



CITY OF
PALO ALTO

Water Gas & Wastewater Utility Standards



2020

Utilities Department

**SECTION 01
INTRODUCTION****1.01 INTRODUCTION**

The 2020 WGW Utility Standards shall govern the requirements for design and construction of all water, gas, and wastewater utilities within the City of Palo Alto's public right-of-way. Private utilities on private properties fall under the jurisdiction of the City's Planning Department, Building Inspection Division. All drawings and specifications for City projects within the public right-of-way shall conform to 2020 WGW Utility Standards, unless otherwise approved by the WGW Engineering Manager.

New editions to WGW Utility Standards will be issued periodically. The electronic downloadable file is available at <https://www.cityofpaloalto.org/gov/depts/utl/eng/standards.asp>.

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**SECTION 800
ADDITIONAL PROVISIONS FOR UTILITIES CONTRACTORS**

PART 1 – GENERAL

1.01 DESCRIPTION

The additional provisions in this section are for contractors work on construction projects.

1.02 PROGRESS PAYMENT

The progress payment invoice on Utilities Capital Improvement Program (CIP) projects must list the locations where the work was performed, including names of streets with reference to the Project drawings and corresponding station numbers. All addresses of service lines, installed or reconnected, and locations of other invoiced items must be also included in the invoice.

The progress payment invoice shall be submitted with:

- A. Record drawings furnished in accordance with the requirements of Section 2740 of these specifications for infrastructure installed in the pay period stated on the invoice.
- B. GPS survey data collected and furnished in accordance with requirements stated in the Section 2740 of these specifications for infrastructure installed in the pay period stated on the invoice. The Contractor shall submit the GPS data set collected for the installation work during the first week of construction for the City to validate its accuracy.
- C. The completeness and accuracy of GPS survey data shall be verified by the City before the issuance of each payment to the contractor.

The City of Palo Alto may require the Contractor, at Contractor's own expense, to reopen or uncover GPS surveyed infrastructure/objects and perform new survey if the accuracy of the originally submitted data is not in compliance with these specifications. The Contractor will be required to perform surface restoration, at the Contractor's own expense, following the additional survey.

- D. Video on USB flash drive or hard drive, or provided through a Cloud platform of post construction sewer main and/or lateral video as specified in these Specifications for pay period stated on the invoice.
- E. List of quantities verified by City Inspection
- F. Additional items (special requirements) as stated below:
 - 1. Water CIP Projects:
 - a. A successful hydrostatic pressure/leak and bacteriological test, as specified in Section 2660 of these specifications, of the water system installed in the pay period stated on the invoice.
 - b. Submission of checklists of all notified affected property owners (7 day and 24 hour notices).
 - 2. Gas CIP Projects:

- a. A successful pressure test of the gas system installed in the pay period stated on the invoice.
- b. Submission of an attached CIP Gas Main Replacement Project Polyethylene Gas Pipe Fusion Records Form and automated fusion machine data printouts.
- c. Post construction sewer lateral/main verification completed, submitted, and accepted in accordance with the procedures stated in Section 2739 of these specifications.
- d. Submission of checklists of all notified affected property owners (7 day and 24 hour notices, and bollards installation).
- e. Full completion of surface restoration on private property affected by the construction in the stated pay period, including but not limited to, installation of bollards and surface restoration around risers.

3. Wastewater CIP Projects: All sewer main/lateral inspections completed.

1.03 CHANGES IN THE WORK (LABOR SURCHARGE)

The labor surcharge percentage to be applied to the actual wages paid shall be as provided in Section 9-1.04 (1b) of the latest edition of the State of California Department of Transportation Standard Specifications.

1.04 COST SAVINGS INCENTIVE

The Contractor may suggest contract cost savings changes by means of a contract cost savings proposal (CCSP). If these changes are approved by the City as deductive change orders, the contract cost savings shall be shared by the Contractor and City. The sharing of cost savings shall be 50 percent to the Contractor and 50 percent to the City. The City's cost for reviewing the Contractor's suggested savings shall include the cost of engineering services for evaluation of proposals and cost of required redesign. The City's total cost for all reviews of Contractor proposals shall be deducted from the total cost savings to be shared.

The Contractor may suggest savings at any time during the contract period. The Engineer will evaluate Contractor-suggested cost savings and the City will make a decision as to whether or not to make the change.

At a minimum, the Contractor shall include in each CCSP the following information:

- A. A description of the difference between the existing contract requirement and the proposed change. The comparative advantages and disadvantages of each, a justification of the alteration of an item's function or characteristics, and the effect of the change on the item's performance.
- B. A list and analysis of the contract requirements that must be changed if the CCSP is accepted, including any suggested revisions to the project specifications.
- C. A separate, detailed cost estimate for (a) the affected portions of the existing contract requirement and (b) the CCSP shall be submitted. The cost reduction associated with the CCSP, shall take into account the Contractor's development and implementation costs as set forth in the City Standard Drawings and Specifications, including any amount attributable to subcontracts.
- D. A statement of the time by which a contract modification accepting the CCSP must be issued

in order to achieve the maximum cost reduction, noting any effect on the contract completion time or delivery schedule.

The Engineer will process CCSP's expeditiously, however, in no case will a deductive change order, proposed during the time period or later in the project, be the basis of a time extension.

If the CCSP is not accepted, the Engineer will notify the Contractor in writing, explaining the reasons for rejection. The Contractor may withdraw any CCSP, in whole or in part, at any time before it is acted upon by the Engineer

1.05 MEETINGS

A. Pre-Construction Meeting

A pre-construction meeting discussing the scope of work, sequence of operations, and project requirements will be held after a satisfactory number, determined by the Engineer, of construction submittals to start construction of the project are approved.. The Contractor, together with the person to be designated as the Contractor's superintendent for the Work, shall be present at this meeting. In addition, the Contractor may request the attendance of such other project supervisory personnel as he may elect.

It is imperative that the Contractor, prior to this meeting, submit: 1) a Project Schedule, including the time impact analysis, for the Work, 2) Traffic Control Plans as defined in the project Special Provisions and in Section 01500 of these specifications, and 3) Schedule of Submittals for review and approval to conform to the Contract Documents. Failure to do so may seriously jeopardize the start of construction date and as such cause serious problems for the Contractor and the CITY in completing the project within the required time frame. The Contractor will not be allowed to proceed with construction until these items are approved in writing.

B. Project Meetings

Project meetings shall be conducted weekly or more frequently as requested by the Engineer or the Contractor. These meetings shall be attended by appropriate representatives of the Engineer and the Contractor's project Superintendent. Subcontractors and suppliers shall only attend by specific request from the Engineer.

The meetings will be conducted by the Engineer, and the Engineer will keep minutes of the proceedings. The minutes will be typed and distributed to all attendees.

The agenda of these project meetings will include such items as reports on construction progress, the status of submittal reviews, the status of record drawings, progress payment requests, the status of information requests, and any general business.

1.06 SUBMITTALS

The Contractor shall comply with IFB Part 5 General Conditions 3.12 and additional requirements in this section for submittals. All construction submittals shall be provided electronically to the Engineer via email within ten (10) working days from the date the Contract is signed. For projects with critical start and/or completion dates, it is the Contractor's responsibility to meet the dates by submitting required submittals in advance to avoid delays due to submittal review or material lead time. All submittals must be approved prior to starting the portion of work, or delivery of the material/equipment

to the job site that the submittal relates to. Unless specifically stated elsewhere in the Contract Specifications, make submittals in advance of ordering the materials to provide sufficient time for review, approval, possible revisions and re-submittals, and placing orders/securing delivery. For Utilities contracts, the issuance of Notice to Proceed pending receipt and approval of required submittals.

Ultimate responsibility for the accuracy and completeness of the information contained in each submittal shall remain with the Contractor. Unless otherwise specified, make submittals in groups containing all associated items to assure that required information is available for checking when the submittal is received. Partial submittals may be rejected as not complying with the provisions of the Contract and the Contractor may be held liable for delays so occasioned. The Engineer will supply a checklist of items that shall be submitted by the Contractor for approval.

If the submittal is returned to the Contractor marked "NO EXCEPTIONS TAKEN" or "MAKE CORRECTIONS NOTED", formal revision and resubmission of the submittal will not be required. Fabrication of any item shall not commence before the Engineer has reviewed the pertinent submittals and returned copies to the Contractor marked "NO EXCEPTIONS TAKEN" or "MAKE CORRECTIONS NOTED."

If the submittal is returned to the Contractor marked "REVISE AND RESUBMIT" or "REJECTED", the Contractor shall, within 5 working days, make a complete and acceptable submittal to the Engineer by the second submission of a submittal item. When material is resubmitted for any reason, transmit under a new letter of transmittal and with a new transmittal number; on re-submittals, cite the original submittal number for reference.

Revisions indicated on submittals shall be considered as changes necessary to meet the requirements of the contract and shall not be taken as the basis of claims for extra work. If the Contractor considers any required revision to be a change, he shall so notify the Engineer as provided for in the General Conditions.

The Contractor shall maintain an accurate submittal log for the duration of the Work, showing current status of all submittals at all times, and keep it available to the Engineer for his review upon request.

Where contents of submitted literature from manufacturers include data not pertinent to the submittal, clearly show which portions of the contents are being submitted for review.

The Engineer's review of the Contractor's submittals shall not relieve the Contractor of the entire responsibility for the correctness of details and dimensions. The Contractor shall assume all responsibility and risk for any work not conforming to the contract. Any fabrication or other work performed in advance of the receipt of approved submittals shall be entirely at the Contractor's risk and expense.

1.07 SCHEDULE UPDATE

- A. The schedule will be used by the Engineer to coordinate the construction project with other contracts and the City's operations in addition to monitoring the project progress, so it is imperative that the schedule be kept up to date. At any time during the progress of the work, the Engineer may request an updated or revised construction schedule. The Contractor shall provide such updated or revised schedule within two (2) Working Days and upon the Engineer's approval adjust his or her operations to conform to the newly approved schedule. An updated schedule shall be submitted monthly with each pay request. The Engineer may withhold approval of

progress payments until such time the Contractor submits a schedule acceptable to the Engineer.

- B. It is the Contractor's responsibility to keep the Engineer continually informed as to the location and timing of all the work. Daily prior to starting work the Contractor shall email the planned work for the day including road or lane closures to the City.

1.08 NOTIFICATION

The Contractor shall provide written notification of the work to abutting property owners at least seven (7) Days and again 24 hours prior to commencing work at their specific locations. If the driveway to any garage or parking area is to be closed for work, the notice shall state the approximate time of work in the driveway and when the work area will be reopened. No overnight closure of any driveway will be permitted.

1.09 ON-SITE SUPERVISION

A contractor's superintendent or foreman, or designated superintendent or foreman, is required to be physically on-site the entire day for the duration of the Work to supervise all construction activities. Substitution of superintendents or foremen shall be approved by the Engineer.

Any superintendent/foreman expected to perform polyethylene pipe fusion shall be tested and qualified in accordance with Section 2300 *Polyethylene Pipe Installation (3.12 H)*.

PART 2 – QUALITY CONTROL

2.01 DESCRIPTION

A. Work Included:

1. Qualifications of workmen
2. Codes and Standards
3. Testing
4. Equipment and materials
5. Inspection and approval of work
6. Manufacturers' recommendations

B. Related Work: Requirements for testing are described in various Sections of the Contract Specifications.

2.02 QUALIFICATIONS OF CONTRACTOR PERSONNEL

Provide workers in sufficient number who are thoroughly trained and experienced in the skills required. They shall be completely familiar with the work requirements and construction methods to complete the work described for each respective Section. A supervisor and competent person shall be present at all times during progress of the work of each respective Section and shall direct all work performed under each respective Section.

Contractor personnel performing polyethylene pipe fusion must produce documentation from a pipe supplier stating their qualification to perform said work and shall be tested by the City for certification to fuse on City piping per Section 2300 of these specifications. See Appendix E and Appendix F for fusion procedures and certification on water, gas, and wastewater facilities.

Workers performing work on natural gas facility shall be tested by the City for the certification per Section 2685.3.07 Operator Qualification Requirements.

Contractor personnel performing directional drilling operations on State of California property, involving a State of California permit, or falling under the authority of the State of California (Caltrans Right-Of-Way) must provide proof-of-training certification acceptable to Caltrans.

Contractor personnel performing pipe-bursting work shall comply to Section 2735 for qualification requirements.

Contractor personnel performing work within Caltrain Property are required to have successfully completed, within the last twelve (12) months, Caltrain's Roadway Worker Protection training program. The Contractor shall forward to Caltrain records of those who successfully completed the course. The Contractor shall, at all time, comply with provisions of the Federal Rail Administration Regulation 49CFR214 (Roadway Worker Protection), the Caltrain/Amtrak Zero Tolerance Policy, and the Permitter (Licensor) On-Track Safety Program

2.03 CODES AND STANDARDS

The following reference standards (latest version) in addition to the **Project Plans and Specifications** are hereby incorporated by reference and shall be referred to in this specification by their abbreviations. These reference standards shall apply to all applicable work of this contract.

- A. **CITY (DEPARTMENT OF PUBLIC WORKS) STANDARD SPECIFICATIONS:** The City of Palo Alto Standard Drawings and Specifications latest version adopted (Available at the Revenue Collection Office, First Floor, Civic Center, 250 Hamilton Avenue, Palo Alto).
- B. **UTILITY STANDARDS FOR WATER, GAS, AND WASTEWATER:** The City of Palo Alto Utility Standards for Water, Gas, and Wastewater, Latest edition (The electronic downloadable file is available at <https://www.cityofpaloalto.org/gov/depts/utl/eng/standards.asp>).
- C. **OPERATIONS, INSPECTION, AND MAINTENANCE PLANS:** The City of Palo Alto, Utilities Department, Gas Division Manual latest adopted edition (Available from the City of Palo Alto Operations, MSC, 3201 East Bayshore Road, Palo Alto).
- D. **CITY OF PALO ALTO TRAFFIC CONTROL MANUAL** Available at the Transportation Division on the sixth floor of the Civic Center at 250 Hamilton Avenue.
- E. **MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES (MUTCD) – CALTRANS**
- F. **WORK AREA TRAFFIC CONTROL HANDBOOK (WATCH BOOK)**
BNI Publications Inc.
- G. **Tree Technical Manual**
Department of Planning and Community Environment Latest edition
- H. **CALIFORNIA SPECIFICATIONS (CalTrans):** The State of California Department of Transportation Standard Specifications, latest edition. Copies are available for purchase at the following address:
State of California

Department of General Services
Publications Distribution Unit
1900 Royal Oaks Drive
Sacramento, CA 95815
(916) 445-3520

- I. **U.S. DEPARTMENT OF TRANSPORTATION, PIPELINE SAFETY REGULATIONS, PARTS 190 TO 199.** Copies of these regulations are available for purchase from the following address:
 - Transportation Safety Institute
 - Pipeline Safety Division DMA-607
 - 6500 S. MacArthur Blvd.
 - Oklahoma City, OK 73125
- J. **OSHA** Consultation and Compliance Section
 - U.S. Department Of Labor
 - Occupational Safety and Health Administration
 - 71 Stevenson St. Suite 415
 - San Francisco, California 94105
- K. **CAL-OSHA** Department of Industrial Relations
 - State of California
 - Occupational Safety and Health Administrations
 - 525 Golden Gate Ave.
 - San Francisco, CA 94102
- L. **UPC** Uniform Plumbing Code
 - 20001 Walnut Drive South
 - Walnut, CA 91789-2825
- M. **UBC** Uniform Building Code
 - 5360 South Workman Mill Road
 - Whittier, CA 90601
- N. **NEC** National Electric Code
 - National Fire Protection Association
 - Batterymarch Park
 - Quincy, MA 02269
- O. **UFC** Uniform Fire Code
 - 5360 South Workman Mill Road
 - Whittier, CA 90601
- P. **UL** Underwriters Laboratories
 - 1655 Scott Boulevard
 - Santa Clara, CA 95050
- Q. **AWWA** American Water Works Association
 - 6666 West Quincy Avenue
 - Denver, CO 80235-3098

- R. **NSF** National Sanitary Foundation
 789 Dixboro Road
 Ann Arbor, MI 48113-0140

2.04 TESTING

- A. Code Compliance Testing: Inspections and tests required by codes or ordinances, or by a plan approval authority, and which are made by a legally constituted authority, shall be the responsibility of and shall be paid for by the Contractor, unless otherwise provided in the Contract Documents.
- B. Contractor's Convenience Testing: Inspection and testing performed exclusively for the Contractor's convenience shall be the sole responsibility of the Contractor.
- C. Provide "Certificates of Compliance" when required and other testing and inspecting as are specified to be furnished by the Contractor in this Section and/or elsewhere in the Contract Documents.
- D. Testing, when required, will be in accordance with the selected standards of the American Society for Testing and Materials (ASTM).
- E. The testing laboratory will be qualified subject to the CITY's approval.

PART 3 - PRODUCTS**3.01 EQUIPMENT AND MATERIALS**

All equipment and materials furnished shall be new and the best of their respective kinds, free from all defects and as specified in the Drawings and Specifications or as approved and accepted in writing by the Engineer.

All equipment, materials, and devices, shall be installed in accordance with the recommendations of the manufacturer, unless otherwise approved by the Engineer. Prior to the start of work, the Contractor shall obtain and deliver copies to the Engineer of all installation manuals, brochures, and procedures that the manufacturer issues for the items supplied.

For projects with specific start or completion dates, it is the Contractor's responsibility to include necessary costs to expediate the delivery of any long-lead items to avoid delays and comply with project specifications.

3.02 EXCESS MATERIALS

The Contractor shall return all salvageable fire hydrants and meter box lids to the City's Municipal Service Center. Any excess materials shall be returned to their appropriate suppliers. At no time shall excess materials be dropped off at the City's Municipal Service Center. All transportation and re-stocking fees (invoice required) will be paid to the Contractor only if the City authorized the work to be canceled. The Contractor will not be paid for excess materials that are over-ordered and/or purchased without approved submittals.

PART 4 - EXECUTION

4.01 APPROVAL OF WORK

All work to be performed and all material to be furnished by the Contractor shall be subject to inspection by the Engineer at all times and shall be performed and furnished to their satisfaction. Any work concealed before it has been inspected by the Engineer or their representative shall, at the request of the Engineer, be reopened or uncovered. If deficiencies are found, these deficiencies shall be corrected at the Contractor's expense.

The City reserves the right to inspect materials or equipment during the production, manufacturing or fabricating process, or before shipment.

Neither acceptance of the Work, nor final payment, shall relieve the Contractor of the responsibility for performing the Work in accordance with the Contract requirements. The Contractor shall remedy any work not conforming to the Contract without expense to the City.

4.02 MANUFACTURER'S RECOMMENDATIONS

Whether specifically mentioned or not in the Drawings or Specifications, all equipment, materials, devices, etc., shall be installed in a manner meeting the manufacturer's recommendations for the particular item. Prior to the start of work, the Contractor shall obtain and deliver copies to the Engineer of all installation manuals, brochures, and procedures that the manufacturer issues for the items supplied. The Contractor shall be held responsible for all installations contrary to the manufacturer's recommendations, unless otherwise approved by the Engineer. If any item or piece of equipment or material is found to be installed not in accordance with the manufacturer's recommendations, or as otherwise directed by the Engineer, the Contractor shall make all necessary changes and revisions to achieve such compliance at the Contractor's expense.

4.03 COOPERATION WITH TESTING LABORATORY

- A. Representatives of the testing laboratory shall have access to the Work at all times and all locations where the Work is in progress. Contractor shall provide such access to enable the laboratory to perform its functions properly.
- B. Cooperate with the City's selected testing agency and all others responsible for testing and inspecting the Work.

4.04 TAKING SPECIMENS

All specimens and samples for testing, unless otherwise provided in the Contract Documents, shall be taken by the testing personnel. All sampling equipment and personnel will be provided by the testing laboratory. All deliveries of specimens and samples to the testing laboratory will be performed by the testing laboratory.

4.05 PRODUCT HANDLING

Contractor shall promptly process and distribute required copies of test reports and related instructions for the "Certificate of Compliance" to allow necessary retesting and/or replacement of materials with the least possible delay in progress of the Work.

4.06 SCHEDULES FOR TESTING

A. Establishing Schedule:

1. By advance discussion with the testing laboratory selected by the City, determine the time required for the laboratory to perform its tests and to issue each of its findings.
2. Provide no less than 48 hours notice to the Engineer when testing will be required and provide all required time within the construction schedule to perform necessary testing.

B. Revising schedule: When changes of construction schedule are necessary during construction, Contractor shall coordinate all such changes with the testing laboratory as required.

C. Adherence to Schedule: If the testing laboratory is prevented from testing or taking specimens due to incompleteness of the Work, all extra charges for testing attributable to the delay will be back-charged to the Contractor and shall not be borne by the City.

4.07 PAYMENT FOR TESTING

Contractor shall pay for all testing (excluding soil compaction testing) and re-testing required to comply with the Contract Specifications, Codes, Regulations, and all other applicable laws. Contractor is responsible to pay for the soil compaction testing technician's waiting time if the trench backfill is not ready to be tested at the scheduled time. Contractor shall also pay for the soil compaction testing technician's time to re-test if the test fails. Progress payments will be deducted for the hours the City is billed due to Contractor's delay.

4.08 DAMAGE TO PUBLIC OR PRIVATE PROPERTY

Damage to public or private property shall be repaired in kind or as the Engineer shall direct, at the Contractor's expense. This includes, but not limited to the repair or replacement of streets, sidewalks, underground utilities, City monuments, traffic facilities, traffic loop detectors, striping, legends, signals, signs, pavement markers, trees, and landscaped areas. Temporary traffic markers shall be placed immediately after final paving to properly channel traffic.

If damage to utilities occurs beyond the City's Right-of-Way, the Contractor shall coordinate with the City's Building Division to acquire permits and schedule on-site inspection. The Contractor is responsible for all costs associated with the repair, inspection, and permits for the restoration of on-site plumbing. Visit <https://www.cityofpaloalto.org/gov/depts/ds/default.asp> to acquire permits or schedule inspection.

4.09 WORK OUTSIDE OF PUBLIC RIGHT OF WAY

Project specified work that is outside the public right-of-way shall be conducted with care and consideration consistent with the requirements of these Specifications and Public Works Standard Specifications including other referenced standards of this specification. The Contractor is prohibited from advertising its services to the Owners/Residents of properties and Businesses affected by the Project Construction for the duration of the Contract.

For work on private property, it is the Contractor's responsibility to contact the owner or occupant to coordinate the schedule and access. Sufficient notification shall be provided by the Contractor to the owner or occupant to avoid delays.

4.10 MONUMENT REPLACEMENT

All monuments within the project site shall be preserved as required by the State and local regulations. Damaged or destroyed monuments shall be replaced by a California licensed Land Surveyor hired by the Contractor. The Contractor shall submit the method and procedures of tying out the monuments for the City Surveyor's approval. The Contractor shall also provide a recorded copy of the "corner record" to the City Surveyor. No separate bid item was made for the cost of any surveying or monument replacement work. The cost shall be included in one or more of the bid items.

4.11 METERED OR PERMIT-REQUIRED PARKING

The Contractor is responsible for obtaining and paying (not compensated by the City) for all metered parking or permit-required parking spaces occupied by contractor's personal vehicles inside or outside of the immediate construction zones. The contractor is also responsible to pay for any metered parking or permit-required parking spaces made unavailable by construction equipment, vehicles, or material during non-working hours or outside the immediate construction zone(s).

END OF SECTION

SECTION 860
STREET PAVEMENT SCHEDULE - EXAMPLE

Surface restoration shall include all materials and labor required to restore the area both below and above ground. Restoration of pavement sections, sidewalks, driveways, landscaping, curbs and gutters, and backfill shall conform the City Standard Drawings and Specifications, latest version adopted. The pavement restoration shall be as per *Required Replacement Pavement Table* and in accordance with the Public Works Department Standard Drawings and Specifications and Project Drawings.

Existing Pavement Section Table

STREET	BETWEEN	AND	SURFACE TYPE	SURFACE THICKNESS (INCH)	BASE TYPE	BASE THICKNESS (INCH)
Main Street	Alma	High	AC	6	PCC	6
Bryant Ave	High St	Emerson St	AC	6	AB	18

LEGEND

Surface Type:

AC – Asphalt Concrete

PCC – Portland Cement Concrete

AB – Aggregate Base

Notes:

The pavement thickness type information provided above may not represent 100% of the actual pavement thickness in the project areas. For estimating purposes, the Contractor shall assume the minimum required thickness from the CPA Standard Specifications if the information is not available. For estimating purposes, the Contractor shall assume additional pavement thickness of up to 25% from the data provided and the CPA Standard Specifications, whichever is greater.

The cost of pavement restoration shall be included in one or more of the bid items. If the discrepancy occurs between the proposed section and the actual pavement thickness, the Engineer shall be informed to verify the existing pavement thickness. The pavement shall be restored “in-kind” meeting the minimum requirement per CPA Standard Specifications.

For restoration within the other agencies R/W the Contractor shall contact and follow the direction of the permitting agency.

END OF SECTION

**SECTION 870
POLICY AND PROCEDURES FOR WATER USE**

PART 1 - GENERAL**1.01 GENERAL**

Reclaimed water shall be used for backfill compaction, and cleaning and testing of manholes. An overhead standpipe with a five hundred (500) gallon per minute (gpm) fill rate is available at the Palo Alto Regional Water Quality Control Plant (RWQCP) between Monday through Friday, 6:30 a.m. to 5:00 p.m., except on public holidays. A recycled hydrant is also available for 24-hours a day, 7-days a week to active permit holders and is located at Greer Park, near 1198 Colorado Avenue, Palo Alto, CA. This will allow self-service pickup and use of reclaimed water on a first come-first serve basis, up to the capacity of the reclamation plant of four and a half (4.5) million gallons per day (MGD).

The permit may be obtained on the City's website at:

https://www.cityofpaloalto.org/gov/depts/pwd/pollution/recycled_n_other_non_potable_water.asp

and shall be submitted to the RWQCP at 2501 Embarcadero Way, Palo Alto, CA with a \$50 check or money order payable to the "City of Palo Alto". For additional information, call 650.329.2598 or e-mail recycledwater@cityofpaloalto.org

The City of Mountain View operates reclaimed water-filling hydrants at the end of Crittenden Lane (E. of N. Shoreline Boulevard), and at Marine Way near Coast Avenue in Mountain View, CA. A key deposit is required. Contact the City of Mountain View at (650) 903-6329 or at recycledwater@mountainview.gov.

Potable water for drinking, filling of water mains, etc. is available from hydrants in the vicinity of the work. Hydrant water shall be metered with a hydrant meter obtained by contacting the City of Palo Alto Utilities Business Office at (650) 329-2161 (Second Floor Civic Center, 250 Hamilton Avenue, Palo Alto). A meter deposit is required. Payment for potable water used will be deducted from the Contractor's deposit at the time the meter is returned. Refer to the *Policy and Procedures for Water Hydrant Meter Use*, for more information.

All costs and expenses for any water used on the project shall be included in one or more of the Bid items and no extra compensation shall be paid to the Contractor for water.

PART 2 - POLICY AND PROCEDURES FOR WATER HYDRANT METER USE**2.01 USE RECLAIMED WATER WHENEVER POSSIBLE**

The water consumption ordinance for the City of Palo Alto requires the review of water use for construction purposes, to encourage the use of reclaimed water. The use of a reasonable amount of potable water, for flushing potable water pipes, for instance, is still permissible through hydrant meters. However, substantial water needs for construction purposes must be met with reclaimed water.

Reclaimed water will be required for the following projects:

1. Grading projects, i.e. road construction, paving, site development, and projects reviewed by the Water/Gas/Wastewater Division.
2. Street washing and flushing for final project clean-up.

3. Projects for which daily water use exceeds 5,000 gallons.
4. Projects for which weekly water use exceeds 25,000 gallons.

Procedures for permission to connect to City of Palo Alto hydrants and the penalties for not using the hydrant meter properly are explained below.

Exceptions to this policy typically are granted only for very small jobs. Requests for exceptions to this policy will be referred to the Senior Engineer in the Water/Gas/Wastewater Division for review and determination.

2.02 HOW YOU CAN GET A HYDRANT METER

Applicants for a water hydrant use permit should come in person to the Utilities Department Customer Service Center, 250 Hamilton Avenue, Ground Floor. At that time:

1. Complete a questionnaire about your project and its location.
2. Pay the \$750 meter deposit fee.
3. Get six meter reading cards. NOTE: On or before the 25th day of each month, a card should be completed with the current meter reading and sent to the Customer Service Center.
4. You will then be given a form to take to the Municipal Services Center (MSC) at 3201 East Bayshore Road where you may pick up a hydrant meter. You will be assigned the meter for a period of six (6) months. At the end of that time the meter must be returned to the MSC. If you need potable water for the same project site after the three months, a new meter will be issued. Included with the hydrant meter will be an instruction sheet for proper use of the meter. **By taking the meter, it is assumed that you will properly use the meter at all times when connecting to City hydrants.**

2.03 PENALTIES

By providing an applicant with hydrant meters for use of potable water at construction sites, the City of Palo Alto is entering into a relationship of trust with the applicant. Nevertheless, City staff will, from time to time, visit the site to ensure that the hydrant meter is being used and that it is being used correctly. Failure to comply with any of the above rules or to properly hook up the meter according to the instruction sheet provided with the hydrant meter, may subject the applicant to penalties. Specifically:

- A. Failure to use the hydrant meter or to use it so that water does not pass through the meter when drawing water from a City of Palo Alto hydrant will result in fines of \$50.00 per day and possible forfeiture of all or part of the deposit, revocation of the permit, and prosecution according to the law (Rule and Regulation 21.D.1.b.i; 21.D.1.b.iv; and 8.C.1-2).
- B. Failure to submit meter-reading cards monthly and in a timely manner may result in forfeiture of all or part of the deposit.
- C. Failure to return the hydrant meter at the end of the three-month period may result in fines of \$50.00 per day and/or part of the deposit.

