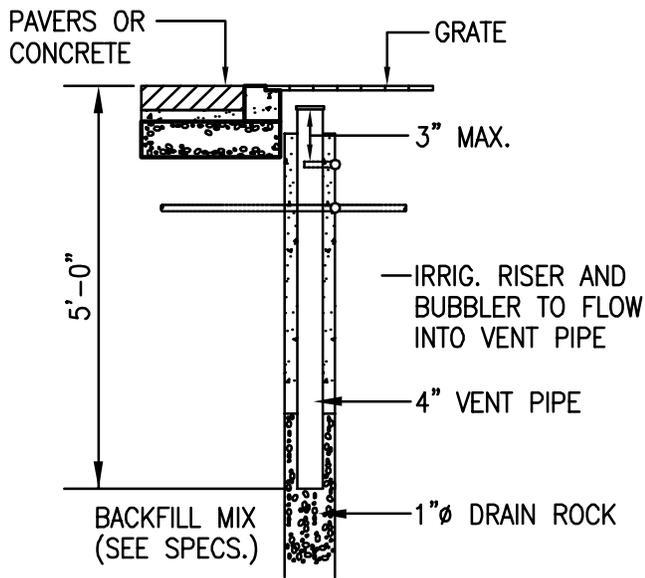
APPROVED BY:
 PEYKAN ABBASSI, P.E.
 CITY ENGINEER
 DATE: JULY 19, 2016

TREE WELL DETAIL 1

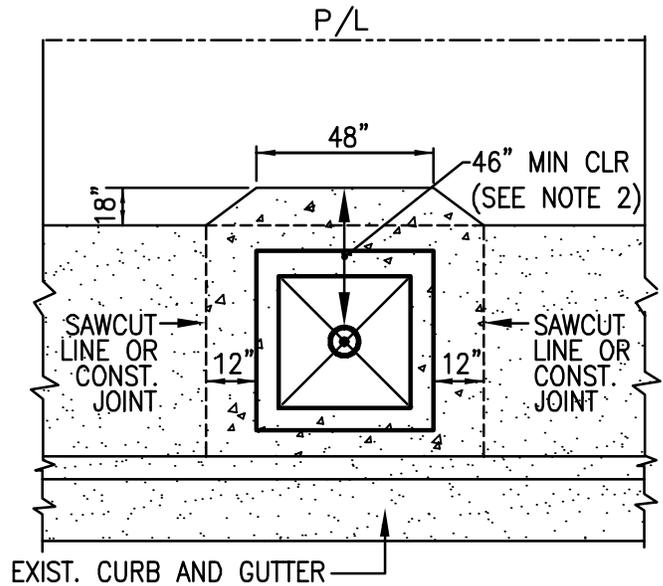
STD. DETAIL No.
SI-21A



CONCRETE FOOTING DETAIL



VENT PIPE DETAIL



ADA ACCESS DETAIL

NOTES:

1. SOUTH BAY FOUNDRY INC. CAN BE REACHED AT 1-(209) 367-1940.
2. FOR SIDEWALKS THAT ARE 5 FEET WIDE OR LESS, OR FOR EXISTING SIDEWALKS WHERE ADA ACCESS IS INSUFFICIENT, SIDEWALK SHALL BE WIDENED TO PROVIDE A 46-INCH MINIMUM CLEARANCE AS DIRECTED BY THE ENGINEER.

NO SCALE

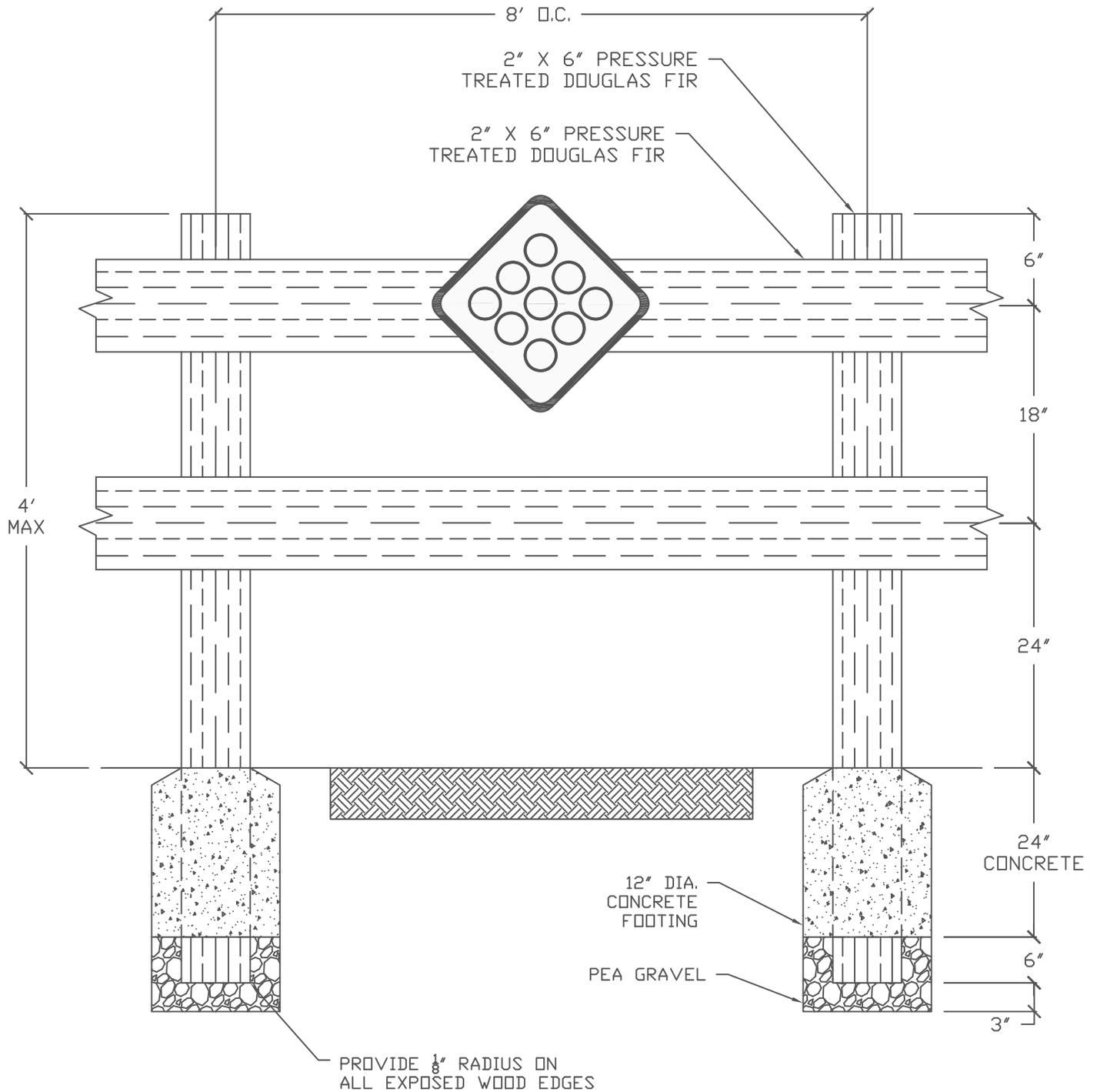


CITY OF HALF MOON BAY, CALIFORNIA STANDARD DETAIL

APPROVED BY:
 PEYKAN ABBASSI, P.E.
 CITY ENGINEER
 DATE: JULY 19, 2016

TREE WELL DETAIL 2

STD. DETAIL No.
SI-21B



NOTES:

- 1) ALL BOLTS, WASHER AND HARDWARE SHALL BE STAINLESS STEEL.
- 2) 1 - TYPE "N" MARKER SIGN PER 8 FEET SECTION MOUNTED AT 8 FEET ON CENTER ON BARRICADE FACING ONCOMING TRAFFIC.

NO SCALE



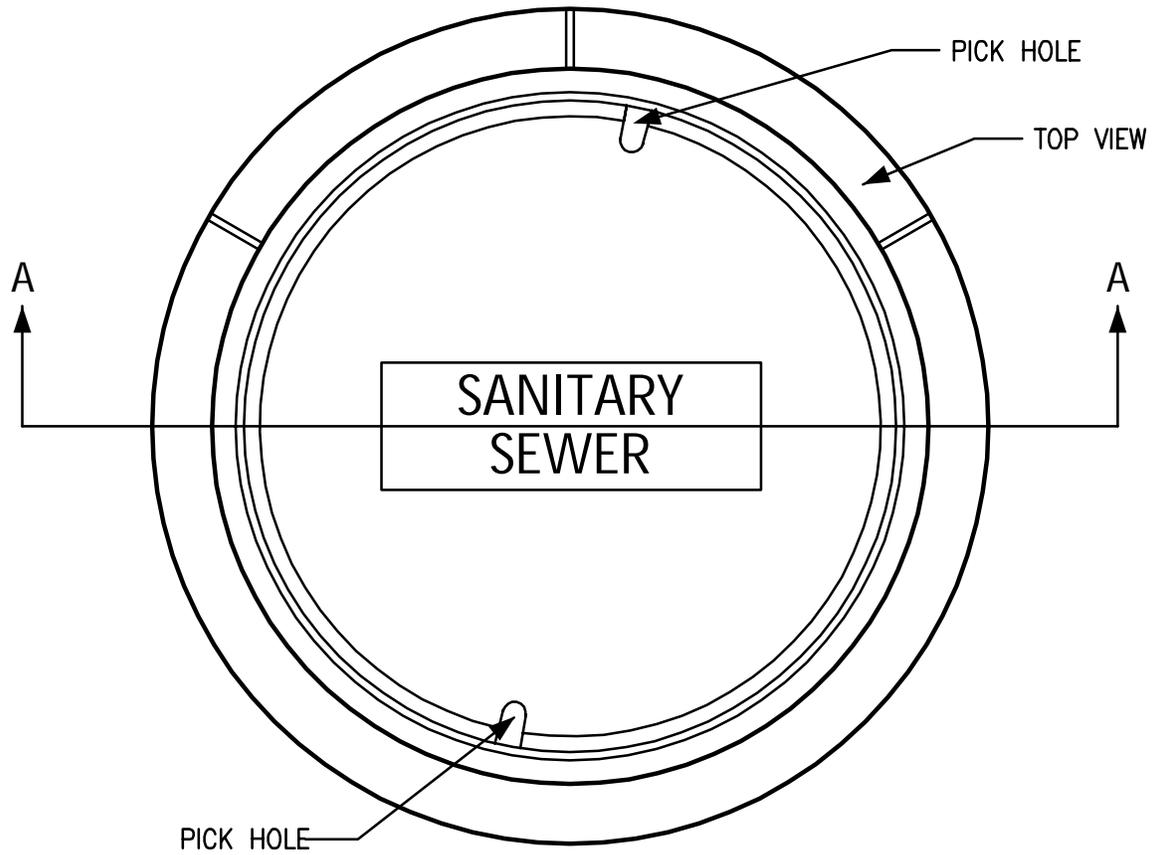
CITY OF HALF MOON BAY, CALIFORNIA STANDARD DETAIL

APPROVED BY:
 MAZIAR BOZORGINIA, P.E.
 CITY ENGINEER
 DATE: JANUARY 29, 2021

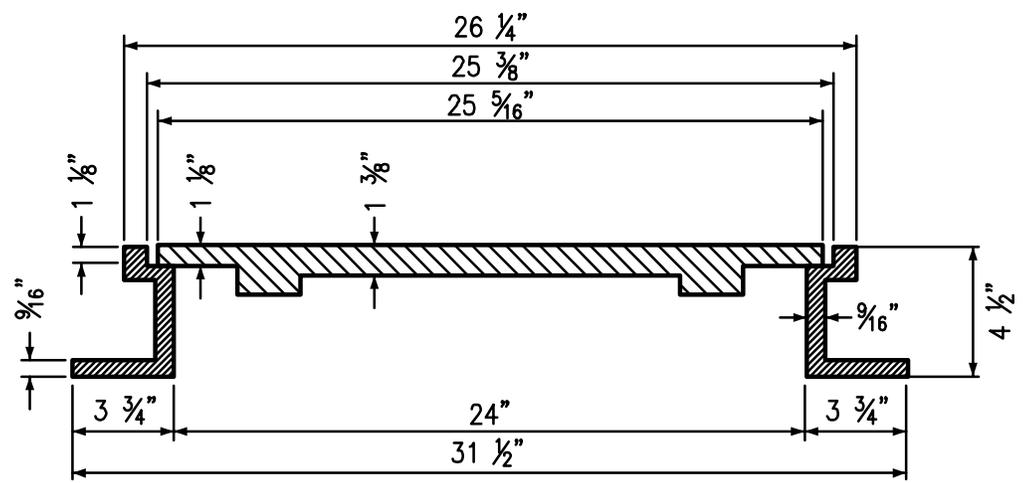
END-OF-ROAD BARRICADE

STD. DETAIL No.

SI-22



PLAN



SECTION A-A

NOTES:

1. ALL MATERIAL USED IN MANUFACTURING SHALL CONFORM TO A.S.T.M. A48, CLASS 30.
2. ALL CASTINGS TO BE COMPLETELY CLEANED AND PAINTED WITH ASPHALTIC VARNISH, AFTER MANUFACTURE.
3. USE PHOENIX P-1090, D&L SUPPLY A-1024, OR EQUAL.

NO SCALE



CITY OF HALF MOON BAY, CALIFORNIA STANDARD DETAIL

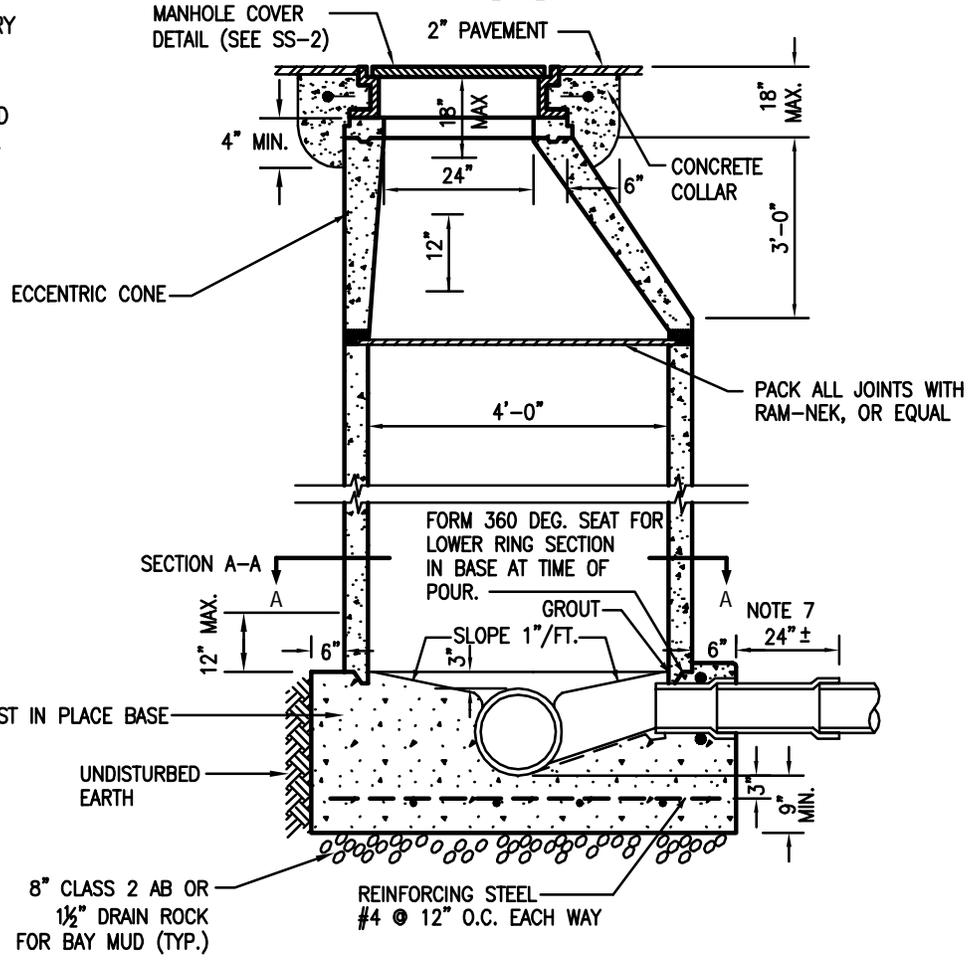
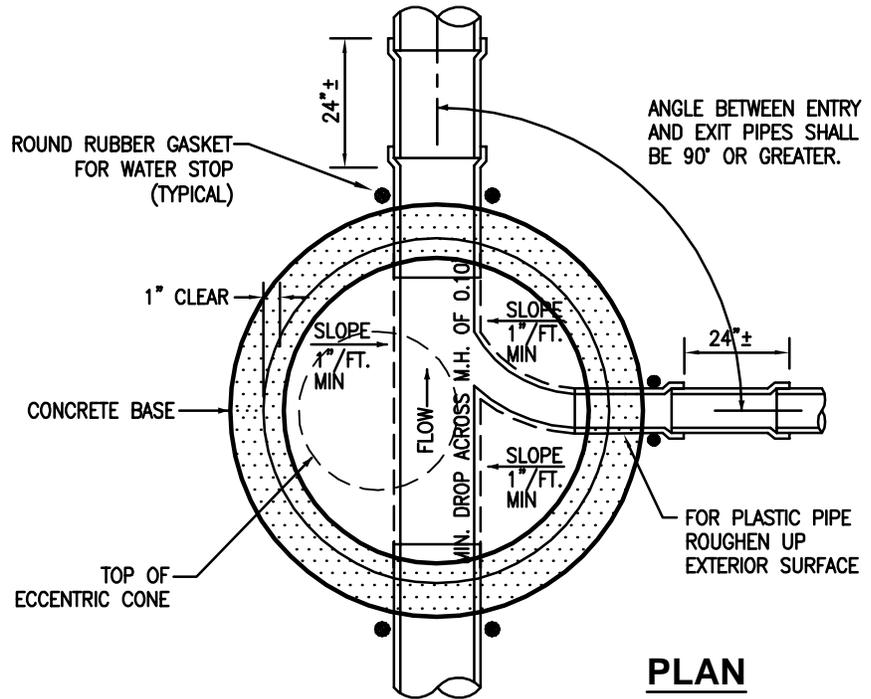
APPROVED BY:
 PEYKAN ABBASSI, P.E.
 CITY ENGINEER
 DATE: JULY 19, 2016

SEWER MANHOLE COVER

STD. DETAIL No.
SS-2

NOTES:

1. PROVIDE A MINIMUM DROP OF 0.10' ACROSS MANHOLE WHEN LINE BENDS AND/OR PIPE DIAMETER CHANGES.
2. CONCRETE SHALL BE CLASS A.
3. ALL JOINTS SHALL BE MADE WATER-TIGHT WITH NEOPRENE GASKETS OR RAM-NECK.
4. MINIMUM CROWN ELEVATION OF SMALLER DIAMETER INLET PIPE SHALL BE NO LESS THAN THE CROWN ELEVATION OF THE OUTLET PIPE WITHOUT APPROVAL OF CITY ENGINEER. MAXIMUM DROP FROM INVERT OF INLET PIPE TO CROWN OF OUTLET PIPE SHALL BE 1'-0".
5. LAY PIPE THROUGH MANHOLE WHEN POSSIBLE.
6. TOP OF PIPE TO BE REMOVED WITHIN MANHOLE. TRIM TO NEAT LINE AND FINISH OFF WITH GROUT TO LEAVE A SMOOTH FINISH.
7. PROVIDE TWO JOINTS AT ALL ENTRY POINTS TO MANHOLES.
8. REINFORCED CONCRETE MANHOLE SECTIONS SHALL BE PRECAST, AND SHALL CONFORM TO ASTM C-478.



ELEVATION

NO SCALE



CITY OF HALF MOON BAY, CALIFORNIA STANDARD DETAIL

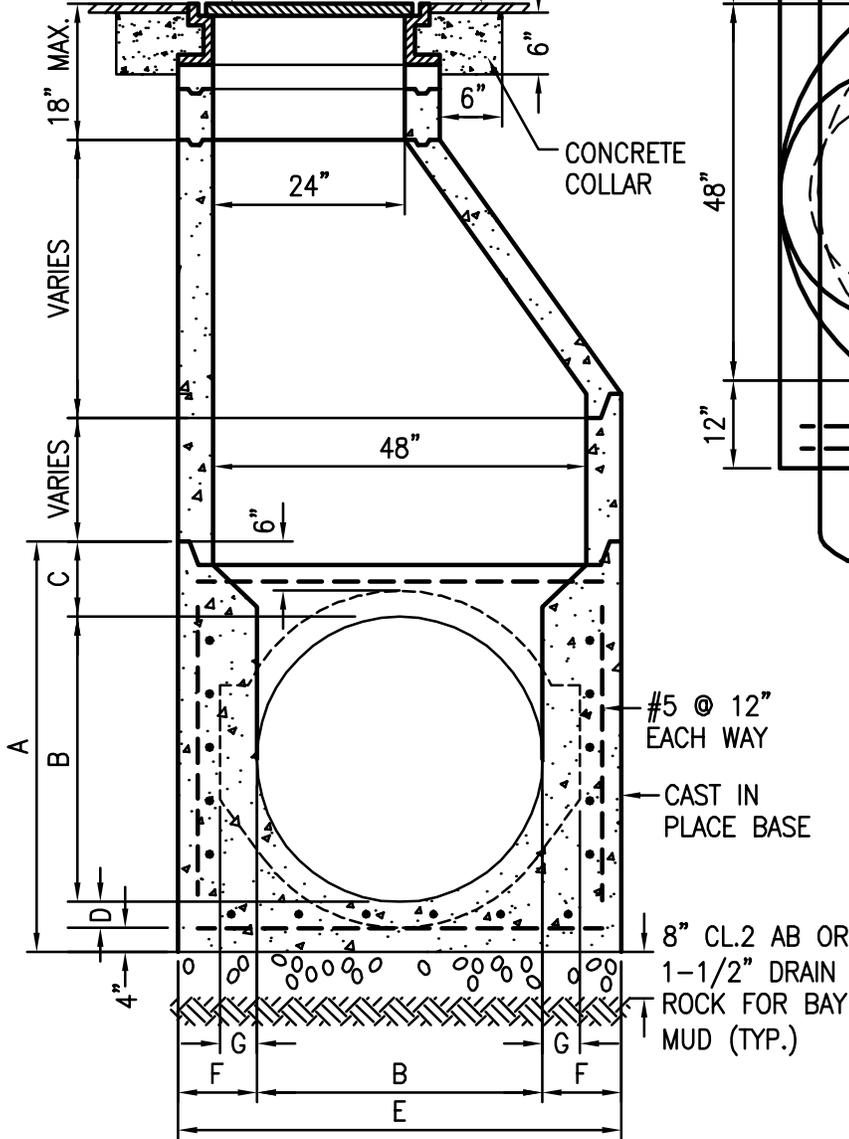
APPROVED BY:
 PEYKAN ABBASSI, P.E.
 CITY ENGINEER
 DATE: JULY 19, 2016

**TYPE I MANHOLE
 (PIPES 6" TO 21" DIAMETER)**

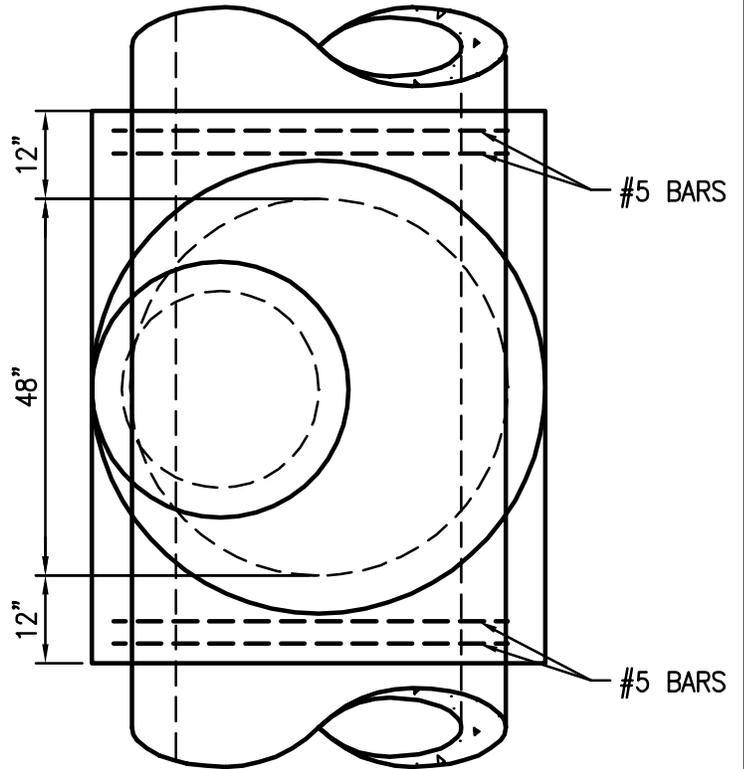
STD. DETAIL No.
SS-3

MANHOLE COVER
DETAIL SS-2

2" PAVEMENT



SECTION



PLAN

NOTES:

1. PROVIDE A MINIMUM DROP OF 0.10' ACROSS MANHOLE WHEN LINE BENDS AND/OR PIPE DIAMETER CHANGES.
2. CONCRETE SHALL BE CLASS A.
3. ALL JOINTS SHALL BE MADE WATER-TIGHT WITH NEOPRENE GASKETS OR RAM-NECK.
4. MINIMUM CROWN ELEVATION OF SMALLER DIAMETER INLET PIPE SHALL BE NO LESS THAN THE CROWN ELEVATION OF THE OUTLET PIPE WITHOUT APPROVAL OF CITY ENGINEER. MAXIMUM DROP FROM INVERT OF INLET PIPE TO CROWN OF OUTLET PIPE SHALL BE 1'-0".
5. LAY PIPE THROUGH MANHOLE WHEN POSSIBLE.
6. TOP OF PIPE TO BE REMOVED WITHIN MANHOLE. TRIM TO NEAT LINE AND FINISH OFF WITH GROUT TO LEAVE A SMOOTH FINISH.
7. PROVIDE TWO JOINTS AT ALL ENTRY POINTS TO MANHOLES.
8. REINFORCED CONCRETE MANHOLE SECTIONS SHALL BE PRECAST, AND SHALL CONFORM TO ASTM C-478.

DIA.	A	B	C	D	E	F	MIN G
24"	40"	24"	9"	3"	56"	16"	3"
27"	43"	27"	9"	3"	56"	14.5"	3"
30"	46"	30"	9"	3"	56"	13"	3"
36"	53"	36"	9.5"	3.5"	56"	10"	3.5"
42"	60"	42"	10"	4"	60"	9"	4"
48"	68"	48"	11"	5"	66"	9"	5"

NO SCALE



CITY OF HALF MOON BAY, CALIFORNIA STANDARD DETAIL

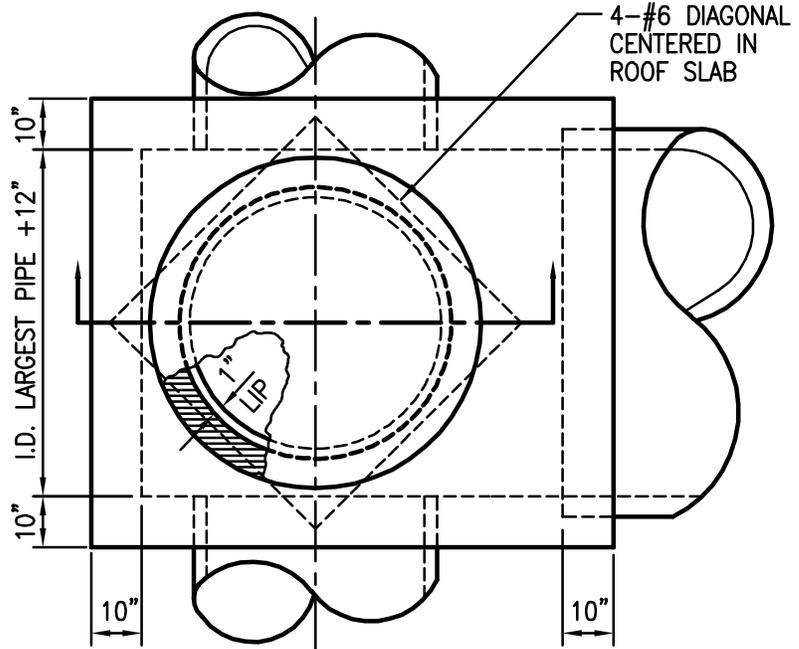
APPROVED BY:
PEYKAN ABBASSI, P.E.
CITY ENGINEER
DATE: JULY 19, 2016

**TYPE II MANHOLE
(24" - 48" DIAMETER PIPE)**

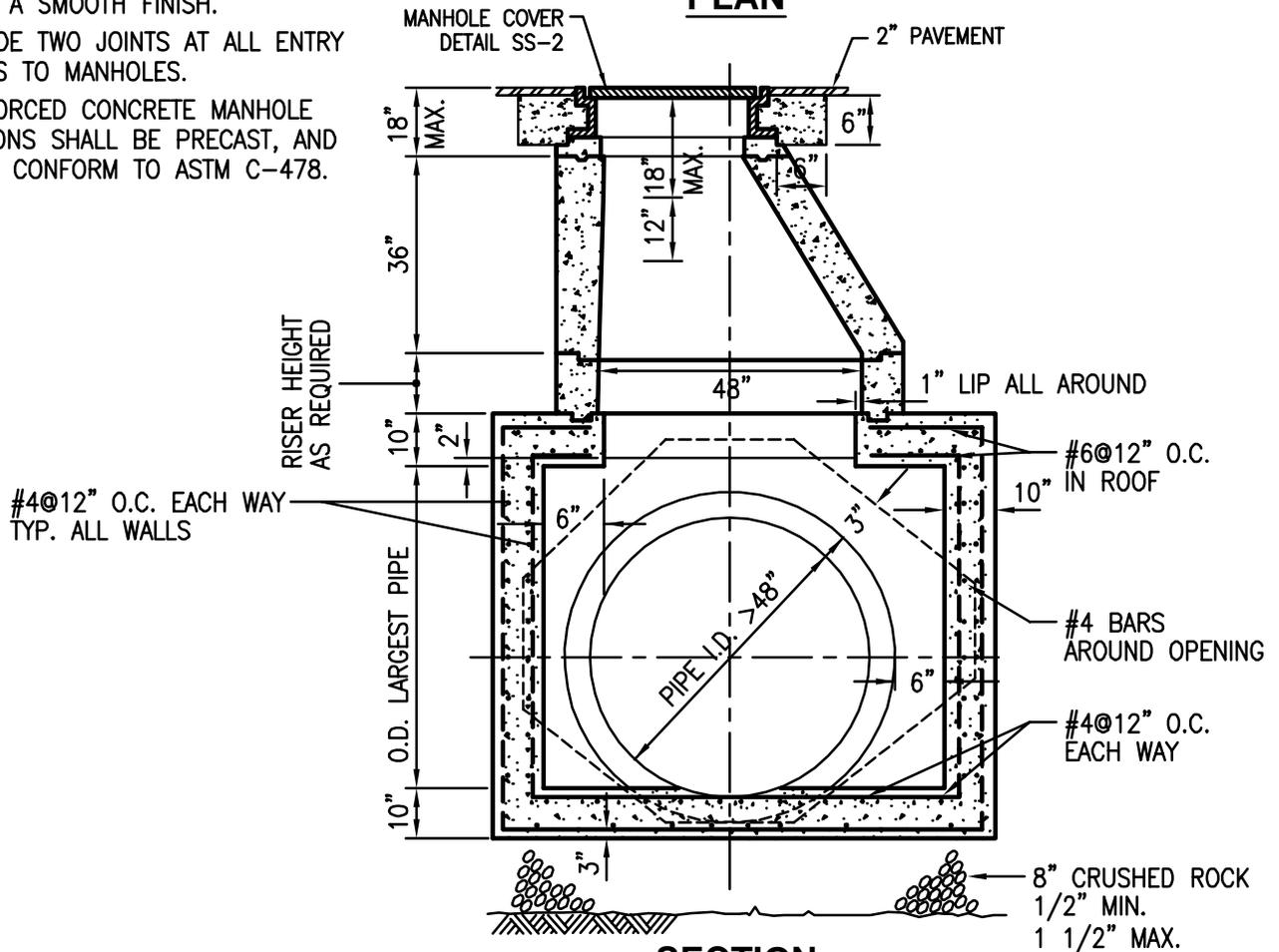
STD. DETAIL No.
SS-4

NOTES:

1. PROVIDE A MINIMUM DROP OF 0.10' ACROSS MANHOLE WHEN LINE BENDS AND/OR PIPE DIAMETER CHANGES.
2. CONCRETE SHALL BE CLASS A.
3. ALL JOINTS SHALL BE MADE WATER-TIGHT WITH NEOPRENE GASKETS OR RAM-NECK.
4. MINIMUM CROWN ELEVATION OF SMALLER DIAMETER INLET PIPE SHALL BE NO LESS THAN THE CROWN ELEVATION OF THE OUTLET PIPE WITHOUT APPROVAL OF CITY ENGINEER. MAXIMUM DROP FROM INVERT OF INLET PIPE TO CROWN OF OUTLET PIPE SHALL BE 1'-0".
5. LAY PIPE THROUGH MANHOLE WHEN POSSIBLE.
6. TOP OF PIPE TO BE REMOVED WITHIN MANHOLE. TRIM TO NEAT LINE AND FINISH OFF WITH GROUT TO LEAVE A SMOOTH FINISH.
7. PROVIDE TWO JOINTS AT ALL ENTRY POINTS TO MANHOLES.
8. REINFORCED CONCRETE MANHOLE SECTIONS SHALL BE PRECAST, AND SHALL CONFORM TO ASTM C-478.



PLAN



SECTION

NO SCALE

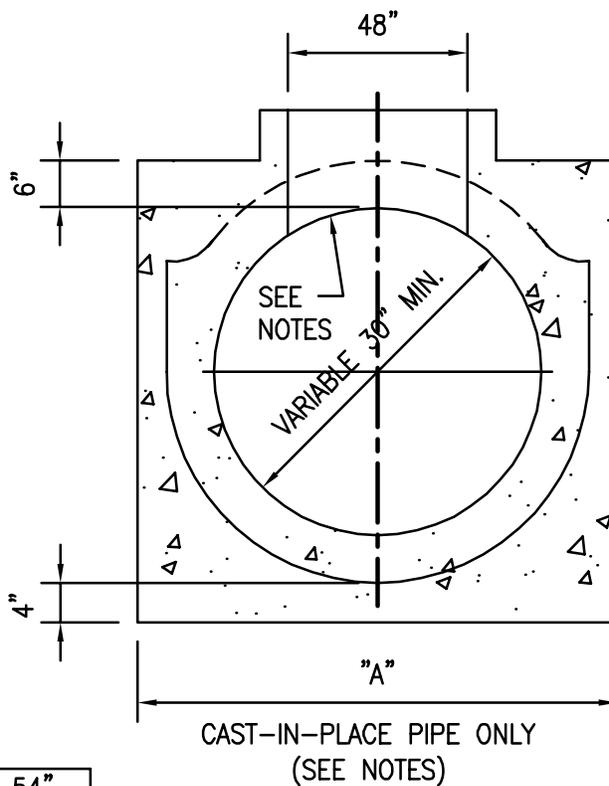
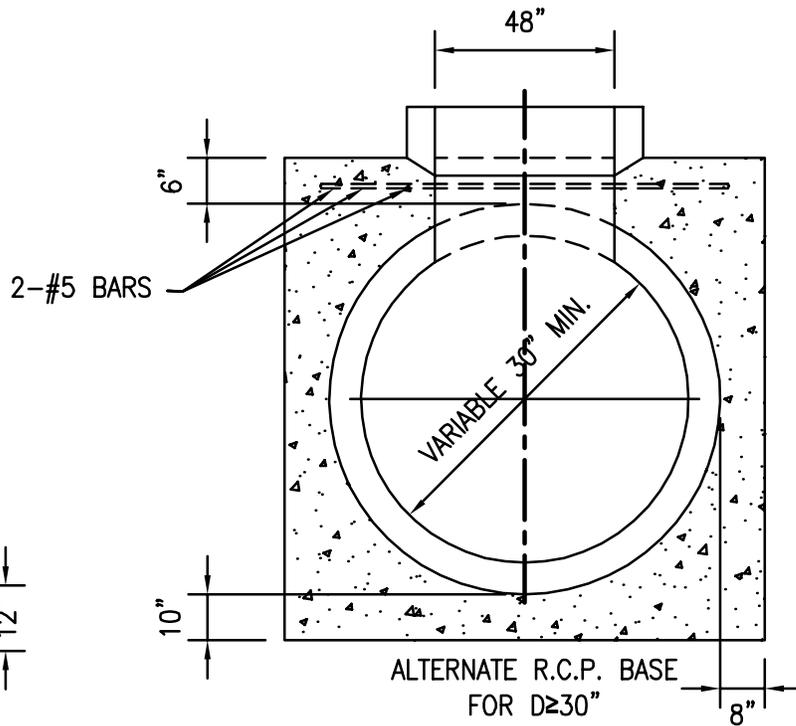
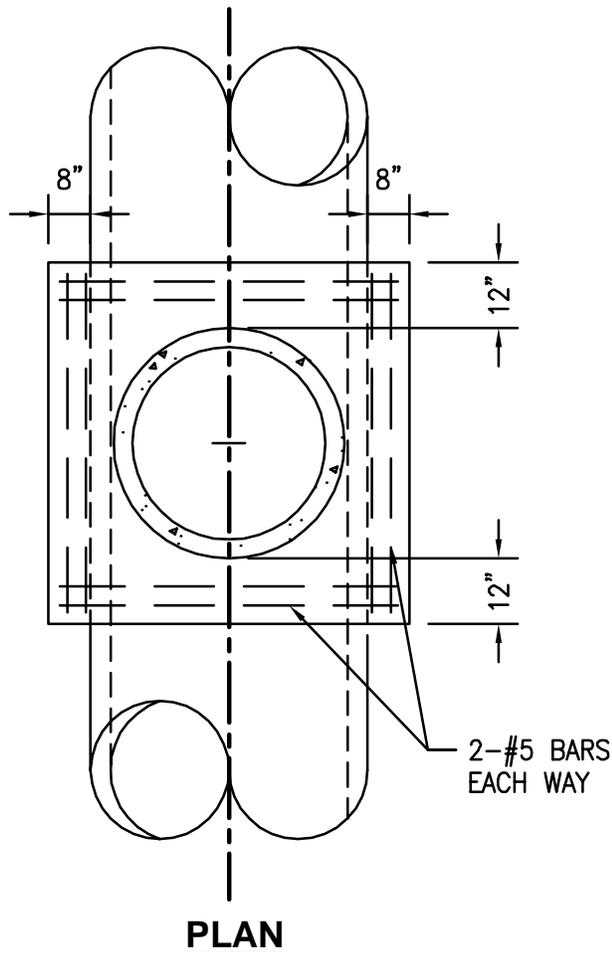


CITY OF HALF MOON BAY, CALIFORNIA STANDARD DETAIL

APPROVED BY:
 PEYKAN ABBASSI, P.E.
 CITY ENGINEER
 DATE: JULY 19, 2016

**TYPE III MANHOLE
 (PIPES LARGER THAN 48" DIA.)**

STD. DETAIL No.
SS-5



SECTIONS

NOTES:

1. REMOVE CONCRETE IN MANHOLE OPENING AND CONSTRUCT RISER BASE WHILE CONCRETE IS STILL FRESH.
2. PLACE RISER SECTION AFTER CONCRETE HAS SET.
- 3.

PIPE DIA.	30"	36"	42"	48"	54"
"A"	5'-0"	5'-0"	5'-0"	5'-8"	6'-3"
PIPE DIA.	60"	66"	72"		
"A"	6'-10"	7'-5"	8'-0"		

NO SCALE

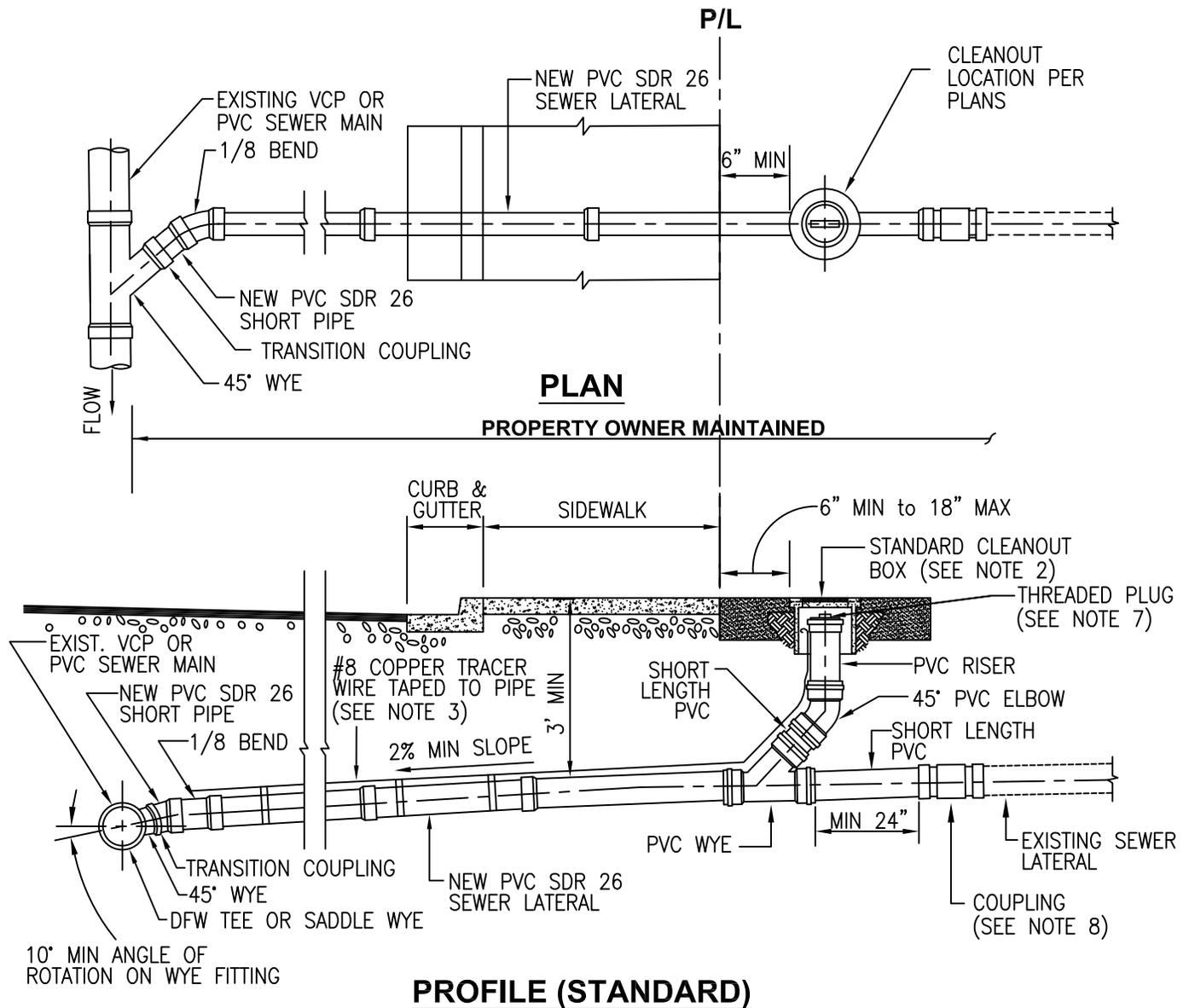


CITY OF HALF MOON BAY, CALIFORNIA STANDARD DETAIL

APPROVED BY:
 PEYKAN ABBASSI, P.E.
 CITY ENGINEER
 DATE: JULY 19, 2016

SADDLE MANHOLE

STD. DETAIL No.
SS-6



NOTES:

1. CLEANOUT BOX SHALL BE CHRISTY CONCRETE TYPE F08 CURB VALVE BOX WITH F08R LID MARKED "SEWER" WHEN INSTALLED IN LOCATION NOT SUBJECT TO VEHICULAR LOADING.
2. WHEN INSTALLED IN LOCATION SUBJECT TO VEHICULAR LOADING, CLEANOUT BOX SHALL BE CHRISTY CONCRETE TYPE G05T TRAFFIC VALVE BOX WITH G05CT TRAFFIC LID MARKED "SEWER AND SHALL BE PROVIDED WITH 8" CONCRETE BASE.
3. TAPE #8 COPPER TRACER WIRE AT 3' INTERVAL WITH FILAMENT TAPE.
4. LATERAL AND RISER SHALL BE ASTM 3034 PVC SDR 26. PVC FITTING SHALL BE SDR 26, AS PER SPECIFICATIONS.
5. TO CONNECT NEW LATERAL TO EXISTING MAIN, USE FLEX-SEAL ADJUSTABLE REPAIR COUPLING (ARC) WITH CONTINUOUS STAINLESS STEEL SHEAR RING, BY MISSION RUBBER COMPANY (800-854-9991) OR APPROVED EQUAL.
6. STAMP "S" ON TOP OF CURB FOR ALL NEW LATERALS.
7. USE PVC CLEANOUT WITH THREADED PLUG.
8. USE FLEXIBLE NON-SHEAR RUBBER COUPLING WITH STAINLESS STEEL SHEAR BAND.

NO SCALE



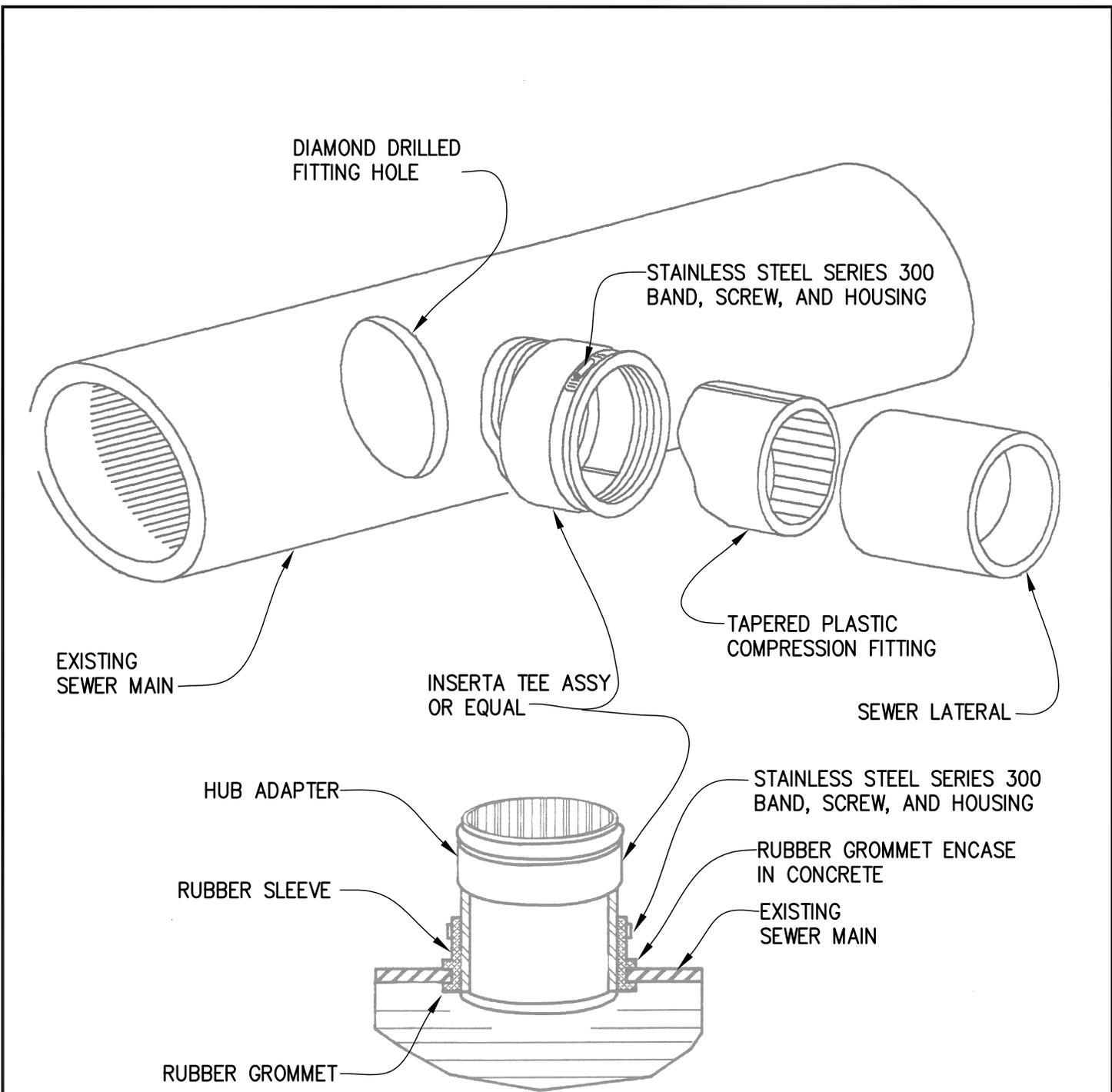
CITY OF HALF MOON BAY, CALIFORNIA STANDARD DETAIL

APPROVED BY:
 MAZIAR BOZORGINIA, P.E.
 CITY ENGINEER
 DATE: JANUARY 29, 2021

STANDARD SEWER LATERAL AND CLEANOUT

STD. DETAIL No.

SS-7



NOTES:

1. THIS CAN ONLY BE USED WITH THE PRIOR APPROVAL OF THE DISTRICT ENGINEER
2. ENCASE RUBBER GROMMET 6" ALL AROUND IN CLASS A CONCRETE

NOT TO SCALE

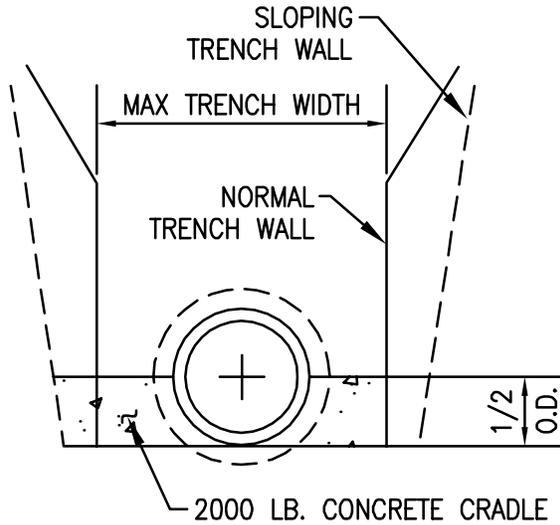


CITY OF HALF MOON BAY, CALIFORNIA STANDARD DETAIL

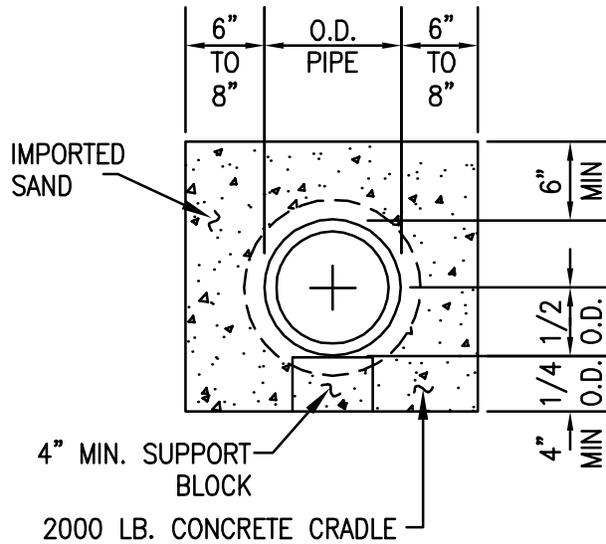
APPROVED BY:
 MAZIAR BOZORGHIA, P.E.
 CITY ENGINEER
 DATE: JANUARY 29, 2021

LATERAL CONNECTION TO EXISTING VCP MAIN - TYPE 5

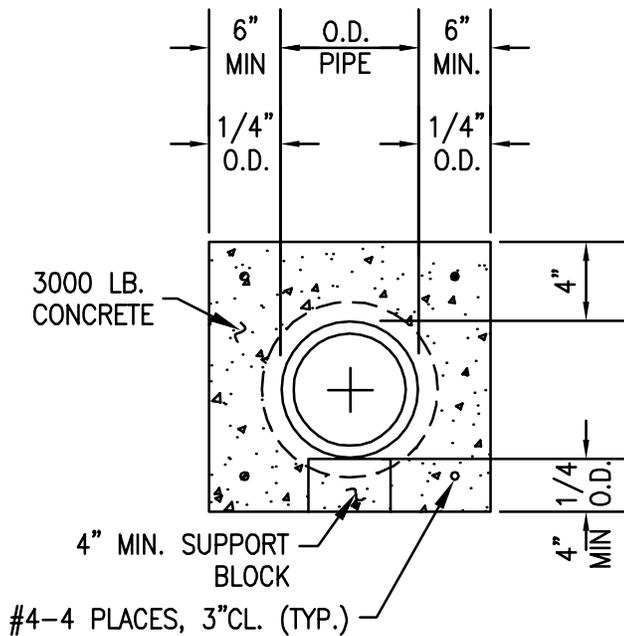
STD. DETAIL No.
SS-7A



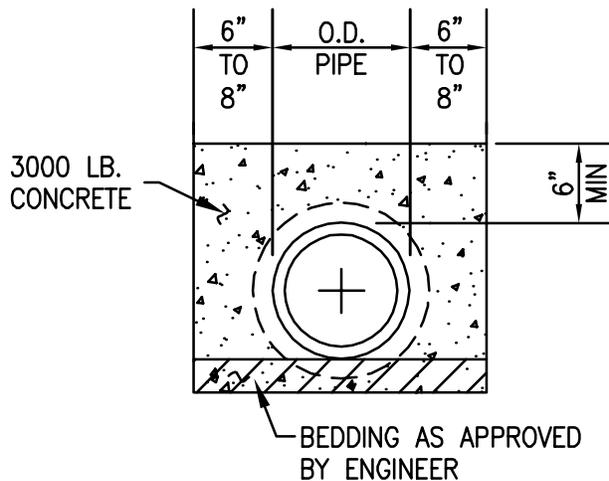
CRADLE FOR EXCESSIVE TRENCH BOTTOM WIDTH



CONCRETE BLOCK



CONCRETE ENCASEMENT



CONCRETE JACKET

NOTES:

1. ALL PIPING TO BE DUCTILE IRON (CONCRETE LINED) AND POLY WRAPPED UNLESS OTHERWISE SPECIFIED BY CITY ENGINEER.
2. SUBSTITUTE MATERIALS CAN BE USED FOR CONCRETE JACKETS AND ENCASEMENT PER APPROVAL OF CITY ENGINEER.

NO SCALE



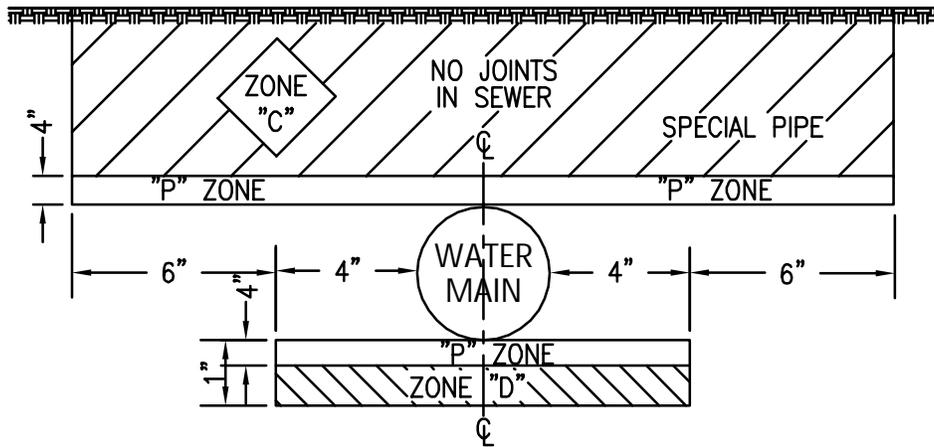
CITY OF HALF MOON BAY, CALIFORNIA STANDARD DETAIL

APPROVED BY:
 PEYKAN ABBASSI, P.E.
 CITY ENGINEER
 DATE: JULY 19, 2016

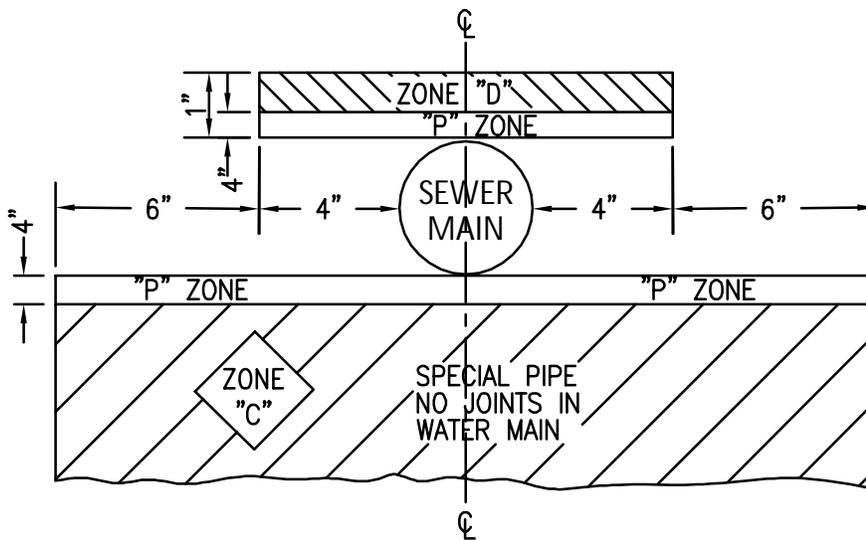
**CONCRETE ENCASEMENT
 DETAIL**

STD. DETAIL No.
SS-9

WATER & SEWER MAIN CROSSINGS



CASE 1
NEW SEWER



CASE 2
NEW WATER

NOTES:

1. "P" ZONE IS A PROHIBITED CONSTRUCTION ZONE PER SECTION 64630, TITLE 22, CALIFORNIA ADMINISTRATIVE CODE.
2. ZONE "C" SPECIAL PIPE, NO JOINTS.
3. ZONE "D" SPECIAL PIPE, NO JOINTS.
4. NO JOINTS TO BE WITHIN 10' OF EDGE OF WATER MAIN, EXCEPT AS APPROVED BY CITY ENGINEER.

NO SCALE

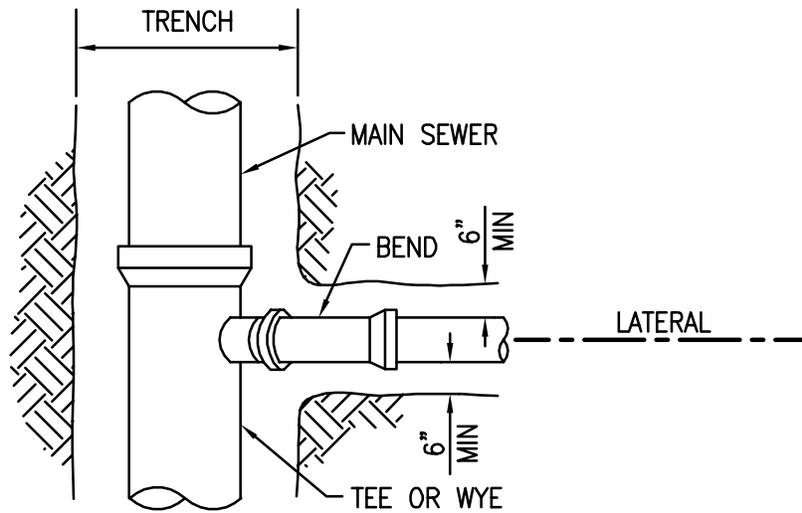


CITY OF HALF MOON BAY, CALIFORNIA STANDARD DETAIL

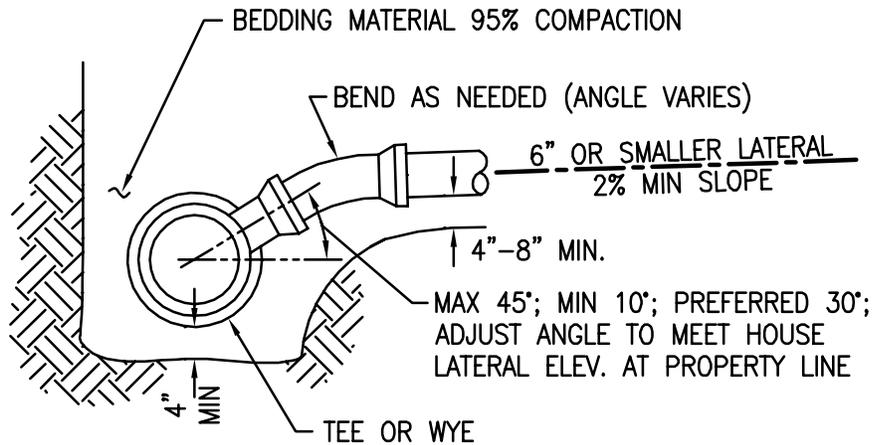
APPROVED BY:
PEYKAN ABBASSI, P.E.
 CITY ENGINEER
 DATE: JULY 19, 2016

**SANITARY SEWER & WATER MAIN
 SEPARATION DETAILS (CROSSING)**

STD. DETAIL No.
SS-10B



PLAN



ELEVATION

NOTES:

1. TEES OR WYES AT VERTICAL ANGLES GREATER THAN 45°, ONLY AT PROPERTY LINE (SEE DETAIL SS-7)
2. EXTRA CARE SHALL BE TAKEN IN PLACING & COMPACTING MATERIAL FOR TEE SUPPORT, TAMP UNDER & AROUND ALL FITTINGS.
3. TYPE "A" 3/8" MINUS PER UTILITY TRENCH DETAIL UT-1. (24" ABOVE PIPE IF TYPE D MATERIAL IS USED IN INTERMEDIATE ZONE.