2.04 HYDRANT METER QUESTIONNAIRE (SAMPLE)

The following is a sample copy of the City's Hydrant Meter Questionnaire.

HYDRANT NUMBER _____

HYDRANT METER QUESTIONNAIRE

NAME: _____

BILLING ADDRESS: _____

TYPE OF BUSINESS: _____

TYPE OF PROJECT: _____

PROJECT ADDRESS: _____

**HOW WILL WATER
BE USED?** _____

IN WHAT QUANTITY? _____

FOR HOW LONG? _____

(CIRCLE ONE)

Does your company own a truck? YES NO

Will a water truck be used on the project? YES NO

What is the capacity of the truck (in gallons)?

"SPECIAL WATER UTILITY REGULATIONS, Rule and Regulation 21, Paragraph B. 1, B. 3."
Failure to return the hydrant meter at the end of the appropriate period may result in additional charges of \$ 50.00 per day.

Have customer read this paragraph and sign for verification.

Signature Title Date

**SECTION 1500
SITE AND TRAFFIC CONTROL
FOR WGW UTILITIES CONTRACTS**

1.01 DESCRIPTION**A. Work Included:**

1. Traffic Control
2. Safety
3. Sanitation Facilities
4. Storage of Equipment and Materials
5. Cleanup
6. Coordination
7. Signage

1.02 TRAFFIC CONTROL**A. General**

All traffic control, depending on location of work and area of jurisdiction, shall be performed in strict compliance with City of Palo Alto Transportation Division per the requirements noted herein, CALTRANS, and/or Santa Clara County traffic control requirements where applicable.

B. Additional Traffic Control Requirements

The contractor shall furnish, erect and maintain sufficient warning and directions signs, working flashers on each barricade, lighted warning signs, and furnish sufficient flag persons to give adequate warning to the public at all times in the road or street under construction.

Contractor shall submit traffic control plans to the Engineer for approval ten (10) Working Days prior to the pre-construction meeting. **The Notice to Proceed will not be issued until the traffic control plans are approved (Allow 15 to 20 working days for the approval process) and all other conditions are met.** The traffic control plan shall include a typical intersection and street for work planned with typical pavement widths and lane widths noted on the plan. Transportation Department may also require site-specific plans on high-volume traffic intersections or streets. For the following major signalized intersections, the traffic control plan shall reflect actual (not typical) intersection layout and indicate islands, medians, lane lines, bike lane lines, nearby driveways, and note all pavement and lane widths:

- All Intersections with Page Mill Road, all Intersection with Embarcadero Road, all Intersections with Arboretum Road, Charleston Road and Commercial Street, and Coyote Hill Road and Hillview Avenue.

All cost and expense for traffic control shall be included in the Bid prices for various Bid items and no special compensation shall be allowed.

Contractor shall not detour traffic without the approval of the Engineer.

The Contractor shall not work on two adjacent parallel streets simultaneously.

The Contractor shall maintain adequate separation between pedestrians, bicyclists, vehicular traffic, truck traffic, and the work site during construction by providing adequate barricades with at least one

working flasher on each, pedestrian bridges, ramps, reflectors, cones, guard rails, fencing and any other warning devices as required. The Contractor shall separate truck traffic from bicycle traffic (i.e. place signs directing bicyclists to an alternate route away from the haul route). Each pedestrian crosswalk, when crossing by or over construction excavation, shall be provided with a pedestrian bridge with handrails. The Contractor shall not remove the barricades in the street at any given location until the final paving repair has been completed and the hazard to bicyclists and motorists no longer exists.

The Contractor shall coordinate the Work with the appropriate Transit Districts, and School Districts running the buses in the area and shall notify the Communications once a week about the construction activities.

The following requirements are minimum and do not limit the Contractor's responsibility of doing all that is practical and necessary to ensure the safety of workers, pedestrians, bicyclists, and motorists:

1. Traffic control shall conform to the latest additions of the Manual of Uniform Traffic Control Devices (MUTCD Caltrans), Work Area Traffic Control Handbook (WATCH BOOK), Traffic Control Manual and the City of Palo Alto Standards.
2. The Contractor is required to submit alternative traffic control plan(s) for day and night work.
3. Local and emergency access shall be maintained on all streets at all times.
4. The Contractor shall protect open excavations, trenches, and such during construction with fences, covers, and railings, as required, together with signs, lights, and other warning devices sufficient to maintain safe pedestrian, bicycle, and vehicular traffic to the satisfaction of the City.
5. After each site has been completed, the Contractor at his expense shall restore planting areas and other areas abutting the work to the condition existing at the start of work. Unless otherwise authorized by the City Inspector, all construction and restoration including tape striping, signing, curb markings, etc. shall be completed within fifteen (15) working days from start of work at any specific location.
6. The Contractor shall conduct operations and schedule cleanup so as to cause the least possible obstruction and inconvenience to traffic, pedestrians, cyclists, and adjacent property owners. All work areas shall be swept clean at the end of each day's work and at other times when directed by the City. A mobile street sweeper shall be used wherever practical and as required by the Project Manager, and dust shall be suppressed to the satisfaction of the City. The Contractor shall remove all debris from the job site at the end of each work day.
7. The Contractor shall notify the abutting property owners at least 7 days in advance and again 24 hours prior to commencing work at their specific locations. **The Contractor will be required to prepare checklists of all notified affected property owners (7 day, and 24 hour notices) and submit the lists to the Engineer prior to commencing a work at their specific locations.** The notice shall include the project title, contact person(s) and a local telephone number, and construction dates. **The notifications of the construction provided to any School or Hospital administrations and records of any subsequent contacts with the School or Hospital administrations, related to the construction, must be maintained and available for inspection for no less than 5 years from the date of notification. Such notifications must include name(s) and title(s) of person(s) contacted/notified.**
8. Contractor shall maintain access to all driveways except when actually doing construction within the driveway boundaries, at which time partial access shall be maintained unless alternate

arrangements are made with the property owners or tenants in advance. If the driveway to any garage or parking area must be closed for construction work, the notice shall state the approximate time it will be reopened.

9. The Contractor shall post "No Parking" signs as required 72 hours in advance. The signs shall be approved by the City Police Department and shall specify the date and time "No Parking" will be allowed. Signs shall be posted a maximum of 50 feet on center and removed immediately after the work is completed. The signs shall be removed when the work is completed.
10. The Contractor is required to provide a written notification regarding bollards installation to the affected property owners and submit a notification checklist to the Engineer.
11. The Engineer shall have the right to limit the amount of trench, which may be opened or partially opened at any time. No more than 500 feet of trench or one City block of trench, whichever is greater, or more than 50 potholes not to exceed a total paved surface area of 500 square feet, shall be opened at any one time. Paved surface disruptions shall be classified as open until final pavement resurfacing has been completed including full surface restoration on the affected by the construction private property.
12. Temporary pavement markings shall be in place prior to allowing traffic to use the street. This includes all markings (STOP bars, crosswalks, arrows, and lane line striping).
13. Damage done by the Contractor during the course of the work to City property shall be repaired and restored to "like-new" condition or, as the Project Manager shall direct, at the Contractor's expense. This includes the repair of traffic loop detectors, striping, signing, curb markings, etc. Unless otherwise authorized by the City Inspector, all construction and restoration including striping, signing, curb markings, etc. shall be completed within one week of work completion. Loop detectors shall be repaired within 72 hours of damage.
14. No stockpiling of materials or parking of equipment during non-working hours will be allowed on City property, i.e., streets, alleys, parking lots, sidewalks, etc. unless specifically approved by the Project Manager. While storing equipment and materials on the street, storage area shall be properly barricaded and shall not block traffic. Materials shall be placed in such a manner that they do not impede the flow of water to the storm drains and shall be covered to avoid run-off during rain.
15. The Contractor will be required to pay for any public off-street or on-street "time-limited" parking spaces, within the University Avenue and California Avenue business districts or Stanford University areas that will be rendered unusable to the public as a result of the permitted operations. This includes spaces to maintain traffic lanes, for parking of construction vehicles during work hours, for issuing parking permits to parked vehicles displaced from their private parking spaces, etc. The proposed use of parking spaces must be included in the traffic control plan submission.
16. All open trench and excavations must be backfilled and paved with temporary asphaltic concrete or steel-plated at the end of each work day with non-skid plates. The Contractor shall place cold cutback around the edges of non-skid steel plates and elsewhere as necessary to eliminate vertical edges. For ADA compliance all cutback on sidewalks shall be placed so there will be a 12:1 slope to allow disabled access.
17. Spillage resulting from hauling operations along or across any public traveled way shall be removed immediately by the Contractor at the Contractor's expense.
18. Compliance with the City of Palo Alto Truck Route Regulations is required at all times.

19. Contractor shall obtain a Transportation permit from the Transportation Division for any vehicle that exceeds weight or dimensions prescribed in California Vehicle Code.
20. Any work along El Camino will require a permit and approval from the State of California Department of Transportation (Caltrans), and work along Oregon Expressway, Page Mill, and Foothill Expressway requires a permit and approval from Santa Clara County Transportation Agency.
21. The contractor shall use only Caltrans-approved traffic control devices. The Contractor shall supply, place, and maintain all necessary traffic control devices in accordance with the State of California "Manual of Traffic Controls for Construction and Maintenance of Work Zones".
22. In general, Contractor shall maintain all vehicular, pedestrian, and bike movements. If possible, the Contractor shall maintain one lane of traffic in each direction at all times on all streets. The clear width of the lane shall be a minimum of 10 feet. When a bike lane is closed in conjunction with a vehicle lane, the clear width of the lane shall be a minimum of 14 feet. No total closure of any arterial or collector street, business district street, or alley will be permitted. City may allow closure of local residential streets, but contractor shall always maintain local and emergency access and provide a signed detour route around the closure.
23. Flashing arrow boards shall be used at all times when shifting traffic to the opposite side of the street, shifting traffic at night, for work on arterial streets (Middlefield, Alma, Embarcadero, University, Charleston, Arastradero, Sand Hill, and San Antonio), and as otherwise required in the approved traffic control plan.
24. All warning signs and cones for night lane closures shall be illuminated or retroreflective. Retroreflection of 28-inch cones shall be provided by a 6" white band and a 4" white band. Flashing warning lights shall be used for all night lane closures.
25. Contractor shall use "Bike Lane Closed Ahead" and "Bike Lane Ends" signs when necessary to close bike lanes. Detour signs shall be provided for any Class I bike path closure.
26. Work shall not restrict visibility of any traffic control device.
27. A minimum four feet (clear) sidewalk shall be maintained unless the work makes closure unavoidable, in which case the sidewalk may be closed while working, subject to the approval of the Project Manager. During sidewalk closures, R96 "No Pedestrian" signs shall be posted at the site and R49M "Sidewalk Closed – Use Other Side" signs posted on both sides of the site at the nearest corners. If the other side of the street is not available or practical for pedestrian use, an alternate pedestrian facility shall be provided for the duration of the closure. The alternate facility shall conform to construction requirements of the Uniform Building Code (UBC) and the Americans with Disabilities Act (ADA). At intersections, work will be permitted at one corner at a time, so pedestrian movements can be maintained through the intersection.
28. **All work within 1500 feet of the school of hospital shall be coordinated with the school or hospital administration.** No work will be permitted within 1500 feet of school grounds until after 8:30 a.m. on school days. Other special restrictions may be required at heavily used school crossings or school commute routes beyond 1500 feet from the school grounds, as deemed necessary for student safety by the Project Manager.
29. Work on Alma Street, Embarcadero Road, Middlefield Road and Oregon Expressway will be permitted between the hours of 9 a.m. and 4 p.m. only.

30. If work will impact transit stops or transit routes, contractor shall be required to contact Santa Clara County Transit District, Samtrans and other affected transit companies to address relocation of facilities or rerouting of buses prior to submitting traffic control plan. Traffic control plan should indicate what actions are being taken with regard to transit services.
31. Any work within 150 feet of any signalized intersection shall be coordinated with the City of Palo Alto Traffic Signal Supervisor at (650) 496-6991.
32. No closure of any lane within 200' of signalized intersection will be permitted between 7 A.M. to 9 A.M. and between 4 P.M. to 6 P.M. In addition, work will not be allowed at or within 200' of signalized intersections between 11:30 A.M. and 1:00 P.M.
33. Traffic shall be fully restored outside the permitted work hours, unless approved Traffic Control Plan modifies work time limitations. Violation of any of the above listed restrictions will lead to a penalty charge to the Contractor at the rate of \$200/hour.
34. Any work in vicinity of a signalized intersection within Caltrans R/W shall be coordinated with Caltrans Signal Operation Division and performed in accordance with the conditions of and encroachment permit.
35. Except in emergency situations, any traffic detour requires five (5) working days advanced notice in order to insure proper advanced planning.
36. The contractor shall place barricades 50 feet on center at the gutter joints and provide one working flasher for each barricade and shall insure that each flasher is maintained in working condition while in use. The Contractor shall not remove the barricades in the street at any given location until the asphalt concrete patching adjacent to the gutter and/or gutter overlay has been done and the hazard to bicyclists and motorists no longer exists.
37. Flaggers shall be equipped with a hard hat, an orange vest, and a C28 "STOP/SLOW" paddle on a 5-foot staff. Additional advance flaggers may be required when traffic queues develop. Flagger stations for work at night shall be illuminated as noted in Section 5-04.6 of the Manual of Traffic Control for Construction and Maintenance Zones.
38. The Contractor may be required, at Contractor's own expense, to hire City of Palo Alto Police Officers to direct traffic if the traffic signals at an intersection or crossing become inoperable due to the Contractor's work, traffic control setup does not conform to the approved traffic control plan, or if the Project Manager determines that Police Officers are necessary to safely guide traffic through the intersection.

1.03 SAFETY

All work shall be conducted in a safe manner and in strict accordance with the rules of the State Division of Industrial Safety (Cal OSHA). The Contractor shall take all reasonable precautions necessary to protect from personal injury all workers and other persons who may be in or about the construction area and to prevent damage to both public and private property. Workers in the public right-of-way shall wear orange safety vests and hard hats at all times.

The Contractor shall assume sole and complete responsibility for job site conditions during the course of construction of this Project, including safety of all persons and property; that this requirement shall apply continuously and not be limited to normal working hours; and that the Contractor shall defend, indemnify and hold the City harmless from any and all liability, real or alleged, in connection with the performance of work on this Project.

The Contractor shall notify the City in writing of all accidents arising out of work performed under this Contract and shall submit to the Engineer a detailed report of each such accident within 24 hours of the event.

The Contractor shall protect open excavations, trenches, manholes, and such during construction with steel plating, fences, covers, and/or railings, together with adequate barricades with at least one working flasher each, signs, lights, and other warning devices, sufficient to maintain safe pedestrian, bicycle and vehicle traffic. The warning devices shall not be removed until the asphalt concrete patching adjacent to the gutter and/or gutter overlay has been completed and the hazard no longer exists.

If, in the opinion of the Engineer, some portion of the work is being done in an unsafe manner, the Engineer may order that portion of the work stopped until proper methods have been adopted by the Contractor to make it safe.

The duty of the Engineer is to conduct construction review of the Contractor's performance and is not intended to include review of the adequacy of the Contractor's safety measures on or near the construction site. Nothing in this Section shall operate or be construed to impose any text or contractual liability on the City or its employees for the Contractor's safety responsibilities.

The above requirements are a minimum and do not limit the Contractor's responsibility of doing all that is practical and necessary to ensure the safety of workers, pedestrians, bicyclists and motorists.

1.04 SANITATION FACILITIES

Temporary Sanitation facilities, required for construction personnel, shall be provided by the Contractor. Contractor shall maintain sanitation facilities on a weekly basis or more frequently if required. If there are any odor complaints, the Contractor shall clean and move sanitation facilities to another location.

1.05 STORAGE OF EQUIPMENT AND MATERIALS

A. Policy for Storage of Equipment, Pipes, Structures and Granular Materials in the Public Right-of-Way

All storage in the public right of way shall be performed in strict compliance with City of Palo Alto Public Works Policy for storage of equipment, pipes, structures and granular materials in the public right-of-way.

Prior to storage of any equipment or material, Contractor shall notify the City Inspector(s) of the proposed equipment or material storage sites and request the City Inspector(s) to take pictures and/or video of the storage sites. If Contractor fails to provide this notification, Contractor shall be held liable for any damage sustained by the storage site and be responsible for site restoration to preconstruction conditions as directed by the Inspector(s).

B. General Storage Requirements

It is the Contractor's responsibility to locate a site for the storage of equipment, materials, and office facilities and to obtain and pay for all permits and fees necessary to make the site legal for storage. The Contractor shall not store any equipment or material on property zoned for residential use. This includes commercial and industrial lots adjacent to residential property.

Any commercial or industrial property being considered as a storage site will require a use permit. The use permit may be obtained through the Planning Department. This permit will expire in forty-five days from the date of issuance and may be renewed (allow 3 weeks of lead time for the renewal process) if the Contractor has acted as a good neighbor. When applying for the use permit, the Contractor may obtain approval for more than one storage site.

Equipment and materials, which are part of the Contract, shall be protected and stored in accordance with the recommendations of the manufacturer. The Contractor shall assume the risk of loss or theft of or damage to all equipment and materials delivered to or accepted by him or her until such equipment and materials have been completely installed and accepted by the Engineer.

Storage in public right of way will not require a use permit, but will require the prior approval of the Engineer.

1. Additional Requirements

- a. Equipment, pipe, structures, and granular materials shall be placed within one block of the location where it is to be used, but no less than three blocks or 1000 feet from an adjacent non-related project. Alternate locations may be determined by the Engineer if construction and traffic conditions warrant.
- b. Equipment, pipe, structure, and granular materials shall not block access to or visibility of any fire hydrants, driveways, traffic signs, utilities, intersections, sidewalks, bike lanes, crosswalks or drainage paths.
- c. A minimum pavement width of 24 feet shall be maintained for traffic purposes.
- d. No equipment, pipe, structures, or granular materials shall extend more than eight feet into the street from the face of the curb and in no other case shall extend more than one third of the roadway.
- e. Two (2) type II barricades, with working flashers, shall be placed at each end of the storage area.
- f. One (1) type II barricade, with working flasher, shall be placed at 25-foot intervals along the street side of the storage area.
- g. Only the amount of pipe and structures that can be installed and back-filled in five (5) consecutive days shall be stored in the public right-of-way.
- h. Pipe or structure that can be easily lifted by hand and weighing less than 200 pounds **shall not** be stored in the public right-of-way.
- i. Steel deck plates shall not be stored in the public right-of-way.
- j. Contractor shall hand deliver advance notice door hangers to businesses, residents, or others, at locations where equipment, pipe, structures, and granular materials will be stored, at least seven days in advance of the storage date. City will provide required notices.

2. Trucks and Equipment

- a. Equipment is defined as, but not limited to, backhoes, trenchers, loaders, rollers, self-propelled pavers, and graders.

- b. Only equipment in good mechanical condition shall be stored in the public right-of-way.
 - c. Any equipment that can not be repaired by the end of the day shall be removed immediately from the public right-of-way.
 - d. Fluid leaks shall be repaired prior to the end of the day.
 - e. Spilled fluids shall be cleaned-up and disposed of in accordance with applicable hazardous waste laws.
 - f. All equipment and materials shall be removed at the request of the Engineer for reasons related to weather, job shutdown, safety or reasonable complaints and requests from residents, and/or business owners.
 - g. Trucks and portable equipment, such as generators, compressors, and arrow boards, shall be removed at the end of the day.
3. Granular Material
- a. Granular material, such as backfill, bedding and cutback shall be placed against an appropriate portable barrier, such as k-rail, to protect the curb and improvements behind the curb.
 - b. The barrier shall be located a minimum of one foot in front of the face of the curb, so as not to obstruct the drainage of water, unless otherwise directed by the Engineer.
 - c. No more than the amount of granular material that can be used in two (2) consecutive days shall be stored at any time.
 - d. No granular material shall be stored within ten (10) feet of any catch basin or curb return.
 - e. Granular material shall not be allowed to enter the storm drain or sanitary sewer systems.
 - f. A tarp covering the granular material and sandbag berms placed around the granular material shall be used as required by the Engineer during rainy periods.
 - g. The job site shall be swept clean at the end of the workday. An Athey Mobile Street Sweeper Model AHL M9 or an approved equal shall be used.

1.06 CLEANUP

A. Daily

The Contractor shall not allow the job site to become littered with trash and waste material but shall maintain the site in a neat, orderly, and dust free condition on a daily basis, or as required by the Engineer, throughout the construction period. The Contractor shall conduct his or her

operations and schedule cleanup so as to cause the least possible obstruction and inconvenience to vehicle, bicycle or pedestrian traffic, and adjacent property owners.

All work areas shall be kept in a dust-free state. A mobile street sweeper shall be used daily to maintain a dust-free condition. At the end of each working day all work areas shall be swept clean by an Athey Mobile Street Sweeper Model AHL M9 or an approved equal, subject to the approval of the Supervisor of the Public Works Inspection Group.

All landscaped areas shall be left with a neatly graded surface, conforming to the adjacent existing ground. All sidewalks should be manually swept to maintain a dust-free condition.

Spilled fluids shall be cleaned up and properly disposed of immediately, using an appropriate absorbent material, by the Contractor at the Contractor's expense.

Spillage resulting from the Contractor's hauling operations along or across any public traveled way shall be removed immediately by the Contractor at the Contractor's expense. All hazardous materials shall be cleaned up per the Fire Department's and Public Works Department's policies, and all applicable hazardous waste laws and regulations.

B. Final

Execute final cleaning prior to final inspection.

1. Clean all furnished equipment to insure proper operation; remove temporary labels, stains, and foreign substances.
2. Clean site; sweep paved areas.
3. Remove waste, surplus materials, and rubbish from project sites to proper legal disposal areas selected by Contractor so that the entire job site and all areas that were occupied by Contractor during the project are restored to pre-job conditions.
4. Existing buildings, street furniture, equipment, piping, pipe covering, paving, sewer laterals, sewers, trees, curb and gutter, sidewalks, landscaping, sprinkler systems, bridge abutments, gas and water services, etc., and other public and private property damaged by the Contractor during the course of his work shall be replaced and/or repaired either by the City or the Contractor at the Contractor's expense.
5. The Contractor shall completely remove all remaining USA markings and all other markings associated with this project from pavement, sidewalk, curbs, driveways, etc.

1.07 SIGNAGE

At the beginning of each work day, the Contractor shall provide project signs for the ends of each location where work is being performed. Signs shall include name of Contractor, Contractor contact information, name of project, dates of work, and work hours (may vary depending on the project location). It is the Contractor's responsibility to move the signs as the project progresses. All costs of project signs, and the associated labor costs to place and move the signs, must be included in one or more of the Bid items. No additional compensation shall be paid to the Contractor for project signs.

Sign Specifications:

Size: 3' X 5'

Color: black letters on white reflective background w/ black border.

Letters: black, 1" min height, 1/4" thick Arial font, spacing approx. as shown below.

Dates or work and work hours shall reflect the correct information at each project location.

Each sign shall be attached to a barricade which can be moved from one construction site to the next. An information box (see attached .gif file) shall also be attached next to the sign. The City will provide the information letters. The Contractor shall provide the box.

Sample Sign:

	CITY OF PALO ALTO UTILITIES	City of Palo Alto Utilities Department (650) 566-4501
Project Name Month Year – Month Year Monday- Friday 8 am to 5 pm		
Contractor's Name Contractor's Local Phone Number		
Project Website: http://www.cityofpaloalto.org/depts/utl/utilities_engineering/major_utility_projects.asp		

END OF SECTION

**SECTION 2200
EXCAVATION, BACKFILL, AND RESTORATION**

PART 1 - GENERAL**1.1 DESCRIPTION**

Excavation, backfill, and restoration shall conform to the City of Palo Alto Department of Public Works Standard Drawings and Specifications, and as specified on the project plans. Excavation and backfill shall conform to the safety requirements of the Contract and the approved traffic control plans.

1.2 APPLICANT INSTALLED WATER, WASTEWATER, AND GAS MAINS OR SERVICES

For applicant installed water and wastewater mains or services (gas shall only be installed by Palo Alto Utilities crews or City Contractor), the applicant shall submit the following to the WGW engineering section of the Utilities Department:

- A. Four copies of the installation of water and wastewater utilities off-site improvement plans in accordance with the Utilities Department design criteria. All utility work within the public right-of-way, or the public portion of the utilities, shall be clearly shown on the plans that are prepared, signed and stamped by a registered civil engineer.
- B. A complete schedule of work.
- C. Method of construction including abandonment details.
- D. The manufacture's literature on the materials to be used for approval by the Utilities Engineering Department.

The applicant's contractor will not be allowed to begin work until the improvement plan and other submittals have been approved by the Water, Gas and Wastewater Engineering Department. WGW inspections shall be scheduled at least five (5) days in advance.

After the work is completed, but prior to sign off, the applicant shall provide record drawings (as-builts) of the installation of water and wastewater utilities to be owned and maintained by the City in accordance with Section 2740 of these specifications.

PART 2 - BACKFILL AND RESTORATION MATERIALS

Contractor shall prepare submittals for sand, 1/2" crushed rock, 3/4" aggregate base, and controller density fill (CDF), for Engineer's approval, and prepare all submittals required by public works.

2.1 BACKFILL

All backfill materials shall comply with the drawings and be in accordance with the latest edition of the California Department of Transportation, Standard Specifications. Excavated material shall not be used for pipe bedding or trench backfill.

2.2 SAND

Sand shall conform with Section 19-3.02E(2) of the latest edition of the Caltrans State Standard Specifications and shall be imported clean natural sand, free from clay, salt, sea shells, or organic material, suitable for the purpose intended and shall conform to the following gradation:

No. 4 sieve..... 90% - 100%
No. 200 sieve..... 0% - 5%

Dredged sand from San Francisco Bay is not acceptable.

2.3 Class 3 Permeable Material (1/2" CRUSHED ROCK)

1/2" crushed rock will be designated by nominal size and shall conform to the following gradation when tested in accordance with sections 6 and 68-2.02F(4) of the latest edition of the Caltrans State Standard Specifications

Class 3 permeable base:

Passing a 1-1/2" sieve..... 100%
Passing a 1" sieve..... 88% - 100%
Passing a 3/4" sieve..... 52% - 85%
Passing a 3/8" sieve..... 15% - 38%
Passing a No. 4 sieve..... 0% - 16%
Passing a No. 8 sieve..... 0% - 6%

This material shall contain at least 75% of the particles having one or more fractured faces. Not over 25% shall be particles showing no such faces.

Crushed rock shall meet the test grading requirements of ASTM C 131 test grading B.

2.4 Class 2 Aggregate Base (3/4")

Class 2 (3/4") will be designated by nominal size, shall conform to the following gradation, and shall meet the requirements of Sections 6 and 26-1.02B of the latest edition of the Caltrans State Standard Specifications:

Passing a 1" sieve.....100%
Passing a 3/4" sieve..... 87% - 100%
Passing a No. 4 sieve..... 30% - 65%
Passing a No. 30 sieve..... 5% - 35%
Passing a No. 200 sieve..... 0% - 12%

2.5 CONTROLLED DENSITY FILL (CDF)

A. Materials:

1. Cement: ASTM C150, Type II or V, 1-1/2 to 2 sack mix.
2. Aggregate: Mixture of clean sand and pea gravel, 3/8 inch maximum size.
3. Fly Ash: ASTM C-618 Class F.
4. Water: Potable water or water of similar quality which is free of deleterious impurities.
5. May use suitable admixture(s).

- B. Mix Design and Performance:
 - 1. CDF shall be non-segregating, flowable, self-consolidating, low-shrink material that flows into place without leaving voids and cures into a stiff non-plastic material.
 - 2. Compressive strength: 28 day strength between 50 psi and 200 psi.
 - 3. CDF shall be supplied by a concrete manufacturing plant.
 - 4. Place CDF so as not to float the pipes.
- C. Submittals:
 - 1. Mix design.
 - 2. Samples of the material to be used.
 - 3. Results of laboratory trial mix compressive strength testing using 6" diameter by 12" test cylinders with cylinder breaks at 7 and 28 days (28 day test shall be average of 2 or more cylinder breaks).

PART 3 - EXECUTION

3.1 EXISTING UTILITIES AND USA

The Contractor shall comply with IFB Part 5 General Conditions 3.28 and additional requirements in this section for Underground Service Alert (USA). For Utilities projects, it is the Contractor's responsibility to notify Underground Service Alert (USA at 811) **a minimum of ten (10) Working Days** in advance of starting excavation. The Contractor shall delineate the areas of work with white paint. Contractor shall only request utility markings at those locations where underground work will occur during the following month.

The Contractor shall completely remove all USA markings and all other markings associated with this project from pavement, sidewalk, curbs, driveways, etc. The method used for removal of the markings shall be approved by the City. The cost to remove the USA markings shall be included in one or more Bid items and no extra compensation shall be paid to the Contractor.

The Contractor shall verify or cause to be verified that all of the utilities shown on the project plans have been USA marked and notify the Engineer if any utility shown on the plans has not been marked. If the contractor is unable to locate underground utilities based on USA marks provided, the contractor will contact the responsible utility owner to remark the facilities in question.

Where underground utility mains such as water, gas, wastewater, electric, telephone, or cable television are shown on the project plans, the Contractor shall assume that every property parcel adjacent to or on the same street as the underground utility mains has an underground service for each type of utility present. In addition, the Contractor shall assume that each property parcel with either an above ground or at grade facility, such as a water meter box, gas meter, or sanitary sewer clean out, has an underground service for the respective utility. If a service is not shown on the project plans for any parcel, not marked, or marked in the incorrect location according to the project plans, the Contractor shall bring it to the attention of the WGW Utilities Inspector at least one working day prior to digging to allow time to resolve the conflict.

Methods of protection of existing utilities shall be approved by the Engineer prior to the start of crossing the existing utilities. All utilities crossing or lying along the trench shall be supported. The work of bracing and the care of all encountered utilities below grade shall be considered a part of excavation and backfill.