NO SCALE

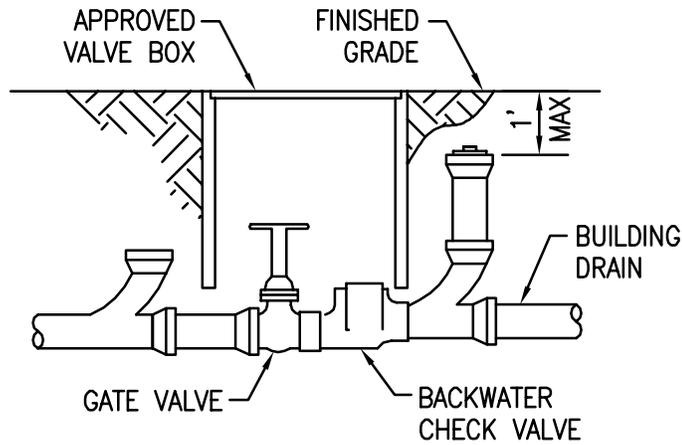


CITY OF HALF MOON BAY, CALIFORNIA STANDARD DETAIL

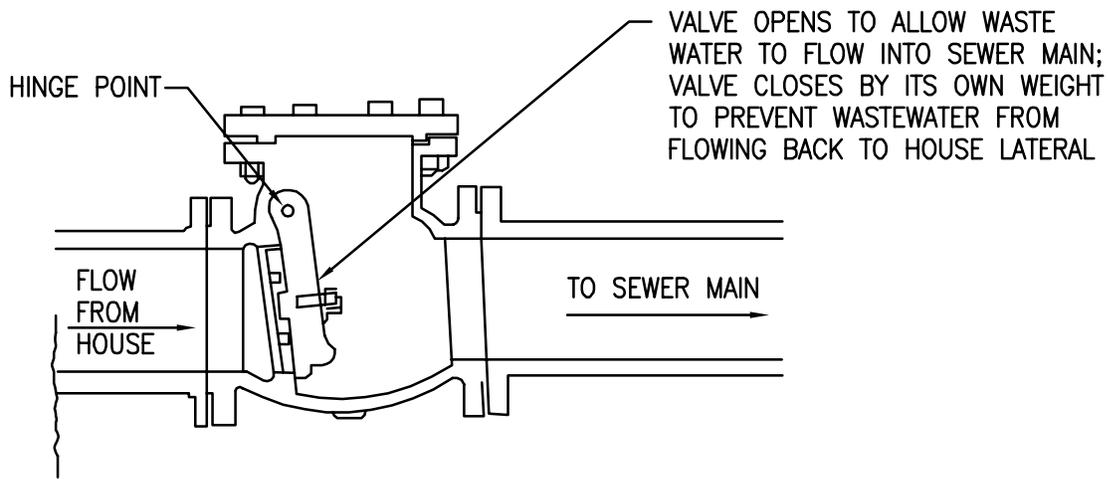
APPROVED BY:
 PEYKAN ABBASSI, P.E.
 CITY ENGINEER
 DATE: JULY 19, 2016

SEWER TEE DETAIL

STD. DETAIL No.
SS-11



**BACKWATER CHECK VALVE
& SHUTOFF SYSTEM**



BACKWATER CHECK VALVE

NOTES:

1. LOCATION OF BACKWATER CHECK VALVE DEVICE TO BE APPROVED BY CITY BUILDING DEPARTMENT PRIOR TO INSTALLATION.
2. BACKWATER CHECK VALVE AND SHUTOFF SYSTEM IS REQUIRED WHEN OVERFLOW SYSTEM CANNOT BE USED WITHOUT POSSIBLE SERIOUS PROPERTY DAMAGE.
3. USE BACKWATER OVERFLOW SYSTEM WHEN THE LEVEL OF THE LOWEST PLUMBING FIXTURE IS AT OR BELOW A POINT 18" ABOVE THE LEVEL OF THE NEAREST UPSTREAM SEWER STRUCTURE (MANHOLE OR RODHOLE).
4. CLEANOUT SIZE SHALL BE EQUAL TO HOUSE LATERAL SIZE.

NO SCALE



CITY OF HALF MOON BAY, CALIFORNIA STANDARD DETAIL

APPROVED BY:
PEYKAN ABBASSI, P.E.
 CITY ENGINEER
 DATE: JULY 19, 2016

**BACKWATER CHECK VALVE
SYSTEM DETAIL**

STD. DETAIL No.
SS-12

NOTES (CONTINUED)

5. LOWERING EXISTING PRECAST CONCRETE SEWER MANHOLE

- A. REMOVE SUFFICIENT GRADE RINGS TO LOWER THE MANHOLES AS REQUIRED. APPLY CLASS "D" MORTAR TO A HEIGHT NOT EXCEEDING (3 IN.) FOR ADJUSTMENT TO FINAL GRADE.
- B. WHERE REMOVAL OF GRADE RINGS WOULD RESULT IN THE UPPER SEGMENT OF THE SHAFT BEING LESS THAN (12 IN.) IN HEIGHT, REMOVE THE REDUCER AND SUFFICIENT SECTIONS OF THE LOWER SEGMENT OF THE SHAFT AND REINSTALL ANY NECESSARY SEGMENT OF THE LOWER SHAFT, THE REDUCER, AND THE GRADE RINGS TO CONFORM TO THE REQUIREMENTS OF THIS PLAN.
- C. EXISTING GRADE RINGS NEED NOT BE REMOVED IF EXISTING MORTAR IS REMOVED, AND AT LEAST (1 ½ IN.) OF MORTAR MAY BE PLACED ON TOP OF THE EXISTING GRADE RINGS TO RESEAT THE FRAME.

6. REPLACE BRICK REDUCER WITH PRECAST CONCRETE REDUCER AND SHAFT

UNLESS OTHERWISE INDICATED ON THE PLANS, THE CONTRACTOR SHALL INSTALL A PRECAST CONCENTRIC CONCRETE REDUCER, CONCRETE GRADE RINGS, AND CONCRETE PIPE IN LIEU OF RECONSTRUCTING A BRICK REDUCER, PROVIDED:

- A. THE MAXIMUM I.D. OF SEWER PIPE CONNECTED TO THE MANHOLE DOES NOT EXCEED (8 IN.)
- B. THE CONTRACTOR SECURES PRIOR APPROVAL FROM THE ENGINEER TO INSTALL THE CONCENTRIC REDUCER ONTO THE MANHOLE SHAFT. THE ENGINEER MAY, AS PART OF THE INSTALLATION, REQUIREMENTS, REQUIRE THE CONTRACTOR TO COAT THE INSIDE OF THE REDUCER, RINGS, AND PIPE WITH AN APPROVED COATING.
- C. THE CONCRETE GRADE RINGS, THE CONCRETE REDUCER, AND ANY CONCRETE PIPE SHALL BE JOINED TOGETHER AND BEDDED ONTO THE EXISTING BRICK MANHOLE WITH CLASS "D" MORTAR. THE DEPTH, WIDTH, AND THICKNESS OF THE MORTAR SHALL BE OF SUFFICIENT DIMENSIONS TO PROPERLY AND ADEQUATELY JOIN AND BED THE COMPONENT PARTS.



CITY OF HALF MOON BAY, CALIFORNIA STANDARD DETAIL

APPROVED BY:
PEYKAN ABBASSI, P.E.
CITY ENGINEER
DATE: JULY 19, 2016

**RAISING AND LOWERING
MANHOLE NOTES (CONTINUED)**

STD. DETAIL No.
SS-13B

CITY OF HALF MOON BAY
DEPARTMENT OF PUBLIC WORKS
STANDARD SPECIFICATIONS

GENERAL NOTES

1. ALL REFERENCES TO "DISTRICT" IN THESE GENERAL NOTES SHALL MEAN THE APPROPRIATE CITY SEWER OR SEWER AUTHORITY MID-COASTSIDE (SAM).
2. THE APPROVAL OF THESE PLANS BY THE CITY SHALL BE INTERPRETED TO MEAN THAT THE SANITARY SEWER DESIGN SHOWN ON THESE PLANS MEETS THE CITY'S STANDARDS. THE CITY'S APPROVAL IN NO WAY GUARANTEES ANY OTHER ASPECT OF THIS PLAN OR ITS ACCURACY RELATIVE TO ACTUAL FIELD CONDITIONS.
3. THE CONTRACTOR SHALL CONTACT THE CITY AT (650) 726-8260 TWO (2) WORKING DAYS IN ADVANCE OF BEING ANY SANITARY SEWER WORK. THE CONTRACTOR SHALL THEREAFTER KEEP THE INSPECTOR FOR HE CITY INFORMED OF SCHEDULE FOR SANITARY SEWER WORK.
4. ALL SANITARY SEWER WORK CONSTRUCTED WITHOUT INSPECTION BY THE CITY OR SAM SHALL BE REMOVED AND RECONSTRUCTED WITH INSPECTION.
5. THE CONTRACTOR SHALL CONTACT UNDERGROUND SERVICE ALERT FORTY-EIGHT (48) HOURS IN ADVANCE OF BEGINNING ANY WORK.
6. THE CONTRACTOR SHALL FIELD VERIFY THE LOCATION OF ALL UTILITIES BEFORE BEGINNING ANY EXCAVATING.
7. THE CONTRACTOR SHALL OBTAIN ANY AND ALL PERMITS REQUIRED BY THE CITY BEFORE BEGINNING ANY SANITARY SEWER WORK.
8. UPON THE COMPLETION OF CONSTRUCTION A COMPLETE SET OF REPRODUCIBLE MYLAR "AS-CONSTRUCTED" PLANS SHALL BE PROVIDED TO THE CITY.
9. SANITARY SEWER SERVICE SHALL BE MAINTAINED AT ALL TIMES. THE CONTRACTOR SHALL USE WHATEVER MEANS ARE NECESSARY (E.G. PUMPS, ETC.) TO MAINTAIN THIS SERVICE DURING CONSTRUCTION.
10. PRIOR TO COMMENCING ANY SANITARY SEWER WORK IN OFF-SITE EASEMENTS THE CONTRACTOR SHALL PROVIDE THE CITY WITH ADEQUATE EVIDENCE THAT ALL AFFECTED PROPERTY OWNERS (AND TENANTS WHERE APPLICABLE) WERE NOTIFIED WELL IN ADVANCE OF THE DATE WORK IN THESE EASEMENTS WAS TO BEGIN AND THAT THEY HAVE UPDATED THAT NOTICE IN A TIMELY MANNER WHEN THOSE DATES HAVE CHANGED.



CITY OF HALF MOON BAY, CALIFORNIA STANDARD DETAIL

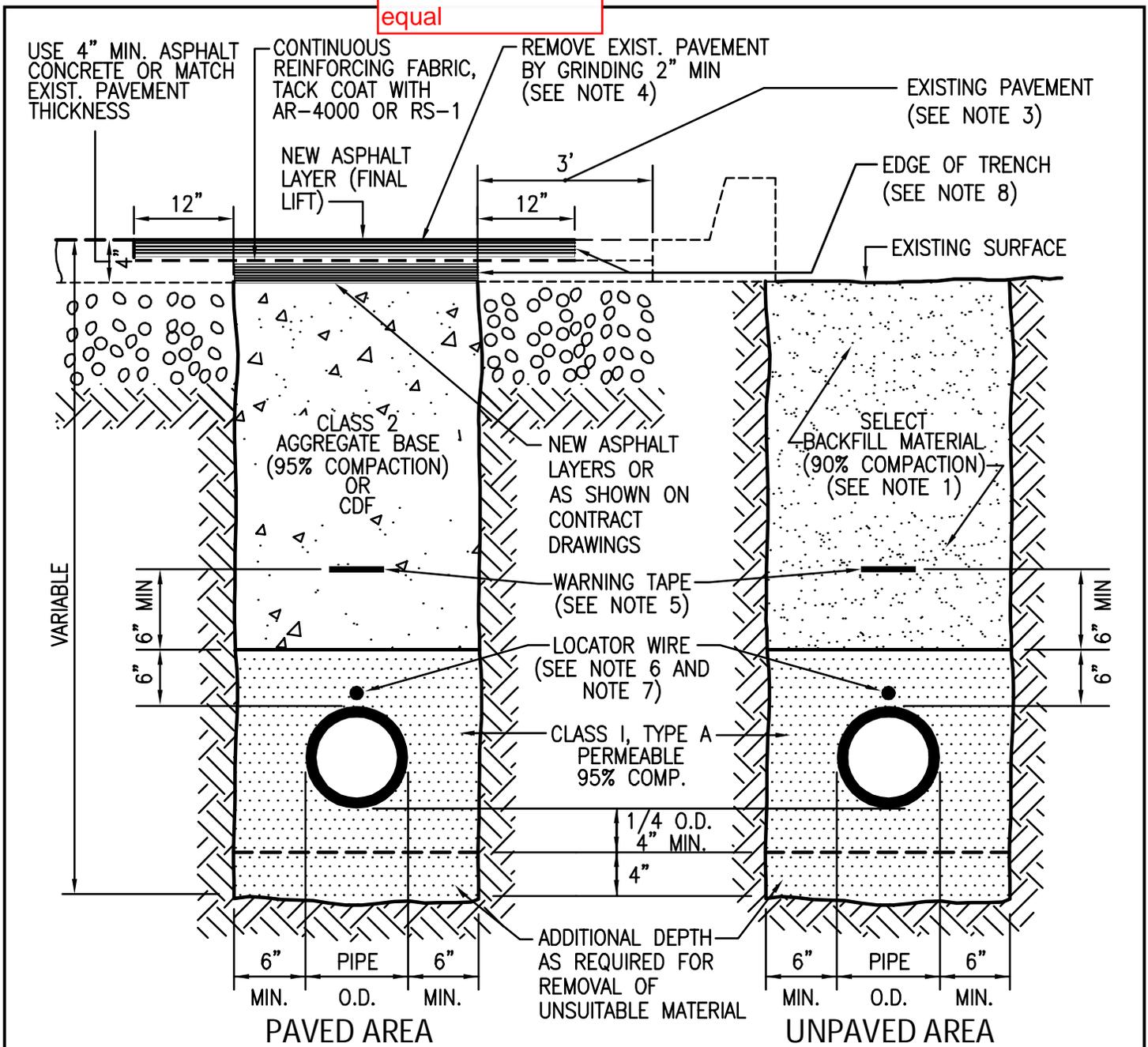
APPROVED BY:

PEYKAN ABBASSI, P.E.
CITY ENGINEER
DATE: JULY 19, 2016

**GENERAL NOTES FOR
SANITARY SEWER PLANS**

STD. DETAIL No.
SS-14

Glass Grid 850 or equal



NOTES:

1. SELECT BACKFILL MATERIAL - MATERIAL FROM EXCAVATION, FREE FROM STONES OR LUMPS EXCEEDING 3" IN GREATEST DIMENSION, VEGETABLE MATTER OR UNSATISFACTORY MATERIAL. (SEE SPECIFICATIONS)
2. FOR NEW STREETS USE DESIGN STRUCTURAL SECTION AS SHOWN ON PLANS.
3. IF THE EDGE OF THE TRENCH FALLS WITHIN 3' OF THE GUTTER, THE ENTIRE PAVEMENT SHALL BE REMOVED.
4. IF EXISTING PAVEMENT IS LESS THAN 3" THICK, PAVEMENT EDGE SHALL BE SAWCUT TO FULL DEPTH IN LIEU OF GRINDING.
5. PLACE WARNING TAPE 14" ABOVE PIPE.
6. PLACE LOCATOR WIRE AT TOP OF PIPE. (FOR WATER PIPES AND SANITARY SEWER FORCE MAIN PIPES ONLY)
7. FOR NEW SANITARY SEWER AND STORM DRAIN PROJECTS, LOCATOR WIRE IS NO LONGER NEEDED.
8. IF IN LIEU OF GRINDING, THE T-TRENCH IS CUT THE FULL DEPTH OF THE PAVEMENT THEN THE EDGE OF THE T-TRENCH SHALL BE CONSIDERED THE NEW EDGE OF TRENCH.

NO SCALE



CITY OF HALF MOON BAY, CALIFORNIA STANDARD DETAIL

APPROVED BY:
 PEYKAN ABBASSI, P.E.
 CITY ENGINEER
 DATE: JULY 19, 2016

UTILITY TRENCH DETAIL

STD. DETAIL No.
UT-1

VOLUME III
DESIGN CRITERIA

DESIGN CRITERIA

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THE CITY OF HALF MOON BAY

ENGINEERING STANDARDS

VOLUME III: DESIGN CRITERIA

PART I - GENERAL ENGINEERING PLAN REQUIREMENTS

The following criteria has been established by the City of Half Moon Bay to guide Consulting Engineers in preparing and processing maps, plans, studies, reports processing and documents for subdivisions and developments, and shall apply to both public and private improvements. Conformance to these Standards is required, and these criteria should be considered as minimum requirements.

See the latest edition of the City of Half Moon Bay Municipal Code for applicable City ordinances and regulations. Copies of Ordinances and Codes can be purchased at the office of the City Clerk.

A. Preliminary Investigation

1. Upon request from the Consulting Engineer, the Engineering Division will furnish if available, the Consulting Engineer with prints of base maps showing existing sanitary sewer lines, "As-Built" plans of adjoining streets (if available), storm drain, bench mark locations, monument locations, and these Design Criteria. The locations and elevations of existing utilities shall be verified in the field by the Engineer and shown on the plans.
2. If there are facilities in the street whose depth and/or location cannot be determined without excavation, and if the knowledge of those depths and locations are critical to the design, the Design Engineer shall engage a private contractor, obtain permits, and make necessary investigations.
3. Submittals are made only after a Registered Civil Engineer has completed and signed the plans. Submittals shall include a cover letter, along with the plans and the design calculations for review and approval by the City Engineer. Incomplete plans will be returned without being reviewed.
4. The design engineer shall also obtain information on utilities from PG&E, AT&T, XFINITY, Cable, Comcast, RCN, and any other known public utility company.

B. Submittal Requirements

1. For the initial submittal, the Design Engineer should use the following checklist for submitting material to the City of Half Moon Bay Engineering Division. Submittals will be rejected unless they are complete, and as a minimum include the following items:
 - a) For All Projects:
 - i. Improvement Plans & Specifications (4 copies)
 - ii. Landscape and Irrigation Plans (3 copies)
 - iii. Soils and Geotechnical Report

- iv. Detailed Cost Estimate
- v. Right-of-Way or Easement Plats and Legal Descriptions
- vi. Hydrology Calculations & Drainage Area Master Plan
- vii. Deposit for Plan Checking and Map Checking (Attachment "H")
- viii. Statement of which flood zone the site is located and whether it is subject to flooding.

b) In Addition to the Above Information, for Projects Involving Subdivision of Land:

- i. Subdivision Map (2 copies)
- ii. Covenants, Conditions & Restrictions (CC&R'S) (3 copies)
- iii. Subdivision Maps of the Surrounding Areas
- iv. Map Calculations and Lot Closures
- v. Preliminary Title Report
- vi. Architectural Plans (for condominium projects)
- vii. *Erosion Control Plan
- viii. *Sewer System Analysis
- ix. *Structural Calculations for retaining walls
- x. Tree Protection Plan

(*) These Items may or may not be required, depending on site conditions, and as determined by the Engineering Division.

- 2. Engineering will review the plans and return "redlined" checkprints. Subsequent submittals shall be accompanied by the City's "redlined" plans and may include a separate, written response.
- 3. Final submission shall include the signed original plans, and for subdivisions shall include the executed subdivision map. (See Attachment "I" for material to accompany the subdivision map.)

C. Improvement Plans

- 1. All plans shall be on City Standard 24" x 36" sheets of good quality paper with a one-and-a-half (1-1/2) inch margin on the left side and a one-half inch margin on the top, bottom and right side. All profiles shall be at the bottom of the sheet. Plan and profile paper shall be used for the sheets containing water, sanitary sewer facilities, and storm drains. The title blocks in electronic format are available at Engineering and Construction.
- 2. Plans shall be in ink. At the discretion of the Engineering Division plans may be rejected for poor quality.
- 3. The scale for improvement plans shall be 1" = 20' for the horizontal, and 1" = 2' for the vertical for slopes up to 5%; 1" = 4' vertical scale may be used for slopes greater than 5%. (1" = 40' for the horizontal may be allowed depending on the complexities of the job and upon prior approval.) Larger scales may be used (i.e., 1" = 10") only if required to show more detailed information, and then on a limited area
- 4. All lettering shall be a minimum height of 0.1".

5. No shading will be allowed.
6. All plans must show the following information, and for multiple sheets of plans, the drawings shall have a cover sheet. That cover sheet shall contain the following items:
 - a. Location map, and vicinity map with north arrow.
 - b. Typical Street Sections, including Design "R" Value and Traffic Index with type of curb and sidewalk for each street.
 - c. Project bench mark and its location referenced to City Datum.
 - d. Title block indicating name of project, name of consultant, scale and date. (See Attachment "G").
 - e. Approval blocks to be signed by City of Half Moon Bay.
 - f. Those parts of the Standard City Legend, (Standard Detail AA-1) and of the Standard City Abbreviations, (Standard Detail AA-2) that are applicable to the project.
 - g. A list of City of Half Moon Bay Standard Details Referred to in the Improvement Plans.
 - h. A composite map showing an overview of the project. Utilities should be shown on the composite maps, but need not be dimensioned.
 - i. General Notes (See Attachment "A").
 - j. Sheet Index.
 - k. Certifications by Soils Engineer and Civil Engineer (See Attachment "B").
 - l. Design Engineer's signature and stamp (including date of expiration). Each additional sheet of the plans shall have an approval block for the City and a title block.
 - m. Design Engineer's business name and address.
7. Details shall be put on a separate sheet and cross-referenced on the appropriate plan sheet:

1 Detail No.
4 Sheet No.

References to City Standard Detail drawings shall be by appropriate drawing number. As follows:

M-1 Standard Drawing No.
 RCS

8. Drawing number. The following information shall be shown on the plans:

- a. Design Data:
 - 1) North Arrow and Scale
 - 2) Right-of-Way Lines
 - 3) Lot Lines
 - 4) Boring Locations
 - 5) Structures
 - 6) Street Names
 - 7) Size, Material and Length of Each Run of Pipe
 - 8) Match Lines
 - 9) Limit of Work & Conforms
 - 10) Coordinate Values on Control Line Monuments Where Available
 - 11) Trees 6" in Diameter and above (existing & proposed)
 - b. Existing topographic information, including property up to at least 50 feet beyond the project boundary of the property; or as required on adjoining streets to establish existing drainage patterns.
 - c. Plan and profiles of proposed public and private streets and utilities.
 - d. Grading, including both existing and proposed contours, and supplemental cross sections as required.
 - e. Traffic control sign and striping.
9. Profile Items Shown When Applicable.
- a. Conventional street cross-sections shall include three-line street profiles: top(s) of curb, centerline and original ground line. Raised median will have top of median curbs in addition to the normal three-line profile. Irregular street sections may use other profiles as required by the City Engineer.
 - b. One line profiles (centerline) will be accepted if the following note is added: "Top of curb elevations are (dimension) feet (above/below) the centerline elevations." Where this standard crown or curb height cannot be maintained, the curb profiles are required.
 - c. Curb return profiles.
 - d. Vertical curb lengths.
 - e. Curb inlet size, type and station.

- f. For cul-de-sacs, top of curb profiles around the sac.
 - g. The size, material, slope, strength (D-load or wall thickness) on each run of pipe.
 - h. Existing improvement profiles being joined.
 - i. Show all existing driveways, structures, pipelines, etc., which affect the profile.
 - j. For storm drains, show the energy grade line and elevations at each structure.
10. Where a partial street is being constructed to widen an existing street, provide working cross sections at 50-foot intervals up to 100 feet past the conforms, more frequently as required to show the conforms with existing pavement.
11. All proposed improvements shall be located on the drawings by one of the following methods:
- a. Stationing and offset (from west increasing easterly, from south increasing northerly.)
 - b. Coordinates
 - c. Dimensions

Whichever of the methods is chosen, the basis of the method must be clear and referenced to some existing feature which will remain.

D. Specifications

Half Moon Bay Standard Technical Specifications and Standard Details are available, at a cost, from the Engineering Division.

E. Utility Systems

- 1. New electrical distribution system, gas, telephone and Cable T.V. facilities shall be placed underground according to the standards of the utility companies.
- 2. The alignment of these installations shall be approved by the Engineering Division, and shown on the improvement plans.

F. Street Trees - Landscaping and Irrigation

- 1. Street trees and landscaping shall be designed and built to the satisfaction of the Public Works Services Department and the Engineering Division. The landscaping includes the common areas and the frontage along the public streets adjacent to the development or subdivision.
- 2. For common area landscaping, soil samples shall be taken off the existing on- site soil, or the imported material, and recommendations shall be submitted for soil amendments.

G. Covenants, Conditions and Restrictions (CC&R's)

1. Where it is applicable for the maintenance of the common areas, the private street system, the sewer facilities, the storm drain facilities, the street lighting and traffic control and the landscaping, a Homeowners Association shall be established prior to the recordation of the Planned Development Permit and the final subdivision map.
2. The CC&R's shall be submitted to the Engineering Division, for coordination and approval.

H. Improvement Security

1. Installation of all improvements shown on the plans as approved by City Engineer for a development shall be secured by bonds or certificates of deposit.
2. Provide a detailed cost estimate prepared by the design engineer for review and approval by the City Engineer. The estimate shall include 10% for contingencies and 5% for construction engineering.
3. Security for Faithful Performance and for payment of Labor and Materials are each to be 100% of the approved Engineer's Estimate.

I. Fees

1. Prior to approval of the subdivision map, the developer shall deposit all City plan checking fees and inspection fees and any other fees to be paid according to City ordinance. (See Attachment "H")
2. Prior to obtaining a building permit, the developer shall pay the necessary sewer and water fees according to the latest City Ordinance.

J. Condominium Plans

1. The condominium plan shall include, but shall not be limited to, the following information: site plan with the private access road layout; parking areas layout with designations; building layout. The site plan shall be dimensioned with bearings, setback distances, etc.
2. The condominium plans shall include all building plans, all or typical unit plans, fully dimensioned, including ceiling heights, etc.
3. Condominium plans shall be on 18" x 26" sheets as part of the Final Map.

K. Final Map

1. Follow the checklist in Attachment "I" for completing the Final Map.
2. Building permits will not be issued and construction shall not start, until the Final Map has been recorded.

L. Construction Permits

1. Construction Permits are required for installing facilities within any public right-of-way or within an easement, where such construction is not covered by a subdivision agreement. Examples would be, permits to extend water, sewer, or storm drain facilities; construction of facilities under a use permit or a building permit.
2. Submit three (3) sets of plans, an engineer's estimate of cost, and a deposit for plan checking and inspection, in accordance with the schedule shown on Attachment "H".
3. The applicant will be required to fill out an application for the Construction Permit, post bonds and insurance as required, before plans can be approved.
4. When a construction permit is approved, the following note will be put on each sheet where it applies.

"For (description of private facility) within the (public right-of-way, drainage easement, etc.), see Construction Permit #_.
5. Some typical examples of construction permits are private drains, fire lines, sewer lines tying into public mains; sidewalk and driveway reconstruction in public right-of-way.

M. Reference Standards for Design

The following texts are some of the references to be used as a minimum requirement in determining the performance standards for improvements designed in this section.

1. Handbook of Hydraulics, King & Brater.
2. American Water Works Association (AWWA) Standards and Manuals.
3. American Society for Testing & Materials (ASTM) Standards.
4. Sewer Design And Construction, Manual No. 37, American Society of Civil Engineers.
5. Uniform Building Code, as adopted by City.
6. Uniform Plumbing Code, as adopted by City.
7. Erosion and Sediment Control Field Manual, published by the California Regional Water Quality Control Board.
8. Highway Design Manual, Traffic Manual (chapters 1, 2, 3, 7, and the lighting portions of chapter 9), Caltrans, latest editions.
9. California Manual on Uniform Traffic Control Devices, Caltrans latest edition
10. Standard Plans and Specifications, Caltrans latest edition.

11. Lighting Handbook, by Illuminating Engineering Society (IES)
12. Institute of Transportation Engineers Traffic Engineering Handbook, latest edition.
13. The Publications of the Portland Cement Association and the Asphalt Institute.
14. Uniform Fire Code, as adopted by Council.

PART II - SOILS AND GRADING CRITERIA

A. Soils and Foundation Report

1. Unless waived by the City Engineer, a soils report shall be prepared by a registered Professional Engineer, which shall include the results of an investigation of the following, based upon adequate test borings.
2. A structural foundation investigation and recommendation for all proposed facilities.
3. Report on investigation and recommendation for excavation and grading.
4. Report on investigation and recommendations for trench backfill for all soils encountered in the work to assure proper compaction.
5. Soil test on "R" values of soil for determining street sections.
6. The soils shall be tested for corrosivity using the procedures described in Appendix "A" of AWWA C-105. Any soil having a soil-test evaluation of 10 points or more shall require the use of cathodic protection.
7. Recommendations for landscaping to maintain adequate slopes for proper drainage and erosion control.

B. Final Soils Report

1. At the completion of a project, the soils engineer shall submit a "Final Report" to the Engineering Division.
2. The Final Report shall include a map showing the locations of all compaction tests, a summary of all compaction tests performed, a certification that the work was substantially completed in accordance with the plans and specifications, comments on any unusual or problem situations which occurred during construction.

C. Grading Plans, General

1. The developer's geotechnical engineer shall review the grading plans prior to City approval and certify that the plans are in compliance with his recommendations.
2. Grading shall conform to the requirements of the Grading Ordinance and Chapter 70 of the UBC. The following general grading requirements shall govern:
 - a. Continuous soils inspection shall be provided by the developer's geotechnical engineer during the grading operation. Compaction reports shall be submitted and approval obtained prior to start of the next phase of the work. Reports shall be signed by a registered Professional Engineer.
 - b. The developer shall submit the compaction test results for review by the City Engineer.

D. Rough Grading Plans

1. Rough grading plans shall be of adequate scale to show all the site information on one sheet.
2. Information to be shown on the rough grading plan shall include, but is not limited to:
 - a. Pad elevation for each building;
 - b. Rough grade at each property corner and at the front yard slope;
 - c. Street grade at each property line;
 - d. Rough street section at subgrade elevation;
 - e. Site drainage pattern and inlet structures;
 - f. Existing and proposed contours;
 - g. Areas of cut and fills, and
 - h. Earthwork quantities, for a balanced site.

E. Plot and Finish Grading Plans

1. There is no set format for the plot and finish grading plan. It should be on a separate sheet from the sheets showing the on-site utilities. The format will depend on (a) the scale, (b) the size of the project, and (c) the detail needed to show the required information clearly. Follow the checklist shown on Attachment "C". The information needed is as follows:
 - a. Top of curb and gutter flowline elevations of the City street to which the project is draining.
 - b. The "finished floor" and "pad" elevations of the buildings. The minimum finished floor elevation shall be set at six inches above the referenced flood plain plus predicted settlement.
 - c. Design finished grade elevations at all lot corners.
 - d. A section showing the relationship between the building foundation and the ground outside the foundation and the sideyard swales.
 - e. Any walls, fences or structures whether existing (if they will remain), or proposed.
 - f. Surface swales, at 2% minimum slope, except that 1.5% slopes on swales are adequate if area drains are provided, and if downspouts are connected to the drainage system.
 - g. Existing contours and proposed elevations (or contours) clearly showing how the site will drain and the depth of cut and fill.
 - h. Existing elevations on adjacent property and up to 50 feet beyond the property, sufficient to show the effect of the new development on those properties.
 - i. On-site and off-site storm drainage system, as necessary to indicate existing and proposed drainage patterns.
 - j. "Grading certificates" (see Attachment "B" for the wording of these items).

2. Each street intersection shall be shown with contours every 0.2' to show proper drainage patterns.
3. All street and on-site areas shall be provided with an adequate drainage system, as required by Part V, "Storm Drainage Design".
4. In hillside areas, the plans shall include an erosion control plan satisfactory to the Engineering Division. Such plan shall contain the following information:
 - a. A delineation and brief description of the measures to be undertaken to retain sediment on the site, including, but not limited to, the designs and specifications for berms, sediment detention basins, dikes, mulches and erosion control planting, and a schedule for their maintenance and upkeep.
 - b. Special consideration may have to be given to providing flow diverters or backfill stabilizers for steep streets and utility trenches.
5. All trees located on the property or affected by the development.

F. Retaining Walls

1. All retaining walls greater than 4 feet in height, as measured from the bottom of the footing to top of the wall, and walls supporting surcharge or supporting sloping backfill, shall be designed by a registered professional engineer, and supporting calculations shall be submitted along with the improvement plans.
2. Walls shall be designed in accordance with Section 2308 of the Uniform Building Code, or more restrictive criteria as recommended by the project soils engineer.
3. Walls supporting traffic loads within a horizontal distance equal to their height shall be designed with a two-foot earth surcharge.
4. Retaining walls which fall within this category shall be constructed of reinforced concrete or reinforced cement masonry.
5. Walls less than four (4) feet in height may be built out of pressure-treated timber, provided that the material shall be stamped or tagged with the appropriate seal from the American Wood Preservative Board (AWPP) Standard LP-22 or better.
6. Provisions shall be made for draining the water behind the wall to prevent build-up of fluid pressure.
7. Retaining walls in marine environment will require special design considerations as required by the City Engineer.

G. Trenching and Backfill

1. Utility trenches shall be designed to provide five feet of horizontal clearance between respective facilities.

2. Where the depth of cover over any utility is less than three feet or greater than 20 feet, the Design Engineer must provide load calculations, special trench designs, or both, to justify inadequate trench depths.
3. In existing public streets the standard "Tee" trench is to be used with no trenches left open overnight; temporary paving or plating is required.
4. The utility trench must be clear of the influence line from the bottom of the footing on adjacent structures (See Attachment "E").
5. Backfill material is imported and must meet the requirements of the Standard Technical Specifications and Standard Details.
6. In bay mud conditions, trenches will require continuous sheet pile shoring designed by a Registered Civil Engineer. See the Standard Technical Specifications and Standard Details for special requirements for trenching and backfilling in bay mud conditions.
7. Utilities shall be designed to provide 12" of vertical clearance between other utilities.

H. Storm Water Discharge Permit

1. The San Mateo Countywide Storm Water Pollution Prevention Program (SWPPP) has implemented a program to investigate and eliminate the illegal discharges of deleterious, toxic, or hazardous substances into the public storm water system. Half Moon Bay is a co-permittee to the "San Mateo County Storm Water Management Plan, 1993-1998", dated June 21, 1993. On September 15, 1993, the California Regional Water Quality Control Board (San Francisco Bay Region) issued Order No. 93-106, NPDES Permit No. CA 0029921, regulating inter alia, storm water discharges by the City of Half Moon Bay.
2. All construction activity related to grading requires conformance to the SWPPP. All construction activity where clearing, grading, and excavation results in a land disturbance must be covered by a General Construction Activity Storm Water Permit, issued by the State Water Resources Control Board.
3. Developers/Contractors must complete a "Checklist for Construction Requirements" and follow construction "Best Management Practices (BMP)" to prevent illicit discharges to the Storm Drainage System.
4. Engineers shall prepare erosion and sedimentation control plans and specifications to prevent erosion and to control sediment transport. Such plans shall follow the guidance of the "Erosion and Sediment Control Field Manual", published by the California Regional Water Quality Control Board
5. Sites which are within 200 feet of wetland, stream, pond, lake, river or bay will require even more stringent controls, as described in the Checklist for Construction Requirements.

PART III - STREET DESIGN CRITERIA

A. Public Streets, General

1. Caltrans Highway Design and Traffic Manuals shall be used in the design of the horizontal and vertical alignment.
2. The width of the street(s) shall be the minimum as shown on the Standard Detail A-1.
3. Wheelchair ramps shall be included at all intersections, and curb returns. The ramp shall conform to the City Standard Details.
4. For new subdivisions, provide a 5' wide Public Service Easement (PSE) on each side of the dedicated right of way.

B. Alignment

1. Minimum centerline radius of horizontal curvature shall be based upon the existing design speed of adjacent roadways or as determined by the City Engineer.
2. Roadway geometrics at intersections shall be designed to accommodate a standard WB-50, 60 foot turning radius to allow for emergency vehicle access.
3. Right-of-way line radii at intersections shall be a minimum of 15 feet, and face of curb radii shall be a minimum of 25 feet.
4. Where the angle of intersection is acute, or where a sight-distance problem may be anticipated, an increased property line radius may be required by the City Engineer.
5. The angle between centerlines of intersecting streets shall be as nearly right angles as possible, but in no case less than 80 degrees or greater than 100 degrees, except as approved by the City Engineer.
6. All streets entering upon any given street shall have their centerlines directly opposite each other or separated by preferably 300 feet, 200 feet minimum.

C. Gradients

1. Minimum longitudinal grade on any street, public or private, shall be 0.5% for curb and gutter, with a minimum fall of 0.2' around curb returns.
2. Transverse slopes shall be 3%.
3. The maximum grade on any street or alley shall be as follows:
 - a. Arterials: 7%
 - b. Collector streets: 12%
 - c. Residential streets and hillside streets: 15%
4. Super-elevation may be provided on streets where required by the City Engineer. Use Caltrans Highway Design Manual for design of super-elevation.

5. Grades on both sides of the street shall be the same.
6. Vertical curves shall be as follows:
 - a. Residential and industrial streets shall be designed to provide a minimum stopping sight-distance corresponding to a design speed equal to the prima facia residential speed limit plus five miles per hour.
 - b. Major streets and collector roads shall be designed to accommodate vehicle speeds of 35 miles per hour or more.
 - c. Vertical curves shall be used when the algebraic change in grade exceeds 1% and shall have a minimum length of 50 feet.
7. The maximum grade for a permanent cul-de-sac street turning area shall be 5%.
8. The maximum grade at any intersection of two streets shall be 10% within the intersection and for at least 50 feet from the curb return.
9. When any road is extended to a subdivision boundary for the purpose of providing a future connection to adjoining property, the subdivider shall submit an alignment and profile demonstrating the feasibility of such future extension.

D. Pavement, Structural Sections

1. All design shall conform to the State of California Gravel Equivalent Hveem Stabilometer method, using the R-value of the native soil and the minimum traffic indices T.I. as follows:
 - a. For all cul-de-sacs a minimum T.I. of 4.5.
 - b. For all residential streets a minimum T.I. of 5.0.
 - c. All others, use the Traffic Index as determined by the City Engineer, based upon the projected volume of traffic.
2. Road surfacing on all classes of residential streets shall be asphaltic concrete, unless otherwise required and approved.
3. Minimum thickness of asphaltic concrete surfacing shall be four inches (4").
4. Minimum thickness of Class 2 aggregate base material shall be eight inches (8").

E. Private Developments

The above design criteria for public streets shall apply to all Private Streets in new developments, and to all off-street parking and loading facilities with the following additional requirements.

1. The Private Street and off-street parking facility can be designed with "crown" section or with "V" section.

2. If the cross section is crowned, then both sides of the street will have vertical curb and gutter. The curb heights will be 6" and the gutter width will be 12".
3. If the cross section is "V", then a concrete gutter shall be placed along the centerline of the street. The concrete gutter shall be three feet wide and six inches thick. Along each side of the street, a vertical curb with six inch curb- face will be placed.
4. It is permitted for private streets or off-street parking facility with "V" section and adjacent parking bays to place the three foot wide concrete gutter along the parking bay side of the street.
5. The minimum longitudinal gutter slope is 0.50%.
6. The cross slope for asphalt surfaces is 3.0% with a longitudinal slope up to 3.0%; however, 2.0% cross slope is permitted if the longitudinal slope exceeds 3.0%.
7. The minimum pavement section shall be four inch (4") A.C. on eight inch (8") Class 2 Aggregate Base.
8. Pavement shall be installed in two lifts, the final lift of paving shall be installed after all the construction activity is complete including housing construction and landscaping and just prior to final acceptance.

F. Speed Humps

Speed humps may only be installed where approved by the City's Traffic Committee, where an engineering evaluation concludes that the use of such control device is warranted.

1. Dimensions, spacing, location, and traffic control shall conform to the City's Standard Details.
2. Installation shall conform to the City's Standard Technical Specifications.

G. Sidewalks

1. Public and private streets shall be designed to accommodate concrete sidewalks, wherever practical.
2. Sidewalk construction shall consist of either a monolithic (integrally cast with the curb and gutter) or parkway style, as directed.
3. New sidewalk shall match existing construction (monolithic or parkway style).

H. Street Names

1. New street names shall be reviewed and approved in advance by the Fire Department and Sheriff's Office.
2. Names shall not conflict with other similar names within San Mateo County.

PART IV - DRIVEWAYS AND OFF-STREET PARKING AND LOADING FACILITIES

A. Driveways

Driveways, which are defined as any approach to or from a street over and upon an adjacent gutter, curb or sidewalk.

1. All driveway approaches shall conform to the City's Standard Details.
2. No driveway approach to off-street parking spaces shall be constructed which does not serve a garage, carport or garage space to the rear of the building setback line established by the Zoning Ordinance; provided, that a single driveway approach may be constructed to serve a vacant or unimproved lot.
3. For residential driveways, a driveway approach serving a single garage, carport or garage space shall not exceed 15 feet in width, measured from top of curb to top of curb; driveway approaches serving garages, carports or garage spaces for two motor vehicles shall not exceed 26 feet in width, and driveway approaches serving garages, carports or garage spaces for three or more motor vehicles shall not exceed 33 feet in width measured between the top of curbs at curb cuts.
4. For commercial driveways, the maximum driveway approach width is 33 feet between top of curbs at curb cuts. Driveway approach width shall match the existing driveway width beyond the sidewalk.
5. In no event shall the total width of all driveway approaches serving any parcel exceed sixty percent (60%) of the street frontage of the parcel.
6. There shall be twenty-two feet or a multiple thereof between driveway approaches on the same parcel; provided, that the City Engineer may approve a distance between driveway approaches which is not a multiple of twenty-two feet if he finds that the total number of parking spaces available on the street adjacent to the parcel is not reduced by allowing such other distance.
7. No driveway approach shall be located within thirty inches (30") of any traffic signal, electrolier, fire hydrant, pedestrian crosswalk, curb inlet, or any other public improvement or facility of a similar nature.
8. All driveway approaches, whether on an improved or an unimproved street, shall be constructed to the established grade for that street at the right-of-way line. In the event no grade has been established for the street on which the driveway or driveway approach is to be constructed, such driveway or driveway approach shall be constructed to a grade at the right-of-way to be approved by the City Engineer.
9. Driveway ramps up or down to elevated or depressed parking lots or garages shall start at a point 3 feet beyond the right-of-way line, and shall have a grade no steeper than 20%, with a 6 feet long vertical curve located at the grade break (See Attachment "D-2").
10. Long, dead end driveways or private access roads shall be provided with fire truck

turnouts which may take the shape of a “hammerhead” at the end or as “shunts” on the intermediate turnouts. The maximum spacing in turnouts shall be 150 feet. Minimum outside turning radius shall be 48 feet; maximum inside radius shall be 22 feet; minimum straight section shall be 35 feet; minimum driveway width shall be 23 feet. (See Attachment “O”).

B. Parking Lots and Off-Street Parking and Loading Facilities

1. Consult the latest edition of the City of Half Moon Bay Municipal Code or Planning Manager for the schedule of the required number and type of parking spaces for each kind of development.
2. Grading and paving requirements shall conform to Part III, "Street Design Criteria."
3. The horizontal layout shall be as shown on Attachment "D-1". Parking lots shall be landscaped and permanently maintained by the property owner, per the City's Zoning Ordinance.
4. Parking lots and off-site parking and loading facilities shall be designed so that vehicles can enter or exit without backing across public sidewalks or rights-of-way. The turning radius of design vehicles shall be as shown on Attachment "D-2".
5. Compact stalls are allowed up to the maximum ratio allowed by Ordinance. Compact stalls must be permanently painted "Compact."
6. The location of compact parking shall be subject to approval by the City Engineer.
7. Parking facilities, except those in residential areas with four or less stalls, shall include a turn-around area satisfactory to the City Engineer.
8. Parking stalls at the end of rows abutting walls, fences, or other continuous fixed object shall have an additional width of 1.0 feet.
9. Parking stalls next to fences, walls, sidewalks, landscapes or structures shall contain wheel stops, curbs or other protective devices. Where a stall is adjacent to a landscaped median, a 12 inch wide concrete curb or mowband shall be used for passenger ingress and egress.
10. Parking stalls shall be clearly striped or marked.
11. Clearly marked handicapped spaces shall be provided in each parking facility as required by State law.
12. All parking spaces shall have a uniform dimension of 8-1/2' x 18', in a manner provided by the Zoning Ordinance.

C. Sidewalk Repair Criteria

1. The City Engineer or his designated representative, may require concrete, curb and gutter, sidewalks, or driveways to be repaired during review of plans submitted for Building Permit or Construction Permit.

2. Concrete repair may be performed by issuance of a Sidewalk or Encroachment Permit; if in the opinion of the Engineer, the work is minor in nature and involves generally less than \$1000 worth of construction, such Sidewalk Permits are issued at the counter and administered by the Building and Inspection Division.
3. Major concrete repair, if in the opinion of the City Engineer requires a Construction Permit issued by Engineering and Construction, including the posting of bonds and insurance as stipulated in the application.
4. The concrete work is deemed in need of repair if any one of the following conditions prevail:
 - a. The vertical displacement in two adjoining sections of concrete exceeds $\frac{1}{2}$ ";
 - b. The horizontal displacement between two adjoining sections exceeds $\frac{5}{8}$ ";
 - c. The rise in grade exceeds 4" over a horizontal length of 4'; and
 - d. The drop in grade exceeds 3" over a horizontal distance of 4'.
 - e. Spalling in excess of $\frac{3}{4}$ " depth.

PART V - STORM DRAIN DESIGN CRITERIA

A. Hydrology Studies and Hydraulic Analyses

1. Drainage area master plans and calculations are to be submitted with all subdivision improvement plans, permit improvement plans for storm drains, street improvements and with all grading plans. The plans should include the following information:
 - a. For the on-site drainage, a scaled Engineering topographic map shall be used. A second map of appropriate scale, preferably 1"= 100' scale, used to show large off-site drainage basins.
 - b. Delineated and labeled project site plan showing all existing drainage basins, both before and after development.
 - c. The area in acres and the flow (Q) in CFS of all drainage entering and leaving the site prior to development, as well as after development.
 - d. Drainage area and design flows for all the drainage facilities to be constructed.
2. The objective of section is to maintain post development peak runoff rates, and average volume of runoff, similar to existing, pre-development levels. This will minimize the impact to downstream drainage systems, eliminating scour and erosion.
3. Hydraulic calculations shall accompany the plans as follows:
 - a. Show the amount of run-off determined for each of the areas for the 100 year storm.
 - b. Show the peak flow of the pipes and inlets, energy grade lines (EGL), and pipe slopes of the proposed drainage system.
 - c. The project shall make provisions for storage and release of storm water at a rate which will not exceed previously existing conditions release shall be provided to a publicly maintained street or storm drain.
 - d. The amount of post development storage can be determined using the Synthetic Unit Hydrograph or other means satisfactory to the City Engineer. (See Attachment "M").
 - e. Using the Rational Method may be satisfactory for small drainage areas (< 5 acres); larger areas may require more sophisticated methods, as approved by the City Engineer.

B. Size Criteria

1. Closed conduits should be designed for the full flow condition. They may be allowed to operate under pressure, provided the hydraulic gradient is 0.50 feet below the intake lip of any inlet, which may be affected after allowance for settlement. In no event shall the energy gradient rise above the lip of the intake.
2. Use the Manning Formula for determining the flow in pipes, with the minimum "n" value of 0.013 for RCP or PVC; "n" = 0.024 for CMP, and other values as recommended by King's "Handbook" for miscellaneous conduit shapes.
3. Match soffits unless pipes are submerged, whereby it is OK to match inverts. Minimum design velocity shall be 2.0 fps for the design flow.
4. For areas less than 200 acres, to determine peak-flow, use rational formula $Q=CIA$. See Attachment "F" for the IDF Curve to determine the rainfall intensity, using the 100-year storm. Runoff coefficients shall be as follows:

<u>"C" Factor</u>	<u>Description</u>
0.30	Parks and Open Areas
0.50	Residential (R-1) Areas
0.70	Multiple Dwelling and Single-Family Attached Areas
0.90	Paved Areas
0.95	Roof Area and Driveway Area of Townhouses Bordering Streets

(For combined paved and unpaved areas, a "weighted" C-factor shall be used.)
 The initial time of concentration may be estimated from the equation below:

$$T_c = 10 + 0.0078 \left[\frac{L^{3/2}}{H^{1/2}} \right]^{0.77}$$

where: L = the maximum length of travel, in feet.

H = the difference in elevation along the effective slope line, in feet.

T_c = the time of concentration, in minutes.

5. For losses in bends and structures, use the following formula:

$$H = \frac{K V^2}{2g} \quad \text{where } K = 1.25 \text{ for } 90^\circ \text{ bends, } K = 0.75 \text{ for bends between } 45^\circ \text{ and } 90^\circ, \text{ and } K = 0.50 \text{ for structures and bends } 0^\circ - 45^\circ.$$

6. Minimum size pipe for publicly-maintained systems shall be 12" in diameter.

C. Alignment

1. Conduits 24 inches or less in diameter should be laid on straight alignment and uniform grade between consecutive manholes.
2. Horizontal and vertical curves are not recommended. However, in cases where justification can be shown, limited use of such designs will be considered. A design report or letter report will be required from the design engineer to document the justifications for utilizing a curved alignment.
3. Radii of curvature must be of sufficient length to limit deflections to 1/2 the manufacturer's recommended allowable deflection. Complete and accurate details shall be furnished, including: the exact location of such curved sewers, length of curve, radius of curvature, and stationing of curve points.
4. Where curved alignments are utilized, the City may require the following:
 - a. Slope greater than minimum slope for the size of pipe.
 - b. Manhole spacing of less than 300 feet.
 - c. Provide a licensed professional land surveyor or engineer to continuously monitor installation of the curved pipe during construction.
 - d. Video inspection of curved pipes prior to final acceptance.
5. The following are common locations required for manholes/drainage structures:
 - a. Where two or more conduits join,
 - b. At intermediate points on long pipe runs, maximum spacing of 300 feet,
 - c. Where the conduit changes in size,
 - d. At sharp curves or angle points in excess of 10 degrees, and
 - e. Points where an abrupt change of the grade occurs.
6. Minimum horizontal clearance to other utilities shall be five feet.
7. Minimum vertical clearance from other utilities shall be one foot.
8. Minimum cover from top of pipe to surface shall be three feet.
9. The maximum angle from in-going pipe to outgoing pipe shall be 90 degrees.
10. Minimum horizontal clearance from any structure shall be based on the criteria of keeping the bottom of the trench clear of the "1 to 1" plane from the bottom of the structural footing (Attachment "E").

D. Materials

1. Materials shall be Reinforced Concrete pipe for pipes 12" in diameter and larger, and PVC for pipes less than 12" conforming to the requirements of the City's Standard Technical Specifications. Minimum "D" Load values for RCP shall be 1350.
2. Trench load calculations shall be provided where depth of cover is less than three feet and greater than 20 feet.
3. For plastic pipe the maximum allowable deflection shall be 3%.

E. Storm Drain Design for Private Street Systems

1. All concentrated run-off shall be carried in to an on-site stormwater treatment facility.
2. The minimum pipe diameter is eight inches. Minimum velocity is 2 fps for the design flow.
3. All downspouts from buildings shall be shown with their relationship to the storm drain system. In no case shall the downspouts be permitted to discharge over walkway or a sidewalk or porch, or patio.
4. Parking bays should drain to a grass/vegetated swale, then into the concrete gutter of the private street.
5. Water from valley gutter and drainage devices shall be intercepted by an appropriately sized stormwater treatment facility and piped to the nearest storm drain in the street.
6. Inlets shall be sized such that the minimum inside width of the structure is 1 foot larger than the inside diameter of the out-going pipe.
7. Inlets over 4 feet deep shall have a minimum opening of 24" x 30", with steps to allow access.

F. NPDES Permit Requirements

1. Every project must have a completed "NPDES Permit Compliance Checklist" (Attachment "P").
2. The checklist shows the requirements needed in order to prevent stormwater pollution as part of the County-wide Stormwater Pollution Prevention Program (STOPPP).
3. In addition to erosion control plans, the applicant will have to provide for permanent source control measures selected from the City's "Model List of Source Control Measures".

4. Group I Projects (over 1 acre of impervious surface) will need to obtain a Notice of Intent (NOI) with the State Water Resources Control Board, and must prepare a Stormwater Pollution Prevention Plan (SWPPP).
5. Developers will be asked to sign an Operations and Maintenance Agreement for any new permanent stormwater treatment control measures.
6. Plans will need to be approved by the San Mateo County Mosquito Abatement District. See the County's Vector Control Plan for guidance on how to address potential mosquito breeding habitat.
7. Group I projects in the hillside area, will require hydrograph modification per City's SWPPP.

PART VI - SANITARY SEWER SYSTEM DESIGN CRITERIA (Public & Private)

A. Size Criteria

1. Definitions
 - a. The main is that portion of the sewer system between manholes, or between manhole and the end of the main line provided with a lamphole.
 - b. A lateral is that portion of the sewer system which is connected to the main and which serves one parcel or building.
2. The gravity sewer main lines shall be a minimum of eight inch (8") in diameter except that dead end lines of less than 300 feet can be 6 inches in diameter. Laterals shall be a minimum of 4" in diameter for single family residences and 6" for commercial, duplex and multi-family lots.
3. Laterals shall be placed at least 3' below top of curb grade elevation with 2% minimum slope and with a cleanout 6" from property line on private property (at the right-of-way or easement line).
4. 6", 8", and 10" main lines shall have a minimum slope of 0.3%; 12", 14" and 15" main lines shall have a minimum slope of 0.2%; slopes to be adjusted to account for partial flow to maintain the minimum velocity.
5. For gravity flow, use the Manning formula with a minimum design velocity shall be 2 fps for the design flow, and with a design "n" factor of 0.013.
6. Lampholes are acceptable at the end of line if the distance is not more than 100' to the downstream manhole.
7. Design flows to be submitted to City for approval. (see Attachment "J" for the sewage generation worksheet).
8. Each lateral must have an approved cleanout. Only one lateral is allowed per parcel.

B. Alignment

1. Under normal conditions, sewers should be located in street right-of-way five feet south or west of the street right-of-way centerline. When it is necessary to locate sewers in easements, such easement shall be at least fifteen feet in width. Sewers 24 inches in diameter or larger, or over twelve feet in depth, may require wider easements.
2. Conduits 24 inches or less in diameter should be laid on straight alignment and uniform grade between consecutive manholes.
3. Horizontal and vertical curves are not recommended. However, in cases where justification can be shown, limited use of such designs will be considered. A design

report or letter report will be required from the design engineer to document the justifications for utilizing a curved alignment.

4. Radii of curvature must be of sufficient length to limit deflections to 1/2 the manufacturer's recommended allowable deflection. Complete and accurate details shall be furnished, including: exact location of such curved sewers, length of curve, degree of curve (or radius) and stationing of curve points.
 5. Where curved alignments are utilized, the City may require the following:
 - a. Slope greater than minimum slope for the size of pipe.
 - b. Manhole spacing of less than 300 feet.
 - c. Provide a licensed professional land surveyor or engineer to continuously monitor installation of the curved pipe during construction.
 - d. Video inspection curved pipes prior to final acceptance.
 6. The following are common locations required for manholes:
 - a. Where two or more sewer mains join,
 - b. At intermediate points on long pipe runs, maximum spacing of 300 feet,
 - c. Where the conduit changes in size,
 - d. At sharp curves or angle points in excess of 10 degrees, and
 - e. Points where an abrupt change of the grade occurs.
 7. Horizontal clearances between water lines and sewer lines shall be 10 feet or unless otherwise approved by the City Engineer. Clearances between all other utilities shall be 5 feet.
 8. Minimum vertical clearance from other utilities shall be one foot; and sewers must clear underneath water lines.
 9. Minimum horizontal clearance from any structure shall be based on the criteria of keeping the bottom of the trench clear of the "1 to 1" plane from the bottom of the structural footing (Attachment "E").
 10. No sewer laterals shall be connected to manholes.
 11. Minimum cover over gravity sewers and force mains shall be three (3) feet.
- C. Materials
1. Materials for sanitary sewers shall be PVC conforming to the City's Standard Technical Specifications.

2. Sanitary sewers will be required to pass a low pressure air test or water test prior to acceptance.

D. Maintenance Requirements

1. The City will maintain sanitary sewers in public streets, private streets, and easements up to the cleanout.
2. Property owners must maintain the cleanout and the pipe beyond the cleanout.

PART VII - TRAFFIC CONTROL, SIGNING AND LIGHTING

A. Traffic Studies

1. Traffic studies may be required by the City Engineer in order to adequately assess the impact of a proposal on the existing and/or planned street system. Unless waived by the City Engineer, a detailed study will be required for a non-residential development proposal when it will generate at least one hundred (100) vehicles per hour during the peak hour, or any residential development with one hundred-fifty (150) or more dwelling units.
2. This study shall be the responsibility of the developer and must be prepared by a registered professional engineer with adequate experience in transportation engineering.
3. All studies must first be reviewed by the City Traffic Engineer before approval by the City Engineer.
4. Guidelines for traffic studies are as outlined in Transportation Impact Analyses for Site Development: An ITE Proposed Recommended Practice, Institute of Transportation Engineers, latest edition.
5. The developer shall submit a design and pay the cost for the modification of traffic signals adjacent to the development, which may need to be relocated or revised because of the development or street widening accompanying that development.
6. When it can be shown that a particular development impacts a street or streets to a point that a traffic signal is deemed necessary for the safety and efficiency of vehicles and/or pedestrians, the developer shall be responsible for the cost and installation.

B. Traffic Signal Design Criteria

1. The plans shall be developed in accordance with Caltrans Standard Specifications Section 86, "Signals, Lighting and Electrical Systems," Caltrans Standard Plans, and the California Manual on Uniform Traffic Control Devices, and shall include as a minimum the following items in the general order and with the basic content indicated.
 - a. One set of the construction plans for a traffic signal installation must be submitted when the design engineer makes his normal submission of improvement plans to the City. This requirement also applies to the second and succeeding plan submissions when plans are revised prior to plan approval.
 - b. The plans must provide for all removals, relocations, temporary signals, and delivery of salvaged materials to a specified location in the City's Corporation Yard. Located at 880 Pine Stone Road, the end of Stone Pine Road.
 - c. All existing traffic signal equipment, pedestrian access routes, and street lights shall remain in operation until new installations are energized.

- d. Minimum conduit size shall be two inches (2"), Schedule 40 PVC electrical conduit.
 - e. Any existing run which is disturbed shall be re-pulled completely with all old wire removed, and new wire installed.
 - f. No conductor splicing shall be permitted, except in pullboxes, terminal compartments, control cabinet and pedestal cabinet.
 - g. All detectors shall be centered in striped traffic lanes.
 - h. In appropriate traffic lanes the detector loop closest to the stop bar shall be capable of detecting bicycles. Bicycle lanes shall be equipped with detector loops capable of detecting bicycles. All detector loops capable of detecting bicycles shall be marked in accordance with the latest edition of the Caltrans Standard Plans, Specifications, and the California Manual on Uniform Traffic Control Devices.
 - c. When feasible on a new street construction, all loops shall be installed prior to the installation of the final pavement lift.
 - i. For advance detectors, avoid installing conduit in the medians.
 - j. In paved areas, use concrete pull boxes, with steel covers.
 - k. Use #3-1/2 pull boxes on detector only runs, #7 pull box adjacent to controller, and #5 pull box everywhere else.
 - l. Emergency vehicle preemption shall be provided at all signalized intersections by a 3M Opticom Priority Control System.
2. The developer will be responsible for the energy and maintenance costs for any and all traffic control devices and lighting installed prior to acceptance of the improvements by the City Engineer.

C. Street Lighting Design Criteria

- 1. In public streets, street lights conforming to City of Half Moon Bay Standard Drawings shall be installed on all public streets in locations as required by Engineering & Construction.
- 2. Design street lighting to maintain illumination levels according to the following table:

**Recommended Illumination Levels
By Illuminating Engineering Society (IES)**

Road Classification	Area Classification	Light Level in Average (Footcandles) (See Note a)	Uniformity Ratio (Average to Minimum)
Collector	Commercial	1.2	4 to 1
	Intermediate	0.9	
	Residential	0.6	
Local	Commercial	0.9	6 to 1
	Intermediate	0.7	
	Residential	0.4	
Sidewalks	Intermediate	0.6	6 to 1
	Residential	0.2	
Intersections		0.8	

Notes

- a. Based upon asphalt road surface with diffuse or slightly specular reflectance.
- b. Based upon using IES Type III light distribution luminaires.
3. Provide distribution cut-off, appropriate IES light Distribution luminaires and shielding to prevent over-illumination onto adjacent private property.
4. In private, residential streets, the poles shall be designed for a minimum height of 8' and a maximum height of 16'. Design street lighting to maintain an average horizontal illumination of 0.25 foot-candles with a 10:1 ratio of average to minimum illuminance.
5. All luminaires shall be LED, as indicated on the plans and described in the specifications; all circuits shall be 240 Volts and wired directly to a service pedestal within the public service easement.
6. Poles shall be anodized aluminum or steel with two coats of factory-applied paint, applied per City Specifications. Shop drawings of the pole and fixture shall be submitted to the City Engineer for approval.
7. Poles, mast arms and footings shall be designed to resist the overturning caused by a 100-mph wind load.
8. In addition to the illumination provided above, local street lighting shall be located at:
 - a. All intersections.
 - b. Near end of cul-de-sac when center line of intersecting street to end of cul-de-sac exceeds 180 feet.
 - c. Abrupt change in street alignment or grade or other unusual condition.

- d. Mid-block locations when intersection center lines are more than 180 feet apart.
 - e. Location where special police traffic control aid is required.
9. Each street light shall be provided with a Caltrans Standard No. 3-1/2 splice box containing a 5-amp in-line fuse for each hot leg, and 1/2" diameter by 8 feet long copper ground rod.
 10. All new conduit shall be a minimum of two inches (2") in diameter and shall be designed for a maximum fill of 26%. Existing conduits may be sized for a maximum of 40% fill.
 11. Street lights for subdivisions shall be designed to be metered separately from other usage. Meter shall be installed within a separate Type III BF Service Pedestal with a single 200 amp (min.) meter.
 12. After street light installation is complete, arrange for the City's Engineering Division to "yellow tag" the facility so that the circuit can be energized by PG&E.

D. Signing and Striping

1. All regulatory, warning and route marker signs shall be made in accordance with the standards indicated in Caltrans Standard Plans and Specifications, latest edition, and the "California Manual on Uniform Traffic Control Devices," latest edition.
2. Pavement and curb markings shall be in accordance with the requirements of the latest editions of the City's Standard Details and Standard Technical Specifications, Caltrans Standard Plans and Specifications, and the "California Manual on Uniform Traffic Control Devices.
3. Striping shall be thermoplastic in accordance with the requirements of the latest editions of the City's Standard Details and Technical Specifications, Caltrans Standard Plans and Specifications, and the "California Manual on Uniform Traffic Control Devices.

E. Maintenance Requirements

1. The City will maintain street lights, signs and striping in publicly dedicated streets only.
2. Private street lights and traffic control devices shall be maintained by the homeowner's association or property owner.