If it is necessary to relocate or temporarily remove and replace existing underground utilities, the Contractor shall first obtain permission from the utility concerned and comply with its requirements in performing the necessary work. Gas and water line relocations shall be performed by the City. All costs incurred shall be paid by the Contractor. Property owners shall be notified at least 24 hours before the planned disruption of any utility service.

Shut down of City WGW Utilities shall be performed by City of Palo Alto Utilities WGW Operations Division. The Contractor shall not disconnect or shutdown any part of the existing City of Palo Alto WGW Utilities System except by expressed written permission of the Engineer. Notify the Engineer five (5) working days in advance of required shutdowns and submit a schedule of the estimated shutdown time to obtain said permission.

It is the Contractor's responsibility to find all known utilities regardless of USA and plan inaccuracies. The contractor shall pothole all crossing and nearby parallel utilities both public and private within the work area. The Contractor shall proceed with caution during the trenching operation to avoid damage to the existing underground utilities. Caution must also be exercised when installing new pipe by directional boring methods. All existing utilities crossing the proposed bore path must be prospected prior to establishing the pilot bore path. Locator devices, careful probing, vacuum, and hand methods of excavation shall be employed to determine the exact horizontal or vertical alignment of underground facilities. All exposed gas lines and electric facilities shall be inspected for damage by the WGW Utilities and Electric Utilities Inspectors prior to backfill. **The Contractor shall immediately notify the Engineer if any Underground Facility is disturbed or damaged.** Repairs to existing City wastewater utilities shall be performed by the Contractor, unless otherwise directed by the Engineer. City forces shall repair, relocate, or replace all other City utilities. The Contractor shall accommodate City forces in his or her operations. **The Contractor shall pay for the full cost to repair the existing utility mains or services, public or private, damaged by his or her operations and any other damages resulting from the damaged utilities.**

The Contractor shall take extreme caution when excavating adjacent to electrical conduits/wires, fiber optic conduits/wires, and traffic signal loops/conduits/wires. The Contractor is expected to carefully crack the concrete and hand-dig when excavating around traffic signal conduits, as they may be shallow and often embedded in concrete and/or asphalt road surface. When a conduit cut or dig-in occurs, the Contractor shall postpone excavating around the conduits to avoid further damage until Electric Operations assesses their condition and repairs are performed. Any damage to electrical conduits, fiber optic conduits, or traffic signal loops and conduits shall be repaired by the contractor at no cost to the City. Any damage to electrical substructure/cable/wires, gas lines, or water mains will be repaired by the city and the cost will be paid by the Contractors. An electrical Inspector shall be present while the contractor repairs electrical, fiber optic, or traffic signal conduits. The Contractor shall contact Electric Operations Dispatch at 650-496-6914 to schedule electrical inspection.

The cost of repairs performed by City crews will be billed to the Contractor by the WGW or Electric Operations Division and shall be paid independently by the Contractor to the City's WGW or Electric Operations Division. Payment must be made when submitting monthly progress payment request. Final project approval or payment will not be made until these bills have been paid.

Wrapping on any exposed steel gas lines shall be inspected by the City prior to backfill. Repairs of customer-owned sprinkler systems shall be made by the Contractor at their own expense.

Contractor shall repair **customer-owned portions** of water and gas services damaged by the Contractor, at their own expense. The repair work must be performed by a licensed plumber in accordance with the requirements of UPC and City of Palo Alto Building Department. The Contractor will be responsible for coordinating access to private property with the owners.

On natural gas capital improvement projects, wastewater pipe inspection must be performed on pipes that intersect with the alignment of new gas pipes installed by directional bore. See Section 2741, "Legacy Cross Bore Inspections for guidelines.

A. Gas Main Replacement Projects

The Contractor is required to locate and identify the alignment of all sewer laterals on public and private property prior to installing new mains and services by directional boring methods. After installation of new infrastructure has been completed, the Contractor shall positively identify and document by CCTV inspection that all sewer laterals and mains that were crossed by the new mains or services, installed by directional boring methods, were not damaged.

The Contractor must video-inspect all sewer laterals on the affected property to determine if damage is present. The Contractor is also required to perform video inspection at all locations where reconnection is specified. The video inspection must include entire length of the lateral from the building foundation to the sewer main including branches and cleanout risers. The Contractor will be compensated for this Work through the appropriate bid items.

The Contractor will be required to video inspect sewer mains that were crossed by directional boring if confirmation that the mains were not damaged cannot be established (it includes location of all laterals). This work (sewer main video verification) is considered a necessary step for installation of new mains and services and all costs associated with this work shall be incorporated in one or more bid items and no separate payments will be made.

If Contractor is unable to find an existing City clean out or private clean out is not present, the Contractor shall locate and expose the sewer lateral and install a double WYE clean out per City standard to facilitate video inspection.

If the Contractor CCTVs the sewer lateral and finds it blocked by roots of debris, Contractor shall clean the line until CCTV verification can be completed. Contractor shall get approval from the City prior to attempting to cut roots.

If the Contractor is unable to complete the CCTV verification in a cleaned pipe, Contractor shall dig as necessary to access the sewer lateral. Inspector shall witness the visual verification and document on a property clearance form.

3.2 POTHOLING

The contractor shall locate and pothole all crossing utilities and parallel utilities within 5 feet of the proposed utility in the work area. The Contractor is required to fully examine and inspect the project site and have full knowledge of the physical conditions of the project area prior to submitting the bid. For public or private utilities that are not shown on the project drawings but can be anticipated from the presence of other visible features or facilities, the Contractor should include the cost under one or more bid items to locate and pothole these utilities in the project area. The Contractor shall

pothole as required to determine the exact locations and elevations of utilities at least 3 working days prior to construction at the subject location to allow sufficient time to resolve potential issues. Using the USA markings as a guide and/or in agreed-upon locations with the City Inspector, the Contractor shall make at least two (2) potholes to locate each utility, public or private, before the City will consider additional compensation for extra work or delays. The Contractor shall anticipate turn-around time for re-marking of public or private utilities. See Part 3.01 (Existing Utilities and USA) of this Specification for additional information on USA marking requirements.

For trenchless construction, all potholed crossing utilities shall remain exposed and visible throughout the boring operation and shall be inspected by the WGW Utilities Inspector prior to backfill. It is the Contractor's responsibility to investigate any unknown utilities and contact any public or private utility agency or owner to resolve the conflicts if conflicts are found during potholing activities. The City is not responsible for any delays or additional costs associated with un-marked third party utilities.

3.3 SAWCUTTING, DEMOLITION, AND REMOVAL FOR UTILITIES CONTRACTS

Trenching shall include the removal of all materials or obstructions of any nature, including asphalt and concrete pavement. **Areas in which sawcutting is performed shall be wet vacuum cleaned to remove the cutting residual, inclusive of the sawcutting fluid. Sawcut slurry shall not be permitted to enter storm drains.** Areas in which sawcutting is performed shall be cleaned to remove the cutting residual, inclusive of the sawcutting fluid, at the end of each work day or more often as required by the Engineer.

Existing street sections shall be removed in such a manner so as not to destroy or damage the structural integrity of the adjacent street section. Trench cutting shall be accomplished by using a pavement saw, cutting through the full pavement thickness of the pavement section. No equipment mounted pavement breakers shall be used. The top portion of the trench (i.e. the pavement thickness) shall be twelve inches wider than the portion extending to the bottom. Lines shall be marked along each side of the trench 6" beyond the edge of the trench and the pavement cut along these lines. To achieve the "T" section required by the City of Palo Alto Public Works Standard Drawings and Specifications "Typical Trench Sections" detail, generally four (4) parallel sawcuts are necessary for any given trench. Removal of concrete sidewalks, driveways, curbs, and gutters shall be to existing joints or to sawcuts made at existing score marks. Tunneling under street, sidewalk, curb and gutter is not permitted except with directional or percussion bore devices and as noted on the construction plans.

All pavement broken out of the trench will be removed by jackhammer, ripper teeth or backhoe. No equipment mounted pavement breakers will be allowed due to the minimal cover over some existing utilities. Valve boxes over abandoned utility main valves shall be removed from the street sections, the risers filled with jetted sand, and the street section restored to match the existing section.

Where the trench is to be located in a Portland cement concrete or asphaltic-concrete paved street, lines shall be marked along each side of the trench and the pavement cut along these lines with a concrete saw to the full thickness of the concrete. Only concrete saws for PCC-based pavement shall be used to remove PCC pavement.

It is the Contractor's responsibility to locate a suitable disposal or recycling site for all material removed from the trench. Asphalt concrete and Portland cement concrete must be disposed of at

an inert solids recycling facility, approved by the Engineer. Documentation of each load recycled is required for payment.

3.4 EXCAVATION

The Contractor is required to fully examine and inspect the project site and have full knowledge of the physical conditions of the project area prior to submitting the bid. Third party utilities are not typically shown on the plans. It is the Contractor's responsibility, prior to construction, to contact all outside agencies or owners to obtain their utility information. Some utilities could be identified from the presence of visible facilities, such as building, meters, junction boxes, manholes, etc. Private irrigation pipes are typically not marked or shown on project plans. The Contractor shall anticipate sprinkler/irrigation pipes to be encountered on private properties and near landscaped median/island/planting strip. The Contractor is responsible to repair in kind if damaged by the Contractor during the construction project.

The Contractor is required to exercise reasonable care when working around any existing utilities at no additional cost to the City. If conflicts are found during construction activities, Contractor shall also contact the responsible agencies or owners to locate their utilities or resolve the issues. The City is not responsible for any delays or additional costs associated with third party utilities.

- A. Trench Excavation (Ref. the City of Palo Alto Public Works Standard Drawings and Specifications). The bottom of the trench shall be a minimum of 8 inches wider than the outer diameter of the pipe. The depth of trench shall be at least the minimum depth of cover (30" for gas main and 36" for 8" water main) plus 4" for pipe bedding plus the outer diameter of the pipe. The Contractor shall support all existing utilities within the excavation or trench as required to avoid damage to the existing utilities. A plan for supporting the existing utilities shall be submitted for approval by the Engineer. The Contractor may not start work prior to approval of the utility support plan.

For Utilities contracts, the cumulative paved surface area opened at any given time due to potholing and/or excavations shall not exceed 500 linear feet. Potholes shall be classified as open until final pavement resurfacing has been completed.

For CIPs no more than one crew installing mains and no more than one continuous trench shall be opened at any given time unless approved by the Engineer.

For Utilities contracts, no excavation shall be left open during nonworking hours. **All** open trenches and excavations shall be steel plated **with non-skid type steel plates** (nominal Coefficient of Friction shall equal 0.35 as determined by California Test Method 342) or backfilled and paved with temporary asphalt concrete (cutback) at the end of each work day. Steel plates shall be shimmed with wooden wedges to prevent rocking and 2" of cutback shall be used at the edges to provide a smooth transition from the pavement surface to the top of the plates (one foot wide minimum ramp with 24:1 slope). Steel plates subject to turning vehicles or vehicle acceleration and de-acceleration shall be welded together and/or anchored to prevent movement. Additionally, steel plates shall not have any protrusions above the top surface of the plate.

Plates shall be checked for proper placement at the end of each work day and adjusted/leveled/shimmed as required. Steel plating shall be avoided in designated bicycle lanes by backfilling and in installing temporary pavement at the end of each day. Plating installed along bike boulevards, arterial roadways, or along roads with a posted speed limit of 35 MPH or greater shall be set flush with the surrounding asphalt concrete surface. Plating

installed in Class II bike lanes or bike boulevards shall be skid resistant and have a reflective thermoplastic coating for additional safety and shall be set flush with the surrounding asphalt concrete surface. Additional warning signage shall be posted on Type II flashing barricades. All temporary steel plates shall be removed within 14 calendar days after placement. Refer to the City of Palo Alto Public Works Standard Drawings and Specifications for additional requirements.

- B. Handling of Pipes and Materials into the Trench. All fittings, valves, hydrant buries, manholes and pipe lengths shall be carefully lowered into the trench by means of suitable tools and equipment, in such a manner as to prevent damage to materials. **Under no circumstances shall utility main materials be dropped or dumped onto the work area or into the trench.** Pipe support stands shall be utilized to support pipe during fusion joining, directional boring pull in, lining sewer mains, and while lowering of the pipe into the trench. Pipe support stands shall not be spaced greater than 15' for directional boring pull in and lining sewer mains.

Throughout the duration of the job, the Contractor shall have a crew available to promptly backfill and repair paving at trench and manhole locations where settlement or cave-ins have occurred. The Contractor shall make periodic inspections of the trench at least once a week as well as immediately after rain to repair any defect at once.

Sufficient pumping equipment shall be provided to maintain the bottom of the trench dry during placement of the pipe bedding and other backfill material. The pump discharge water shall be pumped into sewer or as otherwise directed by the Engineer. The pump discharge water shall not be routed to natural drainage channels or storm sewers (Refer to Public Works Department Storm Water Pollution Prevention policy).

All crossing pipelines shall be protected from damage during excavation by using hand tools or Hydro-Vac to expose them. All exposed gas lines shall be inspected for wrapping damage by the WGW Utilities Inspector prior to backfill. It is the Contractor's responsibility to inform the WGW Utilities Inspector when gas lines are exposed to facilitate an inspection.

Contractor is responsible for disposal of all excavated soils associated with the project during construction. It is the Contractor's responsibility to characterize all excavated soils for disposal by sampling and testing it in accordance with landfill operation requirements. All samples shall be taken in the presence of the City Inspector. The City will not pay for disposal of excavated soils that were not sampled and approved by City Inspector prior to disposal. Once testing has been completed, it is the Contractor's responsibility to identify suitable landfill facility, and to transport and dispose the excavated soils.

3.5 HIGH PRESSURE GAS AND HIGH VOLTAGE ELECTRIC

Extreme caution shall be used when working around PG&E high pressure gas mains and CPA high voltage electric duct bank.

When potholing or working within 10 feet of PG&E mains, the Contractor shall reach out to PG&E when the Notice of Award is issued to coordinate and schedule standby inspection. Hand digging is required within 2 feet on either side of the PG&E mains. The Contractor shall include the cost in one or more bid items and lead time to comply with PG&E requirements such as obtaining applicable permits, scheduling, locating, hand-excavation, restoration, etc.

When potholing or working within 10 feet of CPA electric duct bank(s) containing energized 60kV cables, the Contractor shall notify Utilities Electric Operations at (650) 496-6902 at least 5 working days in advance of construction activities to schedule standby inspection. Hand digging is required within 2 feet on either side of 60kV duct bank. The Contractor shall include the cost in one or more bid items to comply with all Electric Utility requirements, including but not limited to: observing the path of the bore-head, supporting thermal sand surrounding 60kV duct bank to preserve as much of it as possible, hand-excavation, backfilling around 60kV conduits with new thermal select backfill, restoration, etc.

3.6 ALIGNMENT AND GRADE CONTROL

The grade and alignment of new pipe shall be maintained by use of laser survey equipment. The proposed equipment shall be submitted for approval prior to commencing the work. The Engineer, at any time during the course of the work, may require alterations of the grade control method to conform to the required conditions of the work.

3.7 SHORING FOR UTILITIES CONTRACTS

Shoring shall be in accordance with Section 6705 of the California Labor Code. The Contractor shall submit a detailed plan showing design of bracing, sloping or other provisions to be made for worker protection from the hazards of caving ground. Such plan shall be submitted for acceptance at least five (5) days before the Contractor intends to begin work on the trenches or shoring pits. If such plan varies from the shoring system standards established by the Construction Safety Orders, the plan shall be prepared and signed by a registered civil or structural engineer. Said plan shall be accepted by the Engineer prior to any excavation.

When shoring is required at locations other than those specified in the bid items, the Contractor shall, at no additional expense to the City, furnish, put in place, and maintain such sheeting and bracing as may be required to support the sides of all excavations (whether above or below pipe grade) and to prevent any movement which could in any way diminish the required trench section, or otherwise damage or delay the work.

The Contractor shall support all existing utilities within the excavation or trench as required to avoid damage to the existing utilities. Nothing herein shall be deemed to allow the use of a shoring, sloping or protective system less effective than that required by the Construction Safety Orders of the Cal. OSHA.

3.8 GROUNDWATER FLOW CONTROL

It shall be presumed that the presence of groundwater will require dewatering operations. Contractor shall furnish, install, maintain, and operate all necessary pumping and other equipment for dewatering all excavations, including wellpoints or wells containing submersible pumps. At all times, the Contractor shall have on the project sufficient pumping equipment for immediate use, including standby pumps for use in case other pumps become inoperable.

Dewatering devices must be adequately filtered to prevent the removal of fines from the soil. Provide discharge sampling locations for each pump and sample and test groundwater pumped from dewatering devices daily during the first week and weekly thereafter. The results shall be transmitted to the Engineer upon receipt of the lab reports. If soil fines are being pumped, revise dewatering operations to prevent the removal of fines from the soil.

The Contractor shall be responsible for any damage to the underground utilities, roadwork, and/or adjacent structures caused by the Contractor's negligence or willful misconduct, including any failure of any part of the Contractor's protective works. After temporary protective works are no longer required for dewatering purposes, they shall be removed by the Contractor.

If pumping is required on a 24-hour basis, engines shall be equipped in a manner to keep noise to a minimum. Noise level shall conform to the requirements of the City's noise ordinance as stated in the City of Palo Alto Municipal Code.

Prevent disposal of sediments from the soils to adjacent lands or waterways by employing whatever methods are necessary, including settling basins. See latest project drawings and the City's Public Works Standards for additional requirements for groundwater treatment and disposal.

3.9 BACKFILL

A. Pipe Bedding

All excavated material shall be removed from the site. It is the Contractor's responsibility to locate a suitable disposal site for all material removed from the trench. Asphalt concrete and Portland cement concrete must be disposed of at an inert solids recycling facility, approved by the Engineer. Documentation of each load recycled is required for payment. No shoring or bracing shall remain in the trench after backfilling. No wedging or support of the pipe with wood or any other type of material other than the pipe bedding material shall be permitted.

1. Soil Stabilization: Pipe bedding shall not be placed on unsuitable material. Any unsuitable material encountered at the base of a fully excavated trench for the pipes or below the grades shown for manhole excavation shall be removed as directed by the City Inspector. The unsuitable material shall be replaced with subgrade stabilization material (Class 3 Permeable Material) wrapped in geotextile fabric. The Contractor shall remove such unsuitable material to a minimum depth of 12 inches below the bedding to a maximum of 24 inches below the bedding. Subgrade stabilization material shall be compacted per requirements of Section 26-1.02B of the latest edition of the Caltrans Standard Specifications to the satisfaction of the City Inspector. Geotextile fabric shall be Mirafi 600x or equal. Overlap the seam running along the trench 12 inches minimum; overlap the seam perpendicular to the trench 24 inches minimum.

Trench bed shall be smooth, uniform, and free of debris, sharp rocks, etc. before adding the pipe bedding.

2. Pipe Bedding For Wastewater Plastic Pipe Construction: The bedding material shall be washed, $\frac{1}{2}$ " crushed rock from 4" to 6" below the pipe to the springline of the pipe and compacted per requirements of Section 68-2.02F(4) of the latest edition of the Caltrans Standard Specifications.
3. Pipe Bedding For Water and Gas Construction: The bedding material shall be sand bedding 4" to 6" deep below the pipe compacted to a density of at least 90% of the maximum density as determined by the California Test Method 216.

After compaction, bell holes (if required) shall be cut in the material so that the pipe, when laid, will have a uniform bearing under the full length of the barrel. The depth of compacted select material shall be at a minimum of four (4) inches under the barrel, bell or couplings of the pipe, and maximum of six (6) inches.

After the pipe has been properly laid in the trench, select material shall be placed on both sides of the pipe and forced under the haunches of the pipe as shown in standard detail WGW-04 of Appendix A.

B. Initial and Subsequent Pipe Backfill

Initial backfill shall be placed uniformly on both sides of the pipe and in such a manner as to avoid damage or movement to the placed pipe. Initial backfill shall be placed to a compacted depth of 12 inches above the top of the pipe and compacted to 90% of maximum density per ASTM D-1557. When sand is selected the Contractor may elect to "jet" and provide a location where excess water can be collected at the low points and removed by pumping. Jetting and vibration shall be at intervals not to exceed six (6) feet, in accordance with Public Works Standard Drawing (401).

Subsequent backfill shall be placed in 8 inch lifts or less compacted to 90% of maximum density per ASTM D-1557, with the final twenty four (24) inches mechanically compacted to 95% of maximum density per ASTM D-1557.

C. Controlled Density Backfill (CDF)

CDF Backfill shall only be used as approved by the Engineer. A twelve (12) inch sand layer shall be installed above the gas or water pipe before installation of CDF.

3.10 COMPACTION TESTING FOR UTILITIES CONTRACTS

Compaction testing will be performed by the City's contract soils laboratory under the general direction of either the WGW Inspector or the Public Works Inspector. The Contractor shall cooperate, by adjustment of his operation, in order to permit soils compaction testing on all backfill materials. The City will pay for the initial compaction test; all subsequent compaction tests required will be at the Contractor's expense.

One (1) full day advance notice will be required for any soil compaction test request. The City Inspector will schedule the compaction testing according to the date and time provided by the Contractor. If the Contractor is unprepared at the scheduled time, the Contractor shall pay for delaying the soil compaction testing.

All other testing required by the Contract shall be provided at the expense of the Contractor.

3.11 PLAN MODIFICATIONS

Field conditions may necessitate minor revisions to the details shown on the project plans. The Contractor shall obtain the Engineer's approval of any changes necessary for proper crossing of existing utilities. The revisions will be directed by the Engineer and are not anticipated to be of a magnitude causing a change in the nature and scope of work.

3.12 BORING

The Contractor shall not change the installation method from direction boring to open trench without the Engineer's approval.

The pilot bore for utility mains and services shall be a minimum of 24" clear from other underground facilities. Utility mains and services shall have a minimum 24" horizontal separation from other underground utility pipes, services, and facilities, or otherwise approved by the Engineer.

A. Boring Machine

The contractor shall provide a utility line boring machine(s) capable of installing 1" thru 6" pipe by directional boring.

1. Service Line Boring Machine: The contractor shall provide a boring machine or pneumatic gopher capable of installing 1", 1-1/2", and 2" pipe.
2. Directional Boring Machine. The Contractor shall provide a directional boring machine capable of drilling a pilot hole along a predetermined path to a specified target location, then enlarge the pilot hole to desired size while pulling in specified size pipe. The boring machine shall be equipped with mechanical and hydraulic deviation equipment capable of changing the direction of pilot drilling course. The boring machine shall also include a fluid mixing/pumping system capable of lubricating the bore hole with drilling fluid to insure complete consolidation of the soil after pipe installation and to minimize friction forces during pull back.
3. Locating System. The Contractor shall provide a locating system able to monitor the location and orientation of the drilling head assembly along a predetermined course. The locating system shall be capable of locating the drill head both horizontally and vertically to an accuracy of $\pm 1"$ at 10' depth, and detect the rotation angle of the head.
4. Compaction/Reaming Devices Management. The Contractor shall be responsible for selection of the method(s) of expansion of a pilot hole, if required, and assume full and sole responsibility for location and protection of the existing underground facilities as specified in Subpart 3.08 of this specification.
5. Maximum diameter of the pilot drill bit shall not exceed 3.5 inches in diameter, unless approved by the Engineer.

B. Directional Boring Method

1. Drill a pilot hole with fluid assisted mechanical cutting head along a predetermined path to a specified target location. Drilling fluid can be a mixture of water and bentonite, polymers, or other approved additives. No fluid shall be discharged into the streets, gutters, or sewers. Fluid pressure and flow rate shall be minimized through the use of relief holes during the drilling operation to prevent fracturing the subgrade material around and above the pilot hole. Uncontrolled jetting is prohibited. Any fluid discharged onto streets, sidewalks or customer property, shall be properly disposed of including cleaning of the affected area. Excess drilling fluid must be removed from the surface of relief holes prior to paving.

2. Enlarge pilot hole with cutters or reamers to desired size and pull in specified size pipe while injecting fluid mixtures to hold reamed hole open and lubricate the utility line being pulled. Reamers shall be a minimum: 4" for 2" pipe, 8" for 4" pipe, 12" for 6" pipe, 14" for 8" pipe, 18" for 10" and 12" pipe, and for larger than 12" pipe, reamers shall be at least 50% larger than the pipe diameter and approved by the Engineer.
3. A commercially available weak link approved by the Engineer shall be used, in accordance with manufacturer's recommendations, between the puller and the pipe. The maximum pull force shall be **less than**:
 - a. MDPE 2406 (gas pipe) 1,400 lbs for 2", 4,200 lbs for 4", 9,100 lbs for 6", and 15,400 lbs for 8" pipes.
 - b. HDPE 4710 (water pipe) 15,900 lbs for 6", 27,000 lbs for 8", 42,000 lbs for 10", 59,000 lbs for 12", 71,000 lbs for 14", and 93,000 lbs for 16" pipes.
4. The Contractor will be allowed to leave drill rods in the ground overnight, however pipe pulling must be completed on the same day as it is initiated.
5. The Contractor is required to protect pipe from scratching on edge of trench, plate or pavement during pull in. Methods of protection shall be submitted for review and approved by the Engineer prior to performing the Work. Dragging of the pipe on paved surface is not allowed.

C. Bore and Jack

At railroad and major street crossings where open excavation cannot be made, a steel casing shall be installed by boring and jacking after permitting and coordinating with agency having jurisdiction. The grade shall be as shown on the Plan and Profile drawings and the casing shall be installed to permit the carrier pipe to be spaced as shown in the drawings. The size of the casing shall be as specified in the Drawings and Specifications. Link Seals® or approved equal, shall be installed at both ends of the casing and manufactured casing insulators shall be installed at 5 foot maximum intervals on the carrier pipe prior to insertion as shown on the project drawings.

Joints between sections of the casing shall be welded for the entire circumference of each joint. This weld shall be a minimum of two complete passes.

The contractor shall furnish casing for locations shown on the Plan and Profile drawings. If for convenience of construction, the contractor should select to install casings at locations other than those shown on the Plan and Profile drawings, he or she may do so at his/her expense provided the Engineer approves and required permits allow installation at the new locations.

Note: All equipment must be in good working order and properly maintained during project installation. The City will inspect the preceding items and reject those not in compliance. The City shall have the right to reject any or all equipment judged inadequate.

3.13 INSPECTION

All work shall be subject to inspection by the appropriate City departments at all times. Any work concealed before it has been inspected by the Engineer shall, at the request of the Engineer, be reopened or uncovered at the Contractor's expense. If deficiencies are found, these deficiencies shall be corrected at the Contractor's expense.

The City reserves the right to inspect all materials or equipment during the production, manufacturing or fabricating process, before shipment, or when delivered to the site.

Neither acceptance of the work, nor final payment, shall relieve the Contractor of the responsibility for performing the work in accordance with the contract requirements. The Contractor shall remedy any work not conforming to the contract without expense to the City.

Contractors working on City CIP projects shall pay for the City Inspector's overtime at 1.5 times the Council approved inspection rate if work is performed beyond the allowed construction hours unless the work is requested by the City.

Contractors working on private projects shall pay all inspection costs including the City's WGW Utility Inspector's overtime at 1.5 times the Council approved inspection rate for inspections scheduled outside the hours of 8:00 AM to 3:00 PM Monday through Thursday excluding City holidays.

3.14 LICENSES, PERMITS AND FEES

The Contractor shall apply, procure, and pay for all licenses, permits, and fees including but not limited to CPA street-work permit, encroachments permits (including but not limited to the following agencies: Caltrans, VWD, SFPUC, Caltrain, Santa Clara County, PG&E, Stanford, VTA, and etc.), water use, electricity, building permit, noise exception permit, storage of materials, office trailer, erection of construction shack, etc. required by the City or other government jurisdictions or agencies.

It is the Contractor's responsibility, while preparing the Bid, to evaluate what permits need to be obtained to complete the Work. Prior to submitting the bid, the Contractor shall also conduct research of each agency's specific requirements to perform work within the agency's right-of-way or near the agency's utility. The Contractor shall include all associated costs and anticipate potential long lead time to comply with each agency's requirements. The Contractor shall provide the City with copies of permits and licenses.

For any work in railroad's right of way, the Contractor shall pay for the costs incurred by the railroad company such as inspectors' wages, safety flagman's wages, safety training, and rail supports if necessary.

Payment of all costs and expenses for such licenses, permits, and fees shall be included in one or more bid items. No other compensation shall be paid to the Contractor for these items or for delays caused by non-City inspectors or conditions set forth in the licenses or permits issued by other agencies.

3.15 PROTECTION OF TREES, PROPERTY, AND SERVICE STRUCTURES

Trees, shrubbery, fences, poles and other property and service structures shall be protected, unless their removal is shown on the drawings or authorized by the Engineer. Trees shall be protected per the City of Palo Alto Tree Protection Manual.

Where the City (street) trees obstruct the Contractor's equipment, the Contractor shall be responsible for all trimming necessary to create clearance for his or her operations. Trimming shall be done by a certified tree worker or a qualified tree care specialist in accordance with the City of Palo Alto Public Works Standard Drawings and Specifications. The City Arborist shall be notified in advance of all branch and tree roots greater than 4 inches in diameter which need to be trimmed or removed. The trimming or removal of these limbs or tree roots shall be approved by the Arborist prior to removing.

When boring below a tree with a tap root, the minimum depth of boring shall be 5'.

The Contractor will be assessed charges for any damage to City trees including, but not limited to, broken limbs and damaged trunks. Charges will be determined by the City Arborist. Any damage to private trees including, but not limited to, broken limbs and damaged trunks shall be remedied to the homeowners' satisfaction.

3.16 ASPHALT CONCRETE PAVING

Place asphalt concrete in accordance with the City of Palo Alto Public Works Standard Drawings and Specifications, and Caltrans Standard Specifications. Section 17 (Boring, Trenching and Potholing) of the Public Works Standard Drawings and Specifications lists the requirements for street restoration for both open cut and directional drilling/pipe-bursting installation in streets, restoration for both improved and unimproved areas, and required limits of trench restoration. The minimum pavement section restored shall be two (2) inches asphaltic concrete on eight (8) inches of Class 2 aggregate base, or the existing pavement and base section, whichever is greater. Class II aggregate base shall be compacted to 95% compaction.