PART VIII - PRIVATE DEVELOPMENTS: SUBMITTING SHOP DRAWINGS, CUT SHEETS AND REVISIONS AND "AS-BUILT" DRAWINGS

A. Submittals and Shop Drawings

1. To ensure that the specified products are furnished and installed in accordance with design intent, procedures have been established for advance submittal of design data and for its review and approval or rejection by the Developer's Engineer.
2. The term "shop drawings" as used herein includes fabrication, erection and installation, layout, and setting drawings, list or schedules of materials and equipment; manufacturer's standard drawings, descriptive literature, catalogues and brochures, performance and test data; and all other drawings and descriptive data pertaining to materials, equipment, and methods of construction as may be required to show that the materials, equipment, or systems, and the positions thereof, conform to the Contract requirements.
3. Contractor shall be required to check and verify all field measurements and shall submit for review, with such promptness as to cause no delay in his own work or in that of any other contractor or subcontractor, all shop or setting drawings and schedules required for the work of the various trades. Shop drawings shall be prepared at the Contractor's expense and shall be sent to the office of the Developer's Engineer.
4. Shop drawings shall be submitted to the Developer's Engineer, including manufacturers' literature, brochures, catalog cuts, design calculations, and other pertinent printed matter or data.
5. After the Developer's Engineer or Architect has performed his review of shop drawings, he will stamp five sets and he will submit them to the City of Half Moon Bay for review. The City will return three copies of the drawings with appropriate designation: approval, conditional approval, or disapproval.
6. When shop drawings and/or other submittals are required to be revised or corrected and resubmitted, as directed, Contractor shall make such revisions and/or corrections and resubmit the drawings or other material in the same manner as specified in Paragraph 4 above.
7. The Developer's Engineer and the City will review and return shop drawings with reasonable promptness, so as not to cause any delay in the work.

B. Cut Sheets

1. One day prior to starting work on the grading, underground utilities, curb and gutter, the Developer's Engineer must submit "Cut sheets" to the City Engineer.
2. Cut sheets shall show the proposed grade, the existing grade, and the amount of cut or fill for each grade stake to be set on the job.

C. Revisions to Approved Sheets

1. Plans will have been thoroughly checked by the City and/or its authorized representative, but such checking and/or approval does not relieve the developer from his responsibility to correct errors, omissions or make changes required by special conditions.
2. Any change made to a set of plans after they have been signed will require documented revision. These changes will be reviewed and signed by the City Engineer prior to the installation of the improvements.
3. All areas covered by the proposed change shall be enclosed in a numbered "bubble" or "cloud". Refer to Attachment "G" for correct nomenclature for making revisions.
4. All sheets affected by the proposed revision shall be included in the set submitted for checking.

D. Addition of New Sheets

1. If a proposed revision requires the addition of a new sheet, it shall be added to the back of the existing sheet, the new sheet numbered with a suffix "B", and the original sheet renumbered with the suffix "A".
2. When a new drawing is added, all other sheets directly affected by it shall refer to the new drawing (i.e., cross reference).
3. If an existing drawing is being completely revised, the existing sheet will be marked "Void - Replaced by Sheet # -B. This shall be noted as a revision on the voided sheet.
 - a. The revised drawing number shall have the suffix "B" and the original drawing number shall have the suffix "A".
 - b. The drawing being voided shall have a large "X" put through the middle of the drawing, except for the title block area.
 - i. The "X" is not to go through the title block.
 - ii. There shall be no bubbles added to a sheet being voided.

E. Record Drawings

It should be noted that if the above revision procedures have been followed, the plans will already reflect "As-Built" conditions, and only Note 5. on the following page would pertain.

1. Before final approval of the project plans, it shall be the applicant's responsibility to make arrangements with the design engineer for the preparation and submittal of the Record Drawings. The applicant shall submit evidence that such arrangements have been made with the City Engineer.
2. The engineer shall perform sufficient field work to verify that the Record Drawings are in substantial compliance with the field conditions.

3. The Record Drawings shall be the original tracings, or permanent mylar reproductions of the original tracings, good quality, showing the engineer's certificate in accordance with Attachment "B", along with his signature.
4. Indicate "As-Built" changes as a revision to the drawings as described above with a "Cloud", a Numbered Note, and "'As-Built' Conditions Noted" shown in the Revision Block.
5. If no changes occurred, simply write "Record Drawings" in the Revision Block.

**PART IX - SPECIAL REQUIREMENTS FOR UTILITIES LOCATED ON OR NEAR
CLOSED LANDFILL AREAS**

A. General

1. Projects within the limits of closed landfill areas require special consideration be given to the design of underground utilities. The expected settlements will have an impact on future site improvements and, therefore, require an analysis of differential settlement based on the depth of bay mud, depth of refuse, and the amount of fill material placed over the low permeability landfill clay cap. Additionally, the low permeability landfill clay cap must be avoided and preserved at all times during construction.
2. The limits of the closed landfill area shall include a “near” area which extends a minimum of twenty (20) feet outside the limits of the impermeable clay cap layer.
3. The design engineer must consult the project geotechnical report during the initial design phase, verify settlement projections, and then the Geotechnical Consultant must review and approve the grading and utility plans before the initial submittal is made to the City.

B. Design Intent

1. Achieve acceptable performance as the site settles.
2. Avoid penetration of the low permeability landfill clay cap (barrier layer).
3. Minimize future maintenance requirements.

C. Submittal Requirements

1. Post Landfill Closure Settlement Monitoring Data covering a minimum period of two years.
2. Project Geotechnical Report containing at a minimum the following:

Background information including original landfill grading plan, historical sequence of landfill operations, previous uses and topography.

- a. Information about Bay Mud properties from previous laboratory tests.
- b. Information about landfill waste characteristics.
- c. Past and expected future additional fill that will or has contributed to settlement.
- d. Bay Mud settlement calculations.
- e. Landfill waste settlement calculations.
- f. Profiles used for settlement calculations.

- g. Settlement verses time plots.
 - h. Fill locations and amounts.
 - i. Computer program input and output hardcopy files.
 - j. Calculations for the compression coefficient (C_c) and recompression coefficient (C_r).
 - k. Maps of Existing Topography, Utilities, and Landfill Gas Collection Systems preferably at a scale of 1" = 40'.
 - l. Barrier Layer and Refuse Depth Contour Map at a minimum scale of 1" = 40' and a depth contour interval of 1 foot.
 - m. Contour Map of Anticipated Settlement at a minimum scale of 1"=40' and a settlement contour interval of 0.2 foot.
3. Utility Design Documentation showing designed (pre-settlement) and finished (anticipated post-settlement) utility profiles at a minimum scale of 1"= 40' (horiz.) and 1" = 4' (vert.). Design documentation shall also include settlement design calculations.
 4. Utility Inspection, Maintenance, and Ground Settlement Monitoring Manual (Refer to paragraph E. below).

D. Utility Design Criteria

1. A factor of safety shall be applied to the design of pipe slopes. The project geotechnical report shall include a recommendation for an appropriate factor of safety based upon sound engineering judgment and the availability and reliability of the supporting data used to predict settlement. Consideration should be given to the varying thickness of refuse, Bay Mud, recent fill, potential for void collapse within the refuse, and the time history of refuse and fill placement.
2. Particular care shall be given to the slope of gravity utilities so that flow reversal is not created as settlement occurs. Where possible, the direction of flow should be planned such that differential settlements increase rather than decrease the slope of the utility line.
3. Utility connections to pile-supported structures shall be designed to accommodate the total estimated settlement of the surrounding ground.
4. Minimize additional fill over the barrier layer in refuse areas in order to minimize differential settlement.
5. Avoid penetration of the barrier layer. Consideration should be given to minimum cover over utilities, depths of required trench bedding, required thrust block dimensions, minimum depths of cathodic protection appurtenances, minimum excavations for tapping sleeves and valves, utility crossing clearances, utility structure dimensions, etc. A checklist shall be submitted to the City Engineer indicating due consideration for these items (See Attachment "K" for checklist). If the barrier layer is

inadvertently penetrated, the utility trench or excavation shall be lined with an impermeable material and effectively tied back into the barrier layer.

6. Where the potential for gas migration into the utility trench exists, gas barriers such as plugs or collars of impermeable material shall be provided at regular intervals along building service laterals.
7. Align utilities to avoid landfill areas and/or crossing of landfill boundaries wherever possible.
8. Minimize storm drainage piping by sheet flowing surface runoff to the maximum extent possible.
9. Provide leak detection vaults for pressure utilities at a minimum spacing of 250 feet.
10. Pipe materials:

- a. Gravity Pipes:
Sanitary Sewer

Materials shall be PVC AWWA C-900 conforming to the requirements of the City's Standard Technical Specifications.

Storm Drain

Materials shall be polyethylene AWWA C906 conforming to the City's Standard Technical Specifications.

- b. Pressure Pipes:

Sanitary Sewer Force Main and Water

Sizes 4" and larger in diameter - Materials shall be polyethylene AWWA C906 conforming to the City's Standard Technical Specifications.

Sizes 1/2" through 3" in diameter - Materials shall be polyethylene AWWA C901 conforming to the City's Standard Technical Specifications.

Pressure pipes shall be enclosed in a polyethylene containment pipe conforming to the City's Standard Specifications for Utility Polyethylene Containment Pipe System.

11. A gate valve shall be provided on the water line within 50 feet outside the landfill boundary.

E. Utility Inspection, Maintenance and Settlement Monitoring Program

1. A plan for periodic inspection to determine the effects of settlement on underground utilities is required. The ground settlement monitoring program is to be implemented in order to obtain data which will aid in creating accurate projections for future maintenance requirements. At a minimum the inspection, maintenance and

settlement monitoring program shall contain the following:

- a. Discussion on settlement characteristics pertinent to the site.
- b. Discussion of each utility and/or utility structure and its intended function with respect to settlement.
- c. Discussion on inspection, maintenance, repair and settlement monitoring procedures for each utility line, junction box, and service connection, including recommended maintenance schedules.
- d. Appropriate forms to document inspections and maintenance performed as well as the monitoring surveys performed comparing actual verses projected settlement.
- e. The settlement monitoring points and benchmarks shall be established to the satisfaction of the City Engineer and the monitoring program shall begin as soon as the structures and final grades are completed. On-site benchmarks shall be established on pile-supported structures.
- f. To ensure the quality of the survey data, an elevation loop from an off-site benchmark shall be run when the on-site benchmarks are established. The accuracy of the elevations recorded shall be to the nearest one hundredth of a foot. This shall be done before any monitoring points are surveyed. This loop shall be run every five years or whenever one of the on-site benchmarks is disturbed.
- g. The monitoring points shall be surveyed every six months for the first two years after the structures and final grades are completed. The accuracy of the elevations recorded shall be to the nearest one hundredth of a foot.
- h. The Developer shall provide a minimum two year warranty against defects in material, workmanship, and labor. If the Inspection, Maintenance, and Monitoring Program is implemented as specified herein, and after two years the monitoring information indicates acceptable performance of utilities as determined by the City Engineer, then the City will accept and take over maintenance of the utilities which are planned for public maintenance. Should the Inspection, Maintenance, and Monitoring Program not be implemented as specified, or if monitoring information reveals unacceptable performance of utilities as determined by the City Engineer, the City Engineer may request additional warranty period time until an acceptable performance is achieved.

F. Special Drawings for Utilities on Landfill

1. The City Engineer will meet with the Developer to review any special details or specifications, which need to be incorporated into the plans prior to completing the plan review process.
2. Developers are required to implement whichever special details and specifications are deemed appropriate by the City Engineer.

ATTACHMENT A - 1

GENERAL NOTES

1. Elevations and locations of all existing utility crossings shall be verified by the contractor prior to start of any construction affecting said lines. Contact USA at (800) 642-2444 at least two working days prior to excavation.
2. All applicable work and materials shall be done in accordance with the City of Half Moon Bay Standard Technical Specifications and Details, prepared in the office of Engineering and Construction, including modifications contained herein.
3. The Contractor shall restore all damaged, removed or otherwise disturbed walls, fences, services, utilities, improvements or features of whatever nature, due to contractor's work.
4. The Contractor shall coordinate his work with the installation of facilities by PG&E, AT&T, and Cable TV installation. Valve boxes and manholes, and structures to be set to grade in concrete after paving.
5. All street monuments and other permanent monuments disturbed during the process of construction shall be replaced before acceptance of the improvements by the City Engineer.
6. The Contractor shall give the City Engineer two working days advance notice for inspection. (650)726-8265.
7. No trees 12" diameter or larger measured between 6" and 36" above grade, shall be removed without the written consent of the City Engineer. Tree removals, if necessary, shall conform to Chapter 7.40 – Heritage Tree from the City's Municipal Code.
8. For lane closures, the Contractor shall prepare a traffic control plan and obtain approval of the City Engineer before commencing work. The Contractor shall provide flagmen, cones or barricades, as necessary to control traffic and prevent hazardous conditions per the California Standard Plans, Specifications, and Manual on Traffic Control Devices, latest edition.
9. Pedestrian, public accesses, wheelchair accesses shall be maintained during the construction to the satisfaction of the City Engineer.
10. No trenches or holes shall be left open overnight; use steel plating or hot-mix asphalt as required to protect open trenches overnight.
11. The Contractor shall control dust at all times and sweep streets as often as necessary during construction as required by the City Engineer.
12. All revisions to this plan must be reviewed and approved by the City Engineer prior to construction and shall be accurately shown on revised plans stamped and signed by City Engineer prior to the installation of the improvements.
13. All construction staking for curb, gutter, sidewalk, sanitary sewers, storm drains, water lines, fire hydrants, electroliers, etc., shall be done by a registered Civil Engineer or licensed Land Surveyor.

ATTACHMENT A - 2

NOTES FOR WORKING IN UNINCORPORATED AREAS

1. Contractor shall obtain an Encroachment Permit from the County of San Mateo - Department of Public Works prior to commencing any work within the county road right-of-way. Contractor shall abide by all special provisions of the Encroachment Permit including the provision that drainage be maintained throughout the duration of the work and returned to its pre-construction condition at the end of the work.
2. No work shall be done at any waterline when it crosses a sewer main (including service laterals) without the inspector for the local sewer district present to observe the work.
3. No sanitary sewer main or service lateral may be cut to facilitate the laying of the water main or water service lines.
4. If sanitary sewer mains or service laterals are accidentally damaged, all repairs shall be made in accordance with the repair standards of the local sewer district. No repair may be commenced until the District has approved the procedure.
5. When inspections are to be made by County personnel (road department and local sewer district), arrangements shall be made a minimum of two (2) working days in advance of the inspection.
6. Temporary trench paving, consisting of hot-mix asphalt, will be required in paved areas at the end of each working day.
7. The Contractor's Engineer shall stake the location of water main, including fire hydrants and water services, for the City and County Public Works review at least 48 hours in advance of construction.

ATTACHMENT B

The following certificates shall be placed on all improvement plans and signed by a licensed professional.

"GRADING CERTIFICATE" (TO BE SIGNED AT PROJECT COMPLETION)

"Prior to occupancy, a licensed civil engineer shall certify to the City Engineer that the site has been graded to the elevations shown on the Plan, and that the site will drain properly."

R.C.E. / R.G.E. (Date)

"GEOTECHNICAL ENGINEER'S CERTIFICATE"

"Reviewed and Approved for Conformance with Soils Report Requirements"

R.C.E. / R.G.E. (Date)

RECORD DRAWINGS (To be signed at project's completion)

These Record Drawings are based on limited field review and field surveys, as necessary by _____, and we and the City of Half Moon Bay assume no liability for the accuracy of the information.

(R.C.E./LLS/AIA/C-16, as appropriate) (Date)

ATTACHMENT C

PLOT AND FINISH GRADING PLAN REQUIREMENTS FOR PRIVATE DEVELOPMENT

DESIGN STANDARDS FOR DRAINAGE

1. GENERAL

- A. Drainage - both existing and proposed - is the basic consideration in the design of grading. Providing for adequate drainage onto and off of the proposed site is one of the most important aspects of grading plan design since the best compacted fill or graded slope can be completely nullified by inadequate drainage provisions.
- B. These requirements are based on guidelines listed in Chapter 33 of the Uniform Building Code. These are minimum standards, not maximum provisions, which can guarantee adequate drainage under all conditions. Depending on the topography, layout, or soil conditions, more restrictive requirements may be necessary as determined by the reviewing official.
- C. The designer, in coordination with the soil engineer, must determine the necessities of each individual site on its own merits, and design for problems peculiar to the site. Long-term performance must be considered with enough conservatism in design to take into account the general lack of maintenance received by residential sites.
- D. Grading and drainage plans must be signed, dated and stamped by a registered architect or civil engineer, on the original drawing.
- E. For hillside lots, a geotechnical engineer must submit a certified soils report, and stamp the grading plan.

2. DRAINAGE GRADIENTS

- A. The following minimum gradients for drainage are required for development of private property: (See Attachment "C-1"):

Dirt/Grass - 2%
Asphalt Driveway - 1% (longitudinal flow) 2% (sheet flow)
Portland Cement Concrete...- 0.5% (longitudinal swale); 1% (sheet flow)
Terrace/Interceptor Drains ...- 5%

- B. The following are maximum gradients:

Graded earth swales ... - 6%
Driveways - 20% (See Attachment "D-2")

ATTACHMENT C (continued)

3. CUT AND FILL SLOPES

- A. All cut and fill slopes shall be no steeper than 2:1; for steeper slopes, a soils engineer must submit a soils report, and stamp, date and sign the original drawing of the grading plan.
- B. Drainage standards for slopes are established to prevent excessive erosion and subsequent instability. No surface water from buildings or pads should be permitted to flow over the slopes. Drainage from the natural slopes above the graded cut slope should be diverted away by a terrace drain or a "V"-ditch. (See Attachment"C-2").

PLAN REQUIREMENTS

- A. A plot and finish grading plan is required to be submitted with all applications for a building permit. The following is a check list of items which as a minimum, must be shown on the plot and finished grading plans:

- 1. The site address.
- 2. The owner's name, address and phone number.
- 3. The names, addresses and phone numbers of the architect, civil engineer, surveyor, or other designer.
- 4. Location of stockpile area for excess dirt.
- 5. The volume of cut and fill needed, (if greater than 50 CY).
- 6. Import or export of dirt involving 50 CY or more requires a dirt hauling permit from the City Engineer.
- 7. Fully dimensioned property lines and boundaries.
- 8. Vicinity map with enough detail so the site can be easily found.
- 9. North arrow, scale and legend.
- 10. Location of any buildings, structures, driveways, drainage ditches, or element of the project such as pool, patio, tennis court, etc., on or within 15 feet of the property where the work is to be performed.
- 11. Location and height of all retaining walls (note: retaining walls with a height exceeding four feet from the bottom of footing require a special permit per Section 301 of the UBC.
- 12. Accurate contours showing the present topography of the site and adjacent property. Existing and proposed contours shall be shown at intervals of one foot or less on slopes up to five percent, and not more than five feet on slopes in excess of five percent, and shall extend 10 feet across adjoining streets (when said streets are unimproved) and adjoining property lines.
- 13. Elevations, dimensions, locations, extents and slopes of all proposed grading, by contours or other means, including finish curb at points of extension of lot lines and curb return points; finish and existing grade elevations at each principal corner for the structure and points of significant change of slope; the garage and

ATTACHMENT C (continued)

finished floor elevations; center of driveway elevation at property line and curb face elevations at all lot corners. Note: for subdivision lots, contours and elevations shall be on the same datum as the tentative map and improvement plans.

- ___ 14. Adequate drainage notes and specifications. Entire lot drainage pattern and disposition of surface and roof drainage; roof, rear yard, patio, etc., impervious areas drainage is to be collected and conveyed to an on-site stormwater treatment facility. Grass Swales shall be provided to drain side yards to front or rear yards. Provide design consideration for safe over-flow discharge of a 100-year storm event.
- ___ 15. Detailed plans of all drainage devices, walls, cribbing, or other protective devices to be constructed as part of the proposed work.
- ___ 16. All cut and fill slopes with continuous "daylight" lines.
- ___ 17. Top and toe of all cut and fill slopes.
- ___ 18. Maintain post-development storm water runoff to pre-development runoff conditions, especially when existing drainage flows onto private properties.
- ___ 19. Existing easements, streets with center lines, sewer, storm drain, and access easements, existing and proposed.
- ___ 20. Location, diameter and dripline of all existing trees 12 inches or more in diameter measured between 6" & 36", both on the property and within the public right-of-way.
- ___ 21. All cut and fill control specifications.
- ___ 22. Provisions for protecting adjacent properties.
- ___ 23. For hillside lots, erosion control and or slope protection.
- ___ 24. Crawl space height must be defined.
- ___ 25. Easements and controlling dimensions.
- ___ 26. Cleanouts at each bend in the underground drain pipe, including the bend at the downspout.
- ___ 27. Tree protection plan for all trees to be retained and a tree removal notes for trees to be removed. (See Heritage Tree Ordinance)

B. DRIVEWAY REQUIREMENTS

- ___ 1. Show driveway location, width and slope.
- ___ 2. Approach must conform to City Standard Details.
- ___ 3. The construction of new driveway requires a permit from Engineering and Construction.

ATTACHMENT C (continued)

C. SIDEWALK, CURB AND GUTTER REQUIREMENTS

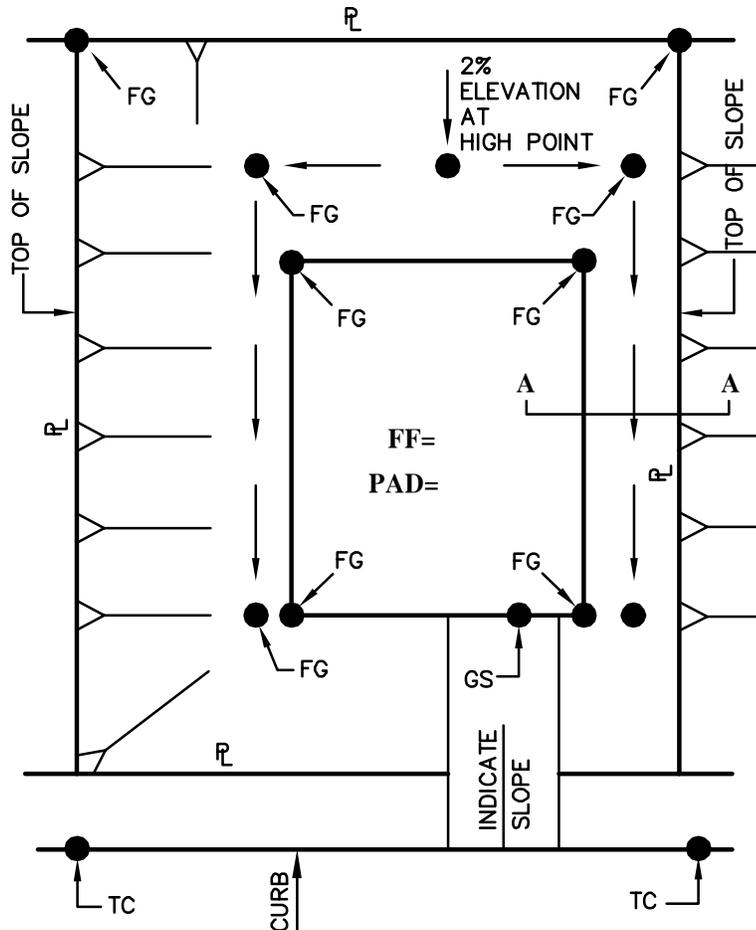
- ___ 1. Show existing curb, gutter, driveways, wheelchair ramps.
- ___ 2. Broken or damaged sidewalk, curb, and gutter must be replaced.
- ___ 3. New sidewalk curb, & gutter must conform to City Standard Details.
- ___ 4. The construction of new sidewalks requires a permit from Engineering and Construction

D. UTILITY REQUIREMENTS

- ___ 1. Show existing and proposed water, sewer, gas, storm drains, electric, and Cable TV.
- ___ 2. Show appropriate City Details for new water, sewer, & storm drains.
- ___ 3. Work within public right-of-way requires construction permit from Engineering Division.
- ___ 4. Show any easements affecting the property.
- ___ 5. Installation of a new sanitary sewer lateral cleanout, next to right-of-way line, requires a permit from Engineering Division. Obtain this permit prior to issuance of a Building Permit.
- ___ 6. All new utility service lines shall be placed underground.

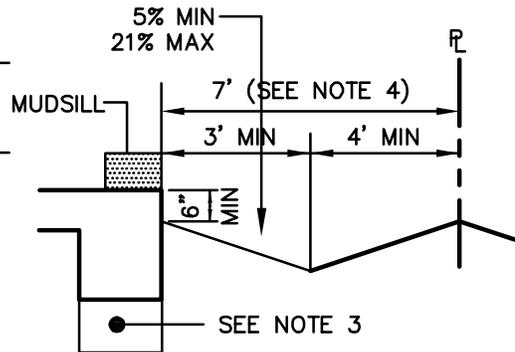
ATTACHMENT C-1

TYPICAL LOT DRAINAGE



LEGEND

- LOCATION OF REQUIRED SPOT ELEVATION
- DIRECTION OF CONCENTRATED FLOW WITHIN A SWALE
- FG = FINISHED GRADE ELEVATION
- FF = FINISHED FLOOR ELEVATION
- TC = TOP OF CURB ELEVATION
- GS = GARAGE SLAB ELEVATION
- PL = PROPERTY LINE



SECTION A-A

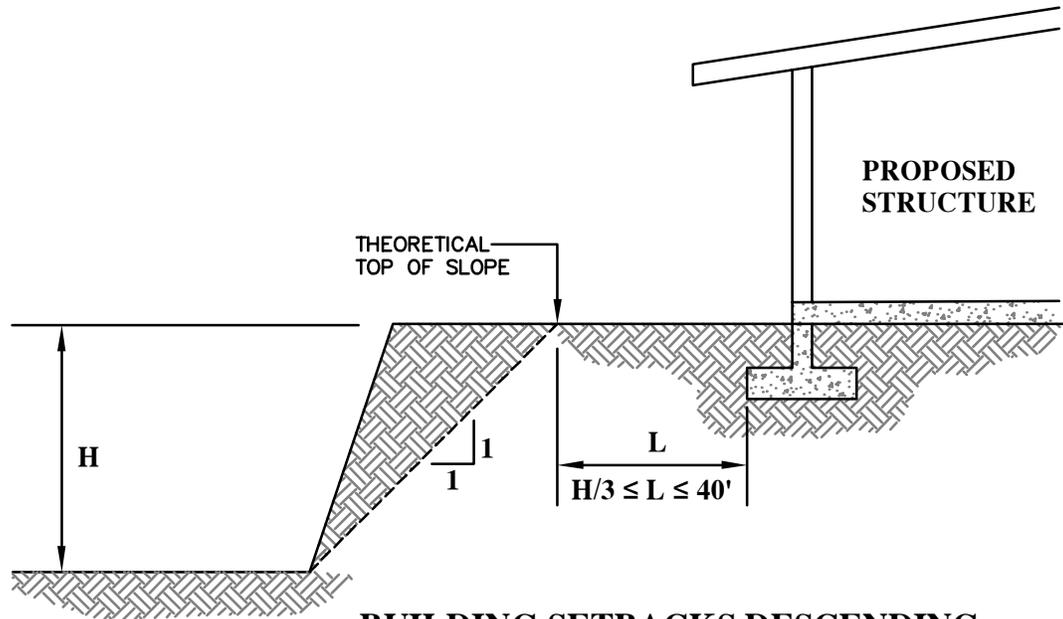
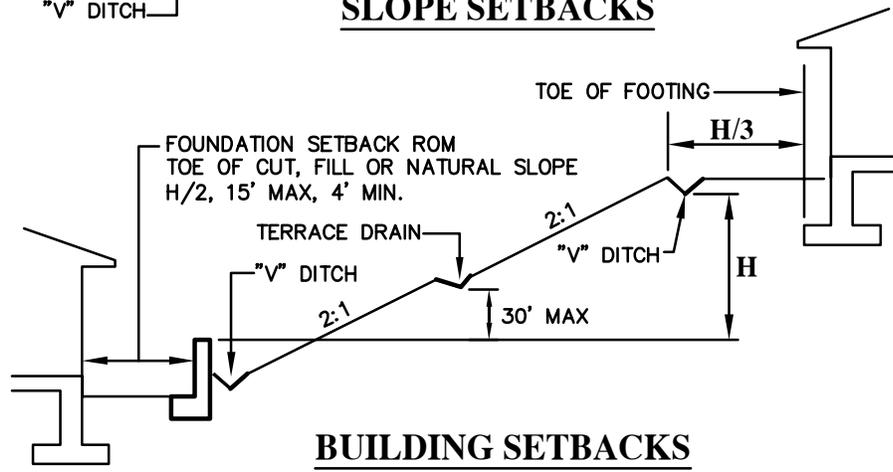
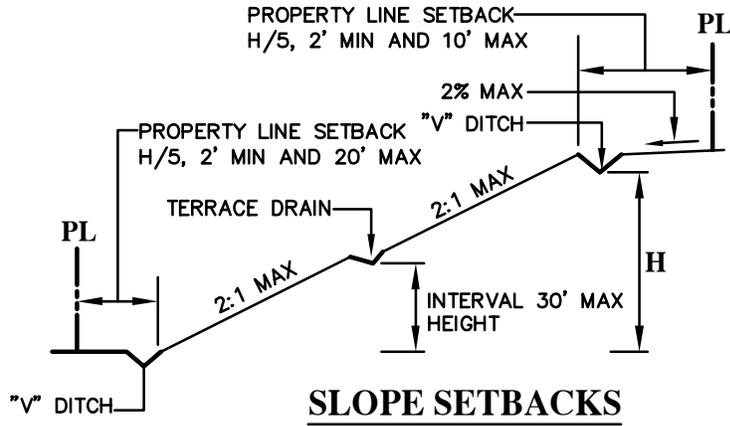
TYPICAL SIDEYARD SWALE

NOTES:

1. GRASSY SWALES ARE PREFERRED.
2. A PAVED DRAINAGE SWALE, A CATCH BASIN AND PIPE, OR SIMILAR DRAINAGE DEVICE IS REQUIRED WHEN A PORCH, FIREPLACE, OR A PORTION OF THE BUILDING EXTENDS WITHIN THE MINIMUM ESTABLISHED SETBACKS.
3. FOUNDATIONS MAY HAVE TO BE DEEPEMED TO PROVIDE CLEARANCE FOR SIDEYARD SWALES AND ADJACENT UTILITIES WITHOUT EXPOSING FOOTINGS; SEE ATTACHMENT D-2 FOR SETBACK REQUIREMENTS AND MINIMUM FLOOR ELEVATIONS.
4. THIS DIMENSION MAY BE CONTROLLED BY ZONING ORDINANCE, BUT IS THE MINIMUM DRAINAGE SETBACK.
5. IF THESE MINIMUM SURFACE DRAINAGE STANDARDS CANNOT BE ACHIEVED, THEN AN APPROVED UNDERGROUND SYSTEM WILL BE INSTALLED, THEREBY CURB DRAINS MAY BE UTILIZED AS APPROVED BY CITY ENGINEER.
6. NO ADDITIONAL DRAINAGE WILL BE PERMITTED ONTO ADJOINING PROPERTY, NOR WILL DRAINAGE FROM ADJOINING PROPERTY BE BLOCKED.
7. LOT DRAINAGE PLANE SHALL BE SIGNED AND STAMPED BY A REGISTERED ENGINEER.
8. CONCENTRATED FLOW ACROSS SIDEWALK IS NOT ALLOWED.

ATTACHMENT C-2 (1 of 2)

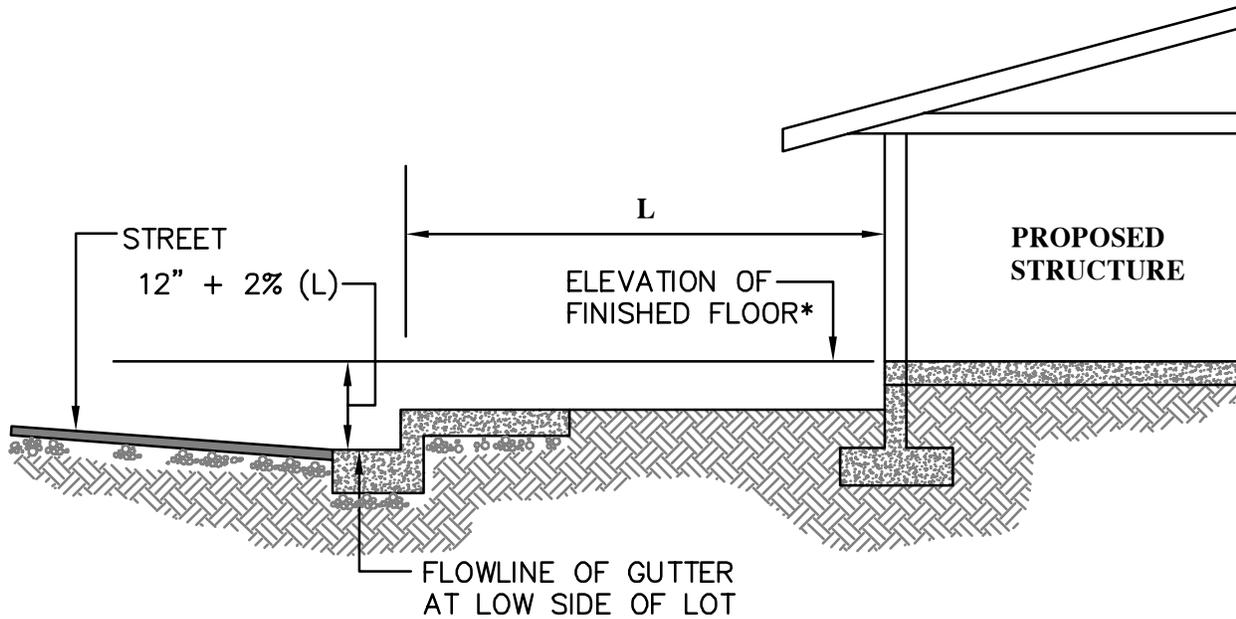
SLOPE REQUIREMENTS, BUILDING SETBACKS, FLOOR ELEVATIONS



**BUILDING SETBACKS DESCENDING
SLOPE (EXCEEDING 1 TO 1)**

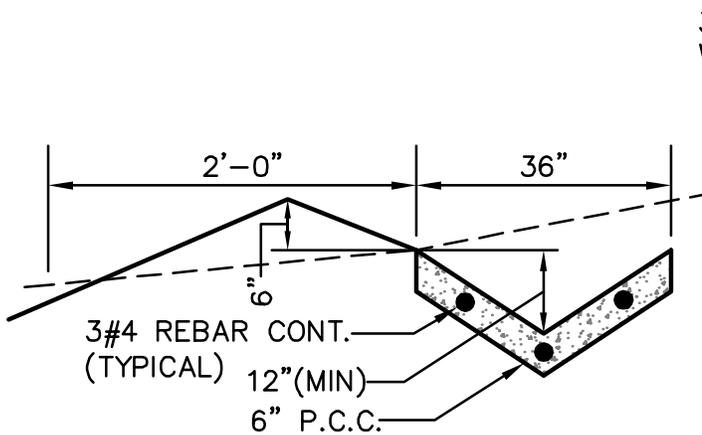
ATTACHMENT C-2 (2 of 2)

SLOPE REQUIREMENTS, BUILDING SETBACKS, FLOOR ELEVATIONS

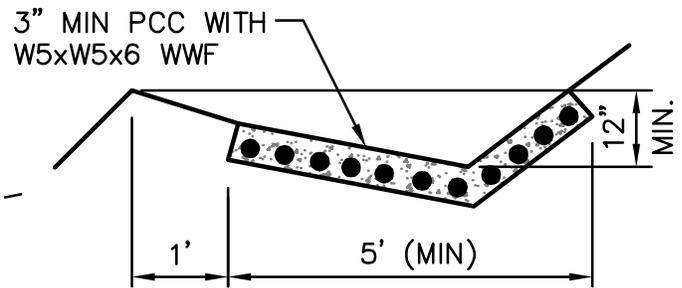


* MINIMUM ELEVATION MUST BE 1' ABOVE FLOOD ELEVATION (PLUS SETTLEMENT) IF IN A DESIGNATED FLOOD PLAIN

MINIMUM FLOOR ELEVATION



"V" DITCH

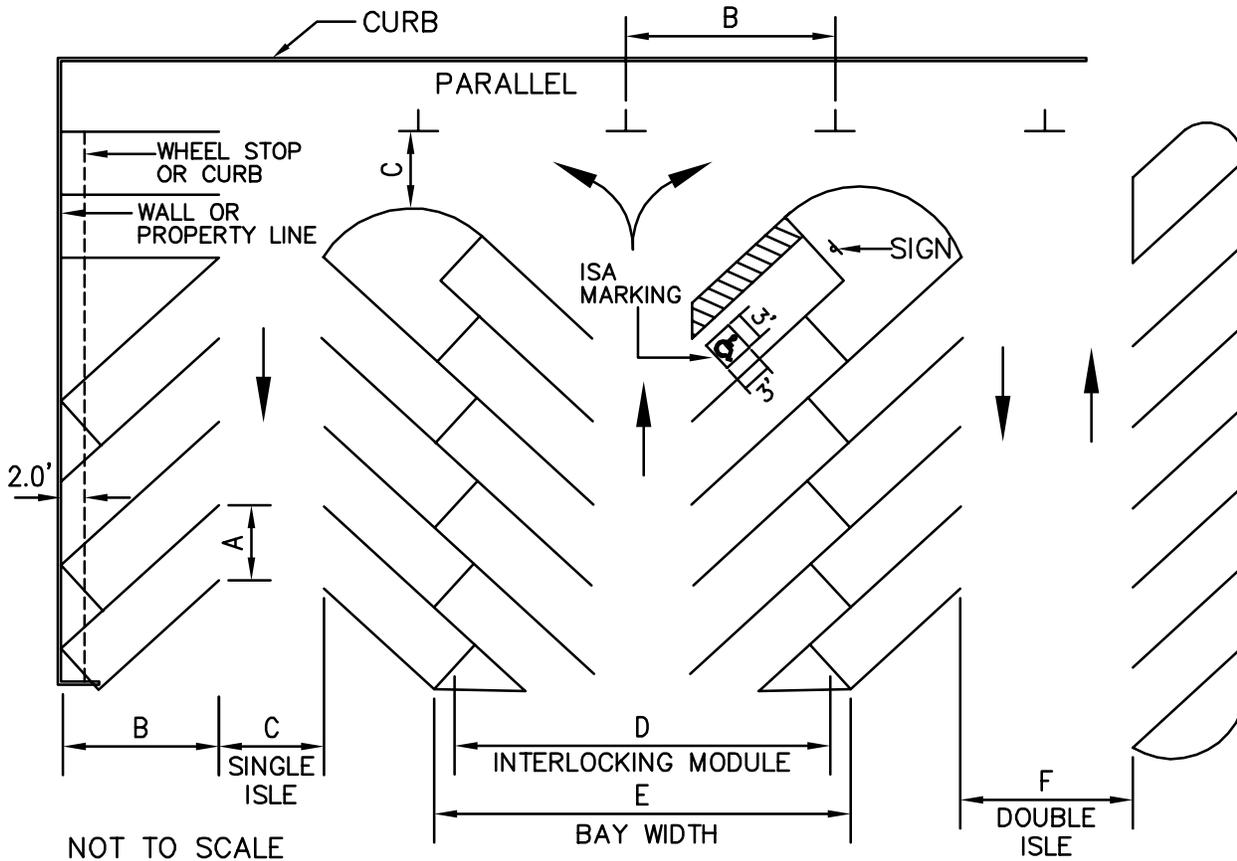


TERRACE DRAIN

CAPACITY SHOULD BE ADEQUATE TO HANDLE CALCULATED FLOW AND MUST BE CHECKED BY THE DESIGNING CIVIL ENGINEER TO CONDUCT TERRACE DRAINAGE TO THE STREET OR IMPROVED DRAINAGE DEVICE.

ATTACHMENT D-1

PARKING DIMENSIONS



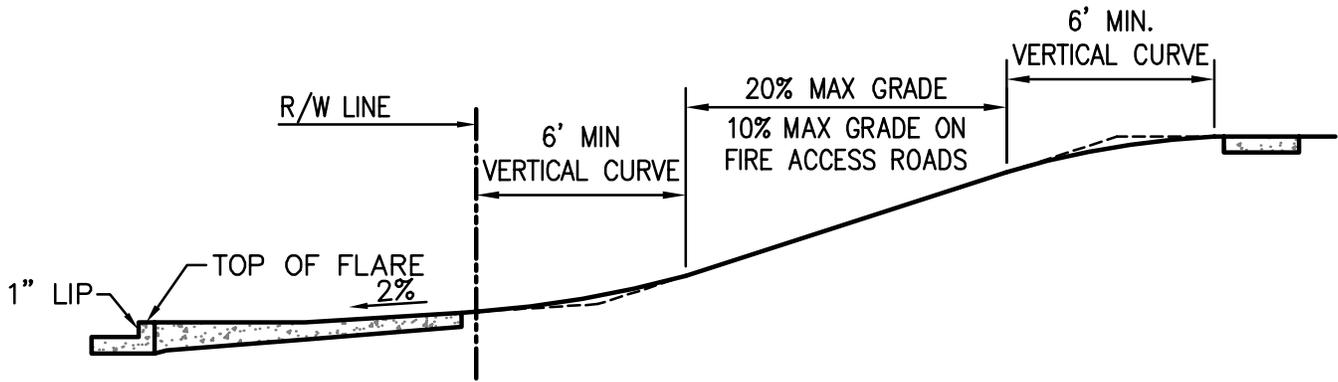
TYPICAL PARKING DIMENSIONS (IN FEET)*

PARKING ANGLE	STALL WIDTH	A	B	C	D	E	F
30°	8.5	17.0	16.4	11.0	36.4	11.0	21.0
45°	8.5	12.0	18.7	12.0	43.4	12.0	22.0
60°	8.5	9.8	19.8	16.0	51.4	16.0	23.0
75°	8.5	8.8	19.6	24.0	61.0	24.0	24.0
90°	8.5	8.5	18.0	25.0	61.0	25.0	25.0
Parallel	8.0	8.0	22.0	12.0	N/A	12.0	24.0

* SEE ZONING ORDINANCE FOR ADDITIONAL PARKING SPACE REQUIREMENTS

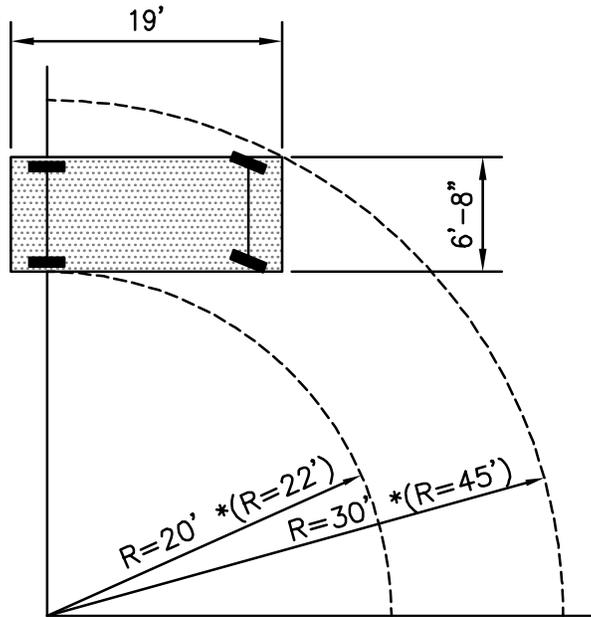
ATTACHMENT D-2

DRIVEWAY RAMPS & TURNING RADII



RAMP DETAIL

ALONG CENTERLINE OF DRIVEWAY



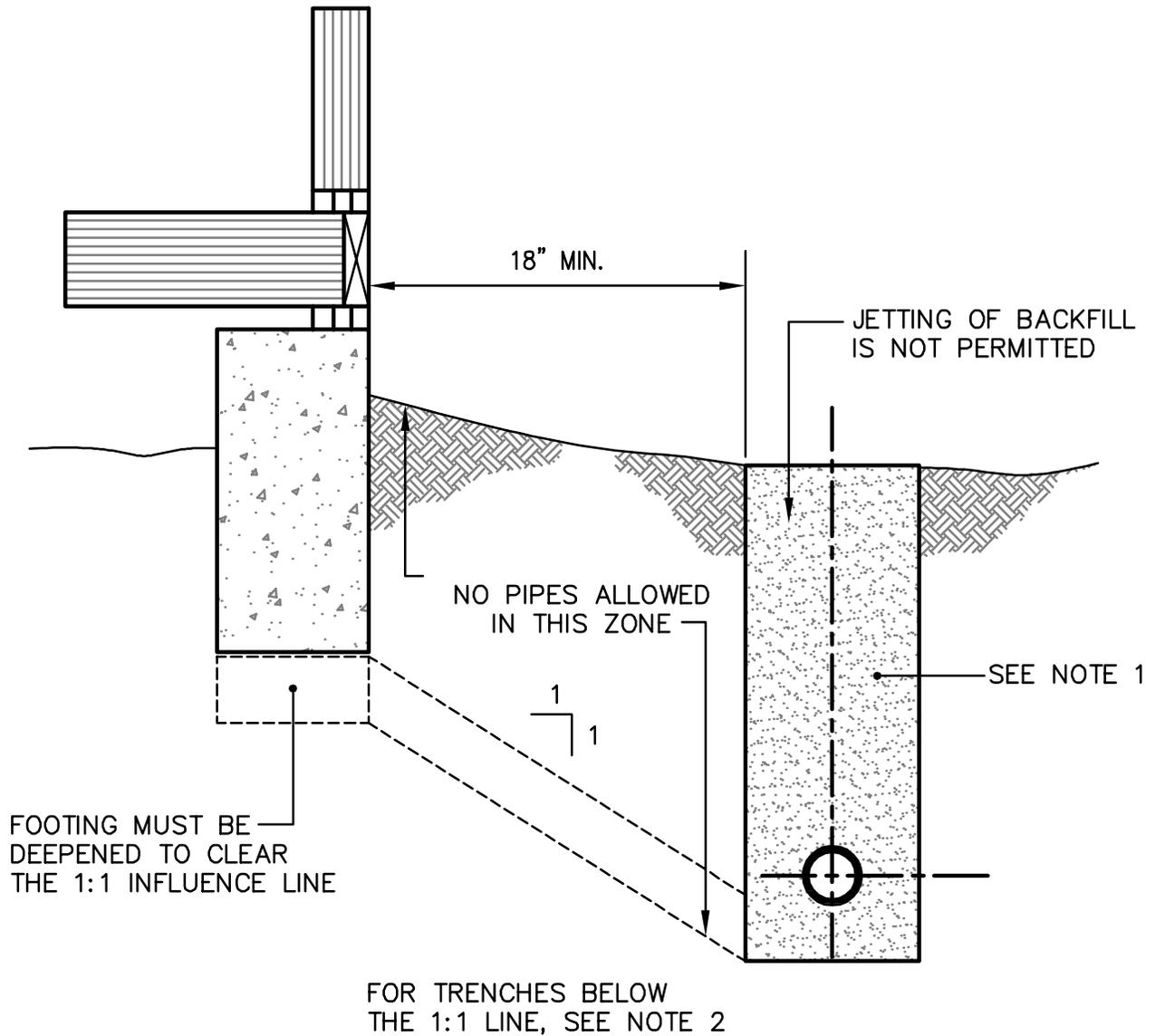
TURNING RADII (DESIGN VEHICLE)

* NOTES:

1. HALF MOON BAY FIRE TRUCK TURNING RADII SHOWN IN PARENTHESES SHALL BE USED FOR DESIGN OF FACILITIES REQUIRING FIRE TRUCK ACCESS. VERIFY WITH FIRE MARSHALL.

ATTACHMENT E

TRENCH CLEARANCE FROM FOOTINGS (TRENCH PARALLEL TO FOOTING)



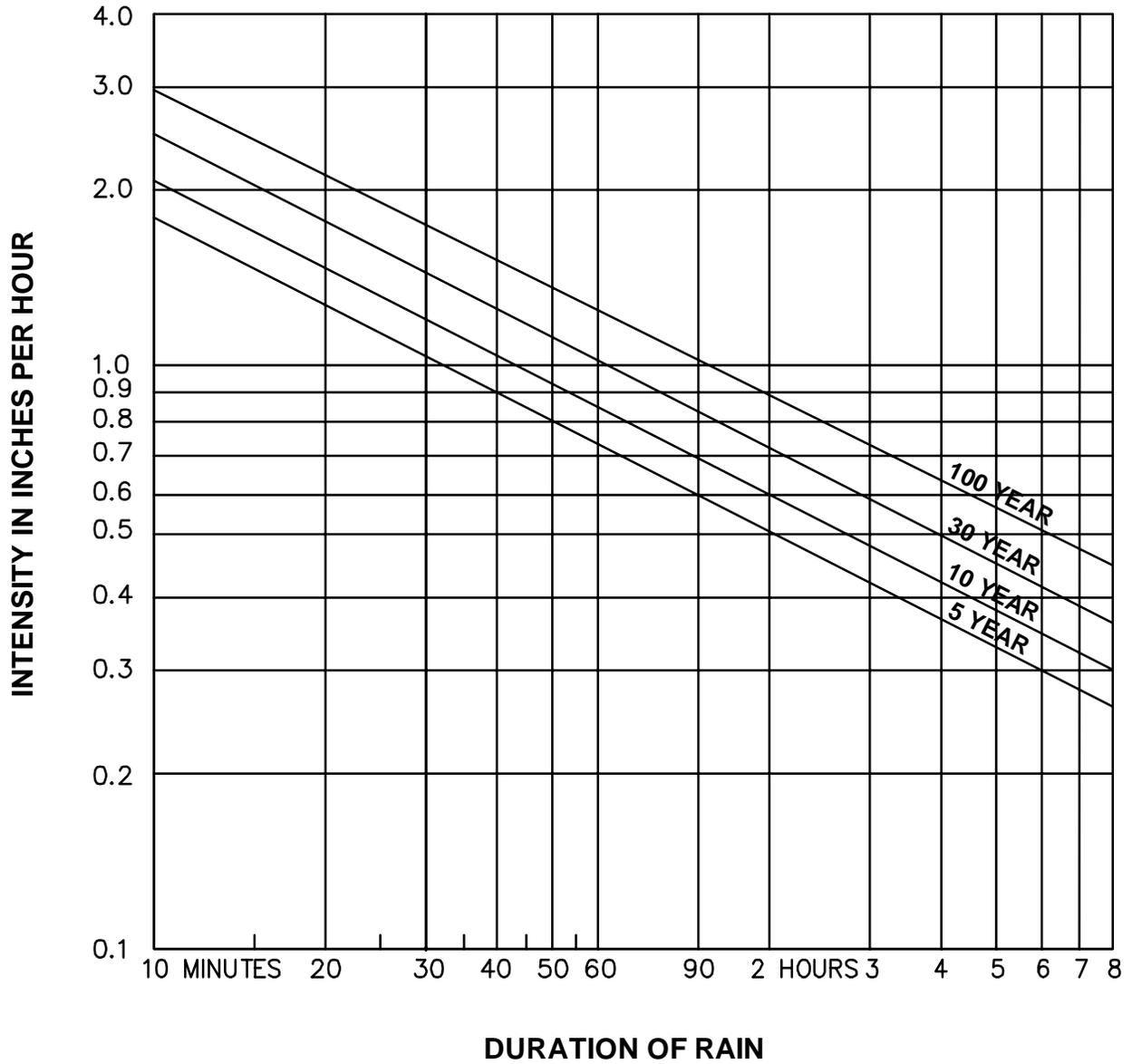
NOTES:

1. SEE SPECIFICATION FOR TRENCH BACKFILL REQUIREMENTS.
2. THIS CASE REQUIRES THE DEEPEMED OF THE PERIMETER FOOTING, OR RELOCATING UTILITY TO CLEAR 1:1 PLANE.

NOT TO SCALE

ATTACHMENT F

I.D.F CURVES



RAINFALL INTENSITY FREQUENCY CURVES FOR HALF MOON BAY

ATTACHMENT H

FEES AND CHARGES

Please see the City of Half Moon Bay's latest Master Fee Schedule for the most current fees and charges.

ATTACHMENT I

CHECKLIST FOR PROCESSING OF FINAL MAPS

NOTE: This checklist has been compiled as an aid for processing of record maps for divisions of land into 5 or more lots generally (some exceptions). See the referenced sections of the City's Municipal Code, Title 17 – SUBDIVISIONS, and the State Map Act (as amended 1 Jan 87) for details and complete exposition.

FORM AND CONTENT OF FINAL MAP

Reference

_____	1. Sheet size – 18 x 26 inches, with blank 1" margin on all sides	66434 (b)
_____	2. Sheet number and total sheets marked on each sheet	" "
_____	3. Relation of each sheet to adjoining sheets clearly shown	" "
_____	4. Legibly drawn, printed, or reproduced permanently in black on:	66434 (a)
_____	a. Tracing cloth or polyester base film	" "
_____	5. Certif., affid., & acknowl. may be stamped or printed (opaque ink)	" "
_____	6. Title block – Name of subdivision	re30.35 (a)
_____	a. Legal description (caption or metes and bonds)	" "(d)
_____	1. Kind of division – subdivision, resub.,	Convention
_____	2. Relation to specified original tract of land – all or part of	re30.35 (d)
_____	3. Details of recordation of original tract	" "
_____	4. Location of subdivision – city, county, state	" "
_____	b. Date of map, scale, north point	" "(a)
_____	c. Firm preparing map – street, city, state, zip code	" "(d)
_____	d. Identification as condominium plan, if applicable	Convention
_____	7. Survey data to locate & retrace monuments, & any all int. & ext. lines	66434 (c)
_____	a. Bearings and distances or straight lines	" "
_____	b. Radii and arc length, or chord bearings and length, for all curves	" "
_____	c. Information necessary to locate centers of curves	" "
_____	d. Ties to existing monuments used to establish subd. boundaries	" "
_____	e. Record dimensions shown in (), if different from measured values	Convention
_____	8. Exterior boundary shown by distinctive symbol and clearly designated	66434 (e)
_____	9. Location of subdivision and its relation to surrounding surveys	" "
_____	10. Remainder (if designated) shown by survey, unless 5 A or more	66424.6, 66434 (e)
_____	11. Location, names, and widths of existing and proposed streets	re30.35 (g)
_____	12. Location, width, and direction of watercourses, including flood area	" "(h) (4)
_____	13. Location, purpose, and widths of existing easements	" "(i)
_____	a. Reference to public record if existing easements recorded	Convention
_____	14. Each lot or parcel numbered or lettered in consecutive sequence	66434 (d)
_____	15. Each block numbered or lettered in consecutive sequence	" "
_____	16. Lot areas to nearest square foot or one-tenth acre	re30.35 (c)
_____	17. Special conditions of tentative map and/or PD approval	30.51

ATTACHMENT I

FORM AND CONTENT OF FINAL MAP (Continued)

Reference

_____	18. Monuments indicated, both found and newly set (per stds. In 8771)	30.85, 66495
_____	a. All exterior boundaries monumented or referenced	" "
_____	1. Subdivision corners & suitable intervals, angle points, curve ends	Convention
_____	b. Reference to recording data, if existing monuments recorded	8771
_____	c. Witness monuments, if recorded monuments not able to be replaced	" "
_____	d. Monuments locating new streets tied to monuments of record	" "
_____	e. Legend identifying found and set monuments, type, and material	Convention
_____	f. Additional monuments as required by City Engineer	30.85
_____	19. Dedications for public uses – show size and indicate purpose	66439, 30.73
_____	a. Streets, highways, expressways, freeways, and alleys	" "
_____	1. Identify special access rights and abutter's rights	" "
_____	2. Note or symbol identifying any waivers of access rights	30.72, 66476
_____	3. Street names as continued, and as approved by CD Director	30.119
_____	4. Street lighting, traffic signal, fire alarm, and water systems	30.87
_____	b. Sanitary sewer systems and appurtenant structures (P.S.E.)	30.73
_____	c. Storm drainage easements-pipes, planned or natural channels (P.S.E.)	30.116 (e)
_____	d. Tree planting & maintenance ease. (T.P.M.E.), earth retaining walls	30.122, 30.87
_____	e. Public utility company easements (P.S.E.)	30.73
_____	1. Electrical, gas, telephone, per 66473.2, cable per 66473.3	30.87 (h) (i)
_____	f. Other improvement easements as conditions of tent. or PD approval	30.87 (m)
_____	g. Pedestrian, equestrian, and bicycle path easements. 66411.1(2),	30.72, 30.120
_____	h. Access easements relating to public waters	30.93
_____	i. School dedications to RC and/or Belmont Elementary Districts	66478.1 et. al
_____	j. Conservation and open space dedications	30.73
_____	20. Reservations for parks, rec., fire stations, libraries, or other	30.98
_____	21. Delineation of areas for non-public use (easements or fee)	Condit. or
_____	a. Common areas, parks, access, sunlight easement (66475.3), other	Convention
_____	b. Reference to any recorded instruments re new private easements	" "
_____	22. See MAP ACT for amending maps and/or certificates of correction	66469
_____	23. Info not affecting title interest, by ordinance only	66434 (f), 66434.2 (a)

CERTIFICATES, ACKNOWLEDGEMENTS, & NOTES

Reference

(Items 1 & 2 may be combined)

_____	1. Owner's certificate - all whose consent is required to pass clear title	30.56
_____	a. Consent to making pf map and recordation	66436
_____	b. Signatures - identify as owners, trustees, executors, or other	" "
_____	c. Exceptions for certain property interests as noted in Map Act	" "
_____	d. Dedications for specified public uses	66439
_____	1. Streets, other ways - with waiver of access, if applicable	30.72, 30.73
_____	2. Easements for sewers, storm drains, and public utilities (P.S.E.)	30.73
_____	3. Easements for pedestrian/bicycle paths (P.S.E.)	30.122
_____	4. Tree planting and maintenance easements (T.P.M.E.)	30.73
_____	5. Optional statement identifying streets not offered for dedication	66439
_____	6. See other check list for subdivisions fronting on public waters	66478.1
_____	7. Signatures - identify as owners, trustees, executors, or others	66439

ATTACHMENT I

CERTIFICATES, ACKNOWLEDGEMENTS, & NOTES (Continued)

Reference

<p>_____ 2. Certificate identifying and designating common areas</p> <p>_____ a. Not dedicated for use by the general public, but ...</p> <p>_____ b. Intended for the common use & enjoyment of owners in the subd.</p> <p>_____ c. As more fully provided in CCR's applicable to (name of subd.)</p> <p>_____ d. Said CCR's are hereby incorporated in and made part of this map</p> <p>_____ e. Signatures - identify as owners, trustees, executors, or others</p> <p>_____ 3. Acknowledgement for each signer - Notary seal not required, if . . .</p> <p>_____ a. Identify and execution attested</p> <p>_____ b. Identify title of signer for corporations - president, etc.</p> <p>_____ 4. Certificate of approval of City Council, with:</p> <p>_____ a. Date of meeting at which map was approved</p> <p>_____ b. Acceptance or rejection of dedications or waivers of access</p> <p>_____ c. See other check list for subdivisions fronting on public waters</p> <p>_____ d. Date and signature of City Clerk - name, title, and city</p> <p>_____ 5. Certificate of RE or surveyor responsible for survey and map</p> <p>_____ a. Map and survey by or under direction, date of survey, true & complete</p> <p>_____ b. Type and position of monuments are as indicated on map, or:</p> <p>_____ c. Will be set on or before a specified later date</p> <p>_____ d. Monuments are (or will be) sufficient to retrace survey</p> <p>_____ e. Signature - Name, registration, seal (with exp. if CE, B & P 6735)</p> <p>_____ 6. Certificate of City Engineer (for execution by Comm. Dev. Dir.)</p> <p>_____ a. Map has been examined</p> <p>_____ b. Subdivision is substantially as approved tentative or alteration</p> <p>_____ c. All provisions of Map Act and local ordinances complied with</p> <p>_____ d. Satisfied that map is technically correct</p> <p>_____ e. Signature - Name, registration, seal (with exp. if CE, B & P 6735)</p> <p>_____ 7. Certificate of County Recorder at request of owners or agent</p> <p>_____ 8. Note identifying resolution creating an owner's development lien</p> <p>_____ a. Recording indicia, & property subject to owner's development lien</p> <p>_____ b. Each parcel subject to prorated amount of owner's development lien</p> <p>_____ 9. Note identifying basis of bearings</p> <p>_____ 10. Note identifying units of dimensions</p> <p>_____ 11. Note identifying borders and acreage of subdivision (to tenths)</p> <p>_____ 12. Signature of util. co. having existing easements; their option, if:</p> <p>_____ a. Decided at tent. review, subd. will not interfere with easements</p> <p>_____ b. Map 7 Sec. 66436 sent to util. co. by developer (certified mail)</p> <p>_____ 13. Statement why signatures unobtainable for obsolete easements, etc.</p> <p>_____ 14. Other certificates & acknowledgements if required by City ordinance</p> <p>_____ 15. Additional certificates as determined by City Engineer</p> <p>_____ 16. Note identifying CA coord. system (if used) & ctrl coords.</p>	<p>Cal Legal Forms 30.54</p> <p>" "</p> <p>" "</p> <p>" "</p> <p>" "</p> <p>66436</p> <p>Civil Code 1191</p> <p>" "</p> <p>66440</p> <p>" "</p> <p>30.72, 66440, 66476</p> <p>66478.1</p> <p>66440</p> <p>66441</p> <p>" "</p> <p>" "</p> <p>" "</p> <p>" "</p> <p>" "</p> <p>66442</p> <p>" "</p> <p>" "</p> <p>" "</p> <p>" "</p> <p>" "</p> <p>66466 (c)</p> <p>66434.1</p> <p>" "</p> <p>" "</p> <p>66434 (e)</p> <p>Convention</p> <p>re30.35 (c)</p> <p>66436 (c) (1)</p> <p>" "</p> <p>" "</p> <p>66436 (c) (2)</p> <p>66443</p> <p>30.52</p> <p>8771.5 P&V, 8813PR</p>
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ATTACHMENT I