Prior to asphaltic concrete pavement installation, all debris (leaves, twigs, trash, etc.) laying on the top of the compacted trench shall be removed and paint binder (RS-1) shall be applied to all vertical edges of the surrounding pavement around the perimeter of the trench at a rate of 0.05 to 0.10 gallons per sq. yd. Do not commence placement of asphaltic concrete materials when the atmospheric temperature is below 50° F, or during fog, rain, or other unsuitable conditions.

The new asphalt concrete shall be placed to the same grade as the surrounding asphalt concrete grade, such that the originally designated cross-sectional geometry of the road is maintained. Excess asphalt shall be removed from the working area and not rolled into the mat. Asphaltic concrete shall be placed with an asphaltic paving machine. A paving box may be used only with the approval of the Engineer. A maximum of a 3 inch lift is allowed for asphalt concrete pavement. Final lift of asphalt for trench restoration shall be 3/8" fine.

Upon completion of all asphalt paving, a seal coat (fog seal or sand seal) shall be applied to all restored surfaces. On streets with slurry seals, the restored trench shall receive a slurry seal coat in accordance with Section 37-2 of the California Specifications.

Unless otherwise authorized by the Engineer, all construction and restoration shall be completed within fifteen (15) working days from start of work at any specific location, and final surface restoration shall be completed within ten (10) working days from the last day pipe was installed on

any particular continuous section. No more than 1,000 feet of temporary pavement will be allowed before the contractor must install permanent paving prior to proceeding with new trenching operations.

3.17 PCC PAVEMENT, CURBS, GUTTERS, SIDEWALKS, AND DRIVEWAYS

Place Portland cement concrete and PCC pavement in accordance with the Public Works Standard Drawings and Specifications, and Caltrans Standard Specifications.

The PCC plug shall be placed to the same grade as the surrounding PCC pavement grade, such that the originally designated geometry of the roadway is maintained. Excess concrete shall immediately be removed from the working area and disposed of properly. After placing, the concrete shall be consolidated sufficiently to produce a dense mass, struck off and floated.

All concrete shall be placed against existing sawcut concrete or 2" thick wood forms. If a gutter exists, twelve inches of AC will have to be removed at the lip of gutter for the placement of these forms. *No concrete shall be placed against asphalt or spalled/broken concrete.*

Forms shall be checked by the WGW Utilities Inspector and Public Works Inspector before any pouring of concrete. PCC shall not be poured when air temperature is below 40 Deg. F or during rain or within two hours before sunset. No on-site mixing of PCC shall be allowed.

All new PCC (at sidewalks, curb and gutter, and concrete roads) shall be doweled into existing PCC using #4 rebar 12" long dowels spaced at a maximum of 2' centers. Dowel holes shall be drilled in the vertical section center. Dowel holes shall be drilled 6" into the existing concrete without causing damage. Dowels shall be epoxied into the existing concrete.

Concrete shall be placed and compacted in forms without segregation. After placing, the concrete shall be consolidated sufficiently to produce a dense mass, struck off and floated. Final finishing operations shall not proceed until all bleed water has evaporated from the surface. Sprinkling of dry cement to absorb excessive surface moisture shall not be allowed. The surface texture of finished concrete shall conform to adjacent concrete. Forms shall not be removed less than twenty-four hours after the concrete has been placed. In no event shall forms be removed while the concrete is sufficiently plastic to slump.

If any portion of sidewalk is sawcut or damaged during the course of work, the Contractor will be required to remove and replace the entire width of sidewalk from the planting strip or property line edge of the walk to the curb edge between the nearest undamaged joints.

As soon as the concrete is set, it shall be cured for a period of at least 72 hours by spraying with an approved pigmented impervious membrane-curing compound.

The Contractor shall protect from damage all completed Work. All discolored concrete shall be cleaned to a uniform color. Repairs and cleaning of new concrete shall be at the expense of the Contractor.

3.18 PAVEMENT STRIPING AND LEGENDS

Contractor shall replace all pavement striping, legends, signs, and curb painting damaged due to the Contractor's activities in kind unless a redesign is ordered by the Engineer. Place pavement

striping, legends, signs, and curb painting in accordance with the Public Works Standard Drawings and Specifications, and Caltrans Standard Specifications.

Temporary traffic striping and legends shall be placed on the newly paved street prior to the release of the street to the public. These materials shall be either pop-up temporary markers (for arterial streets) or tape (for residential streets). The proposed materials must be submitted to the Engineer for approval prior to use. Permanent striping must be installed within seven (7) days.

Alignment lines shall be established by the application of cat tracks or dribble lines, the use of laser guidance devices or a combination of both, as detailed in the Caltrans Standard Specifications.

Pavement markers and Stimsonite fire hydrant markers shall be placed in accordance with the Caltrans Standard Specifications and manufacturer's installation procedures.

Tape striping, legends, signs, markings, or other facilities removed or damaged during construction shall be repaired or replaced in kind at no expense to the City within ten (10) working days of the last day pipe was installed on any given continuous section.

All materials, equipment and labor required to perform surface restorations shall be included in one or more of the bid items and no further compensation will be allowed for surface restoration.

Thermoplastic material and paint for traffic stripes and pavement markings shall be applied in accordance with the California Standard Specifications, Section 84, and manufacturer's installation procedures.

Tape shall be applied using a mechanical applicator furnished by the tape vendor. Installation shall be in accordance with the manufacturer's recommended installation procedures.

3.19 TRAFFIC LOOPS

In the event the Contractor severs any part of a traffic loop, the Contractor is responsible for replacing the entire traffic loop at the Contractor's expense, in accordance with the following standards:

- A. The Contractor shall replace the affected loop within 72 hours following the completion of the surface restoration on the affected street. If this replacement is not done by this deadline, this work will be done by the City at the Contractor's expense.
- B. The Contractor shall coordinate all signal loop work with the City Traffic Signal Division.
- C. Loops shall conform to City of Palo Alto wiring diagram quadrapole detector loops, Drawing K-1184. Each loop shall be identified in the pull box as to location, I.E. "2WR" or "2WL".
- D. No separate bid item is made for the cost of replacing or repairing any traffic loop. It is the contractor's responsibility to determine the expense of potential damage to traffic loops and include cost in the bid items.
- E. Diagrams for City owned traffic detection loops are available from the City of Palo Alto Transportation Division of the Planning Department. For non-City owned traffic detector loops, contact the appropriate agencies (Caltrans, Santa Clara County, etc.)

3.20 LANDSCAPING AND MISCELLANEOUS

All monuments within the project site shall be preserved as required by the State and local regulations. Damaged or destroyed monuments shall be replaced by a California licensed Land Surveyor hired by the Contractor. The Contractor shall submit the method and procedures of tying out the monuments for the City Surveyor's approval. The Contractor shall also provide a recorded copy of the "corner record" to the City Surveyor. No separate bid item was made for the cost of any surveying or monument replacement work. The cost shall be included in one or more of the bid items.

The Contractor shall restore any special surface treatments encountered in the execution of this Work to an equivalent or better condition than existed prior to the commencement of this Work.

After each site has been completed, the Contractor shall restore landscaping and areas abutting the work to the condition existing at the start of work. All materials, equipment and labor required to perform surface restorations shall be included in one or more of the bid items and no further compensation will be allowed for surface restoration.

END OF SECTION

**SECTION 2300
POLYETHYLENE PIPE INSTALLATION
FOR WATER, GAS AND WASTEWATER**

PART 1 – GENERAL**1.01 DESCRIPTION**

Work includes fusion and installation of 1" and greater medium and high density polyethylene services and mains, all appurtenances and all related equipment and fittings in accordance with the requirements of the Contract Documents.

1.02 RELATED WORK

- A. Section 2200: Excavation, Backfill and Restoration
- B. Section 2660: Water Distribution System
- C. Section 2685: Natural Gas Distribution System
- D. Section 2735: Polyethylene Sewer Pipe
- E. Section 2737: Sanitary Sewer Lateral

1.03 POLYETHYLENE PIPE

- A. Gas:** 2708 medium density polyethylene (MDPE), uniformly yellow in color. Pipe wall thickness shall be SDR 11.5 for 1" CTS, SDR 11 for 2" through 8" IPS pipe. Refer to Section 2685 of these Standards for additional requirements. 1" CTS and 2" IPS pipe shall be supplied in coils. The coils shall be furnished in either 500 or 1,000 foot lengths specified at the time of order (2" straight 20' or 40' lengths can be used for shorter services and connections).
- B. Water:** 4710 high density polyethylene (HDPE). Pipe wall thickness shall be SDR 9 for 2" IPS pipe and SDR 11 for 4" and greater IPS pipe. All water main pipes shall be solid blue or black with three (3) longitudinal blue stripes evenly-spaced. Refer to Section 2660 of these Standards for additional requirements. 2" IPS pipe (water services) shall be supplied in straight lengths only.
- C. Wastewater:** 4710 high density polyethylene (HDPE). All wastewater main pipes shall have white, grey, or light colored interior. The exterior color can be black or grey with three (3) longitudinal green stripes evenly-spaced. Solid green exterior color is acceptable if the pipe meets Standard Specifications Section 2735. Pipe wall thickness shall be SDR 17. Refer to Section 2735 of these Standards for additional requirements.

Pipe 4" IPS through 18" IPS shall be supplied in 40 foot or longer straight lengths. Straight lengths shall consist of a single length of pipe without couplings or any intermediate joints.

Pipe markings shall be in a color that contrasts with that of the pipe and space at intervals not exceeding two (2) feet. All required markings shall be legible and so applied as to remain legible under normal handling and installation practices. These markings shall consist of the Utility (GAS, WATER or SEWER), the designation (ASTM D2513 (gas), cell classification confirming to the latest ASTM D3350 234373E (gas), 445574C (water), indicate listing under ANSI/AWWA C906 (water), the manufacturer's name or trademark, the nominal pipe or tubing size (including the sizing system used, such as, IPS, CTS or OD), the type of material, SDR number, the month and year of manufacture, and identification of resin supplier (if other than pipe manufacturer), and manufacturer (P for Performance Pipe, or I for Ineos, etc.).

All pipe shall be made of virgin quality material and be homogeneous throughout and free of visible cracks, holes, foreign inclusions, blisters, dents, and other injurious defects. No reworked material shall be allowed. The pipe shall be as uniform as commercially practicable in color, opacity, density, and other physical properties.

Black polyethylene water pipe and black or grey polyethylene sewer pipe (inner wall shall be white or light in color) shall be no older than three (3) years from the date of manufacture to the date of shipment to CPA. Yellow polyethylene gas pipe shall be no older than six (6) months from the date of manufacture to the date of shipment to CPA. All pipes shall be packaged in standard commercial coils or bundles that provide protection from shipping injuries and shipped with end caps. When storing the pipe on site, the Contractor shall protect pipe from direct sunlight by UV resistant cover.

1.04 POLYETHYLENE FITTINGS

All polyethylene fittings shall have butt end outlets. Molded and fabricated fittings shall have a pressure rating equal to the pipe. Minimum pipe wall thickness for fitting butt outlets shall be equal to the pipe wall thickness.

All fittings shall be made of virgin quality material and be homogeneous throughout and free of visible cracks, holes, foreign inclusions, blisters, dents, and other injurious defects. No reworked material shall be allowed. The fittings shall be as uniform as commercially practicable in color, opacity, density, and other physical properties.

Fittings shall be molded, except fittings larger than 12", which are allowed to be factory fabricated (unless molded fittings are available). Fabricated fittings shall be fabricated on machinery specifically manufactured for that purpose. Fabricated fittings shall be manufactured using Data Loggers recording heating iron face temperatures, fusion pressure and a graphic representation of the fusion cycle. The Data Logger printout shall be part of the required submittal for the fabricated fitting. Fabricated fittings shall be manufactured by ISCO or approved equal. All fabricated fittings must be approved by the Engineer prior to installation.

Gas fitting marking shall be in compliance with ASTM F2897-14 *Standard Specification for Tracking and Traceability Encoding System of Natural Gas Distribution Components (Pipe, Tubing, Fittings, Valves, and Appurtenances)* and consist of 16-digit alpha-numeric code and scannable code 128 barcode, or QR code, which standardizes encoding of pipe specifications as described in the referenced Standard.

In addition to the compliance with the requirements of ASTM F2897-14, gas fitting markings shall also comply with the marking requirements for all polyethylene fittings specified in this Section as stated below.

Fittings shall be marked with the following: ASTM D3261 (Butt type); manufacturer's name or trademark; material designation; date of manufacture or manufacturing code; size (including the sizing system used, such as, IPS, CTS or OD). Where the fitting size does not allow complete marking, marking may be omitted in the following sequence: size, date of manufacture, material designation, and manufacturer's name or trademark.

PART 2 – MATERIALS AND INSTALLATION

2.01 POLYETHYLENE PIPE JOINING EQUIPMENT

All polyethylene pipe joining equipment to be used shall be certified by the City of Palo Alto to be in

good working condition and suitable for the intended purpose prior to being brought on site. Any equipment without a City issued certification tag shall be removed from the site. The Contractor shall have all equipment necessary to install the pipe and appurtenances referred to in the Plans and Specifications, including but not limited to:

- A. Pipe Trailer:** Contractor shall provide a trailer capable of transporting 40' or longer lengths of polyethylene pipe without damaging pipe.
- B. Pipe Spool:** Contractor shall provide a reel type spooling device capable of dispensing 500' long 2" polyethylene pipe coils. Spool can be trailer mounted or suspended from a truck or backhoe (SpeedReel).
- C. Pipe Support Stands:** Pipe support stands shall be utilized to support pipe during fusion joining, directional boring pull in, and while lowering of the pipe into the trench. Pipe support stands shall not be spaced greater than 15' apart for directional boring pull in. Pipe shall be supported with stands at all times and not placed on pavement to avoid scratching the pipe surface.

Additionally, manufactured pipe support stands outfitted with rollers shall be used at the pavement or plate edge where pipe is pulled into the trench/bore hole to avoid scratching of the pipe.

- D. Pipe Cutter:** Pipe cutter for polyethylene pipe shall be:
 - For 2" – 12" diameter pipe guillotine style pipe cutter outfitted with a ratchet drive or power driven designed to cut medium/ high density polyethylene pipe. For 6"-12" diameter pipe PLAS In-line Rotary cutters manufactured by Reed Pipe Tools & Vises (www.reedmfgco.com), or approved equal.
 - For pipe larger than 12" PLAS In-line Rotary cutters manufactured by Reed Pipe Tools & Vises (www.reedmfgco.com), or approved equal.

No other cutting tools will be allowed unless approved by the Engineer.

- E. Butt Fusion Machine:** Contractor shall provide McElroy or approved equal butt fusion machine(s) capable of fusing the range of pipe sizes required in the contract/plans with the following features:
 - 1. **Butt Fusion Machine:** Machine shall be the hydraulic fusion machine with built-in hydraulic pipe lift to assist with the pipe handling and incorporating centerline guidance system and DataLogger™ compatible, and capable of butt fusion of most fittings without special holders or removal of jaw.
 - 2. **Facer:** Pipe facer that attaches to the butt fusion machine. Facer shall have sharp properly aligned blades.
 - 3. **Heating Iron:** Electrically powered heating iron with unscratched clean Teflon coated faces. Heating iron shall have a thermometer and temperature set screw for calibration.
- F. Electrofusion Machine:** The Contractor shall provide a Friatec universal electro fusion control box or approved equal, capable of storing a minimum of 100 fusion records, pipe alignment clamp, tapping tee alignment clamp, tapping wrench, pipe scraper, and all other tooling specified by the electro fusion machine manufacturer installation procedures.

- G. Electric Generator:** Contractor shall provide the necessary power supply to meet the power requirements as specified by the manufacturer of the fusion equipment. Generator shall be in new condition and have a minimum rated capacity of 5 kW for 8" and smaller and 10 KW for 10" and larger.
- H. Pyrometer:** The Contractor shall provide a pyrometer capable of testing the temperature of the heating iron, while at fusion temperature, to an accuracy of 0.5% ($\pm 3^{\circ}\text{F}$). The fusion temperature of the heating iron shall be verified each morning in the presence of the WGW Inspector. More frequent testing may be required at the discretion of WGW Inspector.

Note: The Contractor shall keep a binder on site containing the fusion procedures, names of approved fusers and serial numbers of the approved fusion equipment. All equipment must be in good working order and properly maintained during project installation. The City will inspect the preceding items and reject those not in compliance. The City shall have the right to reject any or all equipment judged inadequate to properly fuse polyethylene pipe and its fittings.

2.02 POLYETHYLENE PIPE INSTALLATION

The City will test to qualify all person(s) intending to make polyethylene joints by fusion. The persons will be allowed to perform fusion only for the utility (water, gas or wastewater) they were qualified. The fusers must be requalified at the start of any new project, regardless of whether or not the fuser was certified previously on another project. A minimum of two certified fusers shall be on-site at all times during fusing operations and all fusions must be conducted in the presence of or with the prior approval of the City's WGW Inspector.

Applicants for testing will need to demonstrate a working knowledge of PE fusion and equipment without any guidance, including setting up the equipment, verifying the proper settings, and completing a test fusion sample. All testing procedures are based on the ASTM F2620 current revision standard. Applicants will have one opportunity to pass the test per day. If the test is failed, another test will not be administered for a minimum of 5 days.

Prior to testing, the Contractor's employees who will be fusing on the project will be required to attend a fusion class sponsored by a certified pipe or equipment manufacturer. Proof of attendance will be required when scheduling fusion testing with the WGW Construction Supervisor. If construction is expected to last more than one year, the Contractor's employees who will be fusing will also be required to attend annual fusion training classes. Proof of attendance shall be submitted to the WGW Construction Supervisor within one year of the original certification date. See Appendix E (HDPE Water and Sewer Pipe – Fusion Training Procedures and Certification) and Appendix F (Polyethylene Gas Pipe Fusion Training Procedures and Certification) for additional testing requirements.

The Contractor's employees will perform the qualification testing using his own equipment and materials, including but not limited the equipment to be used in the field (generator, fusion machines, scrapers, etc.). The Contractor will be required to schedule fusion testing four (4) weeks prior to the start of Work. The Contractor shall coordinate testing schedule with WGW Operations; two (2) weeks advance notice is required.

The City will test the Contractor's fusers once at no cost to the Contractor. Contractor shall send all potential fusers for the project to the test at the same time. If any of Contractor's fuser fails to pass the first qualification test, the City may charge the Contractor for staff time spent retesting each fuser. Any delays in construction that can be attributed to retesting of the Contractor's fusers shall be at the Contractor's expense. No additional contract days, or monies, will be given for required retesting.

A. Underground Clearance: Unless approved by WGW Utilities Engineering, the Contractor shall maintain a minimum clear separation of 12" vertically to crossing utility lines and 48" horizontally to parallel utility lines, duct banks or adjacent foreign structures, except in the case of new water construction. The distance between new water mains and existing sewer lines shall be at least 10-feet horizontally and 1-foot vertically per Regional Water Quality Control Board requirements. If the 10-feet horizontal or 1-foot vertical clearances are not attainable, the RWQCB will need to review and approve the plans. For all other utilities, if horizontal separation is less than 4', review and approval by WGW Utilities Engineering is required.

B. Location: Contractor shall install mains and services as follows:

1. Mains and services shall be located per WGW Utilities standard drawing WGW 01, unless otherwise specified on the Project Drawings.
2. Services shall be installed perpendicular from the main in the shortest straight line to the meter or clean out, if possible. Water meters, services and sewer laterals shall be installed 10' minimum from trees, if possible.

Handling of Polyethylene Pipe: Extreme care must be exercised when moving plastic pipe. Support stands and rollers shall be used when fusing and lowering pipe into the trench or bore hole. POLYETHYLENE PIPE SHALL NOT BE DRAGGED ON THE GROUND OR ON PAVED SURFACES. Support stands/rollers must be used at all times that pipe is above paved surfaces/ground level including during directional boring pull-in or pipe-bursting operations.

C. Pipe Scratches or Cuts: Pipe that has scratches, notches, cuts or any other abrasions that exceed ten percent (10%) of the gas/water pipe wall thickness, or 20 percent (20%) of the sewer pipe wall thickness, shall be disposed of. The Contractor shall use pipe stands, rollers, spooling devices, or other means to avoid damaging the pipe during installation. Observe pipe during installation for scratches, gouges or other defects. If defects are present, remove and discard defective section of pipe. The WGW Inspector must be notified of all defects and subsequent repairs.

D. Pipe Squeeze Off Tools: Manual squeeze off tools can be used for pipelines with diameter of ½"CTS – 2"IPS. Hydraulic squeeze off tools are necessary for pipelines with diameter of 3"IPS – 8"IPS. These tools should be equipped with stops for each size to prevent over squeezing of the pipe.

E. Snaking Pipe: Polyethylene pipe shall be installed in the trench by "snaking" method and additional pipe length shall be allowed for the possible thermal contraction of the pipe.

F. Maximum Pull Force: A commercially available weak link approved by the Engineer for the specific application shall be used, in accordance with manufacturer's recommendations, between the puller and the pipe, for water and gas construction.

G. Butt Fusions: All butt fusions shall be performed by the Contractor as follows:

1. All butt fusions must be performed by the person(s) qualified and certified by the City to butt fuse in the presence of the City's WGW Inspector. Fusion qualified Contract employees found to not be following manufacturer's guidelines or performing fusions with inadequate or defective equipment will have their fusion qualifications revoked and will not be allowed to

perform fusions for the remaining duration of the contract.

2. Pipe fusion shall be conducted in accordance with the manufacturer's recommended fusion procedure and in compliance with the most current version of ASTM F2620, PPI Technical Report TR-33, and in accordance with the "City of Palo Alto, Polyethylene Pipe Fusion Training Procedures". See Appendix E of the City of Palo Alto Water, Gas, & Wastewater Utility Standards.
3. Ambient temperature shall be between 55° F and 85° F prior to pipe fusion; otherwise pipe shall be protected from direct sunlight and cooled down until the ambient temperature falls within the above temperature range.
4. Fusion joints shall be allowed to cool for the times recommended by the pipe manufacturer prior to any movement of the fused joint.
5. All non-manual fusions shall be made using a Data Logger recording heating iron face temperatures, fusion pressure and a graphic representation of the fusion cycle. The Data Logger data shall be reviewed by Inspector prior to pipe being pulled in. Data Logger records shall be uploaded daily to a cloud server for remote viewing from any location.

H. Inspection: The following is a list of inspection duties both required of the City and Contractor:

1. The City will provide a polyethylene certified Inspector at the job site. The Inspector has the right to reject any fusions not meeting City requirements. The Contractor shall replace all fusions not meeting City requirements at its own expense.
2. In addition to the City certified fusers, the Contractor shall also provide a City certified polyethylene fusion supervisor who will be present on site at all times to inspect, guide, advise, ensure that all required procedures are adhered to, to witness the quality of each joint, and to observe pipe fuser(s) as they work. The Contractor's supervisor will be responsible for inspecting all fusions performed. As with the City certified fuser, the fusion supervisor will be tested and qualified by the City.
3. At the City's discretion the Contractor will remove fusion(s) and supply it to the City for testing to insure quality control.
4. Fusion records shall be downloaded and provided to the City in electronic format on a weekly basis. Records of all non-manual butt fusions shall be uploaded daily to the cloud server. The City may require paper record copies on a weekly basis.
5. Any failure recorded by the fusion equipment must be immediately brought to the attention of City's Inspector to avoid the City requiring the contractor to remove fusions to the last recorded acceptable fusion.
6. The fusion number corresponding to each joint shall be written on the pipe at the fusion location with an indelible marker.
7. Fusion number(s) shall also be noted on the Contractor's record drawing at the approximate location(s) of the fusion for both water and gas installation.
8. The City's Inspector will observe plastic fusions and reject all connections which are deficient. All fusions must be conducted in the presence of or with the prior approval of the City's

WGW Inspector. The City's Inspector will review the Data Logger or non-destructively test plastic fusions and reject all connections that are deficient. The contractor will replace all fusions failing non-destructive testing at his expense. The contractor will replace all fusions failing visual inspection or non-destructive testing at his expense.

- I. **Sealing Installed Piping:** Contractor shall seal open all water and gas piping with butt fusion end caps at the end of each workday. No open pipe ends (or ends sealed with tape) will be allowed at the end of the day.
- J. **Minimum Bending Radius:** The minimum bend radius for polyethylene water pipe SDR 9 is twenty (20) times the outside pipe diameter, for SDR 11 is twenty five (25) times the outside pipe diameter, and for SDR 17 is twenty seven (27) times the outside pipe diameter. If fusions, fitting, or flange are present or to be installed in the bend, the minimum bend radius shall be one hundred (100) times the outer pipe diameter.

END OF SECTION

**SECTION 2660
WATER DISTRIBUTION SYSTEM**

PART 1 – GENERAL**1.01 DESCRIPTION**

Work Includes installation of high density polyethylene (HDPE) water mains, water and fire services, fire hydrants, tracer wire, water valves and boxes, mechanical joint and/or flange adapters, all appurtenances, and all related equipment and fittings in accordance with the requirements of the Contract Documents.

1.02 RELATED WORK

- A. Section 2200: Excavation, Backfill and Restoration

PART 2 - MATERIALS**2.01 WATER DISTRIBUTION SYSTEM MATERIALS**

- A. "Wetted surfaces" of all materials, piping, or plumbing fixtures intended for conveying or dispensing potable water, supplied under these specifications, must contain less than 0.25% lead by weight in compliance with AB 1953.

1. Polyethylene (HDPE) Pipe and Fittings:

Pipe: All potable water polyethylene pipe supplied under this Specification shall be High Density Polyethylene Pipe (HDPE) PE 4710 with IPS dimensions conforming to the latest edition of ANSI/AWWA C901 and C906 and ANSI/NSF Standard 61. Resin used in the extrusion of water polyethylene pipe shall conform to the latest edition of the ASTM D 3350 Cell classification 445574C, or 445574E, with the specifications stated herein, and shall have an oxidative resistance category of CC3.

- a. All water main pipes shall be black with three (3) dual longitudinal blue stripes, or solid blue. All water service pipes shall be black with three (3) single longitudinal blue stripes, or solid blue. Both main and service piping shall have AWWA specification stamp embedment or permanent blue-line print.
- b. PENT test values of 2,000 hours min.
- c. Pipe dimensions and tolerances: The outside diameter and wall thickness shall be within the limits specified in Table 1.

Approved Manufacturers: CP CHEM Performance Pipe, CSR Poly Pipe Industries, WL Plastics, JM Eagle, or approved equal.

Table 1: Dimensional Standards for IPS 4710 High Density Polyethylene Pipe

Nominal IPS Size	Actual Outside Diameter (inches)	Minimum Wall Thickness (inches)	Average Inside Diameter (inches)	Standard Dimension Ratio (SDR) (unitless)
2" IPS	2.375	0.264	1.815	9
4" IPS	4.50	0.409	3.633	11
6" IPS	6.625	0.602	5.349	11
8" IPS	8.625	0.784	6.963	11
10" IPS	10.750	0.977	8.679	11
12" IPS	12.750	1.159	10.293	11
14" IPS	14.00	1.273	11.301	11
16" IPS	16.00	1.455	12.915	11
18" IPS	18.00	1.636	14.532	11

Fittings: All potable water polyethylene fittings supplied under this Specification shall be high density 4710 polyethylene manufactured by the injection molding process, pressure class 200 or greater, and conform to the latest edition of ANSI/AWWA C901 and C906 and ANSI/NSF Standard 61. Fabricated fittings may be installed with prior approval from the City Engineer. Resin used in the molding shall conform to the latest addition of the ASTM D 3350 Cell classification 445574C (HDPE 4710) with the specifications stated herein.

- a. All fittings shall have the AWWA specification stamp embedment or permanent line print. All fittings shall be pressure class 200 or greater. Additional pipe thickness required for saddle fusion fittings and other fittings to reach pressure class 200 shall be on the outside of the pipe so flow is not constricted.
- b. **Approved Manufacturers:** CP CHEM Performance Pipe, CSR Poly Pipe Industries, Central Plastics/Georg Fischer, ISCO, or approved equal.

- 2. Ductile Iron (DI) Pipe and Fittings:** Upon approval of the Engineer, DI pipe and fittings will be accepted to facilitate water main tie-ins and valve replacement, or at locations where HDPE cannot be used. For material requirements in contaminated areas, refer to 'Installation in Contaminated Areas' in this Section.

All DI water pipe shall be Class 52 push-on type, in standard lengths to conform to ANSI/AWWA C151/A21.51, ANSI/AWWA C111/A21.21 and ANSI/AWWA C150/A21.50. DI water pipe shall be asphalt coated in accordance with ANSI/AWWA C151/A21.51 and shall be lined with cement mortar lining of 1/16-inch minimum thickness, conforming to ANSI/AWWA C104/A21.4.

Mechanical joint fittings, joint restraints, shall be ductile iron Class 350, and shall be produced in strict accordance with ANSI/AWWA C104/A21.4, ANSI/AWWA C153/A21.53 and shall conform to details and dimensions published therein. Mechanical joint offsets shall conform to ANSI/AWWA C110-82 and offset joints shall conform to ANSI/AWWA C111/A21.11. Push-on joint ductile iron and cast iron fittings shall be in strict accordance with all applicable terms and provisions of ANSI/AWWA C110/A21.10 and ANSI/AWWA C153. Joints shall be in accordance with ANSI/AWWA C111/A21.11.

All DI pipe and fittings shall be encased in blue polyethylene tubing, 8 mil thick minimum, in accordance with ANSI/AWWA C105/A21.5.

- 3. Polyvinyl Chloride (PVC) Pipe (DI Fittings):** Upon approval of the Engineer, PVC pipe and ductile iron fittings will be accepted to facilitate water main tie-ins and valve replacement.