REVIEW AND RECORDING OF FINAL MAP

Reference

<p>_____ 1. Final map conforms with approved tentative map</p> <p>_____ a. Conditions of approval incorporated in map and CCR's</p> <p>_____ b. Conditions of PD approval incorporated</p> <p>_____ c. Approved recommendations of agencies within 3 miles, if any</p> <p>_____ d. Approved recommendations of State Dept. of Transportation, if any</p> <p>_____ 2. Map complies with Map Act and City Subdivision Ordinance</p> <p>_____ a. Sufficiency of affidavits and acknowledgements</p> <p>_____ b. Correctness of survey and mathematical data</p> <p>_____ c. Sufficiency and adequacy of public service easements</p> <p>_____ d. No lots divided by a City boundary line</p> <p>_____ 3. Title report examined</p> <p>_____ a. All persons required to consent to map, dedications, and recording</p> <p>_____ b. Existing easements shown and referenced on map</p> <p>_____ 4. Monuments in conformity with Sec. 8771 Bus. & Prof. code</p> <p>_____ a. Min. 1 ext. boundary line set or referenced before map recorded</p> <p>_____ b. Interior monuments set before map is recorded, or:</p> <p>_____ c. Interior monuments set later if performance security deposited</p> <p>_____ 5. Improvement plans and cost estimate approved by City Engineer</p> <p>_____ 6. Improvement agreement drafted by City Attorney</p> <p>_____ 7. Grant deeds to City, for land or easements not dedicated by map</p> <p>_____ 8. CCR's reviewed by City attorney, Engineering, and Planning</p> <p>_____ a. Maintenance responsibilities of Association specifically detailed</p> <p>_____ b. City, State, & Federal maintenance stds., City right to enforce</p> <p>_____ c. City right to approve maintenance amendment</p> <p>_____ d. Private streets irrevocably private, with right of City access</p> <p>_____ 9. Executed mylars submitted, with 1 cloth and 1 paper copy</p> <p>_____ a. Certificate signatures underprinted, permanent, & reproducible</p> <p>_____ 10. Certificate of City Engineer executed & sealed by CD Director</p> <p>_____ 11. City Council approval of map, deeds, 7 agreement</p> <p>_____ 12. Improvement agreement sent by City Clerk for execution</p> <p>_____ a. Bonding and insurance to City Clerk by Developer</p> <p>_____ b. Additional deposit if required for plan review costs _____</p> <p>_____ 13. Tax certificate obtained by Developer (delivered to Engr.)</p> <p>_____ a. Surety for estimated taxes, as noted on tax certificate</p> <p>_____ 14. Certificate of Council approval executed & sealed by City Clerk</p> <p>_____ 15. Map and documents transmitted to County by City Clerk</p> <p>_____ a. Transmittal letters to County Clerk of Board, and Recorder</p> <p>_____ b. Improvement agreement with resolution #8722</p> <p>_____ c. Deeds of dedication with resolution of acceptance #7101</p> <p>_____ d. Map recording fee _____ (\$6 first sheet, \$2 each after)</p> <p>_____ 16. Additional documents accompanying map to County</p> <p>_____ a. Tax certificate & surety; CCR's; deeds to Association, other</p> <p>_____ 17. Map Guarantee, required by Recorder at time of recordation</p> <p>_____ 18. After recordation, following item required from subdivider</p> <p>_____ a. One copy of CCR's with recording indicia, for Eng. Division files</p>	<p>30.51</p> <p>" "</p> <p>Per Cond.</p> <p>66453</p> <p>66455</p> <p>30.54 (c)</p> <p>30.54 (a)</p> <p>" " (b)</p> <p>" " (d)</p> <p>30.117 (d)</p> <p>30.56</p> <p>30.56, 66436</p> <p>" "</p> <p>30.85</p> <p>30.85</p> <p>66496 et al</p> <p>" "</p> <p>30.86 (b)</p> <p>Procedural</p> <p>30.56</p> <p>30.53 (g)</p> <p>Convention</p> <p>" "</p> <p>" "</p> <p>Council</p> <p>30.54. 66466 (e)</p> <p>30.54</p> <p>30.54, 66457</p> <p>30.55</p> <p>30.79</p> <p>30.79, 30.80</p> <p>30.71</p> <p>66492</p> <p>66493</p> <p>66440</p> <p>30.57, 66464</p> <p>" "</p> <p>" "</p> <p>" "</p> <p>Procedural</p> <p>30.57</p> <p>" "</p> <p>66465</p> <p>30.57</p> <p>" "</p>
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ATTACHMENT J

SEWAGE GENERATION PROJECTION WORKSHEET

JOB TITLE _____
JOB NUMBER _____
JOB LOCATION _____

CAL. BY _____
CHKD. BY _____
DATE _____

ATTACHMENT Q MUST BE COMPLETE BEFORE PROCEEDING SEWER GENERATION IS BASED ON 95% OF INDOOR WATER DEMAND PROJECTION

Key: GPD_w = GPD Water Demand Projected from Attachment Q
 GPD_s = GPD Sewer Demand Projected

A. RESIDENTIAL

_____ GPD_w X 0.95 = _____ GPD_s

B. OFFICE/COMMERCIAL

_____ GPD_w X 0.95 = _____ GPD_s

C. HOTEL

_____ GPD_w X 0.95 = _____ GPD_s

D. RESTAURANTS

_____ GPD_w X 0.95 = _____ GPD_s

E. ALL OTHERS TO BE REVIEWED ON A CASE BY CASE BASIS

= _____ GPD_s

F. INFILTRATION

1. PVC pipe: _____ miles X 100 GPD X _____ diameter (in.) = _____ GPD_s

2. Clay pipe: _____ miles X 500 GPD X _____ diameter (in.) = _____ GPD_s

G. AVERAGE DAILY FLOW = _____ GPD (SUM OF A – F)

H. PEAK HOURLY FLOW* FOR PUMPING STATIONS

1. Peak Business Hr. Flow = $[(B+C+E)/12 \text{ hrs} + (F/24 \text{ hrs})] \times 2.5/60 \text{ min} + [(A+D)/12 \text{ hrs}]/60 \text{ min}$ = _____ **GPM**

2. Peak Off-Hrs. Flow = $[(A+C+D)/12 \text{ hrs} + (F/24 \text{ hrs})] \times 2.5/60 \text{ min} + [(B+E)/12 \text{ hrs}]/60 \text{ min}$ = _____ **GPM**

* Peak hourly flows assume an effective 12-hour day and that office and residential peaks occur at separate times.

ATTACHMENT K

DESIGN REVIEW CHECKLIST

The improvement plans accompanying this check list have been prepared by me or under my direction and checked for conformance with the City of Half Moon Bay Engineering Standards.

Engineer's Signature

Date

Instructions: Place a check mark to indicate you have addressed the utility design issue with respect to its potential impact to the low permeability clay cap over the landfill areas.

- 1. Minimum pipe cover requirements.
- 2. Minimum depth of required trench bedding.
- 3. Minimum dimensions of required thrust blocks.
- 4. Minimum depths of required cathodic protection devices.
- 5. Minimum excavation required for tapping sleeves and valves.
- 6. Minimum vertical clearances at crossings.
- 7. Minimum dimensions of utility structures such as manholes, junction boxes, leak detection vaults, etc.

ATTACHMENT L

HALF MOON BAY SPEED HUMP POLICY SUMMARY

Definitions

Speed hump: A raised pavement area for speed control purposes conforming to explicit engineering specifications for maximum height, profile and minimum length (in direction of vehicle travel).

Speed bump: A raised pavement area for speed control purposes *not* conforming to recognized engineering specifications for *speed humps*; generally, more abrupt (higher/or shorter) than *speed humps*

Eligibility Conditions

Eligible For Humps	Ineligible/Questionable For Humps
Persistent speed problem : 85 th 5ile speed 33mph or greater or 66% of all vehicles exceed 25mph or average of top 15 5ile speeds observed is 40 mph or greater.	Speeds unremarkable: Criteria opposite not met.
Local access street.	Arterial or collector street.
Two-lane street.	Street with more than two lanes.
Street less than 40 feet wide.	Street wider than 40 feet.
Pavement quality satisfactory.	Pavement needs resurfacing / reconstruction.
Grades lees than 5 percent in area of hump.	Grades greater than 5 percent or sustained downgrade present.
Straight and level or mild horizontal and/or vertical curves.	Horizontal curves of less than 300 foot centerline radius or vertical curves with less than safe stopping sight distance
Streets posted 30 mph or less.	Streets posted 35 mph or more.
Low volume streets (generally below 3000 ADT).	Moderate to high volume streets (generally more than 3000 ADT).
Streets used by a relatively normal percentage of long wheelbased vehicles (trucks).	Streets used by an abnormally high percentage of long wheelbased vehicles.
Streets used occasionally by emergency vehicles operating at low to moderate speeds.	Streets used as primary emergency vehicle circulation routes.
Streets not used for frequent, regularly-scheduled public transit routes. Use by school transit, paratransit and infrequent conventional transit tripper service is acceptable.	Regular frequently served conventional transit routes.

Design and Construction Considerations

Maximum height: 3 inches, Minimum length; 14 feet. See profile detail on Figure III.

Signs and markings: See details per Figure IV.

Spacing: 200 feet to 750 feet; 275 to 550 feet desirable.

Location: 60 feet minimum from intersections; 200 foot sight distance desirable for isolated mid-block locations.

Drainage: Maintain gutter flows.

Illumination: Locate to take advantage of existing street lighting where feasible.

Appearance: Locate to minimize visibility of signs and markings from closest homes.

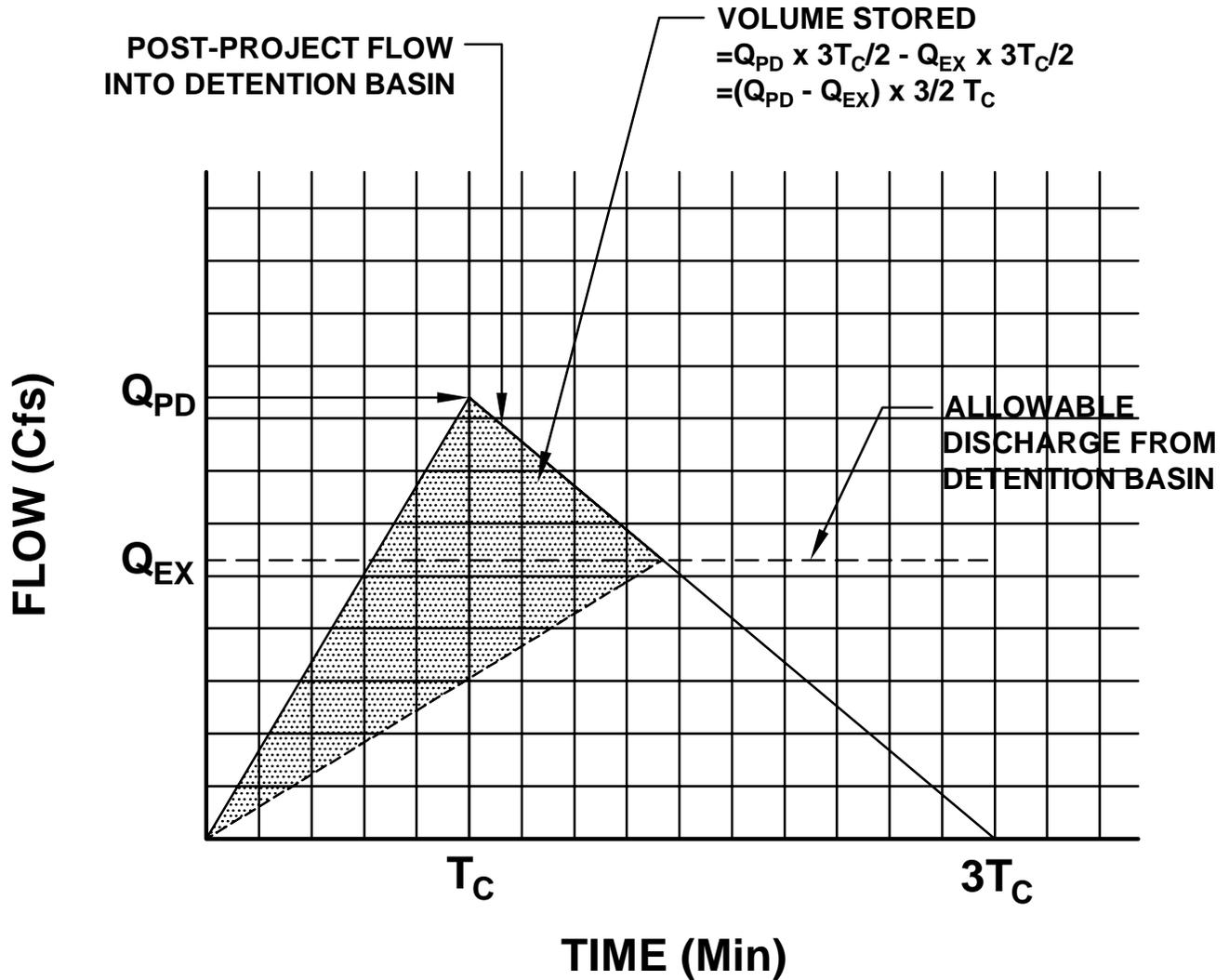
Avoid the following:

- Locations within intersections
- Locations at driveways
- Locations over utility manholes, gate valves, pull boxes, access vaults or ventilation gratings
- Locations at fire hydrants
- Locations immediately upgrade from drainage inlets.
- Locations at or adjacent to surface cross drains.

ATTACHMENT M

SYNTHETIC UNIT HYDROGRAPH

FOR ESTIMATING POST-DEVELOPMENT STORMWATER STORAGE



$$Q_{PD} = C_{PD}IA$$

$$Q_{EX} = C_{EX}IA$$

PD = POST-DEVELOPMENT CONDITIONS

EX = EXISTING PRE-DEVELOPMENT CONDITIONS

ATTACHMENT N

CITY OF HALF MOON BAY

GEOTECH/GEOLOGIST FINAL REPORT FOR CONSTRUCTION PERMIT NO. _____

To be completed by Geotechnical Engineer:

_____ is the Soils Engineer/Engineering Geologist
of Record for the proposed grading located at _____;
work performed by _____ (Contractor).

Per the International Building Code, the Soils Engineer/Engineering Geologist of Record is responsible for continuous inspection during all aspects of grading at the subject site. The Soils Engineer/Engineering Geologist will provide this Final Report upon completion of grading, certifying that all grading has been completed satisfactorily. The Soils Engineer/Engineering Geologist of Record should be familiar with Volume III, Engineering Design Standards of City of Half Moon Bay, "Soil and Grading Criteria", 2006, and the 2006 edition of the International Building Code. The Soils Engineer/Engineering Geologist of Record shall be familiar with the project geotechnical report(s), grading plans, and building plans for this project. If the Soils Engineer/Engineering Geologist of Record changes during the course of this grading work, a new Geotech/Geologist of Record form must be completed, signed by the appropriate parties, and submitted to this office within 5 working days of the change.

SUPPLEMENTARY INFORMATION REQUIRED

The following information is required as part of the final report and special inspection declaration:

- A. A complete record of all field and laboratory tests, including location and elevation of all field density tests.
- B. Special Inspectors Report Declaration (if Special Inspectors were used)

"I declare that based upon personal knowledge (observation of work), the work performed and materials used during the grading operations described in this report are in conformance to those anticipated in the geotechnical report for this project and in accordance with the plans and specifications for this project as approved by the City of Half Moon Bay."

by: _____ Inspector

ATTACHMENT N (continued)

This declaration shall be signed by the inspector. If more than one inspector observed grading operations, each shall sign an individual declaration and shall indicate the dates for which the declaration applies.

C. Geologists Certificate Declaration

"I declare that all work for which I have professional responsibility, performed during the grading operations described in this report, was done in accordance with the recommendations contained in the geotechnical report(s) for this project and in accordance with the plans and specifications for this project as approved by the City of Half Moon Bay."

"I further declare that the Special Inspector(s) whose report(s) appear in this document were under my professional supervision, and that I have reviewed his/her/their reports and find them to be correct and accurate to the best of my knowledge and belief."

"I attest under penalty of perjury to the truth and correctness of all the facts, exhibits, maps, and attachments presented with and made a part of this application."

Signed* _____

Date _____

Mailing Address _____

Phone _____

(Affix and sign professional stamp below.)

Property Owner _____

Date _____

ATTACHMENT O

 COASTSIDE FIRE DISTRICT	<i>Fire Marshal's Office</i>	Date: Feb. 4, 1997
	<i>Coastside Fire Protection District</i>	Revised: June 30, 2015
	<i>1191 Main St., Half Moon Bay, California 94019 (650) 726-5213</i>	Number: R-001
Title: <i>Roads and Turnarounds</i>	Approved: <i>Mark Mondragon</i>	

ROADS AND TURNAROUNDS

Purpose:

This provision establishes the minimum requirements necessary to provide safe and adequate access for emergency equipment, civilian evacuation, and to allow unobstructed traffic circulation during an emergency. The provisions of this regulation shall apply to new and existing roadways or driveways, which are extended, reconstructed, or improved pursuant to a new development approval. Fire department emergency access shall be provided when new structures or buildings are constructed, and for existing structures where the San Mateo County or City of Half Moon Bay Building Regulations requires the entire structure or building to conform to the requirements for new structures or buildings.

Fire Department Emergency Access:

Fire department emergency access is to be provided to within 150 ft of all portions of the facility and all portions of the exterior walls of the first story of the buildings as measured by an approved access route around the exterior of the building or facility.

Dimensions:

All new emergency access roads shall have 15 ½ feet of vertical clearance, and have an unobstructed minimum width of 20 feet. Where hydrants are located, the road shall be a minimum of 26 feet wide for a length of 20 feet on each side of the hydrant (40 feet total length).

Surface:

Emergency access roads shall be designed and maintained to support the imposed load of a fire apparatus weighing at least 75,000 lbs. and shall have a minimum of 2" asphalt surface providing all-weather driving capabilities. Certification by a civil engineer may be required.

Grades of less than 15% shall be surfaced with a minimum Class 2 aggregate base with 95% compaction and an asphalt surface.

Grades of 15% to 20% shall require a non-skid asphalt or concrete surface, or equivalent. Grades 15% to 20% shall be limited to 150 ft. in length.

Turning Radius:

The centerline turning radius for emergency apparatus access roads shall be 35 feet.

Turnarounds:

Dead-end emergency access exceeding 150 ft shall be provided with width and turnaround provisions meeting California Fire Code appendix D. Turnarounds shall have a maximum longitudinal slope no greater than eight percent (8%). The longitudinal slope is defined as the slope corresponding to the long axis of a vehicle as it travels into, out of, and through a turnaround. This slope shall be maintained beginning at and ending at the point of tangency of the edge of pavement curves for the turnaround. The cross slope perpendicular to the longitudinal slope shall not exceed five percent (5%).

Road Grade:

1. Road grades shall not exceed 15% without the approval of the Fire Marshal. (See surface requirements above.)
2. Road grades shall not exceed 20%.
3. Grades 15% to 20% shall be limited to 150 ft. in length.

Parking:

Parking on emergency access roads shall be as follows:

- a. 20-26 feet road width -no parking on either side of the roadway.
- b. 26-35 feet road width -parking is allowed on only one side of roadway.
- c. 36 feet road width -parking is not restricted.
- d. Turnaround bulbs -no parking is allowed in bulb if diameter is less than 96 feet.
- e. The posting of no parking signs may be required on roadways where parking is restricted.

Bridges:

When a bridge is used as a part of emergency access, it shall be constructed and maintained in accordance with AASHTO HB-17. The bridge shall be designed for a live load sufficient to carry the imposed loads of fire apparatus as stated herein:

1. Weight: Every private bridge hereafter constructed or re-constructed due to damage, deterioration, or obsolescence shall be designed to support an imposed load of fire apparatus weighing at least 75,000 lbs. Vehicle loads shall be posted and dated at both entrances to bridges. (HS20-44 Highway loading)
2. Height: A minimum clear vertical clearance of 13 ½ feet as measured from the driving surface of the bridge shall be provided. In situations where a grade change occurs which might require a greater vertical clearance, such additional clearance shall be determined on a case-by-case basis by the Fire Marshal.
3. Width: All bridges must be a minimum of 20 feet clear width. The Fire Marshal may allow the width to be reduced for a bridge providing access to R-3, U-1, or U-2

occupancies. One-way bridges, and bridges with less than 20' of clear width, require a turnout at both ends of the bridge.

4. Certification: Every private bridge providing fire apparatus access hereinafter constructed or re-constructed shall be engineered by a licensed civil or structural engineer and approved by the Fire Marshal. Certification that the bridge complies with the design standards required in sub-section (a) of this section must be provided by the design engineer, to the Fire Chief.

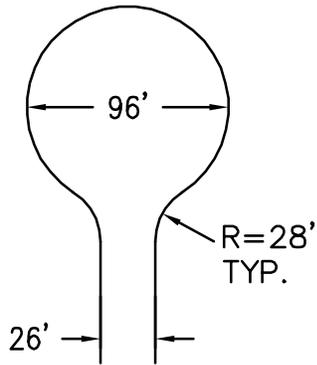
5. Re-certification: Every private bridge shall be re-certified every ten (10) years or whenever deemed necessary by the Fire Marshal.

Gates:

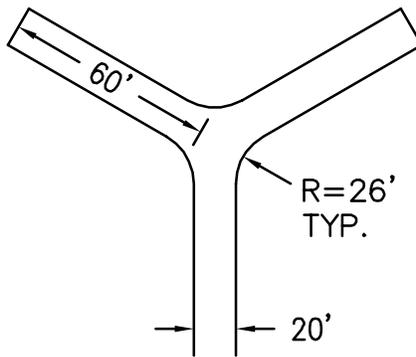
Gates shall be a minimum of 2 feet wider than the roadway they serve. Overhead gate structures shall have a minimum of 15 ½ feet of vertical clearance. Locked gates shall be provided with a Knox Box or Knox Padlock for fire department access. Electric gates shall be provided with a Knox Gate Switch and automatically open during power failures unless equipped with manual override capability (when authorized by Coastside Fire Dist.). Gates providing fire access to a driveway or other roadway shall be located at least 35 feet from the primary road or street and shall open to allow a vehicle to stop without obstructing traffic on the adjoining roadway. Contact Coastside Fire District for Knox Box application.

ATTACHMENT O

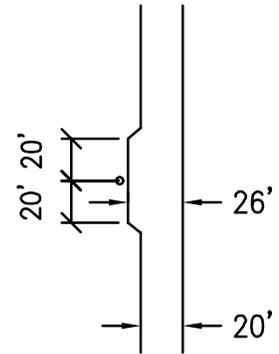
ROADS AND TURNAROUNDS



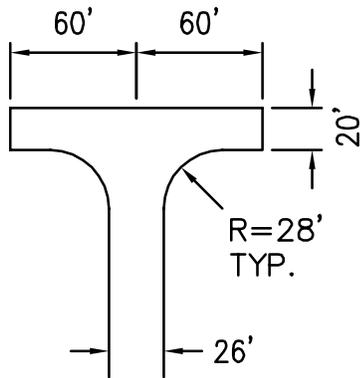
**96' DIAMETER
CUL-DE-SAC**



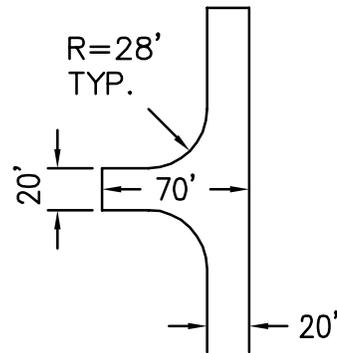
60' "Y"



**MINIMUM CLEARANCE
AROUND A FIRE
HYDRANT**



120' HAMMERHEAD



**ACCEPTABLE ALTERNATIVE
TO 120' HAMMERHEAD**

C.3 and C.6 Development Review Checklist

Municipal Regional Stormwater Permit (MRP) Stormwater Controls for Development Projects

Project Information

I.A Enter Project Data (For "C.3 Regulated Projects," data will be reported in the municipality's stormwater Annual Report.)

Project Name: _____ Case Number: _____

Project Address & Cross St.: _____

Project APN: _____ Project Watershed: _____

Applicant Name: _____ **I.A.4 Slope on Site:** %

Applicant Phone: _____ Applicant Email Address: _____

- Development type: (check all that apply)
- Single Family Residential: A stand-alone home that is not part of a larger project.
 - Single Family Residential: Two or more lot residential development.¹ # of units: _____
 - Multi-Family Residential # of units: _____
 - Commercial
 - Industrial, Manufacturing
 - Mixed-Use # of units: _____
 - Streets, Roads², etc.
 - 'Redevelopment' as defined by MRP: creating, adding and/or replacing exterior existing impervious surface on a site where past development has occurred.

- I.A.1**
- 'Special land use categories'** as defined by MRP: (1) auto service facilities³, (2) retail gasoline outlets, (3) restaurants, (4) uncovered parking area (stand-alone or part of a larger project)
 - Institutions: schools, libraries, jails, etc.
 - Parks and trails, camp grounds, other recreational
 - Agricultural, wineries
 - Kennels, Ranches
 - Other, Please specify _____

Project Description⁴:
(Also note any past or future phases of the project.)

I.A.2 Total Area of Site: _____ acres

I.A.3 Total Area of land disturbed during construction (include clearing, grading, excavating and stockpile area): _____ acres.

I.A.5 Certification:

I certify that the information provided on this form is correct and acknowledge that, should the project exceed the amount of new and/or replaced impervious surface provided in this form, the as-built project may be subject to additional improvements.

- Attach Preliminary Calculations Attach Final Calculations Attach copy of site plan showing areas

Name of person completing the form: _____ Title: _____

Signature: _____ Date: _____

Phone number: _____ Email address: _____

¹ Common Plans of Development (subdivisions or contiguous, commonly owned lots, for the construction of two or more homes developed within 1 year of each other) are not considered single family projects by the MRP.

² Roadway projects creating 10,000 sq.ft. or more of contiguous impervious surface are subject to C.3 requirements if the roadway is new or being widened with additional traffic lanes.

³ See Standard Industrial Classification (SIC) codes [here](#)

⁴ Project description examples: 5-story office building, industrial warehouse, residential with five 4-story buildings for 200 condominiums, etc.

I.B Is the project a “C.3 Regulated Project” per MRP Provision C.3.b?

I.B.1 Enter the amount of impervious surface⁵ Retained, Replaced and/or Created by the project:

Table I.B.1 Impervious⁵ and Pervious Surfaces

Type of Impervious ⁵ Surface	I.B.1.a	I.B.1.b	I.B.1.c	I.B.1.d	I.B.1.e
	Pre-Project Impervious ⁵ Surface (sq.ft.)	Existing Impervious ⁵ Surface to be Retained ⁶ (sq.ft.)	Existing Impervious ⁵ Surface to be Replaced ⁶ (sq.ft.)	New Impervious ⁵ Surface to be Created ⁶ (sq.ft.)	Post-Project Impervious ⁵ Surface (sq.ft.) (=b+c+d)
Roof area(s)					
Impervious ⁵ sidewalks, patios, paths, driveways, streets					
Impervious ⁵ uncovered parking ⁷					
Totals of Impervious Surfaces:					
I.B.1.f - Total Impervious⁵ Surface Replaced and Created (sum of totals for columns I.B.1.c and I.B.1.d):					
Type of Pervious Surface	Pre-Project Pervious Surface (sq.ft.)				Post-project Pervious Surface (sq.ft.)
Landscaping					
Pervious Paving					I.B.1.e.1:
Green Roof					
Totals of Pervious Surfaces:					
Total Site Area (Total Impervious ⁵ +Total Pervious=I.A.2)					

I.B.2 Please review and attach additional worksheets as required below using the Total Impervious Surface (IS) Replaced and Created in cell I.B.1.f from Table I.B.1 above and other factors:

	Check all that apply:	Check One		Attach Worksheet
		Yes	No	
I.B.2.a	Does this project involve any earthwork? If YES, then Check Yes, and Complete Worksheet A. If NO, then go to I.B.2.b	<input type="checkbox"/>	<input type="checkbox"/>	A
I.B.2.b	Is I.B.1.f greater than or equal to 2,500 sq.ft? If YES, then the Project is subject to Provision C.3.i. - complete Worksheets B, C & go to I.B.2.c. If NO, then Stop here - go to I.A.5 and complete Certification or ask municipal staff for Small Project Checklist.	<input type="checkbox"/>	<input type="checkbox"/>	B, C
I.B.2.c	Is the total Existing IS to be Replaced (column I.B.1.c) 50 percent or more of the total Pre-Project IS (column I.B.1.a)? If YES, site design, source control and treatment requirements apply to the whole site. Continue to I.B.2.d If NO, these requirements apply only to the impervious surface created and/or replaced. Continue to I.B.2.d	<input type="checkbox"/>	<input type="checkbox"/>	
I.B.2.d	Is this project a Special Land Use Category (I.A.1) and is I.B.1.f greater than or equal to 5,000 sq.ft? If YES, project is a Regulated Project. Fill out Worksheet D. Go to I.B.2.f. If NO, go to I.B.2.e	<input type="checkbox"/>	<input type="checkbox"/>	D
I.B.2.e	Is I.B.1.f greater than or equal to 10,000 sq.ft? If YES, project is a C.3 Regulated Project - complete Worksheet D. Then continue to I.B.2.f. If NO, then skip to I.B.2.g.	<input type="checkbox"/>	<input type="checkbox"/>	D
I.B.2.f	Is I.B.1.f greater than or equal to 43,560 sq.ft? If YES, project may be subject to Hydromodification Management requirements - complete Worksheet E then continue to I.B.2.g. If NO, then go to I.B.2.g.	<input type="checkbox"/>	<input type="checkbox"/>	E
I.B.2.g	Is I.A.3 greater than or equal to 1 acre? If YES, check box, obtain coverage under the CA Const. General Permit & submit Notice of Intent to municipality - go to I.B.2.h. If NO, then go to I.B.2.h. For more information see: www.swrcb.ca.gov/water_issues/programs/stormwater/construction.shtml	<input type="checkbox"/>	<input type="checkbox"/>	
I.B.2.h	Is this a Special Project or does it have the potential to be a Special Project? If YES, complete Worksheet F - then continue to I.B.2.i. If NO, go to I.B.2.i.	<input type="checkbox"/>	<input type="checkbox"/>	F
I.B.2.i	Is project a High Priority Site? (Determined by the Municipality. High Priority Sites can include those located in or within 100 feet of a sensitive habitat, an Area of Special Biological Significance, a body of water, or starting 7/1/16 on sites disturbing >=5,000 ft ² with slopes >=15% (see I.A.4) (or per municipal criteria/map) and are subject to monthly inspections from Oct 1 to April 30.) If YES, complete section G-2 on Worksheet G - then continue to I.B.2.j. If NO, then go to I.B.2.j	<input type="checkbox"/>	<input type="checkbox"/>	G
I.B.2.j	For Municipal Staff Use Only: Are you using Alternative Certification for the project review? If YES, then fill out section G-1 on Worksheet G. Fill out other sections of Worksheet G as appropriate. See cell I.B.1.e.1 above - Is the project installing 3,000 square feet or more of pervious paving? If YES, then fill out section G-3 on Worksheet G. Add to Municipal Inspection Lists (C.3.h)	<input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/>	G

⁵ Per the MRP, pavement that meets the following definition of pervious pavement is NOT an impervious surface. Pervious pavement is defined as pavement that stores and infiltrates rainfall at a rate equal to immediately surrounding unpaved, landscaped areas, or that stores and infiltrates the rainfall runoff volume described in Provision C.3.

⁶ “Retained” means to leave existing impervious surfaces in place, unchanged; “Replaced” means to install new impervious surface where existing impervious surface is removed anywhere on the same property; and “Created” means the amount of new impervious surface being proposed which exceeds the total existing amount of impervious surface at the property.

⁷ Uncovered parking includes the top level of a parking structure.