All PVC pipe supplied shall be class 200 meeting the requirements of ANSI/AWWA C900. PVC pipe shall be no older than 1 year from the date of manufacture to the date of shipment to CPA, provided the pipe is stored indoors in suitable containers; otherwise the pipe shall be no older than 6 months from date of manufacture to date of shipment to CPA.

Mechanical joint fittings, joint restraints, for PVC pipe shall be ductile iron in accordance with ANSI/AWWA C153/A21.53 and ANSI/AWWA C111/A21.11 with a rated working pressure of 350 psi. All tees, crosses, and elbows used with PVC pipe shall have mechanical joint ends. Reducers shall have mechanical joint by mechanical joint (MJxMJ) ends. All ductile iron fittings shall have an asphaltic coating in accordance with ANSI/AWWA C153/A21.53 and shall be cement lined and seal coated with an asphaltic material in accordance with ANSI/AWWA C104/A21.4. Mechanical joint ductile iron fittings shall be in accordance with ANSI/AWWA C110/A21.10 and joints shall be in accordance with ANSI/AWWA C111/A21.11.

Joining standard lengths of PVC pipe shall be with bell ends consisting of an integral wall section with a locked-in solid cross section elastomeric ring which meets the requirements of ASTM F477 or couplings supplied by the manufacturer meeting the requirements of AWWA C900.

Additional Outside Agency Approvals: All PVC fittings for use with AWWA C900 pipe shall have the approval of Factory Mutual (FM) and be listed by Underwriters Laboratories, Inc. (UL).

4. Main Tapping Hardware: All hardware must be ANSI/NSF 61 listed.**a. Tapping Sleeve**

- i. HDPE Main: For HDPE main connections, saddle shall be HDPE 4710, class 200 electrofusion branch saddle (IPS to IPS), NSF 61 listed and meet or exceed applicable ANSI/AWWA requirements manufactured by Georg Fischer Central Plastics, or approved equal. The fittings shall be provided with bottom underclamps or installed using a loading tool as specified by manufacturer's installation procedure.
- ii. Non-HDPE Main: All tapping sleeves shall be epoxy coated with 304 stainless steel washers, nuts and bolts. Tapping sleeves shall be as follows for Non-HDPE main connections:
 - CIP/DIP/PVC: Tapping sleeve shall be Mueller H-615.
 - ACP: Tapping sleeve shall be Smith-Blair 622 or Mueller H-619.
 - CCP: Tapping sleeve shall be Smith-Blair or JCM 415.

- b. Tapping Valves: Tapping valves shall be Mueller A-2361 class 250 ductile iron resilient wedge gate valve with flange inlets and outlets, EPDM disc and O-rings, and be supplied with 316 stainless steel washers, nuts and bolts.

5. Main Joining Hardware: All hardware must be ANSI/NSF 61 listed.

- a. Electrofusion Couplings (HDPE to HDPE): Electrofusion couplings shall be Georg Fischer Central Plastics, Integrity IntegriFuse, or approved equal for HDPE 4710, IPS DR 11 (4" and greater) and DR 9 (2"), Class 200 or greater, and ANSI/NSF 61 listed. HDPE pipe to HDPE pipe shall be joined by butt or electro fusion.
- b. Mechanical Joint (MJ) HDPE Adapter Kit (HDPE to PVC/DIP): Mechanical Joint (MJ) adapter kit shall be pressure class 200 or greater, designed for fusion to HDPE pipe, and mechanical connection to DIP or PVC pipe. Glands, material assembly and bolting shall be in accordance with ANSI A21.11 (AWWA C111); full face rubber gasket shall be included in the kit. The MJ adapter connection shall provide a fully self-restrained joint and shall not require additional restraint.
- c. Mechanical Couplings: All mechanical couplings (parts) shall be NSF 61 listed and pressure class 200 or greater and in accordance with ANSI/AWWA C153/A21.53. HDPE pipe shall have a pipe stiffener at each mechanical coupling joint.
 - i. HDPE to HDPE: Mechanical coupling for joining HDPE when a complete water shutdown is not possible, and electrofusion couplings cannot be used, shall be a Romac Industries Alpha Restrained Joint, EBAA Iron Mega-Coupling Series 3800, or approved equal.
 - ii. HDPE to ACP (asbestos cement pipe): Mechanical couplings shall be Smith & Blair 462 Quantum Coupling, Romac Macro HP, EBAA Iron Mega-Coupling Series 3800, or approved equal, meeting the following minimum requirements:
 - Sleeve: Ductile Iron ASTM A-536 designed for high strength/weight ratio. Ends shall have smooth inside taper for uniform gasket seating.

- Gaskets: Nitrile (Buna N)
 - Follower Flanges: Ductile Iron ASTM A-536 designed for high strength/weight ratio. Thickness determined by coupling size.
 - Bolts & Nuts: 304 Stainless.
 - Finish: Fusion bonded epoxy coating in accordance with AWWA C213.
- iii. HDPE to CIP (cast iron pipe) or DIP (ductile iron pipe): Mechanical coupling shall be Krausz Hymax Grip, Smith & Blair 462 Quantum Coupling, Romac Macro HP, EBAA Iron Mega-Coupling Series 3800, or approved equal.
- iv. HDPE to PVC (polyvinyl chloride pipe): Mechanical coupling shall be Smith & Blair 462 Quantum Coupling, EBAA Iron Mega-Coupling Series 3800, or approved equal. HDPE pipe shall be restrained by electrofusion flex restraints, and PVC pipe shall be restrained using a tapered gripping ring.
- d. Joint Restraints: All joint restraints shall be EBAA IRON 2000PV for PVC pipe and EBAA IRON MEGALUG 1100 series for ductile iron pipe, or approved equal.
- e. Mechanical Joint Bolts: Bolts for mechanical joint glands shall be Central Steel Services, Inc. Corten T-Bolts, or approved equal, and shall be high strength, low alloy steel bolts only, meeting the requirements of ANSI/AWWA C111/A 21.11 for rubber gasket joints for cast iron or ductile iron pipe and fittings.
- f. HDPE to Flange Connection: HDPE flange adapter shall be pressure class 200 or greater and used to join HDPE pipe to an existing flange or gate valve. A backup ring for flange adapter shall be pressure class 200 or greater and stainless. HDPE flange adapter shall meet the following minimum requirements:
- i. Bolts & Nuts: 304 stainless.
 - ii. Gasket: Garlock Blue-Gard 3000 gasket, blue, nitrile rubber, full face gasket designed to be used with water systems.
- g. Bolting For Buried Flanged Joints: Bolting for buried flanged joints shall be Type 304 stainless steel, Grade B8 Hex Head bolts with Grade B8M Hex Head nuts, and shall comply with all requirements of ASTM A193 and A194, respectively.
- h. Gaskets for Flanged Joints: Gaskets for flanged joints shall be 1/8" thick cloth inserted rubber, one-piece, full-face type, conforming to AWWA C207. For installation requirements in contaminated areas, see Section 2.02 of this Specification.
- i. Flexible Restraint Devices: Electrofusion HDPE pipe flex restraint device, encased in concrete, shall be attached to HDPE pipe near all transition connections to prevent pull out of HDPE pipe and/or movement of existing pipe. Flex restraint device shall be ISCO Georg Fischer Central Plastics or approved equal, designed for installation after a pipe is in place, and be rated at min. 7000 lbs of force per fitting. Resin used to make this fitting shall meet the requirements of ASTM 3350 with a cell classification of 345464C.

The electrofusion HDPE pipe flex restraints shall be installed in accordance with manufacturer's recommendations. Approximate Poisson effect pull force (lb.), calculated per AWWA M55 manual, for selected sizes of ANSI/AWWA C906 pipe operated at full rated pressure, plus maximum allowable occasional surge pressure as follows:

Pipe size (in.)	Approximate Pull Force (lb)	Calculated Number of Flex Restraints (each)
6	7,553	2
8	13,428	2
10	20,981	3
12	30,213	5
14	41,124	6
16	53,712	8

The Thrust Block Table and Valve Tie-Back Detail (Standard Details WD-13 and WD-18) shall be used to size concrete encasement.

6. Service Hardware and Appurtenances: All hardware must be ANSI/NSF 61 listed.

a. HDPE Water Main Connection

- i. HDPE Service: Service saddle shall be electrofusion IPS, HDPE 4710, Class 200 Electrofusion Branch Saddle manufactured by Georg Fischer Central Plastics, SA Branch Saddle manufactured by Friatec, IntegriFuse manufactured by Integrity, or approved equal. The fitting shall be NSF Standard 61 listed and meet or exceed ANSI/AWWA applicable requirements. Pneumatic top-loading tool is required for proper installation. Alternate installation methods may be used with prior approval from the City Engineer.
- ii. Ball Valve (HDPE Service): Ball valve shall be 2" IPS DR 11, HDPE 4710 Class 200 Full Port Polyethylene Ball Valve manufactured by Georg Fischer Central Plastics, or approved equal.
- iii. Copper Service: Service Saddle shall be electrofusion IPS, HDPE 4710, Class 200 Electrofusion Branch Saddle manufactured by Georg Fischer Central Plastics, VA Branch Saddle manufactured by Friatec, IntegriFuse manufactured by Integrity, or approved equal, with brass 360 Alloy outlets and Stainless 304 compression rings. The fittings shall be NSF Standard 61 listed and meet or exceed ANSI/AWWA applicable requirements. Pneumatic top-loading tool is required for proper installation. Alternate installation methods may be used with prior approval from the City Engineer. The fittings' outlets shall be designed for AWWA straight iron pipe thread.
- iv. Flare Nut Transition (Copper Service): Flare nut transition shall be Poly-Cam Series 914 female **swivel** flare nut, lead free, transition designed for connecting 2" IPS HDPE 4710 potable water services directly to Mueller angle meter stops H-14255N (1" and smaller) or H-24277N (1-1/2" and larger), and 2" Mueller corporation stops B-25025N, or approved equal.

The HDPE portion of the transition fitting shall be HDPE 4710 SDR 9, IPS size conforming to the latest edition of ANSI/AWWA C906, and have legible marking indicating word "Water", type of material (HDPE 4710), cell classification 445574C, ANSI/AWWA C906, the manufacturer's name or trademark, IPS size, OD, SDR, resin supplier identification, and year of manufacture. All flare nut transition fittings shall conform to NSF 61 standards.

- v. Corporation Stops (Copper Service): Corporation Stops for connection to non-HDPE mains shall be Mueller B-25000N with AWWA taper thread and copper flare straight connection outlets, or approved equal.
- vi. Three Part Unions (Copper Service): Three part unions shall be Mueller H-15400 with copper flare nut on both ends, or approved equal.
- b. Non-HDPE Water Main Connection (DIP, ACP, or PVC C-900 main/copper services): Services Saddle shall be Class 200 NSF 61 listed Mueller BR2B bronze series with double strap, or approved equal.
- c. Angle Meter Stop: Angle meter stop shall be Mueller B-24255N for 1" and smaller services and Mueller B-24277N for 1-1/2" and 2" services, or approved equal.
- d. Ball Straight Meter Valve: Ball straight meter valve shall be Mueller B-20287N, or approved equal.
- e. Meter Boxes: Meter boxes shall be supplied by the Contractor when box replacement is required or a new service is installed. The boxes shall be the following sizes:

Armorcast 11" x 21" x 12" Polymer Concrete Box (Part No. A6000492) and Cover (Part No. A6000489TDQ) Assembly with Drop-In Lid (Part No. A6000487T) for 5/8", 3/4" or 1" meters (Box Assembly Part No. A6000492TACPA).

Armorcast 17" x 30" x 12" Polymer Concrete Box (Part No. A6001640PCX12) and Cover (Part No. A6001647TDZ) Assembly with Drop-In Lid (Part No. A6000482T) for 5/8" meters with 3/4" double headers (Box Assembly Part No. A6001640TAPCX12CPA).

Armorcast 24" x 36" x 12" Polymer Concrete Box (Part No. A6001974PCX12) and Cover (Part No. A6001974TDZ) Assembly with Drop-In Lid (Part No. A6000482T) for 1" meters with 1" double headers (Box Assembly Part No. A6001974TAPCX12CPA).

Armorcast 30" x 48" x 18" Rotocast Polyethylene Box (Part No. A6001430PCX18) and two (2) Covers (Part No. A6001470TDZ) with two (2) Drop-In Lids (Part No. A6000482T) for 1" quadruple headers and 1-1/2" and 2" double and triple headers (Box Assembly Part No. A6001430TAPCX18CPA).

Armorcast 48"x96"x48" Polymer Concrete Vault (Part No. A6004896) with three (3) piece cover for 4" and 6" water meter sets with 2" by-pass, and where combination fire/domestic water services are installed. Oldcastle Precast/Christy B48 Box with two (2) self-closing, reading lids may also be used, as needed, if approved by the Engineer.

Box assemblies include box, covers and lids. Box and lid shall have a minimum 10K rating (Tier 5) for sidewalk and planting strip applications and a minimum 20K rating (Tier 22) for driveway and parking lot applications. Meter boxes shall not be installed in driving lanes of public or private streets. For installation in areas subject to vehicular traffic meter box shall have 20k (Tier 22) load rating. Lids shall have "Water" marked on them and magnet imbedded in cover.

All new water meter boxes shall be installed at standard depth (water meters shall be installed at a depth of 10" from existing grade to the center of the meter per City standard details). No additional extensions will be allowed to accommodate existing deep meters.

If a meter is found to be deeper than the standard 10", Contractor will be required to raise the meter to the standard depth of 10".

7. Fire Hydrant Assemblies: Fire Hydrant assemblies shall use wet barrel type hydrants meeting AWWA C503 standards. The fire hydrant assemblies shall be constructed using the following materials:

- a. Hydrants: Hydrants shall be Clow Valve No. F76, or approved equal, in residential, commercial, and heavy industrial areas. Clow Valve No. F76 hydrant shall be supplied with two (2) 2-1/2" and one (1) 4-1/2" outlets conforming to AWWA C503, and shall be painted Safety Yellow.
- b. Hydrant Risers: Hydrant Risers shall be AVK Series 24/88X Flowguard II Hydrant Check Valve conforming to the latest edition of ANSI C110/A21.10 standards and AWWA C503, and as shown on WGW Utility Standards detail drawing WD-15.
- c. Hydrant Bury: Hydrant Bury shall be 6" mechanical joint ductile iron conforming to the latest edition of ANSI C110/A21.10 standards and AWWA C503, and as shown on WGW Utility Standards detail drawing WD-15.
- d. Hydrant Valves Locations: Hydrant valves shall be placed as close as practical to the water main. For information on hydrant valves, see Section 2.01A.8 of this Specification.
- e. Hydrant Valve Boxes: Hydrant Valve Boxes shall be Oldcastle Precast/Christy G05TBox Traffic Valve Box with G05CT non-locking type metal traffic lid marked "Water". Valve box risers shall be solid 8" C-900 PVC pipe (Pressure Class 200) as shown on WGW Utility Standard Detail WD-19.

8. Gate Valves (Hydrants and Mains)

- a. 12" or Smaller (Installed with New HDPE Main): Gate valves 12" or smaller that are installed on HDPE pipe shall be 250 psi, ductile iron ASTM A536 body, resilient-seated, tight closure gate valves with non-rising stems, and have IPS HDPE 4710 DR 11 polyethylene pipe ends. The valve shall be NSF 61 listed and meet or exceed AWWA C515 applicable requirements. All gate valves shall have protective interior/exterior electrostatically applied fusion bonded epoxy-resin coating in accordance with AWWA C550 requirements, stainless steel A2-Grade 304 bonnet and stuffing box bolts, and shall open counter clockwise. All gate valves shall be American AVK 66/EEN (PE x PE), or approved equal.
- b. 12" or smaller (Installed on Existing Non-HDPE Main): Gate valves 12" or smaller that are installed on non-HDPE pipe shall be 250 psi, ductile iron ASTM A536 body, resilient wedge gate valves with four point wedging mechanism, EPDM discs and O-rings, and non-rising stems. The valve shall be NSF 61 listed and meet or exceed AWWA C515 applicable requirements. All gate valves shall have protective interior/exterior fusion epoxy coating in accordance with AWWA C550 requirements, and shall open counter clockwise. All bonnet and stuffing box bolts shall be stainless steel 316. Valves shall have flange joint ends (FL x FL), mechanical joint ends (MJ x MJ), or both flange and mechanical joint ends (FL x MJ). Joints shall be in accordance with ANSI/AWWA C110/A21.10 (FL) and ANSI/AWWA C111 (MJ) requirements, as applicable. All gate valves shall be Mueller A-2361 Series, or approved equal.

- c. 14" or Larger: Gate valves 14" or larger shall be 250 psi, ductile iron ASTM A536 body, resilient wedge gate valves with four-point wedging mechanism, EPDM discs and O-rings, and non-rising stems. The valve shall be NSF 61 listed and meet or exceed AWWA C515 applicable requirements. All gate valves shall have protective interior/exterior fusion epoxy coating in accordance with AWWA C550 requirements, and shall open counter clockwise. All bonnet and stuffing box bolts shall be stainless steel 316. Valves shall have flange joint ends (FL x FL), mechanical joint ends (MJ x MJ), or both flange and mechanical joint ends (FL x MJ). Joints shall be in accordance with ANSI/AWWA C110/A21.10 (FL) and ANSI/AWWA C111 (MJ) requirements, as applicable. All gate valves shall be Mueller A-2361 Series, or approved equal.

9. Butterfly Valves (Transmission Mains)

- a. Butterfly valves shall 250 psi rated, with ductile iron body conforming with ASTM 536 standards. The valve shall be NSF 61 certified and shall meet requirements of ANSI/AWWA C504 Standard Class 250B. The valve shall have ductile iron disc conforming with ASTM 536 standards. The valve shall have seat-in-body design and nonmetallic bearings. All butterfly valves shall be coated in accordance with AWWA C550 and C504 standards. All valve hardware shall be 304 stainless steel. Butterfly valves shall have a 2" bypass per Standard Detail WD-14. All butterfly valves shall be Mueller, Lineseal Series or approved equal.

- 10. Valve Stem Extensions:** Valve stem extensions shall be fusion coated and furnished with an AWWA brass wrench; top of AWWA brass wrench nut not to exceed two (2) feet below finished grade. The valve stem extension shall have a six inch (6") diameter, 1/4-inch thick, fusion-coated black iron guide plate welded six inches (6") below the AWWA brass wrench nut. Stem extensions are to be installed on valves four (4) feet and greater in depth.

- 11. Valve Boxes:** Valve boxes shall be Oldcastle Precast/Christy G05TBox Traffic Valve Box with G05CT non-locking type metal traffic lid marked "Water". Valve box risers shall be corrugated 8" HDPE (smooth inner pipe). The riser outside diameter shall be between 9.0" to 9.4" and closely match the valve box inside diameter at the point of insertion. See WGW Utility Standard Detail WD-14.

12. Air Release and Air/Vacuum Valves

- a. Air Release Valves: Air release valves shall be APCO, Crispin-Multiplex Mfg. Co., or approved equal, and shall conform to the latest edition of AWWA C512. For 8" through 12" HDPE mains, air valve assemblies shall be a minimum of 1", and for 14" and larger HDPE mains, air valves assemblies shall be a minimum of 2". All assemblies shall have stainless steel floats.
- b. Air/Vacuum Valves: Air/Vacuum valves shall be APCO, Crispin-Multiplex Mfg. Co., or approved equal, and shall conform to the latest edition of AWWA C512. For up to 10" HDPE mains, air/vacuum valve assemblies shall be a minimum of 1", and for 12" and larger HDPE mains, air/vacuum assemblies shall be a minimum of 2". All assemblies shall have stainless steel floats. Air Release/Vacuum valve vents shall be placed above flood plain.

13. Line Stopping:

Line stopping is used when existing distribution valves do not exist, have failed, or if line stops are called out on the plans. The line stopping shall be performed following written approval of the engineer. All line stopping equipment **must be disinfected** prior to use per ANSI/AWWA C651/B301. Line stop types shall be utilized in the following order:

- a. Permanent Insertion Valves (for pipes with smooth interior walls): valve box and optional Permanent insertion valve line stops shall be installed similar to a gate valve for future operability. Insertion valves shall be class 250. Insertion valves shall be Insta-Valve™ by Hydra-Stop, or an approved equal.
- b. Temporary Internal Line Stops (for all pipe types): Saddles shall be bolted with stainless steel bodies and components. Saddles shall be class 250 and compatible with the main (asbestos cement, PVC, ductile iron, or cast iron pipe, fused (HDPE) or welded (concrete cylinder pipe)) and line stop equipment. Saddles shall be manufactured by Hydra-Stop, JCM or an approved equal.
- c. HDPE Squeezing: Following Engineer's approval, HDPE may be squeezed-off per the manufacturer's recommended procedures. Generally, pressure pipe squeezing is limited to 18" IPS at operating pressure not exceeding 100 psi. Squeeze-off tools shall be designed for use on HDPE pipe in accordance with AWWA F1563. The tools and procedures shall be approved by the City prior to use. Squeeze-off tool shall be manufactured by Reed or an approved equal.

14. Thrust Blocks: Thrust blocks shall be Class B Portland cement concrete, Type II, meeting Caltrans Standard Specification Section 90 requirements and sized according to the detail shown on the WGW Utility Standard Detail WD-13.

15. Shell Cutter: Shell cutters shall be Mueller, or approved equal, for tapping HDPE 4710, C900 PVC, asbestos cement (AC), ductile iron (DI), or cast iron (CI) pipe. A shell cutter for both plastic pipe and/or AC/DI/CI pipe shall be approved by the engineer prior to use. Shell cutters shall be tungsten carbide tipped, designed for an easy fit through valves, and shall have large slots for debris removal. "Drill-bit" type cutters shall not be used.

16. Tracer Wire and Connections: Tracer wire shall be Agave Wire, LTD 10 AWG solid copper wires coated with .45 mils Type HMW - PE insulated conductor, blue in color, or approved equal. The wire shall meet all requirements of the latest version of ASTM D1351 and ASTM B8 and shall be UL listed as direct burial wire for temperatures between -20° C and 80° C for circuits not exceeding 600 volts. The surface of the insulation shall be durably marked, at intervals not exceeding 24 inches, with only the following information: maximum working voltage "**600 VOLTS**", wire type, manufacturer's name or trademark, AWG size, and UL required markings. Tracer wire shall be installed on all HDPE pipe mains and services.

One tracer wire shall be installed with the pipe. All tracer wire connections shall be made using the Nicotap connector system T1-102-D, wrapped with aqua seal and electrical tape. All Nicotap fittings must be installed with tooling specified by the manufacturer. The use of pliers or other crimping devices will not be allowed.

Anode boxes, and 5 to 10 lb. Mg anode bags (provided by City), shall be installed at fire hydrants as directed by the City, with tracer wire extending as shown on WGW Utility

Standard Detail WD-15. For single service installations that are not part of a Capital Improvement Project, anode boxes, and 1 lb. Mg anode bags (provided by City), shall be installed at water meter, with tracer wire extending as shown on WGW Utility Standard Detail WD-15. The wire configuration shall be as follows: North tracer wire – terminal 1, no knot, East tracer wire – terminal 2, with one knot, South tracer wire – terminal 3, with two knots, and West tracer wire – terminal 4, with three knots.

17. Warning Tape: Warning tape shall be Northtown Pipe Protection Products Hytech Non-Detectable Tape, or approved equal, 3 inches wide, blue and carry the inscription: "Caution Buried Water Line Below". Warning tape shall be installed 12 inches above the top of the new water main (initial backfill zone).

18. Anode Boxes: Anode boxes shall be Oldcastle Precast/Christy G05TBox Traffic Valve Box with G05CT non-locking type metal lid marked "Anode Water".

2.02 INSTALLATION IN CONTAMINATED AREAS

For areas of known contamination or where contaminated soil is found the following materials must be used:

- A. Mains: Ductile iron water pipe (DIP) per Section 2.01A.2 of this Specification.
- B. Gaskets: NBR or FKM gaskets, depending on the contamination type/levels. Submittals shall be approved by the Engineer. Gasket lubricant shall be as specified by the pipe manufacturer.
- C. Services: 2 CTS inch diameter, Type K copper tubing meeting ASTM B88 copper tubing specification. If the existing service is not copper, the service shall be replaced with new copper tubing. All services shall be replaced or reconnected in the original size, or 2" copper, whichever is larger. Four inch and larger services shall be installed using DIP pipe. All services shall be installed and/or reconnected in accordance with AWWA C800.
- D. Service Saddle: Shall be Mueller BR2B series.
- E. Gate Valves: Gate valves per Section 2.01A.8 of this Specification.

2.03 TEMPORARY WATER MAIN BYPASS SYSTEM (REPLACE-IN-PLACE METHOD)

In order to eliminate water service disruptions to customers who require 24 hour a day service, a temporary water main bypass system will be required. Temporary water main shall be a minimum of 2-inch diameter unless otherwise specified. Temporary water main is required to be disinfected, flushed, and sampled prior to any service connections being made. The temporary water main shall also be tested at static main pressure for a period of 2-hours.

Bypass piping required for an extended period of time, if directed by the Engineer, shall be buried or covered by granular material ramps where the pipe crosses bike trails, sidewalks, driveways, roads, pedestrian crossings, etc. Products used shall be manufactured from water distribution piping and couplings and shall be NSF approved for potable water use.

2.04 WATER METER REPLACEMENT

- A. Work Materials to be Furnished by the City: The City will provide new water meters for

replacement where designated by the engineer. All other materials shall be provided by the Contractor. All meters to be obtained from the City of Palo Alto Water Operations Department.

- B. Work Materials to be Furnished by the Contractor shall include, but are not limited to:**
1. All materials and equipment needed to complete installation of new HDPE mains and services.
 2. Expendable Concrete Materials: Materials required to install and finish Portland cement concrete, such as form lumber, tie-wire, nails, etc.
 3. Concrete: All Portland cement concrete including reinforcing steel, wire mesh, etc.
 4. Temporary and Permanent Fencing: All fencing including traffic barricades required to provide a barrier between vehicular/pedestrian movements and excavations.
 5. Trench Backfill Sand: All backfill sand shall be clean, imported sand, rock and salt free. Bay sand will not be accepted.
 6. Paving Material: All materials required for temporary and permanent street repairs including base materials.
 7. Landscaping Materials: All landscaping materials, plants and surface materials that are damaged due to Work.
 8. Traffic Control Materials: All materials required to direct vehicular/pedestrian traffic, including striping, loop detectors, reflectors, etc. that may be damaged by the Work.
 9. Drilling fluids and bentonite for directional drilling operations.
 10. Non-skid trench plates.
 11. Project notification signs.

2.05 MANUFACTURER'S TESTING

- A. Health effects evaluation: All materials in direct contact with potable water, including but not limited to, pipe and fittings must comply with ANSI/NSF Standard 61.
- B. Long-term hydrostatic strength: Materials must be tested to establish that their minimum long-term hydrostatic strength is in compliance with the requirements of the applicable AWWA product standard (AWWA C906).
- C. Material cell classification: PE materials must have a cell classification 445574C per ASTM D3350.

2.06 SUBMITTALS AND QUALITY CONTROL

- A. The Manufacturer shall submit a written quality control procedure conforming to requirements of ANSI/AWWA C901 (up to 4") and C906 (4" and larger), which shall be subject to approval by engineer.

- B. The Manufacturer shall permit City representatives to tour extrusion facilities for the purpose of evaluating manufacturer's capabilities. The tour shall be during extrusion of a City order or if prior to order placement during the extrusion of a similar material.
- C. The Manufacturer shall certify that the plastic pipe and or fittings supplied meet all the requirements of this Specification. When requested by the City, the Manufacturer shall supply certification for all items ordered. Failure to do so shall be cause for order rejection.

2.07 MATERIAL INSPECTION

- A. City reserves the right to inspect all material and may reject any items not meeting these Specifications.

PART 3 - EXECUTION

3.01 HDPE WATER MAIN SYSTEM INSTALLATION

- A. Minimum size of new main: The minimum size of new HDPE water main shall be 8" (I.D. = 6.963), SDR 11.
- B. Minimum/Maximum Cover: Water mains shall be installed with a minimum and maximum cover, as measured vertically from the top of pipe to the top of pavement. For 8" HDPE, a minimum depth of 3-feet is required, with a maximum of 4.5-feet. For 10" and larger HDPE, a minimum depth of 4-feet is required, with a maximum of 5.5-feet. Upon approval of the engineer, exceptions may be allowed if existing conditions do not allow for the required minimum and maximum depths to be maintained.
- C. Underground Clearances:
 - 1. Sewer, Recycled Water and Storm Utility Separation: For parallel construction, the distance between new water mains and sewer, recycled water and storm drain lines shall follow the State Water Resources Control Board's separation requirements. Separation distances shall be measured from the nearest edge of the facilities. Water mains and non-potable fluid-carrying pipelines shall not be installed in the same trench. In the event that the minimum clearances cannot be achieved the City and the State Water Resources Control Board will need to approve the plans. Any changes due to field conditions during construction that decreases the separation will need to be reapproved prior to construction.
 - 2. Gas, Electric, and other Utility Structures: For all other utilities, unless otherwise specified, a minimum of 12-inches vertically and 48- inches horizontally shall be maintained between the pipe surface and other utility line or structures. In the event that it is not possible to maintain the required minimum vertical clearance from other structures, the Contractor shall encase the water main in steel pipe or concrete at the discretion of the engineer. If horizontal separation is between 1-foot and 4-foot, review and approval by the engineer is required. Horizontal separation less than 1' is prohibited.
- D. Location: Water mains shall be located 7-feet off the lip of gutter/edge of pavement on the north or east side of streets, if possible, unless otherwise specified on the Project Drawings. Water services shall be installed perpendicular from the water main, in the shortest straight line to the water meter. Water meters and services shall be installed 5-feet minimum from trees, edge of

driveway, and the sanitary sewer house lateral.

Water meters 2" and smaller in size shall be installed in the public right-of-way. The meter location and installation shall conform to the WGW Utility Standard Details. Water meters larger than two inches in size shall be installed on the customer's property, adjacent to the customer's property line. The meter location and installation shall conform to the WGW Utility Standard Details.

On a monthly basis, Contractor shall provide digital photographs of the underground work completed, including, but not limited to; open trench construction, main tie-ins, service tie-ins, bore pits, areas where minimum/maximum cover depths and underground clearances cannot be met, and existing utility conflicts.

- E. Maximum Velocity of Flow for Water Main: The maximum design flow velocity in any water main shall not exceed 7 feet per second, based on the maximum calculated loads.
- F. Water Pipe Bedding: Trench shall be free of debris, sharp rocks, etc. before adding the sand bed for the new water main. Sand bedding shall be installed per WGW Utility Standard Detail WGW-02.
- G. Location of Valves: Main line valves shall, where possible, be located on property line extensions unless shown otherwise on the Project Drawings. Each valve's position shall be GPS surveyed and submitted per requirements listed in Section 2740 (Record Drawings and Survey Date Collection) of these Specifications. In order to minimize customer shutdowns and construction time, line stopping for the installation of main line valves shall be implemented as directed by the engineer.

Where no permanent fixtures are available in the right-of-way, the valves shall be located by a fiberglass utility marking post, offset 5-feet from the mains, and marked with a utility decal with the words "WATER VALVE" on both sides of the marker.
- H. Valve Boxes/Valve Pits: Main line valve boxes shall be installed per Section 2.01.A.9 of this Specification.
- I. Line Stopping:
 - 1. Internal Line Stops (All pipe types): In order to minimize potential traffic hazards, all excavation and necessary preparation, prior to line stopping and new line valve installation, shall be done one (1) day in advance prior to the actual plumbing work. Each line valve installation shall include two (2) line stops, one upstream and one downstream of the line valve to be replaced, complete with all necessary equipment (i.e., bypass, sawcutters, backhoes, deck plates, traffic control, etc.) and materials (i.e., piping, disinfectant, couplings, concrete, AC, backfill, restraint, etc.), needed to assemble and complete installation of the new line valve.
 - 2. HDPE Squeezing: Closing and opening rates are key elements in squeezing off HDPE. Squeeze pipe slowly to close and more importantly slowly to open. Do not squeeze-off pipe in the same location. After squeeze-off is complete make the pipe 'Squeezed-off' and wrap vinyl tape at the squeeze off location to 6 inches on each side.
- J. Main Filling: All main filling shall be done in the presence of the Engineer and/or field inspector, and field operations personnel. Corporation stops shall be installed on the main so as to remove trapped air prior to pressure testing.

- K. Maximum Pull Force: A commercially available weak link approved by the Engineer shall be used, in accordance with manufacturer's recommendations, between the puller and the pipe during directional drilling operations. The maximum pull force for PE 4710 HDPE is as shown in the following table:

Pipe Diameter (Inches)	Maximum Pulling Force (Pounds)
8	27,000
10	42,000
12	59,000
14	71,200
16	93,000

3.02 HDPE WATER SERVICE INSTALLATION

All new services, except in areas of known contamination, shall be HDPE 4710, installed as shown on the Project Drawings and as described in these Specifications. In areas of known contamination, existing copper services shall be replaced with copper, as directed on the Project Drawings. All connections are to be electrofusion type HDPE for the portion of a new service, and flare type HDPE/Cu transition to angle meter stop. Flare type connections shall be used on all reconnected copper services.

The minimum distance between service taps shall be 24 inches. New services shall be installed perpendicular to the main. All new services shall be shown accurately on the record drawings as described in Section 2740 (Record Drawings and Survey Data Collection) of these Specifications.

Transfer or reconnection of a water service from the existing main to a new main may cause an interruption in the customer's service. The contractor must notify the customer via door hanger notices, 24 hours in advance of the service interruption with the approximate time (8 am -12 pm or 1 pm - 5 pm) and duration of the service interruption. At the time of service interruption, the customer shall be notified by ringing the door bell or knocking. The customer's main water valve will be closed if it can be located. After the service has been transferred/reconnected the customer's main water valve will be opened, and customer's service pipe flushed through a hose bib to remove air, sand, chlorine, shaving material, etc.

- A. Minimum size of new service: The minimum size of a new water service line shall be 2" IPS HDPE 4710 SDR 9 pipe. For installation requirements in contaminated areas, see Section 2.02 of this Specification.
- B. Depth: Water services shall be installed with a minimum cover of 24", as measured vertically from the top of pipe to the top of pavement. The maximum depth of installation shall not exceed 30".
- C. Maximum Velocity of flow: The maximum design flow velocity in any residential or commercial water service shall not exceed 10 feet per second, based on the maximum calculated loads.

3.03 HDPE HYDRANT ASSEMBLIES AND FIRE SERVICES

Hydrant Assemblies shall be installed and field tested according to the requirements of AWWA M17, ANSI/AWWA C503, and as shown on the Project Drawings.

Prior to reconnection, all existing fire services shall be potholed by the Contractor to avoid possible

conflicts. Existing fire service pipe shall be joined with new HDPE pipe, connected to a new HDPE water main by MJ adapter, or as shown on the WGW Utility Standard Details. Contractor may be required to furnish shop drawings of how re-connection will be constructed and shall inform the nearest City Fire Station, City Communications Center, and Customers regarding the fire service work. The Contractor will be required to make all necessary schedule arrangements to accommodate the customer's needs.

PART 4 - TESTING

4.01 Testing and Inspection

The Engineer or Inspector shall have access to the Work area at all times, and the Contractor shall provide proper facilities for such access and inspection. If the Specifications, the Engineer's instructions, law, ordinances, or any other public authority require any work to be specially tested or approved, the Contractor shall give the Engineer 24 hours notice of its readiness for inspection. If the inspection is by an authority other than the Engineer, the Contractor shall make special arrangements for the outside authority to make its inspection. Work covered up without approval or consent of the Engineer or Inspector, shall, if required by the Engineer or Inspector, be uncovered for examination and properly restored at the Contractor's expense.

Authorized Inspectors are considered to be representatives of the City, limited to the duties and powers entrusted to them. It will be the Inspectors' duty to inspect materials and workmanship of those portions of the Work to which they are assigned, either individually or collectively, under the instructions of the Engineer, and to report any and all deviations from the Project Drawings, Specifications and other Contract provisions which may come to their notice. An Inspector will order the Work entrusted to his/her supervision stopped if in his opinion such action becomes necessary. The Engineer will be notified and will determine if the Work is proceeding in due fulfillment of all Contract requirements.

All pipe and accessories shall be laid, jointed and tested under pressure for defects and leakage the manner specified, in the presence of and as approved by the Engineer or Inspector.

- A. Connection to Existing Main: The Contractor shall make connections to existing mains where indicated on the Drawings. All necessary preparation (not limiting to traffic control and excavation) for system connections shall be done one (1) day prior to actual materials installation. **All new water mains shall be kept isolated from the City system until they are flushed, bacteriologically tested, and accepted. New system isolation by a closed valve will not be permitted.** The Engineer will review the Contractor's method and sequence of connecting to existing mains to minimize contamination danger. Connections to existing valves prior to obtaining satisfactory leakage and pressure tests of the new facilities will not be allowed.

The City assumes no responsibility for the water tightness of existing valves. If necessary, the Contractor must work with the City to accomplish water tightness. All costs and expenses for obtaining water tightness shall be included in the bid price for various bid items, and no special compensation shall be allowed.

Service interruptions on existing mains impacted by a shutdown shall be coordinated with the Engineer, who will specify time and duration of the interruption. The Contractor shall notify all affected users in writing at least 48 hours in advance of service interruption. The Contractor shall notify the City's Water-Gas-Wastewater Operations Division (496-6967) at least **5 days** in advance to schedule valve closures for service interruptions. **Manipulation of existing valves**

shall only be done by or under the direction of City Water Division personnel.

After the new water system has been flushed, bacteriologically accepted, pressure and leak tested, and placed into service, all valves in the system shall be maintained in an "on" position unless otherwise directed by the Engineer.

- B. Hydrostatic Pressure and Leak Testing: Installed main shall be adequately anchored with a covering of at least 6" of initial backfill, if installed by open trench method. The joints and fittings, particularly flange connections, shall be left uncovered for visual leak inspection.

Leak tests of the new HDPE water system shall be conducted in accordance with ASTM F2164. The pipeline should be slowly filled with potable water and all trapped air bled off. The main should undergo a hydrostatic pressure test using a pressure of 150 psi. The pressure shall be maintained constant for a 4-hour period by adding makeup water. After 4 hour period is completed, the pressure shall remain steady within 5% (7.5 psi) of a target 150 psi test pressure for one hour. The total test time should not exceed 8 hours. If the pipeline has to be retested – the pipe must be depressurized and allowed to "relax" for at least 8 hour period before the next testing sequence.

In fused polyethylene water piping system, no leakage shall be present. If leakage is observed at a fusion joint, complete rupture may be imminent. The Contractor shall move all personnel away from the joint and depressurize the main. Leaks, failure, or defective construction shall be promptly repaired by the Contractor, at the Contractor's sole expense. Payment for pressure and leakage testing shall be considered included in the price paid per linear foot for water main installation.

- C. Disinfection and Bacteriological Testing: Newly installed potable water pipelines (mains and services) require disinfection in accordance with ANSI/AWWA C651/B301. Disinfection shall take place after the initial flushing, and after the completion of the pressure testing. Individual new water services will be flushed through the angle meter stop after connection to the new water main. The new pipe, connections, and fittings must be kept clean and swabbed with a 5% solution of hypochlorite before installation.

Injection of liquid chlorine solution shall be used to disinfect HDPE water pipes. With this method, the main is filled to remove air pockets and chlorine is injected continuously until a concentration between 25mg/L and 50 mg/L is obtained throughout the main. The chlorinated water in all portions of the main shall have a residual of not less than 10 mg/L of free chlorine after a 24-hour period. Contractor shall note that prolonged exposure to highly concentrated disinfection chemicals may damage the inside surface of HDPE pipe and shall be avoided. Air is to be exhausted from each high point, dead end, branch run and hydrant run. The chlorinated water shall be removed prior to samples being collected for bacteriological testing.

Before bacteriological testing samples are taken, each hydrant run, branch run and dead end shall be thoroughly flushed to clear foreign matter and until the residual chlorine concentration is less than one part per million (if discharging to the storm drainage system). The Contractor shall measure residual chlorine concentrations by using a color comparator test that is witnessed and approved by the Inspector. Samples shall be gathered and tests conducted according to the provisions of AWWA C651-92, at the expense of the Contractor, by a laboratory approved by the Engineer. Samples shall be taken at representative points as required to thoroughly test the installed pipe. Fire hoses and fire hydrants shall not be used to gather samples. The Contractor will be required to perform two consecutive Coliform tests at a minimum of 16-hours apart. The testing laboratory used by the Contractor shall be State Certified and provide QA/QC reports.

The new facilities shall remain isolated and out of service until satisfactory test results have been obtained that meet the requirements of the State Water Resource Control Board, and the Engineer has accepted the results as indicative of the bacteriological condition of the new water pipe. If unsatisfactory or doubtful results are obtained from the initial sampling, the pipe (mains and services) shall be flushed and the chlorination process shall be repeated until acceptable test results are obtained. The bacteriological test takes at least 48 hours for results to be conclusive.

Disposal of chlorinated water shall comply with all federal, state, and local regulatory requirements. Disposal directly to the storm drain system without removal of chlorine is strictly prohibited. No discharge into the storm drain system shall be allowed during rain. Upon termination of the flushing, any standing water in the gutter shall be removed by sweeping it to the nearest storm drain catch basin or sewer manhole. Flushing of chlorinated water directly into the sanitary sewer system will only be allowed with Engineer's approval.

If new water mains will not be tied into the water distribution system within 72 hours following the Engineer's acceptance of the bacteriological test results, Contractor may be required to flush the highly chlorinated water from the main, refill the main with potable water, and maintain pressure in the main until the tie-in is complete. If the main is allowed to sit empty for a period longer than 24 hours, the Contractor will be required to repeat flushing, disinfection and bacteriological testing procedures at the Contractor's expense.

- D. Washing/Flushing Vehicles: All vehicles used for street washing or flushing must be equipped with meters and have air gap separation connections to hydrants and filling tanks.

PART 5 – DESIGN AND REGULATORY STANDARDS

5.01 DESIGN STANDARDS

- A. Service Load: The design load shall be the total present (and additional future) water demand as presented on the Utilities Application - Load Sheet.
- B. Calculating Service Size: The service size calculation must be based on the Hazen-Williams Formula to calculate the head loss due to pipe friction.
- C. Available Pressure: The service designer must consult the Fire Hydrant Flow Data (available at Fire Station 5, located at 600 Arastradero Rd. Phone 650-329-2187), and the Pressure Contour Map for an estimate of static pressure at the water supply main. The water pressures in the distribution system vary with elevations of the area served. During average demand conditions, pressures range from 30 to 125 psi, with an average of approximately 50 psi. The lowest design pressure that should be used is 20 psi. However, the City does not guarantee any water main pressure, during peak hour and/or emergency conditions, as certain areas of the City are subject to inadequate pressures. The water pressure in Foothill, west of highway 280, may be as high as 200 psi.
- D. Blowoffs and air release valves: Water mains shall not be designed as dead end mains. Easements shall be provided to cross-tie water mains in cul-de-sacs, and as required by the City. Blowoffs shall be provided at all low points and as required by the City. Temporary blowoffs shall be provided as necessary to pressure test and chlorinate new water main. Vacuum and air release valves shall be installed at all summits in the water main, and as directed by the City.
- E. Valves: All main line valves shall be installed per Section 2.01.A.8 of this Specification. Four water

valves shall be installed at each water main intersection or cross, and three valves shall be installed at each water main tee at the property line extensions. Valve spacing shall not exceed 500 LF unless approved by the City. See Figure 1. A 2" HDPE bypass with 2" full port ball valve (NSF 61 listed) shall be installed around each 14" and larger gate valve to facilitate operation of the valve (standard detail WD-14). For installation requirements in contaminated areas see Section 2.02 of this Specification.

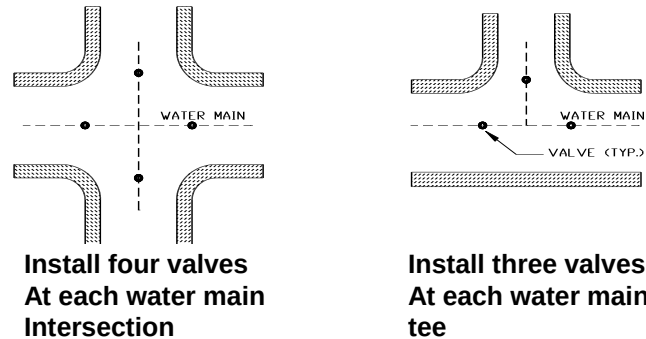


Figure 1.

- F. Meter Bypasses: Some customers, such as hospitals, schools, beauty shops, and factories with processes requiring uninterrupted water service, shall have bypasses installed around the meter so that tests and repairs can be carried out without inconvenience to either the customer or the utility.
- G. Elevation of the Customer's System: Customers on hillsides or in high-rise buildings will be affected by the difference in elevation between the utility's water main and customer's outlet. If the customer is at an elevation less than that of the water main, then he can anticipate a higher pressure than that in the main, and conversely, the homeowner at a higher elevation than the main will encounter lower water pressure. Multistory buildings will often be too high to use the available main pressure, and pumping will be necessary. It is the responsibility of the customer's engineer to design the system from the meter outlet to determine the pressure that will be available to meet their demand.
- H. Pressure Reducing Valves: Pressure reducing valves (PRVs) are used in mountainous and hilly areas to control the downstream pressure and protect the property owner's plumbing from excessive pressure when his building is located in the lower elevations of the pressure zone. These are installed by the customer at the meter or at a suitable location in the customer's plumbing system to permit reduced pressure to the house fixtures. PRV's must be installed to leave maximum pressure at outside hydrants. It is customer's responsibility to install and maintain all PRVs.
- I. New Developments: When the City deems it necessary, the Developer will be required to create a water model showing that the existing water distribution system will not be impacted by the new development. The applicant's engineer shall prepare and submit a complete report for the new subdivision water distribution system. The report shall analyze the existing City of Palo Alto water system and the new development by the use of a hydraulics model. The recommendations for the new development water system improvements shall include a cost estimate and suggested design criteria.

- J. Irrigation Meters: Water service for all new and rehabilitated industrial, commercial, and institutional landscaping, and new and rehabilitated multi family common areas, requires a permit and/or review by the City and shall be provided by a separate irrigation meter. This meter shall be designed as an irrigation account and no other utilities will be billed on such accounts. The customer shall pay for the additional service according to rate schedule W-5.
- K. Fire Hydrants: Fire hydrants shall be located no more than 500 feet apart in residential areas and no more than 300 feet apart in the downtown areas. Locations and usage shall comply with City of Palo Alto Rule and Regulation 21.
- L. Cross Connection Control: Cross Connection Control shall be installed per City of Palo Alto **SPECIAL WATER UTILITY REGULATION 21-E** entitled "Water System Protection", the revised California Administrative Code (Title 17, Sections 7583 through 7605), and WGW Utility Standards Details WD-11 through WD-12D. For further questions contact the Utilities Cross Connection Inspector at 650-496-6972.
1. Type of Protection Required: The type of protection provided to prevent backflow into the public water supply will directly correlate with the degree of hazard that exists on the consumer's premises, as determined by the Cross-Connection Control Officer. In locations where the water service may not be interrupted during normal working hours, two parallel backflow preventer assemblies shall be installed (**Reference: California Administrative Code, Title 17, Section 7604**).
 2. Testing and Maintenance of Backflow Preventers: The Cross-Connection Control Officer will ensure that adequate maintenance and periodic testing is provided. Backflow preventers will be tested by a certified tester. Backflow preventers will be tested at least annually or more frequently if determined to be necessary by the Cross-Connection Control Officer. When a backflow preventer is found to be defective, it shall be repaired or replaced within 30 calendar days. Backflow preventers will be tested immediately after installation, relocation, or repair prior to being placed into service. The Cross-Connection Control Officer will notify the water user when testing is needed. Reports of testing and maintenance will be maintained by the City of Palo Alto for a minimum of three years. These regulations are to be reasonably interpreted. It is the intent of these regulations to recognize that there are varying degrees of hazard and to apply the principle that the degree of protection should be commensurate with the degree of hazard. It is recognized that the control of cross-connections requires cooperation between the City of Palo Alto, the water consumer, and the Water Resource Control Board. The City of Palo Alto has the primary responsibility to prevent water from unapproved sources, or any other substance from entering the public water supply system. The Water Resource Control Board has the overall responsibility for preventing water from unapproved sources from entering either the potable water system within consumer's premises or the public water supply (**Reference: California Administrative Code, Title 17, Section 7605**).
 3. Parallel Reduced Pressure Principle Assemblies: Parallel reduced pressure principle assemblies shall be installed at all locations where the water can not be interrupted during normal working hours. Only backflow assemblies approved for the State of California by USC Foundation for Cross-Connection Control and Hydraulic Research may be used.

5.02 Water Service Abandonment Procedure

- A. Excavate the existing water service at the main.

- B. Service with a corporation stop and service saddle: turn off corporation stop and check for leaks. Cut the copper or HDPE tubing with a tubing cutter and bend both cut ends over approximately 1" from cut end (copper service) or electrofuse HDPE electro fusion end cap (HDPE service).
- C. Service with a corporation stop with no service saddle: notify and coordinate with all affected Customers, along with City Utility Operations staff, of the pending service interruption. Remove corporation stop and install a Mueller or Ford repair clamp. Any leaks, failures, or defective repairs shall be promptly repaired by the contractor.
- D. Remove water meter and salvage to the City of Palo Alto corporation yard water meter repair shop.
- E. Remove abandoned water meter vault. Backfill and compact hole to City standards with top soil or clay dirt.
- F. Backfill, compact and pave hole at the main per WGW Utility Standard Detail WGW-02.
- G. Abandonment of all existing water services shall be witnessed by the City's Utilities Inspector. Schedule WGW utilities inspections at 650/566-4504 five working days before start of abandonment.

5.03 ACP Pipe and Hazardous Material Disposal

Asbestos containing pipe must be properly disposed of per State and Federal regulations. Contractor and subcontractors, if any, shall be in full compliance with any and all laws, orders, citations, rules, regulations, standings and statutes in effect with respect to handling, storage and removal of Hazardous Material. Contractor accepts sole responsibility for insuring the adequacy of any required use of all safety practices, procedures and equipment.

END OF SECTION

**SECTION 2685
NATURAL GAS DISTRIBUTION SYSTEM**

PART 1 - GENERAL**1.01 DESCRIPTION**

Work includes installation of natural gas mains, natural gas services, tracer wire, polyethylene valves and boxes, polyethylene fittings, excess flow valves, anode boxes, modification of existing natural gas house plumbing to accommodate relocation of gas meters, and all related equipment and fittings in accordance with the requirements of the Contract Documents.

1.02 RELATED WORK

- A. Section 2200: Excavation, Backfill and Restoration
- B. Section 2300: Polyethylene Pipe Installation for Water, Gas and Wastewater

1.03 QUALIFICATION OF NATURAL GAS DISTRIBUTION SYSTEM CONTRACTOR

The Contractor performing work on the City of Palo Alto natural gas distribution system shall have and must submit for approval by the City of Palo Alto a drug testing program in place per **Pipeline Safety Regulations Part 199 "Drug Testing Pipeline Safety" and Part 40 "Procedures for Transporting Workplace Drug and Alcohol Testing Programs."**

PART 2 - MATERIALS**2.01 NATURAL GAS DISTRIBUTION SYSTEM MATERIALS**

- A. POLYETHYLENE PIPE:** Polyethylene pipe supplied under this section shall be in compliance with ASTM D2513-09a "Standard Specification for Polyethylene (PE) Gas Pressure Pipe, Tubing and Fittings", incorporated by reference into Code of Federal Regulations (CFR) Title 49, Part 192.7 and specifications stated herein:
 - 1. All pipe shall be Medium Density Polyethylene (MDPE) 2708, uniformly yellow in color, conforming to the latest edition of ASTM D3350 "Standard Specification for Polyethylene Plastics Pipe and Fittings Materials", cell classification 234373E extruded from one of the following: Performance Pipe Company Marlex HHM TR-418Q Resin or Ineos Fortiflex® K38-20-160 Resin.
 - 2. **Pipe dimensions and tolerances:** The outside diameter and wall thickness shall be within the limits specified in Table 1.
 - 3. **Markings:** Pipe markings for gas pipe shall be in compliance with the latest edition of ASTM F2897 "Standard Specification for Tracking and Traceability Encoding System of Natural Gas Distribution Components (Pipe, Tubing, Fittings, Valves, and Appurtenances)" and consist of a 16-digit alpha-numeric code and scannable code-128 barcode, or QR code, with standardized encoding of pipe specifications as described in the referenced Standard. In addition, gas pipe markings shall also comply with the marking requirements for all polyethylene pipe specified in Section 2300 of these Specifications.

4. **Approved Manufacturers:** The City of Palo Alto approved PE pipe manufacturer is Chevron Phillips Chemical Company (CP CHEM) Performance Pipe. Any other pipe manufacturer such as JM Eagle or equal must receive prior approval.

Table 1: Dimensional Standards for Polyethylene Pipe and Tubing (Per ASTM D2513)

Nominal Pipe/ Tubing Size	Average Outside Diameter (inches)	Outside Diameter Tolerance (inches)	Minimum Wall Thickness (inches)	Wall Thickness Tolerance (inches)	Out of Roundness Tolerance (inches)	Standard Dimension Ratio (unitless)
1" CTS	1.125	± 0.005	0.099	+ 0.012 - 0.000	-	-
2" IPS	2.375	± 0.006	0.216	+ 0.026 - 0.000	± 0.024	11.0
3" IPS	3.500	± 0.008	0.304	+ 0.036 - 0.000	± 0.030	11.5
4" IPS	4.500	± 0.009	0.391	+ 0.047 - 0.000	± 0.030	11.5
6" IPS	6.625	± 0.011	0.576	+ 0.069 - 0.000	± 0.070	11.5
8" IPS	8.625	± 0.013	0.750	+ 0.090 - 0.000	± 0.080	11.5

Note: 3" IPS PE pipe shall only be used for the repair of existing 3" PE pipe only.

- B. PE Fittings:** All molded polyethylene fittings supplied under this section shall be in compliance with ASTM D2513-09a "Standard Specification for Polyethylene (PE) Gas Pressure Pipe, Tubing and Fittings", incorporated by reference into CFR Title 49, Part 192.7 and ASTM D3261 "Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing", and specifications stated herein:

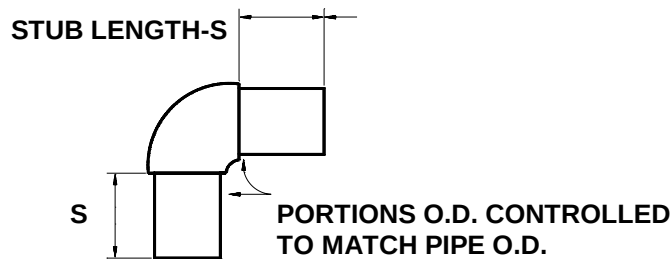
1. All fittings shall be Medium Density Polyethylene (MDPE) 2708, uniformly yellow in color, conforming to the latest edition of ASTM D3350 "Standard Specification for Polyethylene Plastics Pipe and Fittings Materials", cell classification 234373E molded from one of the following: Performance Pipe Company Marlex HHM TR-418Q Resin; or Ineos Fortiflex® K38-20-160 Resin.
2. Dimensions and tolerances: Butt Fusion Fittings shall conform to the dimensions given in Table 2.
3. **Approved Manufacturers:** The City of Palo Alto approved PE fitting manufacturer is Chevron Phillips Chemical Company (CP CHEM) Performance Pipe. Any other pipe manufacturer such as CSR Poly Pipe Industries or equal must receive prior approval.

Table 2: Dimensional Standards for Polyethylene Butt Fusion Fittings

Nominal Fitting Size	Ave Outside Dia at Point of Fusion (inches)	Outside Diameter Tolerance (inches)	Minimum Wall Thickness (inches)	SDR (unitless)	Minimum Stub Length* (inches)
2" IPS	2.375	± 0.006	0.216	11.0	2.0
4" IPS	4.500	± 0.009	0.391	11.5	3.0
6" IPS	6.625	± 0.011	0.576	11.5	3.5
8" IPS	8.625	± 0.025	0.750	11.5	3.5

* As defined in Figure 1 (only applicable to tees, 45° and 90° ells).

Figure 1: Definition of Stub Length for Butt Fusion Fittings



C. Polyethylene Gas Valves: All polyethylene gas valves supplied under this section shall be in compliance with ASTM D2513 "Standard Specification for Polyethylene (PE) Gas Pressure Pipe, Tubing and Fittings", CFR Title 49, Part 192.145 "Valves" and the latest editions of ANSI/ASME B16.40 "Manually Operated Thermoplastic Gas Shutoffs and Valves in Gas Distribution Systems", and specifications stated herein:

1. The polyethylene portion of the gas valve shall be one piece molded medium density PE 2708 polyethylene conforming to the latest edition of ASTM D3350 "Standard Specification for Polyethylene Plastics Pipe and Fittings Materials", cell classification 234373E manufactured from Performance Pipe Company Marlex HHM TR-418Q Resin, Rigidex PC 2040Y, or FINATHENE 3802Y.
2. All polyethylene gas valves shall be manufactured within 6 months from the date of sale to the City.
3. All polyethylene gas valves shall be full port, assembled to operate smoothly and provide a gas tight seal(s). Polyethylene gas valves shall utilize a 2" square operating nut with positive position indication and over-torque protection actuator. Each valve's stem shall be equipped with weather seal(s) protecting inner parts from ground water and foreign debris intrusion. All polyethylene valves shall be supplied with the butt end outlets.
4. For purging at designated locations, Flowserve Corp. (Nordstrom Valves) with integral polyethylene purge connections shall be used. These valves shall comply with all specifications for polyethylene gas valves of this section.
5. **Markings:** Polyethylene gas valve markings shall be in compliance with the latest edition of ASTM F2897 "Standard Specification for Tracking and Traceability Encoding System

of Natural Gas Distribution Components (Pipe, Tubing, Fittings, Valves, and Appurtenances)" and consist of a 16-digit alpha-numeric code and scannable code-128 barcode, or QR code, with standardized encoding of pipe specifications as described in the referenced Standard.

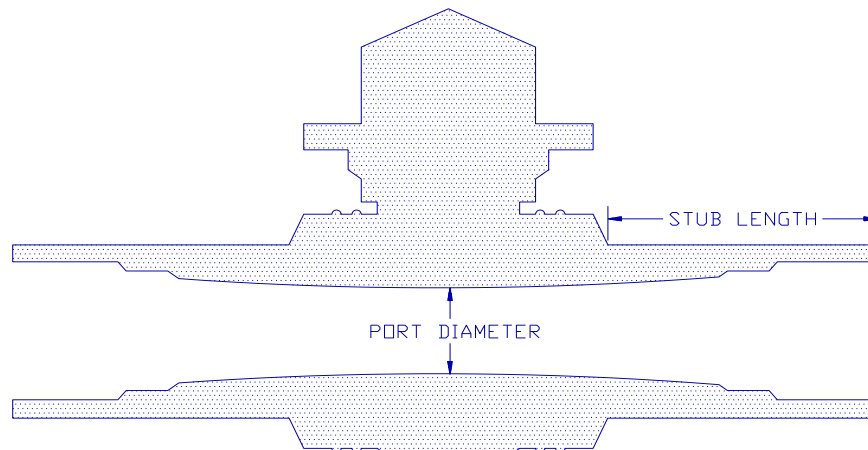
6. **Approved Manufacturers:** The City of Palo Alto approved PE gas valve manufacturer is Flowserve Corp. Polyvalve Poly-Gas (Formally Nordstrom Valves). Any other pipe manufacturer such as Kerotest Manufacturing Corp (PolyBall), or Broen, Inc. (Ballomax) CSR Poly Pipe Industries or equal must receive prior approval.