Worksheet A

C6 – Construction Stormwater BMPs
--

Identify Plan sheet showing the appropriate construction Best Management Practices (BMPs) used on this project:
(Applies to all projects with earthwork)

Yes	Plan Sheet	Best Management Practice (BMP)
<input checked="" type="checkbox"/>		Control and prevent the discharge of all potential pollutants, including pavement cutting wastes, paints, concrete, petroleum products, chemicals, wash water or sediments, rinse water from architectural copper, and non-stormwater discharges to storm drains and watercourses.
<input checked="" type="checkbox"/>		Store, handle, and dispose of construction materials/wastes properly to prevent contact with stormwater.
<input checked="" type="checkbox"/>		Do not clean, fuel, or maintain vehicles on-site, except in a designated area where wash water is contained and treated.
<input checked="" type="checkbox"/>		Train and provide instruction to all employees/subcontractors re: construction BMPs.
<input type="checkbox"/>		Protect all storm drain inlets in vicinity of site using sediment controls such as berms, fiber rolls, or filters.
<input type="checkbox"/>		Limit construction access routes and stabilize designated access points.
<input type="checkbox"/>		Attach the San Mateo Countywide Water Pollution Prevention Program's construction BMP plan sheet to project plans and require contractor to implement the applicable BMPs on the plan sheet.
<input type="checkbox"/>		Use temporary erosion controls to stabilize all denuded areas until permanent erosion controls are established.
<input type="checkbox"/>		Delineate with field markers clearing limits, easements, setbacks, sensitive or critical areas, buffer zones, trees, and drainage courses.
<input type="checkbox"/>		Provide notes, specifications, or attachments describing the following: <ul style="list-style-type: none"> ▪ Construction, operation and maintenance of erosion and sediment controls, include inspection frequency; ▪ Methods and schedule for grading, excavation, filling, clearing of vegetation, and storage and disposal of excavated or cleared material; ▪ Specifications for vegetative cover & mulch, include methods and schedules for planting and fertilization; ▪ Provisions for temporary and/or permanent irrigation.
<input type="checkbox"/>		Perform clearing and earth moving activities only during dry weather.
<input type="checkbox"/>		Use sediment controls or filtration to remove sediment when dewatering and obtain all necessary permits.
<input type="checkbox"/>		Trap sediment on-site, using BMPs such as sediment basins or traps, earthen dikes or berms, silt fences, check dams, soil blankets or mats, covers for soil stock piles, etc.
<input type="checkbox"/>		Divert on-site runoff around exposed areas; divert off-site runoff around the site (e.g., swales and dikes).
<input type="checkbox"/>		Protect adjacent properties and undisturbed areas from construction impacts using vegetative buffer strips, sediment barriers or filters, dikes, mulching, or other measures as appropriate.

Worksheet B

C3 - Source Controls

Select appropriate source controls and identify the detail/plan sheet where these elements are shown.

Yes	Detail/Plan Sheet No.	Features that require source control measures	Source Control Measures (Refer to Local Source Control List for detailed requirements)
<input type="checkbox"/>		Storm Drain	Mark on-site inlets with the words "No Dumping! Flows to Bay" or equivalent.
<input type="checkbox"/>		Floor Drains	Plumb interior floor drains to sanitary sewer ⁸ [or prohibit].
<input type="checkbox"/>		Parking garage	Plumb interior parking garage floor drains to sanitary sewer. ⁸
<input type="checkbox"/>		Landscaping	<ul style="list-style-type: none"> ▪ Retain existing vegetation as practicable. ▪ Select diverse species appropriate to the site. Include plants that are pest- and/or disease-resistant, drought-tolerant, and/or attract beneficial insects. ▪ Minimize use of pesticides and quick-release fertilizers. ▪ Use efficient irrigation system; design to minimize runoff.
<input type="checkbox"/>		Pool/Spa/Fountain	Provide connection to the sanitary sewer to facilitate draining. ⁸
<input type="checkbox"/>		Food Service Equipment (non-residential)	<p>Provide sink or other area for equipment cleaning, which is:</p> <ul style="list-style-type: none"> ▪ Connected to a grease interceptor prior to sanitary sewer discharge.⁸ ▪ Large enough for the largest mat or piece of equipment to be cleaned. ▪ Indoors or in an outdoor roofed area designed to prevent stormwater run-on and run-off, and signed to require equipment washing in this area.
<input type="checkbox"/>		Refuse Areas	<ul style="list-style-type: none"> ▪ Provide a roofed and enclosed area for dumpsters, recycling containers, etc., designed to prevent stormwater run-on and runoff. ▪ Connect any drains in or beneath dumpsters, compactors, and tallow bin areas serving food service facilities to the sanitary sewer.⁸
<input type="checkbox"/>		Outdoor Process Activities ⁹	Perform process activities either indoors or in roofed outdoor area, designed to prevent stormwater run-on and runoff, and to drain to the sanitary sewer. ⁸
<input type="checkbox"/>		Outdoor Equipment/ Materials Storage	<ul style="list-style-type: none"> ▪ Cover the area or design to avoid pollutant contact with stormwater runoff. ▪ Locate area only on paved and contained areas. ▪ Roof storage areas that will contain non-hazardous liquids, drain to sanitary sewer⁸, and contain by berms or similar.
<input type="checkbox"/>		Vehicle/ Equipment Cleaning	<ul style="list-style-type: none"> ▪ Roofed, pave and berm wash area to prevent stormwater run-on and runoff, plumb to the sanitary sewer⁸, and sign as a designated wash area. ▪ Commercial car wash facilities shall discharge to the sanitary sewer.⁸
<input type="checkbox"/>		Vehicle/ Equipment Repair and Maintenance	<ul style="list-style-type: none"> ▪ Designate repair/maintenance area indoors, or an outdoors area designed to prevent stormwater run-on and runoff and provide secondary containment. Do not install drains in the secondary containment areas. ▪ No floor drains unless pretreated prior to discharge to the sanitary sewer.⁸ ▪ Connect containers or sinks used for parts cleaning to the sanitary sewer.⁸
<input type="checkbox"/>		Fuel Dispensing Areas	<ul style="list-style-type: none"> ▪ Fueling areas shall have impermeable surface that is a) minimally graded to prevent ponding and b) separated from the rest of the site by a grade break. ▪ Canopy shall extend at least 10 ft. in each direction from each pump and drain away from fueling area.
<input type="checkbox"/>		Loading Docks	<ul style="list-style-type: none"> ▪ Cover and/or grade to minimize run-on to and runoff from the loading area. ▪ Position downspouts to direct stormwater away from the loading area. ▪ Drain water from loading dock areas to the sanitary sewer.⁸ ▪ Install door skirts between the trailers and the building.
<input type="checkbox"/>		Fire Sprinklers	Design for discharge of fire sprinkler test water to landscape or sanitary sewer. ⁸
<input type="checkbox"/>		Miscellaneous Drain or Wash Water	<ul style="list-style-type: none"> ▪ Drain condensate of air conditioning units to landscaping. Large air conditioning units may connect to the sanitary sewer.⁸ ▪ Roof drains from equipment drain to landscaped area where practicable. ▪ Drain boiler drain lines, roof top equipment, all wash water to sanitary sewer.⁸
<input type="checkbox"/>		Architectural Copper Rinse Water	<ul style="list-style-type: none"> ▪ Drain rinse water to landscaping, discharge to sanitary sewer⁸, or collect and dispose properly offsite. See flyer "Requirements for Architectural Copper."

⁸ Any connection to the sanitary sewer system is subject to sanitary district approval.

⁹ Businesses that may have outdoor process activities/equipment include machine shops, auto repair, industries with pretreatment facilities.

Worksheet C

Low Impact Development – Site Design Measures

Select Appropriate Site Design Measures (Required for C.3 Regulated Projects; all other projects are encouraged to implement site design measures, which may be required at municipality discretion.) Projects that create and/or replace 2,500 – 10,000 sq.ft. of impervious surface, and stand-alone single family homes that create/replace 2,500 sq.ft. or more of impervious surface, must include **one of Site Design Measures a through f** (Provision C.3.i requirements).¹⁰ Larger projects must also include applicable Site Design Measures g through i. Consult with municipal staff about requirements for your project.

Select appropriate site design measures and Identify the Plan Sheet where these elements are shown.

Yes	Plan Sheet Number	
<input type="checkbox"/>		a. Direct roof runoff into cisterns or rain barrels and use rainwater for irrigation or other non-potable use.
<input type="checkbox"/>		b. Direct roof runoff onto vegetated areas.
<input type="checkbox"/>		c. Direct runoff from sidewalks, walkways, and/or patios onto vegetated areas.
<input type="checkbox"/>		d. Direct runoff from driveways and/or uncovered parking lots onto vegetated areas.
<input type="checkbox"/>		e. Construct sidewalks, walkways, and/or patios with pervious or permeable surfaces. Use the specifications in the C3 Technical Guidance (Version 4.1) downloadable at www.flowstobay.org/newdevelopment .
<input type="checkbox"/>		f. Construct bike lanes, driveways, and/or uncovered parking lots with pervious surfaces. Use the specifications in the C3 Technical Guidance (Version 4.1) downloadable at www.flowstobay.org/newdevelopment .
<input type="checkbox"/>		g. Limit disturbance of natural water bodies and drainage systems; minimize compaction of highly permeable soils; protect slopes and channels; and minimize impacts from stormwater and urban runoff on the biological integrity of natural drainage systems and water bodies.
<input type="checkbox"/>		h. Conserve natural areas, including existing trees, other vegetation and soils.
<input type="checkbox"/>		i. Minimize impervious surfaces.

Regulated Projects can also consider the following site design measures to reduce treatment system sizing:

Yes	Plan Sheet Number	
<input type="checkbox"/>		j. Self-treating area (see Section 4.2 of the C.3 Technical Guidance)
<input type="checkbox"/>		k. Self-retaining area (see Section 4.3 of the C.3 Technical Guidance)
<input type="checkbox"/>		l. Plant or preserve interceptor trees (Section 4.1, C.3 Technical Guidance)

¹⁰ See MRP Provision C.3.a.i.(6) for non-C.3 Regulated Projects, C.3.c.i.(2)(a) for Regulated Projects, C.3.i for projects that create/replace 2,500 to 10,000 sq.ft. of impervious surface and stand-alone single family homes that create/replace 2,500 sq.ft. or more of impervious surface.

Worksheet D

C3 Regulated Project - Stormwater Treatment Measures

Check all applicable boxes and indicate the treatment measure(s) included in the project.

Yes										
<input type="checkbox"/>	<p>Is the project a Special Project?¹¹ If yes, consult with municipal staff about the need to evaluate the feasibility and infeasibility of 100% LID treatment. Indicate the type of non-LID treatment to be used, the hydraulic sizing method¹², and percentage of the amount of runoff specified in Provision C.3.d that is treated:</p> <table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left; border-bottom: 1px solid black;">Non-LID Treatment Measures:</th> <th style="text-align: left; border-bottom: 1px solid black;">Hydraulic sizing method¹²</th> <th style="text-align: right; border-bottom: 1px solid black;">% of C.3.d amount of runoff treated</th> </tr> </thead> <tbody> <tr> <td><input type="checkbox"/> Media filter</td> <td><input type="checkbox"/>2.a <input type="checkbox"/>2.b <input type="checkbox"/>2.c</td> <td style="text-align: right;">____%</td> </tr> <tr> <td><input type="checkbox"/> Tree well filter</td> <td><input type="checkbox"/>2.a <input type="checkbox"/>2.b <input type="checkbox"/>2.c</td> <td style="text-align: right;">____%</td> </tr> </tbody> </table>	Non-LID Treatment Measures:	Hydraulic sizing method ¹²	% of C.3.d amount of runoff treated	<input type="checkbox"/> Media filter	<input type="checkbox"/> 2.a <input type="checkbox"/> 2.b <input type="checkbox"/> 2.c	____%	<input type="checkbox"/> Tree well filter	<input type="checkbox"/> 2.a <input type="checkbox"/> 2.b <input type="checkbox"/> 2.c	____%
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<input type="checkbox"/> Tree well filter	<input type="checkbox"/> 2.a <input type="checkbox"/> 2.b <input type="checkbox"/> 2.c	____%								
<input type="checkbox"/>	<p>Is the project using infiltration systems? The MRP no longer requires the use or analysis of the feasibility of infiltration, but infiltration systems are encouraged and may be beneficial depending on the project. Indicate the infiltration measures to be used, and hydraulic sizing method:</p> <table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left; border-bottom: 1px solid black;">Infiltration Measures:</th> <th style="text-align: left; border-bottom: 1px solid black;">Hydraulic sizing method¹²</th> </tr> </thead> <tbody> <tr> <td><input type="checkbox"/> Bioinfiltration¹³</td> <td><input type="checkbox"/>1.a <input type="checkbox"/>1.b <input type="checkbox"/>2.c <input type="checkbox"/>3</td> </tr> <tr> <td><input type="checkbox"/> Infiltration trench</td> <td><input type="checkbox"/>1.a <input type="checkbox"/>1.b</td> </tr> <tr> <td><input type="checkbox"/> Other (specify): _____</td> <td></td> </tr> </tbody> </table>	Infiltration Measures:	Hydraulic sizing method ¹²	<input type="checkbox"/> Bioinfiltration ¹³	<input type="checkbox"/> 1.a <input type="checkbox"/> 1.b <input type="checkbox"/> 2.c <input type="checkbox"/> 3	<input type="checkbox"/> Infiltration trench	<input type="checkbox"/> 1.a <input type="checkbox"/> 1.b	<input type="checkbox"/> Other (specify): _____		
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<input type="checkbox"/> Other (specify): _____										
<input type="checkbox"/>	<p>Is the project harvesting and using rainwater? The MRP no longer requires the use or analysis of the feasibility of rainwater harvesting, but it rainwater harvesting and use is encouraged and may be beneficial depending on the project."</p> <table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left; border-bottom: 1px solid black;">Rainwater Harvesting/Use Measures:</th> <th style="text-align: left; border-bottom: 1px solid black;">Hydraulic sizing method¹²</th> </tr> </thead> <tbody> <tr> <td><input type="checkbox"/> Rainwater Harvesting for indoor non-potable water use</td> <td><input type="checkbox"/>1.a <input type="checkbox"/>1.b</td> </tr> <tr> <td><input type="checkbox"/> Rainwater Harvesting for landscape irrigation use</td> <td><input type="checkbox"/>1.a <input type="checkbox"/>1.b</td> </tr> </tbody> </table>	Rainwater Harvesting/Use Measures:	Hydraulic sizing method ¹²	<input type="checkbox"/> Rainwater Harvesting for indoor non-potable water use	<input type="checkbox"/> 1.a <input type="checkbox"/> 1.b	<input type="checkbox"/> Rainwater Harvesting for landscape irrigation use	<input type="checkbox"/> 1.a <input type="checkbox"/> 1.b			
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<input type="checkbox"/>	<p>Is the project installing biotreatment measures? Indicate the biotreatment measures to be used, and the hydraulic sizing method:</p> <table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left; border-bottom: 1px solid black;">Biotreatment Measures:</th> <th style="text-align: left; border-bottom: 1px solid black;">Hydraulic sizing method¹²</th> </tr> </thead> <tbody> <tr> <td><input type="checkbox"/> Bioretention area</td> <td><input type="checkbox"/>2.c <input type="checkbox"/>3</td> </tr> <tr> <td><input type="checkbox"/> Flow-through planter</td> <td><input type="checkbox"/>2.c <input type="checkbox"/>3</td> </tr> <tr> <td><input type="checkbox"/> Other (specify): _____</td> <td></td> </tr> </tbody> </table>	Biotreatment Measures:	Hydraulic sizing method ¹²	<input type="checkbox"/> Bioretention area	<input type="checkbox"/> 2.c <input type="checkbox"/> 3	<input type="checkbox"/> Flow-through planter	<input type="checkbox"/> 2.c <input type="checkbox"/> 3	<input type="checkbox"/> Other (specify): _____		
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<input type="checkbox"/> Other (specify): _____										

A copy of the long term Operations and Maintenance (O&M) Agreement and Plan for this project will be required. Please contact the NPDES Representative of the applicable municipality for an agreement template and consult the C.3 Technical Guidance at www.flowstobay.org for maintenance plan templates for specific facility types.

¹¹ Special Projects are smart growth, high density, or transit-oriented developments with the criteria defined in Provision C.3.e.ii.(2), (3) or (4) (see Worksheet F).

¹² Indicate which of the following Provision C.3.d.i hydraulic sizing methods were used. Volume based approaches: 1(a) Urban Runoff Quality Management approach, or 1(b) 80% capture approach (recommended volume-based approach). Flow-based approaches: 2(a) 10% of 50-year peak flow approach, 2(b) 2 times the 85th percentile rainfall intensity approach, or 2(c) 0.2-Inch-per-hour intensity approach (recommended flow-based approach – also known as the 4% rule). Combination flow and volume-based approach: 3.

¹³ See Section 6.1 of the C.3 Technical Guidance for conditions in which bioretention areas provide bioinfiltration.

Worksheet E

Hydromodification Management

E-1 Is the project a Hydromodification Management¹⁴ (HM) Project?

E-1.1 Is the total impervious area increased over the pre-project condition?

- Yes. Continue to E-1.2
- No. The project is NOT required to incorporate HM Measures.
Go to Item E-1.4 and check "No."

E-1.2 Is the site located in an HM Control Area per the HM Control Areas map (Appendix H of the C.3 Technical Guidance)?

- Yes. Continue to E-1.3
- No. Attach map, indicating project location. The project is NOT required to incorporate HM Measures.
Skip to Item E-1.4 and check "No."

E-1.3 Has an engineer or qualified environmental professional determined that runoff from the project flows only through a hardened channel or enclosed pipe along its entire length before emptying into a waterway in the exempt area?

- Yes. Attach map of facility. Go to Item E-1.4 and check "Yes."
- No. Attach map, indicating project location. The project is NOT required to incorporate HM Measures.
Skip to Item E-1.4 and check "No."

E-1.4 Is the project a Hydromodification Management Project?

- Yes. The project is subject to HM requirements in Provision C.3.g of the Municipal Regional Stormwater Permit.
- No. The project is EXEMPT from HM requirements.

- If the project is subject to the HM requirements, incorporate in the project flow duration control measures designed such that post-project discharge rates and durations match pre-project discharge rates and durations.
- The Bay Area Hydrology Model (BAHM) has been developed to help size flow duration controls. See www.bayareahydrologymodel.org. Guidance is provided in Chapter 7 of the C.3 Technical Guidance.

E-2 Incorporate HM Controls (if required)

Are the applicable items provided with the Plans?

Yes	No	NA	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Site plans with pre- and post-project impervious surface areas, surface flow directions of entire site, locations of flow duration controls and site design measures per HM site design requirement
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Soils report or other site-specific document showing soil type(s) on site
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	If project uses the Bay Area Hydrology Model (BAHM), a list of model inputs and outputs.
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	If project uses custom modeling, a summary of the modeling calculations with corresponding graph showing curve matching (existing, post-project, and post-project with HM controls curves), goodness of fit, and (allowable) low flow rate.
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	If project uses the Impracticability Provision, a listing of all applicable costs and a brief description of the alternative HM project (name, location, date of start up, and entity responsible for maintenance).
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	If the project uses alternatives to the default BAHM approach or settings, a written description and rationale.

¹⁴ Hydromodification is the change in a site's runoff hydrograph, including increases in flows and durations that results when land is developed (made more impervious). The effects of hydromodification include, but are not limited to, increased bed and bank erosion of receiving streams, loss of habitat, increased sediment transport and/or deposition, and increased flooding. Hydromodification control measures are designed to reduce these effects.

Worksheet F Special Projects

Complete this worksheet for projects that appear to meet the definition of "Special Project", per Provision C.3.e.ii of the Municipal Regional Stormwater Permit (MRP). The form assists in determining whether a project meets Special Project criteria, and the percentage of low impact development (LID) treatment reduction credit. Special Projects that implement less than 100% LID treatment must provide a narrative discussion of the feasibility or infeasibility of 100% LID treatment. See Appendix J of the C.3 Technical Guidance Handbook (download at www.flowstobay.org) for more information.

F.1 "Special Project" Determination (Check the boxes to determine if the project meets any of the following categories.)

Special Project Category "A"

Does the project have ALL of the following characteristics?

- Located in a municipality's designated central business district, downtown core area or downtown core zoning district, neighborhood business district or comparable pedestrian-oriented commercial district, or historic preservation site and/or district¹⁵;
- Creates and/or replaces 0.5 acres or less of impervious surface;
- Includes no surface parking, except for incidental parking for emergency vehicle access, ADA access, and passenger or freight loading zones;
- Has at least 85% coverage of the entire site by permanent structures. The remaining 15% portion of the site may be used for safety access, parking structure entrances, trash and recycling service, utility access, pedestrian connections, public uses, landscaping and stormwater treatment.

No (continue) Yes – Complete Section F.2 below

Special Project Category "B"

Does the project have ALL of the following characteristics?

- Located in a municipality's designated central business district, downtown core area or downtown core zoning district, neighborhood business district or comparable pedestrian-oriented commercial district, or historic preservation site and/or district²⁰;
- Creates and/or replaces more than 0.5 acres of impervious area and less than 2.0 acres;
- Includes no surface parking, except for incidental parking for emergency access, ADA access, and passenger or freight loading zones;
- Has at least 85% coverage of the entire site by permanent structures. The remaining 15% portion of the site may be used for safety access, parking structure entrances, trash and recycling service, utility access, pedestrian connections, public uses, landscaping and stormwater treatment;
- Minimum density of either 50 dwelling units per acre (for residential projects) or a Floor Area Ratio (FAR) of 2:1 (for commercial projects) - mixed use projects may use either criterion. **Note Change on 7/1/16¹⁶**

No (continue) Yes – Complete Section F-2 below

Special Project Category "C"

Does the project have ALL of the following characteristics?

- At least 50% of the project area is within 1/2 mile of an existing or planned transit hub¹⁷ or 100% within a planned Priority Development Area¹⁸;
- The project is characterized as a non-auto-related use¹⁹; and
- Minimum density of either 25 dwelling units per acre (for residential projects) or a Floor Area Ratio (FAR) of 2:1 (for commercial projects) - mixed use projects may use either criterion. **Note Change on 7/1/16¹⁶**

No (continue) Yes – Complete Section F-2 below

¹⁵ And built as part of a municipality's stated objective to preserve/enhance a pedestrian-oriented type of urban design.

¹⁶ **Effective 7/1/16**, the MRP establishes definitions for "Gross Density"(GD) & FAR. GD is defined as, "the total number of residential units divided by the acreage of the entire site area, including land occupied by public right-of-ways, recreational, civic, commercial and other non-residential uses." FAR is defined as, "the Ratio of the total floor area on all floors of all buildings at a project site (except structures, floors, or floor areas dedicated to parking) to the total project site area."

¹⁷ "Transit hub" is defined as a rail, light rail, or commuter rail station, ferry terminal, or bus transfer station served by three or more bus routes. (A bus stop with no supporting services does not qualify.)

¹⁸ A "planned Priority Development Area" is an infill development area formally designated by the Association of Bay Area Government's / Metropolitan Transportation Commission's FOCUS regional planning program.

¹⁹ Category C specifically excludes stand-alone surface parking lots; car dealerships; auto and truck rental facilities with onsite surface storage; fast-food restaurants, banks or pharmacies with drive-through lanes; gas stations; car washes; auto repair and service facilities; or other auto-related project unrelated to the concept of transit oriented development.

F.2 LID Treatment Reduction Credit Calculation

(If more than one category applies, choose only one of the applicable categories and fill out the table for that category.)

Category	Impervious Area Created/Replaced (sq. ft.)	Site Coverage (%)	Project Density ¹⁶ or FAR ¹⁶	Density/Criteria	Allowable Credit (%)	Applied Credit (%)
A			N.A.	N.A.	100%	
B				Res ≥ 50 DU/ac or FAR ≥ 2:1	50%	
				Res ≥ 75 DU/ac or FAR ≥ 3:1	75%	
				Res ≥ 100 DU/ac or FAR ≥ 4:1	100%	
C				Location credit (select one)²⁰:		
				Within ¼ mile of transit hub	50%	
				Within ½ mile of transit hub	25%	
				Within a planned PDA	25%	
				Density credit (select one):		
				Res ≥ 30 DU/ac or FAR ≥ 2:1	10%	
				Res ≥ 60 DU/ac or FAR ≥ 4:1	20%	
				Res ≥ 100 DU/ac or FAR ≥ 6:1	30%	
				Parking credit (select one):		
				≤ 10% at-grade surface parking ²¹	10%	
No surface parking	20%					
TOTAL TOD CREDIT =						

F.3 Narrative Discussion of the Feasibility/Infeasibility of 100% LID Treatment:

If project will implement less than 100% LID, prepare a discussion of the feasibility or infeasibility of 100% LID treatment, as described in Appendix K of the C.3 Technical Guidance.

F.4 Select Certified Non-LID Treatment Measures:

If the project will include non-LID treatment measures, select a treatment measure certified for “Basic” General Use Level Designation (GULD) by the Washington State Department of Ecology’s Technical Assessment Protocol – Ecology (TAPE). Guidance is provided in Appendix K of the C.3 Technical Guidance (download at www.flowstobay.org).²²

²⁰ To qualify for the location credit, at least 50% of the project’s site must be located within the ¼ mile or ½ mile radius of an existing or planned transit hub, as defined on page 1, footnote 2. A planned transit hub is a station on the MTC’s Regional Transit Expansion Program list, per MTC’s Resolution 3434 (revised April 2006), which is a regional priority funding plan for future transit stations in the San Francisco Bay Area. To qualify for the PDA location credit, 100% of the project site must be located within a PDA, as defined on page 1, footnote 3.

²¹ The at-grade surface parking must be treated with LID treatment measures.

²² TAPE certification is used in order to satisfy Special Project’s reporting requirements in the MRP.

Worksheet G (For municipal staff use only)

G-1 Alternative Certification: Were the treatment and/or HM control sizing and design reviewed by a qualified third-party professional that is not a member of the project team or agency staff?

Yes No Name of Reviewer _____

G-2 High Priority Site: High Priority Sites can include those located in or within 100 feet of a sensitive habitat, an Area of Special Biological Significance (ASBS), a body of water, or **starting 7/1/16** on "hillside projects" disturbing $\geq 5,000$ sq.ft. of land and with steep slopes (of $\geq 15\%$ - see cell **I.A.4** - or as identified by municipal criteria or map). These sites are subject to monthly inspections from Oct 1 to April 30. See MRP Provision C.6.e.ii.(2).

Yes No If yes, then add site to Staff's Monthly Rainy Season Construction Site Inspection List

G-3 Inspections of Sites with Pervious Paving: Starting 7/1/16, Regulated projects that are installing 3,000 sq.ft. or more of pervious paving (see cell **I.B.1.e.1**) (excluding private-use patios in single family homes, townhomes, or condominiums) must have the paving system inspected by the jurisdiction upon completion of the installation and the site must be added to the jurisdiction's list of sites needing inspections at least once every five years – see provision C.3.h. Pervious pavement systems include pervious concrete, pervious asphalt, pervious pavers and grid pavers etc. and are described in the C3 Technical Guidance (Version 4.1) downloadable at: www.flowstobay.org/newdevelopment.

Yes No If yes, then add site to Staff's Lists for Inspections at the end of Construction and O&M.

Operations and Maintenance (O&M) Submittals

G-4 Stormwater Treatment Measure and/HM Control Owner or Operator's Information:

Name: _____

Address: _____

Phone: _____ Email: _____

➤ *Applicant must call for inspection and receive inspection within 45 days of installation of treatment measures and/or hydromodification management controls.*

The following questions apply to C.3 Regulated Projects and Hydromodification Management Projects.

	Yes	No	N/A
G-4.1 Was maintenance plan submitted?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
G-4.2 Was maintenance plan approved?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
G-4.3 Was maintenance agreement submitted? (Date executed: _____)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

➤ *Attach the executed maintenance agreement as an appendix to this checklist.*

G-5 Annual Operations and Maintenance (O&M) Submittals (for municipal staff use only):

For C.3 Regulated Projects and Hydromodification Management Projects, indicate the dates on which the Applicant submitted annual reports for project O&M:

G-6 Comments (for municipal staff use only):

G-7 NOTES (for municipal staff use only):

Section I Notes: _____
 Worksheet A Notes: _____
 Worksheet B Notes: _____
 Worksheet C Notes: _____
 Worksheet D Notes: _____
 Worksheet E Notes: _____
 Worksheet F Notes: _____

G-8 Project Close-Out (for municipal staff use only):

	Yes	No	NA
8.1 Were final Conditions of Approval met?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8.2 Was initial inspection of the completed treatment/HM measure(s) conducted? (Date of inspection: _____)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8.3 Was maintenance plan submitted? (Date executed: _____)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8.4 Was project information provided to staff responsible for O&M verification inspections? (Date provided to inspection staff: _____)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

G-9 Project Close-Out (Continued -- for municipal staff use only):

Name of staff confirming project is closed out: _____
 Signature: _____ Date: _____
 Name of O&M staff receiving information: _____
 Signature: _____ Date: _____

ATTACHMENT Q (1 of 3)

WATER DEMAND PROJECTION WORKSHEET

JOB TITLE _____
JOB NUMBER _____
JOB LOCATION _____

CAL. BY _____
CHKD. BY _____
DATE _____

INDOOR WATER DEMAND PROJECTION

A. RESIDENTIAL

1. Single Family (1-7 Units/Acre)
_____ Units X 2.8 Persons = _____ Persons
2. Multi - Family (8-20 Units/Acre)
_____ Units X 2.5 Persons = _____ Persons
3. High - Density (21+ Units/Acre)
_____ Units X 2.2 Persons = _____ Persons
_____ Persons X 60* GPD = _____ GPD Projected

B. OFFICE/COMMERCIAL

_____ sqft X 0.13 gpd/sqft = _____ GPD Projected

C. HOTEL

_____ rooms X 195 gpd/room = _____ GPD Projected

D. RESTAURANTS

_____ seats X 30 gpd/seat = _____ GPD Projected

E. ALL OTHERS SEE PAGE 3:

= _____ GPD Projected

LANDSCAPING WATER DEMAND PROJECTION

_____ sqft X 3.5 cuft of water /sqft of
landscape per year = _____ CUFT/YR

To convert to GPD:

_____ cuft/yr X 7.48 gal/ X 1 yr/
cuft 365 days = _____ GPD Projected

TOTAL DOMESTIC WATER DEMAND PROJECTION

INDOOR + LANDSCAPING PROJECTION = _____ GPD Projected

* From SFPUC Demand Study by URS, " Projected Water Usage for BAWSCA Agencies " ,
Tech Memo of August 2006.

ATTACHMENT Q (2 of 3)

WATER DEMAND PROJECTION WORKSHEET OCCUPANT LOADS

JOB TITLE _____
JOB NUMBER _____
JOB LOCATION _____

CAL. BY _____
CHKD. BY _____
DATE _____

DESIGNED USE OF THE FACILITY

OCCUPANT LOAD OF FLOOR AREA

A. SCHOOL/CLASSROOM

20 sqft/person

B. HEALTH CLUB

50 sqft/person

C. MANUFACTURING AREAS

200 sqft/person

D. NURSERIES (DAY-CARE)

35 sqft/person

E. STORAGE FACILITIES

300 sqft/person

ATTACHMENT Q (3 of 3)

WATER DEMAND PROJECTION WORKSHEET

UNIT LOADS

JOB TITLE _____
JOB NUMBER _____
JOB LOCATION _____

CAL. BY _____
CHKD. BY _____
DATE _____

TYPE OF ESTABLISHMENT

VOLUME OF CONSUMPTION/DAY

Assembly Halls	2 gal per seat
Bowling Alley	75 gal per lane
Churches	7 gal per seat
Dance Halls	2 gal per person
General Hospitals	0.27 gal per sqft
Health Clubs	25 gal per person
Laundries	400 gal per machine
Manufacturing (excluding industrial usage)	30 gal per person/shift
Motels with bath, toilet and kitchen wastes	170 gal per room
Nursing homes/Daycare	75 gal per person
Medical Offices (other than hospitals)	0.18 gal per sqft
Research and Development	0.21 gal per sqft
Schools	35 gal per person
Service Station	750 gal per bay
Storage facilities	1 gal per person
Stores (Retail type)	450 gal per 25 ft frontage
(Food -- non-restaurant type)	900 gal per 25 ft frontage
Trailer parks or tourist camps (with built-in bath)	50 gal per person