Table 3: Dimensional Standards for Full Port Polyethylene Valves

VALVE SIZE	SDR	MIN. PORT DIA.*	MIN. STUB LENGTH*
2"	11	1.82"	6.375"
4"	11.5	3.62"	7.50"
6"	11.5	5.20"	7.00"
8"	11.5	6.60"	5.250"

*as defined in Figure 2

Figure 2: Definition of Dimensions for Polyethylene Valves



- D. Gas Service Riser (Anodeless):** Risers must meet or exceed the latest editions of the following standards or requirements:

- Department of Transportation (DOT) Code of Federal Regulations, Title 49, Part 192.
- ASTM D2513 "Standard Specification for Tracking and Traceability Encoding System of Natural Gas Distribution Components (Pipe, Tubing, Fittings, Valves, and Appurtenances)"
- ANSI B1.20.1 "Pipe Threads, General Purpose, Inch", latest edition
- ASTM G8 "Standard Test Methods for Cathodic Disbonding of Pipeline Coatings", latest edition

- 100% factory leak tested
- Polyethylene pigtail markings shall be in compliance with the latest edition of ASTM F2897 "Standard Specification for Tracking and Traceability Encoding System of Natural Gas Distribution Components (Pipe, Tubing, Fittings, Valves, and Appurtenances)" and consist of a 16-digit alpha-numeric code and scannable code-128 barcode, or QR code, with standardized encoding of pipe specifications as described in the referenced Standard.

1. Prebent Risers:

- a. **Anodeless 1"PE CTS X ¾" MPT PREBENT:** The 1" casing pipe shall be fabricated from ASTM A53 schedule 40, Grade A steel pipe. The casing shall also conform to the following requirements: gray fusion bonded epoxy coated (8 mil minimum thickness); 46 inches long, 1.500" OD x 0.075" wall thickness; ASTM A513 mechanical tubing with ¾" MPT nipple outlet and neoprene bushing, crimped in place, moisture seal. Additionally, the casing pipe shall be bent to a 12-inch minimum radius resulting in a min. 16" horizontal by 30" vertical configuration.

A minimum 10-inch-long, 1" CTS (0.099 wall thickness) PE pigtail shall extend from the steel pipe casing. The 1" CTS carrier pipe shall be medium density PE 2708 polyethylene, uniformly yellow in color, conforming to the latest edition of ASTM D3350 "Standard Specification for Polyethylene Plastics Pipe and Fittings Materials", cell classification 234373E extruded from one of the following Performance Pipe Company Marlex HHM TR-418Q Resin or Ineos Fortiflex® K38-20-160 Resin.

The transition from steel to PE shall occur within 6 inches of the threaded end. Risers shall include insulation between the steel casing and the PE carrier pipe by means of an o-ring/air space configuration or using a sleeve made of non-heat conducting materials. All exposed threads and openings shall be covered with protective caps. The riser label shall include manufacturers name, part number, lot number and casing pipe shall have indication of ground level.

Anodeless risers must have approved meter valves included.

- b. **Anodeless 1"PE CTS X 1-1/4" MPT PREBENT:** The 1-1/4" casing pipe shall be fabricated from ASTM A53 Schedule 40, Grade A steel pipe. The casing shall also conform to the following requirements: gray fusion bonded epoxy coated (8 mils minimum thickness); 60 inches long, 1.625" O.D. x 0.072 wall thickness; ASTM A513 mechanical tubing with 1-1/4" MPT nipple outlet and neoprene bushing, crimped in place, moisture seal. Additionally, the casing pipe shall be bent to a 12-inch minimum radius resulting in a 30" horizontal by 30" vertical configuration.

A minimum 10-inch long, 1" CTS (0.099 wall thickness) PE pigtail shall extend from the steel pipe casing. The 1" CTS carrier pipe shall be medium density PE 2708 polyethylene, uniformly yellow in color, conforming to the latest edition of ASTM D3350 "Standard Specification for Polyethylene Plastics Pipe and Fittings Materials", cell classification 234373E extruded from one of the following: Performance Pipe Company Marlex HHM TR-418Q Resin or Ineos Fortiflex® K38-20-160 Resin.

The transition from steel to PE shall occur within 6 inches of the threaded end. Risers shall include insulation between the steel casing and the PE carrier pipe by means of an o-ring/air space configuration or using a sleeve made of non-heat conducting materials. All exposed threads and openings shall be covered with protective caps. The riser label

shall include manufacturers name, part number, lot number and casing pipe shall have indication of ground level.

Anodeless risers must have approved meter valves included.

- c. **Anodeless 2"PE IPS X 2" MPT PREBENT:** The 2" casing pipe shall be fabricated from ASTM A53 Schedule 40, Grade A steel pipe. The casing shall also conform to the following requirements: gray fusion bonded epoxy coated (8 mil minimum thickness); 72 inches long, 2" MPT nipple outlet and neoprene bushing, crimped in place, moisture seal. Additionally, the casing pipe shall be bent to a 24-inch minimum radius resulting in a 36" horizontal by 36" vertical configuration.

A minimum 10-inch long, 2" IPS (0.216 wall thickness) PE pigtail shall extend from the steel pipe casing. The 2" IPS carrier pipe shall be medium density PE 2708 polyethylene, uniformly yellow in color, conforming to the latest edition of ASTM D3350 "Standard Specification for Polyethylene Plastics Pipe and Fittings Materials", cell classification 234373E extruded from one of the following: Performance Pipe Company Marlex HHM TR-418Q Resin or Ineos Fortiflex® K38-20-160 Resin; SDR 11.0.

The transition from steel to PE shall occur within 6.5 inches of the threaded end. Risers shall include insulation between the steel casing and the PE carrier pipe by means of an o-ring/air space configuration or using a sleeve made of non-heat conducting materials. All exposed threads and openings shall be covered with protective caps. The riser label shall include manufacturers name, part number, lot number and casing pipe shall have indication of ground level.

Anodeless risers must have approved meter valves included.

2. Straight Risers:

- a. **Anodeless 1"PE CTS X ¾" MPT STRAIGHT** - The ¾" casing pipe shall be fabricated from ASTM A53 Schedule 40, Grade A steel pipe. The casing shall also conform to the following requirements: gray fusion bonded epoxy coated (8 mils minimum thickness); 60 inches long, 1.500" OD x 0.072" wall thickness; ASTM A513 mechanical tubing with ¾" MPT nipple outlet and neoprene bushing, crimped in place, moisture seal.

A minimum 10-inch-long, 1" CTS (0.099 wall thickness) PE pigtail shall extend from the steel pipe casing. The 1" CTS carrier pipe shall be medium density PE 2708 polyethylene, uniformly yellow in color, conforming to the latest edition of ASTM D3350 "Standard Specification for Polyethylene Plastics Pipe and Fittings Materials", cell classification 234373E extruded from one of the following Performance Pipe Company Marlex HHM TR-418Q Resin or Ineos Fortiflex® K38-20-160 Resin.

The transition from steel to PE shall occur within 6.5 inches of the threaded end. Risers shall include insulation between the steel casing and the PE carrier pipe by means of an o-ring/air space configuration or using a sleeve made of non-heat conducting materials. All exposed threads and openings shall be covered with protective caps. The riser label shall include manufacturers name, part number, lot number and casing pipe shall have indication of ground level.

Anodeless risers must have approved meter valves included.

- b. **Anodeless 2" PE IPS X 2" MPT STRAIGHT** - The 2" casing pipe shall be fabricated from ASTM A53 Schedule 40, Grade A steel pipe. The casing shall also conform to the following requirements: gray fusion bonded epoxy coated (8 mil minimum thickness); 72 inches long, 2" MPT nipple outlet and neoprene bushing, crimped in place, moisture seal.

A minimum 10-inch long, 2" IPS (0.216 wall thickness) PE pigtail shall extend from the steel pipe casing. The 2" IPS carrier pipe shall be medium density PE 2708 polyethylene, uniformly yellow in color, conforming to the latest edition of ASTM D3350 "Standard Specification for Polyethylene Plastics Pipe and Fittings Materials", cell classification 234373E extruded from one of the following: Performance Pipe Company Marlex HHM TR-418Q Resin or Ineos Fortiflex® K38-20-160 Resin; SDR 11.0.

The transition from steel to PE shall occur within 6.5 inches of the threaded end. Risers shall include insulation between the steel casing and the PE carrier pipe by means of an o-ring/air space configuration or using a sleeve made of non-heat conducting materials. All exposed threads and openings shall be covered with protective caps. The riser label shall include manufacturers name, part number, lot number and casing pipe shall have indication of ground level.

Anodeless risers must have approved meter valves included.

3. **Approved Manufacturers:** The City of Palo Alto approved anodeless gas riser manufacturer is RW Lyall & Company, Inc. Any other anodeless gas riser manufacturer such as Elster Perfection, Continental Industries, George Fischer Central Plastics Company, or equal must receive prior approval.

- E. **Electrofusion Tapping Tees and Couplings:** All electrofusion tapping tees and couplings supplied under this section shall be in compliance with ASTM F1055-1998 "Standard Specification for Electrofusion Type Polyethylene Fittings for Outside Diameter Controlled Polyethylene Pipe and Tubing", and be manufactured in accordance with ASTM D2513-09a "Standard Specification for Polyethylene (PE) Gas Pressure Pipe, Tubing and Fittings".

1. All electrofusion tapping tees shall be DAA designated: 1-1/4" x 1", 2" x 1", 4" x 1", 6" x 1", and 8" x 1" (IPS x CTS) and, 4" x 2", 6" x 2", and 8" x 2" (IPS x IPS) - main size x outlet size.
2. All electrofusion couplings 1-1/4" and larger (including coupling reducer 2" x 1-1/4") shall be IPS, 4710 HDPE; SDR 11 (2" x 1-1/4" and 2") and SDR 11.5 (4" through 8") ANSI/NSF 61 listed; 1" coupling shall be CTS, 4710 HDPE.
3. **Markings:** Electrofusion tapping tee and coupling markings shall be in compliance with the latest edition of ASTM F2897 "Standard Specification for Tracking and Traceability Encoding System of Natural Gas Distribution Components (Pipe, Tubing, Fittings, Valves, and Appurtenances)" and consist of a 16-digit alpha-numeric code and scannable code-128 barcode, or QR code, with standardized encoding of pipe specifications as described in the referenced Standard.
4. **Approved Manufacturers:** The City of Palo Alto approved electrofusion gas tapping tee and coupling manufacturer is Friatec (Frialen Safety Fittings). Any other electrofusion gas tapping tee and coupling manufacturer such as Kerotest (Innogaz Electrofusion Products) or equal must receive prior approval.

- F. Valve Boxes:** Valve boxes for 2" through 8" valves shall be Oldcastle Precast/Christy G05TBox Traffic Valve Box with G05CT non-locking type metal traffic type lid marked "GAS". Corrugated 8" HDPE pipe shall be used as valve box extension for gas valve sizes 2" through 8" diameter. Valve supports shall be supplied for 2" valve sizes only and be manufactured by C. P. Test Services Inc., model FPKPV2.3, or approved equal.
- G. Tracer Wire:** Tracer wire shall be 10 AWG solid copper wire coated with 45 mils Type HMW - PE insulated conductor, yellow in color. The wire shall meet all requirements of the latest editions of ASTM D1351 and ASTM B8 and shall be UL listed as direct burial wire for temperatures between -20° C and 80° C for circuits not exceeding 600 volts. The surface of the insulation shall be durably marked, at intervals not exceeding 24 inches, with only the following information: maximum working voltage "**600 VOLTS**", wire type, manufacturer's name or trademark, AWG size, and UL required markings. Tracer wire shall be installed on all polyethylene mains and services.
- H. Meter Valve:** Meter valves shall meet all applicable parts of CFR Title 49, Part 192 and ASME/ANSI B16.33, and shall be insulated Mueller H-11179 (3/4", 1-1/4", or 2"), with a 3/4", 1-1/4", or 2" steel plug. Any other meter valve manufacturer must receive prior approval.
- I. Anode Boxes:** Anode box shall be Oldcastle Precast/Christy G05TBox Traffic Box with G05CT non-locking type metal traffic lid marked "ANODE".
- J. Warning Tape:** Warning tape must be non-metallic, a minimum of 6" wide, "yellow" in color and have the following print line "CAUTION: GAS LINE BURIED BELOW". Warning tape must be installed in all open excavations at 12" above the natural gas pipeline.
- K. Excess Flow Valves (EFV):** All EFVs supplied under this section shall be in compliance with the requirements of CFR Title 49, Part 192.381 "Service lines: Excess Flow Valve Performance Standards" and, where applicable, MSS SP-115 "Excess Flow Valves, NPS 1-1/4" and Smaller, for Fuel Gas Service". All EFVs shall be tested in accordance with the latest edition of ASTM F1802 "Standard Test Method for Performance Testing of Excess Flow Valves".
1. All EFVs must be manufactured within 6 months of the date of sale to the City.
 2. The design of excess flow valves shall incorporate a bypass to allow the valve to automatically reset and resume normal operation after repairs are made to the severed gas line. Each valve shall be fixed or anchored to the interior of the fitting to preclude movement of the valve.
 3. The polyethylene portion of EFV shall be one piece molded medium density PE 2708 polyethylene conforming to the latest edition of ASTM D3350 "Standard Specification for Polyethylene Plastics Pipe and Fittings Materials", cell classification 234373E extruded from one of the following: Performance Pipe Company Marlex HHM TR-418Q Resin or Ineos Fortiflex® K38-20-160 Resin.
 4. Each valve also shall have an affixed tag, identifying the EFV's capacity range and flow direction, and be individually packaged and supplied with the operating instructions. An additional stainless-steel tag or washer shall be included in the package indicating the size and flow capacity of the valve, which will be attached to the gas riser.
 5. **Markings:** EFV markings shall be in compliance with the latest edition of ASTM F2897

"Standard Specification for Tracking and Traceability Encoding System of Natural Gas Distribution Components (Pipe, Tubing, Fittings, Valves, and Appurtenances)" and consist of a 16-digit alpha-numeric code and scannable code-128 barcode, or QR code, with standardized encoding of pipe specifications as described in the referenced Standard.

6. **Approved Manufacturers:** The City of Palo Alto approved EFV manufacturer is UMAC. Any other EFV manufacturer such as Elster Perfection or equal must receive prior approval.

1. APPROVED MODELS (shall be designed for electrofusion applications):

• **UMAC**

Model 41, 1" CTS Series 1800
 Model 41, 1" CTS Series 2600
 Model 41, 1-1/4" IPS Series 5500
 Model 41, 2" IPS Series 5500
 Model 41, 2" IPS Series 10000

Table 4: EFV Trip and Load Information

EFV Models	Inlet Pressure (PSIG)	Pressure Drop at Typical Load (PSIG)	Minimum Trip Point (SCFH)	Service Length Protected (FT)
Model 41, 1" CTS, Series 1800	10	0.44	1800	213
Model 41, 1" CTS, Series 2600	10	0.9	2600	205
Model 41, 1-1/4" IPS, Series 5500	10	1.3	5500	23
Model 41, 2" IPS, Series 5500	10	1.3	5500	1899
Model 41, 2" IPS, Series 10,000	10	0.51	10,000	667

2. DESIGNATION:

a. 1" Service (CTS):

Medium Capacity: Model 41, 1" CTS, Series 1800 – typical customer load between 250 SCFH and 1,600 SCFH.

High Capacity (I): Model 41, 1" CTS, Series 2600 – typical customer load between 1,400 SCFH and 2,200 SCFH.

High Capacity (II): Model 41, 1-1/4" IPS, Series 5500 – typical customer load between 2,000 SCFH and 4,800 SCFH. **This EFV requires transition from 1-1/4" IPS to 1" CTS**, as 1" CTS for this size is not available.

b. 2" Service (IPS):

Medium Capacity: Model 41, 2" IPS, Series 5500 – typical customer load 4,800 SCFH or less

High Capacity: Model 41, 2" IPS, Series 10,000 - typical customer load between 4,400 SCFH and 8,800 SCFH

Pressure Drop: An average pressure drop across EFV at an inlet pressure of 10 psig shall not exceed: for 1" CTS - 0.6 psig @ 700 scfh, 1.1 psig @ 1800 scfh, 1.1 psig @ 2600 scfh, and 1.3 psig @ 5500 scfh.

Dimensions: 1" EFV shall be 1" CTS SDR 11.5 with 0.099" min. wall thickness with a minimum length of 10". 2" EFV shall be 2" IPS SDR 11 with 0.216" min. wall and a minimum length of 10". Valves shall be supplied with plain pipe ends.

- c. Installation:** EVFs shall be installed in compliance with CFR Title 49, Part 192.383 "Excess Flow Valve Installation". If EFV on a service line is not feasible due to customer application (can interfere with normal operation) or is not commercially available, in compliance with CFR Title 49, Part 192.385 "Manual Service Line Shut-Off Valve Installation", a manual service line shut-off valve near the source of gas must be installed.

- L. Meter Boxes:** Curb meter installation in sidewalk or planting strip will be allowed only when there is no above ground location on the property (the building occupies the entire property or underground parking garage prohibits above ground installation). All meter boxes shall be supplied and installed by the Contractor when box replacement is required, or a new service is installed. Boxes shall be supplied with self-closing meter reading lids. Box and lid shall have a minimum Tier 5 rating (per ANSI/STCE 77 2010) for sidewalk and planting strip applications. Meter boxes shall not be installed in driving lanes of public or private streets. Lids shall have "GAS" marked on them. For installation in areas subject to vehicular traffic, meter box and lid shall have H-20 load rating.

- M. Valve Extensions for Polyethylene Gas Ball Valves:** Valve extensions shall be installed when the valve's actuator is 4' or more below the finished grade. The extension shall be a telescopic spindle designed to operate polyethylene gas ball valves (with 2" operating square actuator) specified in Section 2.01 of this Specification. The extension design shall incorporate the following features:

- The conical key adaptor that fits most standard T-keys.
- Lock spring preventing the telescopic part from collapsing during installation.
- Protection against penetration of impurities under key adaptor.
- Yellow indication plate with the inscription "1/4" turn, "Ball valve" and indication of "Open-Close" positions.
- Key adaptor – cast stainless steel.
- Inner tube – galvanized steel.
- Outer tube – polyethylene.
- Actuator adaptor – stainless steel designed to operate 2" operating square actuator.

Approved Manufacturers: The City of Palo Alto approved valve extension manufacturer is

American AVK Co. Any other valve extension manufacturer must receive prior approval.

2.02 STEEL GAS MATERIAL

- A. Steel Pipe - Gas Carrier:** All steel pipe supplied under this Section shall conform to the requirements stated in CFR Title 49, Part 192.55 "Steel Pipe" and shall conform to the latest edition of ASTM A106/A53, Type E (Electric-resistance-welded) or S (seamless), Schedule 40, Grade B steel pipe. The pipe shall contain markings in accordance with requirements of CFR Title 49, Part 192.63 "Marking of Materials", including pipe manufacturer's name, material, size, type, grade, pressure ratings, and date of pipe manufacture.

Markings: Pipe marking shall be in compliance with the latest edition of ASTM F2897 "Standard Specification for Tracking and Traceability Encoding System of Natural Gas Distribution Components (Pipe, Tubing, Fittings, Valves, and Appurtenances)" and consist of a 16-digit alphanumeric code and scannable code-128 barcode, or QR code, with standardized encoding of pipe specifications as described in the referenced Standard.

- B. Steel Pipe – Gas Carrier Coating:** The external protective coating shall be in compliance with CFR Title 49, Part 192.461 "External Corrosion Control: Protective Coating", and NACE. The pipe shall be coated by application of Fusion Bonded Epoxy (FBE). The coating resin shall be virgin, high density polyethylene 30 mil extruded coatwrap. The resin color shall be yellow. The coating shall contain markings including pipe manufacturer's name, material, size, type, grade, pressure rating, coating manufacturer's name, date of pipe manufacture and date of coating.

Steel Pipe – Gas Carrier Rehabilitation Coating System minimum requirements:

- Must meet all applicable NACE standards.
- Must comply with requirements of CFR Title 49, Part 192.461 "External Corrosion Control: Protective Coating".
- Must not interfere with Cathodic Protection and prevent cathodic disbondment.
- Shall be designed by manufacturer for application directly on and being compatible with the existing coating.
- Require minimal surface preparation.
- Shall be multilayer system including at min. primer, coating (wrap – wax tape), and, if necessary, in the opinion of Cathodic Technician, outerwrap for above or below ground application.
- Shall be able to conform to irregular shapes including pipe supports and fasteners (above ground application attached to the bridges).
- Must resist weathering and UV (above ground application).
- Nontoxic, noncarcinogenic, minimum VOCs.
- Provide great adhesion and cohesive and tensile strength.
- Be able to withstand deformation of the substrate.
- Impact resistance per the latest edition of ASTM G14 "Standard Test Method for Impact Resistance of Pipeline Coatings (Falling Weight Test).
- Dielectric strength per the latest edition of ASTM D149 "Standard Test Method for Dielectric Breakdown Voltage and Dielectric Strength of Solid Electrical Insulating Materials at Commercial Power Frequencies".
- Puncture resistant.
- Fast drying/curing compounds.
- Must comply with all applicable Environmental Regulations.
- Must be installed in accordance with the system manufacturer's recommendations.

Approved Coating System(s):

- Primer- Trenton Temcoat 3000, or approved equal.
- Coating – Trenton #1 Wax-Tape (below ground application) or approved equal. If in the opinion of Cathodic Technician additional mechanical protection is required and depending on the soil/backfill conditions apply either Poly-Ply, Guard-Wrap, Glas-Wrap, or MC Outerwrap. No drying or curing time is required and after application the pipe can be immediately backfilled.
- Coating – Trenton #2 Wax-Tape (above ground application) or approved equal. If in the opinion of Cathodic Technician additional mechanical protection is required apply Trenton MC Outerwrap. Trenton #2 Wax-Tape can be painted using an acrylic latex paint. Depending on atmospheric conditions shall be allowed 2-14 days before paint application.

C. Steel Valves: All steel valves supplied under this Section shall conform to CFR Title 49, Part 192.145 “Valves”, and meet the minimum requirements of the latest edition API 6D “Specifications for Pipeline Valves”. The valve shall be ANSI class 150 (unless specified higher during specific order), ball valve with weld ends full port only for 2”, 4”, 6”, 8”, 10” sizes; reduced port for 12” size is allowed unless full port is available. Each valve shall be manufacture air tested to ensure integrity and leak tightness. The valves shall be shipped with 2” operating squares (2” and 4”) and gear operator (6” through 12”) with cast steel ultra-stop, unless specified otherwise during the order. The valve shall have markings stating at minimum manufacturer, size, pressure rating/class, and date of manufacture. The minimum end-to-end length for weld end valves shall be as follows:

- 2” – 11.81” (full port)
- 4” – 12.80” (full port)
- 6” – 15.35” (full port)
- 8” - 20.47” (full port)
- 10” – 25.00” (full port)
- 12” – 25.00” (reduced port)

Markings: Gas Valve marking shall be in compliance with the latest edition of ASTM F2897 “Standard Specification for Tracking and Traceability Encoding System of Natural Gas Distribution Components (Pipe, Tubing, Fittings, Valves, and Appurtenances)” and consist of a 16-digit alpha-numeric code and scannable code-128 barcode, or QR code, with standardized encoding of pipe specifications as described in the referenced Standard.

Approved Manufacturer: The City of Palo Alto approved steel valve manufacturer is Kerotest Weldball. Any other steel valve manufacturer such as Ballomax by Broen, Inc. or equal must receive prior approval.

D. Flanges: Each flange or flange accessory shall conform to CFR Title 49, Part 192.147 “Flanges and Flange Accessories”, and must meet the minimum requirements of ASME/ANSI B16.5-03 “Pipe Flanges and Flanged Fittings” and MSS SP-44-10 “Steel Pipe Flanges”. Flange shall be ANSI class 150, pressure rating 285 PSIG, unless specified otherwise. Material shall be carbon steel and shall conform to the requirements of the latest edition of ASTM A105 “Standard Specification for Carbon Steel Forgings for Piping Applications”.

Markings: Flange marking shall be in compliance with the latest edition of ASTM F2897 “Standard Specification for Tracking and Traceability Encoding System of Natural Gas Distribution Components (Pipe, Tubing, Fittings, Valves, and Appurtenances)” and consist of a

16-digit alpha-numeric code and scannable code-128 barcode, or QR code, with standardized encoding of pipe specifications as described in the referenced Standard.

- E. Non-Pressure Control Fittings:** Fittings shall conform to CFR Title 49, Part 192.149 “Standard Fittings”. All welded fittings shall be schedule 40 and shall comply with the latest editions of ASTM A234 “Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service” (materials) and ASME B16.9 “Standards for Pipes and Fittings” (dimensions). All threaded fittings shall be malleable iron, IPT, finish black (BLK), conforming to the latest editions of ASTM A197 “Standard Specification for Cupola Malleable Iron” (materials) and ASME B16.3 “Malleable Iron Threaded Fittings” (dimensions).

Markings: Fitting markings shall be in compliance with the latest edition of ASTM F2897 “Standard Specification for Tracking and Traceability Encoding System of Natural Gas Distribution Components (Pipe, Tubing, Fittings, Valves, and Appurtenances)” and consist of a 16-digit alpha-numeric code and scannable code-128 barcode, or QR code, with standardized encoding of pipe specifications as described in the referenced Standard.

- F. Pressure Control Fittings:** Fittings top and bottom halves shall be forged steel and be in compliance with the latest edition of ASTM A105 “Standard Specification for Carbon Steel Forgings for Piping Applications”. All fittings shall have a class 150 flange and meet requirements of ANSI B16.5 “Flanges and Bolt Dimensions Class 150 to 2500” and have a maximum working pressure of 275psig.

Line Stopper Fittings “Low Pressure” (H-17190):

- i. For steel pipelines 2” to 4” in diameter, low pressure stopper fittings (half pressure control fittings), weld type, may be used to stop the flow of gas.

Line Stopper Fittings “Full Encirclement”:

- i. For steel pipelines 2” to 12” in diameter, full encirclement pressure control fittings may be used to stop the flow of gas. Line stopper, Bottom-out, or Side-out fittings may be used for pipeline connections to control flow.

- 2” (H-17155, H-17160)
- 2-1/2” (H-17155, H-17160)
- 3” to 12” (H-17255, H-17355, H-17360)

Markings: Gas line stopper fittings shall be in compliance with the latest edition of ASTM F2897 “Standard Specification for Tracking and Traceability Encoding System of Natural Gas Distribution Components (Pipe, Tubing, Fittings, Valves, and Appurtenances)” and consist of a 16-digit alpha-numeric code and scannable code-128 barcode, or QR code, with standardized encoding of pipe specifications as described in the referenced Standard.

Approved Manufacturer: The City of Palo Alto approved steel line stopper fitting manufacturer is Mueller Co. – Gas Division. Any other steel line stopper fitting manufacturer must receive prior approval.

- G. Drilling Nipples (Sav-a-Valve – H-17490):** Fitting shall be forged steel and be in compliance with the latest edition of ASTM A105 “Standard Specification for Carbon Steel Forgings for Piping Applications” and have a maximum working pressure of 250psig.

Markings: Drilling nipples shall be in compliance with the latest edition of ASTM F2897 “Standard Specification for Tracking and Traceability Encoding System of Natural Gas Distribution

Components (Pipe, Tubing, Fittings, Valves, and Appurtenances)” and consist of a 16-digit alpha-numeric code and scannable code-128 barcode, or QR code, with standardized encoding of pipe specifications as described in the referenced Standard.

Approved Manufacturer: The City of Palo Alto approved steel line stopper fitting manufacturer is Mueller Co. – Gas Division. Any other steel line stopper fitting manufacturer must receive prior approval.

- H. **Casing:** Casings shall be steel pipe, Schedule 40, Grade A106. Polyethylene casings shall be high density HDPE 4710 polyethylene pipe (DR 11) with cell classification of 345464C, D or E per ASTM D3350 “Standard Specification for Polyethylene Plastics Pipe and Fittings Materials”.
- I. **Vent Pipe:** Vent pipes for steel casings shall be 2-inch in diameter, Schedule 40, Grade A106 and shall terminate in a protected location, above ground, with back-to-back 90-degree elbows to avoid water intrusion. Vent pipes for polyethylene casings shall be 2” in diameter, high density HDPE 4710 polyethylene pipe (DR 11) with cell classification of 345464C, D or E per ASTM D3350 “Standard Specification for Polyethylene Plastics Pipe and Fittings Materials” and shall transition to steel schedule 40 pipe and terminate in a protected location above ground with back-to-back 90-degree elbows to avoid water intrusion.
- J. **Casing Insulators:** Commercially available casing insulators with a minimum of 4 plastic runners, each runner a minimum of 1/4” high, shall be installed at 5 feet maximum intervals on the steel gas main prior to insertion. Insulators shall be sized to center the gas main in the casing.
- K. **Cable Protectors:** When inserting the pipe into the casing, the Contractor shall use a suitable cable protector on the casing end to protect the pipe and pipe coating from damage. Cable protectors shall be left in place after pipe insertion is completed.
- L. **Casing End Seals:** End seals shall be Link Seal™, or approved equal, capable of forming a watertight seal at the ends of the casing. Seamless or wrap around end seals may be used in addition to Link Seal™ to perform a watertight seal between the casing and carrier pipe. Seamless and wrap around end seals shall be made of synthetic rubber and secured with stainless steel banding clamps.

2.03 PVC PIPE AND TUBING

This specification covers PVC pipe, tubing, and fitting for use **only** to maintain or repair existing PVC gas piping. All PVC pipe, tubing, and fitting used under these specifications shall be in accordance with the latest edition of ASTM F2817 “Standard Specification for Poly (Vinyl Chloride) (PVC) Gas Pressure Pipe and Fittings for Maintenance or Repair.

- A. **Pressure Control Fittings:** Fittings components shall have an alloy composition that complies with requirements of CFR Title 49, Part 192.455(f) “External Corrosion Control: Buried or submerged pipelines Installed after January 31, 1971”. The fitting must have a maximum working pressure greater than the system pressure of which the fitting is to be used on.
 - a. **Line Stopper Fittings:**
 - i. For PVC pipelines 2” in diameter, coated steel fittings or stainless-steel fittings may be used if all components of the fitting are constructed of an alloy material not requiring cathodic protection. Approved stopping system is Kleiss MCS60-2.

- ii. For PVC pipelines 3" to 8" in diameter, coated steel fittings or stainless-steel fittings may be used if all components of the fitting are constructed of an alloy material not requiring cathodic protection. Approved stopping system is Kleiss MCS60-38.

Markings: Line stopper fittings shall be in compliance with the latest edition of ASTM F2897 "Standard Specification for Tracking and Traceability Encoding System of Natural Gas Distribution Components (Pipe, Tubing, Fittings, Valves, and Appurtenances)" and consist of a 16-digit alpha-numeric code and scannable code-128 barcode, or QR code, with standardized encoding of pipe specifications as described in the referenced Standard.

Approved Manufacturer: The City of Palo Alto approved PVC line stopper fitting manufacturer is Kleiss. Any other steel line stopper fitting manufacturer must receive prior approval.

2.04 WORK MATERIALS TO BE FURNISHED BY THE CITY

The City will provide all gas meter sets.

2.05 WORK MATERIALS TO BE FURNISHED BY THE CONTRACTOR

Work materials supplied by the Contractor shall include but not be limited to:

- A. All materials, equipment and appurtenances needed to complete installation of new PE mains and services.
- B. Expendable Concrete Materials: Materials required to install and finish Portland cement concrete, such as form lumber, tie-wire, nails, etc.
- C. Concrete: All Portland cement concrete including reinforcing steel, wire mesh, etc.
- D. Temporary and Permanent Fencing: All fencing including traffic barricades required to provide a barrier between vehicular/pedestrian movements and excavations.
- E. Trench Backfill Sand: All backfill sand shall be clean imported sand, rock and salt free. Bay sand shall not be accepted.
- F. Paving Material: All materials required for temporary and permanent street repairs including base materials.
- G. Landscaping Materials: All landscaping materials, plants and surface materials that are damaged due to this Work.
- H. Traffic Control Materials: All materials required to direct vehicular/pedestrian traffic including striping, loop detectors, reflectors, etc. that may be damaged by the Work.
- I. Drilling fluids and bentonite for direction drilling operations.
- J. Non-skid trench plates.
- K. Project notifications signs.

2.06 MANUFACTURER'S TESTING

- A. Minimum burst pressure tests, conducted in accordance with the latest editions of ASTM D1599 “Standard Test Method for Resistance to Short-Time Hydraulic Pressure of Plastic Pipe, Tubing and Fittings” and ASTM D2290 “Standard Test Method for Apparent Hoop Tensile Strength of Plastic or Reinforced Plastic Pipe”, and as incorporated in ASTM D2513-09a “Standard Specification for Polyethylene (PE) Gas Pressure Pipe, Tubing and Fittings”, shall be performed by the manufacturer to determine the short term rupture strength of the pipe and fittings furnished. The minimum short term burst pressure shall be that required to develop a minimum tensile strength value at yield of 2520 psi. This test shall be performed on each lot of pipe ordered, and the manufacturer shall provide all test data as requested by the City. A lot shall mean all material covered by a single item on a City order. Fittings shall be tested at the frequency specified in the latest edition of ASTM D2513 “Standard Specification for Polyethylene (PE) Gas Pressure Pipe, Tubing and Fittings”, Annex A1.
- B. Sustained pressure tests shall be performed to ensure that the pipe and fittings supplied have passed the sustained pressure test outlined in the latest edition of ASTM D1598 “Standard Test Method for Time-to-Failure of Plastic Pipe Under Constant Internal Pressure”. The minimum sustained pressure shall be that required to produce a minimum hoop stress value of 1320 psi. Testing frequency shall meet or exceed that called for in ASTM D2513-09a “Standard Specification for Polyethylene (PE) Gas Pressure Pipe, Tubing and Fittings”, Annex A1. Manufacturer shall provide test data for each lot of pipe and/or fittings ordered as requested by the City.
- C. **Polyethylene Fusion Joints (Butt and Electrofusion):** All joint integrity qualification tests shall be performed by the manufacturer in accordance with the requirements of CFR Title 49, Part 192.281 (c) (1) and (3) “Plastic Pipe” and Part 192.283 (a) (1) (i) and (iii) “Qualifying Joining Procedures”.
- D. **Mechanical Plastic Joints:** All joint integrity qualification tests shall be performed by the manufacturer in accordance with the requirements of CFR Title 49, Part 192.281 (e) “Plastic Pipe” and 192.283 (b) “Qualifying Joining Procedures”.
- E. **Solvent Cement (PVC Repair Only):** All joint integrity qualification tests shall be performed by the manufacturer in accordance with the requirements of CFR Title 49, Part 192.281 (b) “Plastic Pipe” and 192.283 (a) “Qualifying Joining Procedures”.

2.07 SUBMITTALS AND QUALITY CONTROL

- A. The manufacturer shall submit to the City a written quality control procedure conforming to the latest edition of ASTM D2513 “Standard Specification for Polyethylene (PE) Gas Pressure Pipe, Tubing and Fittings”, Annex A1, or as required by CFR Title 49, Part 192.283 “Plastic Pipe” and 192.283 “Qualifying Joining Procedures”, which shall be subject to approval by the City.
- B. The manufacturer shall permit City representatives to tour extrusion facilities for the purpose of evaluating manufacturer’s capabilities. The tour shall be done during extrusion of a City order, or if prior to order placement during the extrusion of a similar material.
- C. The manufacturer shall certify that the plastic pipe and or fittings supplied meet all the requirements of this Specification. When requested by the City, the Manufacturer shall supply certification for all items ordered; failure to do so shall be cause for order rejection.

2.08 INSPECTION

The City reserves the right to inspect each order upon delivery and, at the option of the City, reject any items not meeting this Specification.

PART 3 – EXECUTION

3.01 POLYETHYLENE PIPE INSTALLATION – GAS MAINS

- A. Minimum Cover:** Gas mains shall be installed with a minimum cover of 30", as measured vertically from the top of pipe to the top of pavement.
- B. Underground Clearance:** Unless otherwise specified, a minimum of 12 inches vertically and 24 inches horizontally shall be maintained between the pipe surface and other utility lines or adjacent foreign structures. If it is not possible to maintain required vertical clearance from other structures, the Contractor shall receive prior approval or case the gas main in steel pipe or concrete at the discretion of the City's representative.
- C. Gas Pipe Bedding:** Trench shall be free of debris, sharp rocks, etc. before adding the sand bed for the new gas main. Sand bed shall have a minimum thickness of 4" below and 12" above the gas main.
- D. Tracer Wire Connections:** One tracer wire shall be installed with the pipe. All tracer wire connections shall be made with the Nicotap lateral splice sleeve wrapped with aqua seal and electrical tape. All Nicotap fittings must be installed with tooling specified by the manufacturer; the use of pliers or other crimping devices will not be allowed. Tracer wires from the four pipelines feeding into an intersection will be terminated at an anode box located by the "northerly" valve. Tracer wire shall have knots tied in the wire as follows: north wire - no knot attached to terminal 1 of the anode box; east wire - one knot attached to terminal 2; south wire - two knots attached to terminal 3; west wire - three knots attached to terminal 4. Each wire shall extend a minimum five feet above grade. The Drawings detail installation requirements. Tracer wires from steel gas mains inserted into casings shall be extended to the closest "westerly" anode box with four knots tied.
- E. Valves:** Valves shall be installed at the marked locations. Valve supports are required for 2" valves only. Valves shall be installed with the operating nut on top, facing vertically up. The City will not accept valves that are cocked or oriented in any direction except up.
- F. Anode Boxes:** Anode boxes shall be installed at locations shown on plans or as directed by the City Inspector. Anode boxes shall be installed in the same manner as valve boxes.
- G. Pressure Test:** The Contractor will conduct air pressure tests at 100 psig on the newly installed system, including all main and service lines, for a minimum time of 25 hours. The City will provide a pressure chart recorder to document all air tests. The pressure shall not decrease during the test period. A digital gauge shall be supplied by the Contractor at a separate location to record pressure at the start and end of pressure test. Tests shall be performed on each block of main installed after service installation is completed.
- H. Boring:** All underground utilities shall be located and potholed prior to the start of boring. One tracer wire shall be attached to all pipe prior to insertion into the bore hole. All pipe ends shall be sealed with a butt fusion end cap or similar fitting prior to pulling into a bore hole.
- I. Sealing Installed Piping:** Contractor shall seal open piping with butt fusion end caps at the end

of each workday. No open pipe ends will be allowed.

3.02 GAS SERVICE (INSERTION INTO EXISTING PIPE)

When inserting a PE pipe into an existing (abandoned) pipe, the Contractor shall follow the procedures listed below to minimize gas service disruption:

- A. Install new 1" PE services.
- B. Perform all required house plumbing modifications.
- C. Pressure test the entire length of pipe to be inserted, before insertion, for a minimum period of 24 hours at 100 psig with air.

Inserting new PE pipe into an existing (abandoned) pipe, must be approved prior to insertion.

3.03 GAS HOUSE LINES

All materials and installation methods must comply with the latest City adopted version of Uniform Plumbing Code.

3.04 INSTALLATION – GAS SERVICES

A. Tapping Tee Installation

1. Contractor shall install tapping tees at the locations marked by the City. Bell holes shall be excavated, if installing the gas mains by boring methods, at each tapping tee installation site to provide an adequate work area for installation and inspection of tapping tees. The tapping tees shall be installed in accordance with Appendix F by the person(s) qualified by the City to install tapping tees. Tapping tee fusions must be conducted in the presence of, or with the prior approval of, the City Inspector. **TAPPING TEES SHALL ONLY BE INSTALLED ON THE TOP OF THE GAS MAIN.**
2. The main shall be tapped after the tapping tee outlet coupling has cooled for the time period specified in Appendix F and the service line has been soaped and pressure tested. The manufacturer supplied tapping wrench or fitting shall be the only tool used for turning the tapping tee cutter to avoid tapping the backside of the main or loss of the cutter into the main. Allen wrenches shall not be used.
3. Tapping tee cutter shall be moved back to the top of the tee tower prior to seal cap installation.

B. Service Pipe Installation with Excess Flow Valves

1. All services must be installed with boring type devices, approved by the Engineer, except in cases where ground conditions or existing underground utility congestion precludes it. Open cut trenching of services must be approved by the Engineer.
2. Excess flow valves shall be installed on all service lines, where commercially available, as close as practical to the tapping tee, connected by electrofusion couplings. Care shall be taken to ensure that the excess flow valve is installed with the arrow pointing towards the riser (away from the tapping tee).
3. For 1" services, a 1" cap shall be attached in accordance with Appendix F by a qualified

person(s) and in the presence of, or with the prior approval of, the City's Inspector, to the end of the 1" service pipe, and tracer wire attached to the service pipe prior to inserting the pipe into the bore hole. Services shall be one continuous polyethylene pipe with no fusion joints.

4. For 2" services, a 2" cap shall be attached in accordance with Appendix F by a qualified person(s) and in the presence of, or with the prior approval of, the City's Inspector, to the end of the 2" service pipe, and tracer wire attached to the service pipe prior to inserting the pipe into the bore hole. Services shall be one continuous polyethylene pipe with no fusion joints. Contractor shall also install 2" inline ball valve as close to the outlet of the tapping tee as possible.
 5. A qualified person shall make all connections between the excess flow valve and the service line by electrofusion couplings in accordance with Appendix F and in the presence of, or with the prior approval of, the City's Inspector.
 6. A qualified person shall connect by electrofusion the service line to the service riser in accordance Appendix F and in the presence of, or with the prior approval of, the City's Inspector.
 7. The Contractor shall install a meter valve, by-pass assembly (if indicated on construction drawings), and end plug on each service riser. Stop cock shall be installed with operating shut off nut facing away from structure (or facing the opening of the curb meter vault lid) with the regulator at its left side per City Standard Specification and Details.
 8. The location of all gas services shall be marked by a delta symbol, 2" in height, impressed or chiseled to a depth of 1/4" into the curb (or sidewalk if no curb line). The base of the delta shall be parallel to the street (or curb) and its vertex shall be located on the gas service line, pointed toward the structure in the direction of the gas meter. The marking must be placed at the time of service installation by attaching a line locator device to the tracer wire to ensure that the marking is located directly above the service. All old gas markings shall be removed prior to installation of new gas meter.
 9. House line: All materials and installation methods must comply with the latest City adopted version of Uniform Plumbing Code.
- C. Minimum Cover:** Gas services shall be installed with 24" minimum cover, as measured vertically from top of pipe to top of pavement or below existing grade.
- D. Maximum Cover:** Gas services shall not be installed any deeper than 30" below existing grade unless directed by the Engineer.
- E. Service Leak Testing:** Prior to tapping the main, the contractor shall conduct air pressure tests, in the presence of qualified City staff, at 100 psig on all service lines for a minimum of 15 minutes using a digital gauge. The pressure shall not decrease during the test period. Air pressure shall be held until after soap testing is complete. Soap test the service connection by brushing a liquid soap and water solution around the tapping tee base at the main, both ends of the outlet coupling, the outlet connection of the excess flow valve, the pipe to riser connection in the customer's yard, and at the meter valve inlet and outlet. If any leaks appear, the City's Inspector will direct repair procedures.
- F. Surface Restoration:** Once the City's Inspector has noted the location of the service pipe in the customer's property, the Contractor shall restore the customer's surface improvements to the

preconstruction condition.

3.05 STEEL PIPE INSTALLATION

- A. Welding:** All steel gas carrier pipe shall be welded in accordance with CFR Title 49, Part 192, Subpart E “Welding of Steel in Pipelines”, by a welder qualified under Section 192.227 “Qualification of Welders and Welder Operators”, and certified by the City.
- B. Wrapping of Welds:** Primer (Royston Roybond 747, or approved equal) and a 30-mil minimum thickness wrapping tape shall be applied over welded joints and any other bare metal surface of the pipe. Complete wrap shall be two (2) thicknesses of cold wrap tape covering the metal in all places (50% overlap of the cold wrap tape) and overlapping the plant coat wrap by a minimum of 2”. Manufacturer’s primer shall not be applied to polyethylene pipe.

3.06 SYSTEM PRESSURE TEST

The Contractor will conduct an air pressure test at 100 psig on all newly installed pipelines, including services and mains, for a minimum time of 25 hours. Test shall only be performed Monday-Thursday. The City will provide a pressure chart recorder to document the system air test. A digital gauge shall be supplied by the Contractor at a separate location to record pressure at the start and end of pressure test. The pressure shall not decrease during the test period.

For pressure testing newly installed service pipelines on ABS or PVC gas mains, a separate pressure test for a minimum of 15 minutes at a minimum of 50psig shall be performed for the service connection tee only. All other PE service piping shall be pressure tested at a minimum of 15 minutes at a minimum of 100psig.

All customer piping shall be inspected and approved by the building department inspector before gas service will be instituted. Gas meters will be installed within ten working days after the building inspector approved the building gas piping and releases a set tag for the gas meters to the Utilities Department.

3.07 OPERATOR QUALIFICATION REQUIREMENTS

A. Polyethylene Pipe Fusion:

- a. **General Conditions:** The Contractor shall have qualified persons to perform the polyethylene pipe joining as per Appendix F of these standards and **CFR Title 49, Part 192, Subpart F “Joining of Materials Other Than by Welding”**.
- b. **Qualification Testing:** Qualification testing is required for **all** Contractor employees that will be performing City of Palo Alto Operator Qualification identified tasks. Said person(s) will be deemed the Qualified Person(s) and shall be the only person(s) performing the individual task on the job site. The Contractor will perform the qualification testing using their own equipment and materials. At the discretion of the City, the Contractor may be required to obtain certification through the City or with a City approved Industrial Training Services contractor. At a minimum, all fusion equipment used must be inspected by the City and receive a certification sticker. The certified equipment must be used to obtain Operator Qualification fusion certification and be used to perform fusions on the project. All testing and certifications must be coordinated with the WGW Project Manager a minimum of three weeks in advance.

Below are the minimum required Operator Qualification tasks assigned to all contractors performing work on City of Palo Alto natural gas pipelines:

- F01.1.0721 – Joining of Pipe: Threaded Joints
- F01.1.0761 – Butt Heat Fusion (Hydraulic)
- F01.4.0781 – Electrofusion
- G01.0981 – Backfilling
- G01.1321 – Damage Prevention During Excavation Activities
- G02.0641 – Visually Inspect Pipe and Components Prior to Installation
- G02.0901 – Installation of Plastic Pipe in a Ditch
- G02.0941 – Install Tracer Wire
- G04.0911 – Installation of Plastic Pipe in a Bore
- I07.0041 – Installation and Maintenance of Mechanical Electrical Connections
- L01.a.1101 – Tapping a Pipeline with a Built in Cutter
- M08.0201 – Visual Inspection of Installed Pipe and Components for Mechanical Damage
- M08.0211 – Measure and Characterize Mechanical Damage on Installed Pipe and Components

Polyethylene fusion requirements are addressed in full detail in Section 2300 and Appendix F of these Specifications.

The City reserves the right to add additional qualification testing based on the work being performed. It is the responsibility of the Contractor to request what, if any, additional qualification testing may be required.

3.08 ABANDONMENT OF NATURAL GAS FACILITIES

A. MAINS

1. The City's Water-Gas-Wastewater Operations shall perform the abandonment of the natural gas mains after the new gas main and service pipelines meet pressure tests outlined in 3.01 and 3.06 of Section 2685. The Contractor shall notify the Engineer five (5) days in advance of the pressure test to schedule the abandonment of the natural gas main and services.

B. SERVICES AND SERVICE RISERS

1. Where a new gas service is to be installed or a service reconnection is to be performed, the City's Water-Gas-Wastewater Operations shall cut and cap the old service near the gas main or the reconnection point after the new gas service meets the pressure tests outlined in 3.01 and 3.06 of Section 2685.
 - a. On gas services abandoned by Water-Gas-Wastewater Operations, the Contractor shall verify the presence of gas by opening the meter valve to ensure the service is inactive and there is no potential hazard for combustion. After verification, the Contractor shall proceed to cut the riser flush to grade and restore the disturbed surface to match existing.

C. VALVES

1. The Contractor shall perform the abandonment of valves on distribution pipelines that are

inactive and disconnected from the distribution system. The Contractor shall remove the valve box lid and cover and restore the surface to match existing.

3.09 DESIGN STANDARDS

Polyethylene piping (medium density PE 2708) is currently the only material installed in the City's natural gas distribution system (except at the locations where repair work is done on steel and/or PVC segments of the natural gas distribution system).

D. LOCATION

1. Gas mains shall be located two (2) feet off the lip of gutter on the north and east side of streets, unless otherwise specified on the Project Drawings. Gas mains shall be twenty-four (24) inches minimum from any parallel utility line, or as determined by the City. Gas mains and services shall have a minimum of one (1) foot vertical clearance from any crossing utility lines or other underground facilities.
2. Gas services shall be installed perpendicular from the gas main in the shortest straight line to the gas meter location.
3. Above ground gas meters shall be installed on private property adjacent to the building. Curb meter installations shall only be allowed with prior approval of the Engineer. The meter location and installation shall be as specified on the project documents.
4. No meter or regulator shall be installed inside of a building, garage, carport, crawlspace, or in any other enclosed area with walls on more than two sides or under a roof structure. The Owner is responsible for installing a concrete meter pad, concrete walkway for meter access, and bollards as required by the City.

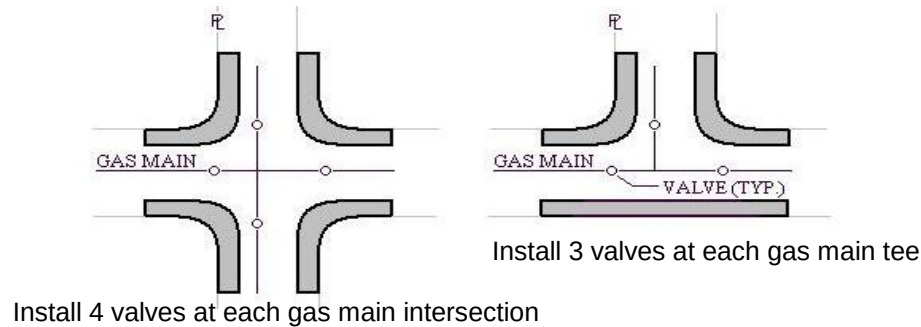
E. DEPTH OF PIPE: Minimum depths are to be provided to the finished street surfaces, unless otherwise specified on the Drawings.

1. Gas mains shall be installed with a minimum cover of 30", as measured vertically from the top of pipe to the top of pavement.
2. The depth of new gas services shall be a minimum of 24" unless the service serves more than one gas meter; then the minimum depth shall be 30".
3. Unless otherwise specified a minimum of 12" shall be maintained between the pipe surface and other utility lines or adjacent foreign structures. If it is not possible to maintain 12" of clearance from other structures, the Contractor shall receive prior approval or case the gas main in steel pipe or concrete at the discretion of the City's Inspector.

F. MINIMUM SIZE OF NEW MAINS AND SERVICES: The minimum new gas main size is 2" (ID = 1.917", SDR 11.0). The minimum service size for new construction is 1" (ID = 0.919", SDR 11.5)

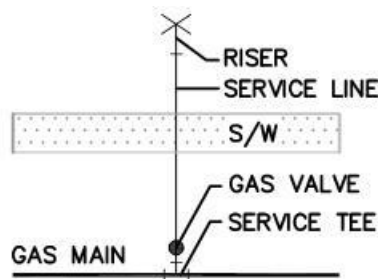
G. VALVES: Four valves shall be installed at each intersection and three valves shall be installed at each tee (at the property line extensions as shown on Figure 3), or as shown on the construction drawings or as directed/approved by the Engineer.

Figure 3



A 2" inline ball valve will be required on all gas services 2" and larger (as shown on Figure 4). Placement of valve shall be as close to the tapping tee as practical.

Figure 4



- H. LOAD:** The maximum connected load shall be used for design purposes (the total shown on the submitted load sheet plus any anticipated future load when available). Coincidence or diversity factors shall not be used when designing gas services.
- I. CALCULATING SERVICE SIZE:** The sizing of gas services shall be based on the High-Pressure Mueller Equation (applicable for 1 psi and greater) where the length of the service is doubled to account for fittings and a factor of safety.

Note: the absolute pressure (psia) must be used when performing calculations with the Modified High-Pressure Mueller Equation. The standard barometric pressure correction is 14.7 psia.

J. AVAILABLE PRESSURE

The typical pressure in the City's natural gas distribution system is approximately 20 psig. The City's standard delivery pressure is 7" w.c. (water column). Non-standard delivery pressures above 7" w.c. will be limited to 14" w.c., and 1, 2, 3 and 5 psig. Approval from the Engineering Manager is required for any delivery pressures greater than 7" w.c. For sizing:

1. Residential gas services: The pressure at the main is assumed to be 10 psig, and the pressure at the meter set riser shall be assumed to be 8 psig, or as noted on the individual Gas Meter Set Standard Drawings. The services shall be sized based on the calculated head loss between the main and the riser. If the head loss is too great, then the service size shall be increased.

2. Commercial/Industrial Services: The minimum required pressure upstream of the regulator, and pressure loss through the riser, meter valve, and filter (if applicable), or as specified in the notes on the individual Gas Meter Set Standard Drawings, shall be considered in the design of the service. After calculating the minimum pressure required at the meter set riser, the service shall be sized by calculating the head loss and comparing the calculated pressure at the main to the available pressure as projected by the Gas Model. If the head loss is too great, then the service size shall be increased.

PART 4 - NATURAL GAS HOUSE PLUMBING

Part 4 is only for City gas main replacement projects (CIP work) where the gas meter needs to be relocated as part of the CIP. Any other gas house plumbing (any piping downstream of the gas meter) is the sole responsibility of the property owner.

4.01 DESCRIPTION

The work to be performed shall consist of furnishing all tools, equipment, materials, supplies, manufactured articles, transportation and services (including fuel, power, and essential communication), labor, and other operations necessary for the modification of existing natural gas house plumbing to accommodate relocation of gas meters including: obtaining required permits, installation of new house gas pipes, new shut off valves and flexes, subsequent pressure testing of the entire house gas plumbing system, and passing required inspections for houses located in Palo Alto, for the City of Palo Alto. The work shall be complete and performed in strict accordance with the Contract Specifications, and in compliance with all applicable codes and standards. All work, materials and services not expressly shown or called for in the Contract Documents, which may be necessary for the complete and proper construction of the Work, shall be performed, furnished, and installed by the Contractor at no increase in cost to the City.

4.02 QUALIFICATIONS OF WORKMEN

Journeyman plumbers shall be licensed plumbers completely familiar with the design and application of the work described.

4.03 MANUFACTURER'S RECOMMENDATIONS.

All equipment, materials, devices, etc., shall be installed in a manner meeting the manufacturer's recommendations for the particular item. Prior to the start of work, the Contractor shall obtain and deliver copies to the Engineer of all installation manuals, brochures and procedures that the manufacturer issues for the items supplied. The Contractor shall be held responsible for all installation's contrary to the manufacturer's recommendations, unless otherwise approved by the Engineer. If any item or piece of equipment or material is found to be installed not in accordance with the manufacturer's recommendations, or as otherwise directed by the Engineer, the Contractor shall make all necessary changes and revisions to achieve such compliance, at the Contractor's expense.

4.04 EXISTING GAS PLUMBING

The modification of the existing gas plumbing shall be performed by the contractor only after receiving written approval from the Engineer. With the Engineer's authorization, the Contractor shall perform all repairs and modifications required for code compliance of existing customer owned natural gas plumbing. The Contractor shall remove and dispose of all abandoned gas plumbing materials. The Contractor shall not modify the existing gas plumbing until the City's Inspector verifies the new stubout

location.

4.05 TESTING OF CUSTOMER OWNED GAS PIPING

Contractor shall pay for all testing and retesting required showing compliance with the Contract Documents, Codes, Regulations, and all other applicable laws. Meter sets will not be installed until all testing has been completed and the Building Department Inspector approves the work.

A. SYSTEM PRESSURE TEST: The Contractor will conduct an air pressure test in accordance with the latest adopted version of the Uniform Plumbing Code and as required by the City's Building Department Inspector. The pressure shall not decrease during the test. Other inspections and tests required by the City Building Inspector, codes, ordinances, or other legally constituted authority, shall be the responsibility of and paid for by the Contractor. Testing of the existing gas house plumbing shall be performed prior to connecting the new supply line.

B. TESTING: Testing will be in accordance with the City's Building Department requirements.

C. CONTRACTOR'S CONVENIENCE TESTING: Costs associated with inspection and testing performed exclusively for the Contractor's convenience shall be the sole responsibility of the Contractor.

D. SCHEDULE FOR TESTING

1. Testing shall be scheduled with the Building Department in advance.
2. At least 48 hours' notice shall be provided to the Engineer when testing is required.
3. Testing that involves City personnel shall not be scheduled on Fridays.

4.06 COOPERATION WITH THE BUILDING DEPARTMENT

City building inspectors shall have access to the Work at all times and in all locations where the Work is in progress. Contractor shall provide such access to enable the Building Department to perform its functions properly.

A. Revising schedule: When changes of construction schedule are necessary during construction, Contractor shall coordinate all such changes with the Building Department.

B. Adherence to Schedule: When the Building Department is ready to inspect, but is prevented due to incompleteness of the Work, all extra charges for testing attributable to the delay will be back charged to the Contractor and shall not be borne by the City.

4.07 COORDINATION WITH CUSTOMERS

The Contractor is responsible for coordinating access to private property with the homeowners. The Contractor shall notify the property owner/ resident at least 7 days and again 24 hours in advance of performing work. Prior to starting work at a specific location, the Contractor shall schedule the work with the homeowner or resident, as the customer's presence during the work is required.

City Operations staff shall relight all pilot lights the same day (before 5:00 P.M.) after the City installs the new gas meter and regulator. No residence shall be left out of service overnight. Each residence shall be reconnected, and all pilot lights relit before 5:00 P.M. each day.

4.08 RESTORATION

The contractor shall restore all existing improvements and landscaping at each location to the pre-construction condition as soon as practical, after completing the work at each house location, but in no case later than one (1) week after Work is complete. The Contractor shall include restoration in the appropriate bid items; no separate payment will be made for restoration.

END OF SECTION

**SECTION 2730
WASTEWATER DESIGN STANDARDS**

1.01 WASTEWATER FLOW DESIGN

A. General: A capacity study report prepared by a licensed Engineer shall be submitted to the City of Palo Alto Utilities Engineering Department by the project's Engineer when design (or permit) plans are submitted for review. The report shall provide the following information for the study area:

1. For new development connections, flow monitoring data and hydraulic analysis of the sewage drainage basin shall be submitted to assess the new connections' effects on the hydraulic characteristics of the basin.
2. Pipe information for each new sanitary sewer segment, including pipe diameter, slope, invert elevations, length, roughness coefficient for Manning's equation, design capacity, full pipe capacity, design flow, percentage of full pipe capacity utilized (calculated by dividing the design flow by the full pipe capacity and multiplying by 100), and pump station operation parameters (if applicable).
3. Land use information for conditions prior to commencement of project, immediately after completion of project, and at build-out, including category of land use, number and type of residential dwelling units, square footage for commercial/industrial users, square footage for industries with unusually high water requirements, number of students (for schools), and sewer acreage.
4. Map showing location of new sewer segments (and pump stations, if applicable), proposed connection point(s) to existing City sewers, and location of residential/commercial/industrial users.

B. Design: Sewer segments shall be designed for a design flow 20 years from the current year. The Design Flow (DF) for a sewer segment is composed of three components: Peak Base Wastewater Flow (PBWF), Groundwater Infiltration (GWI), and Rainfall-Dependent Inflow (RDI). The Design Flow shall be based on the greater of the following two formulas:

$$\begin{aligned} DF &= (PBWF \times 0.75) + GWI + RDI \\ DF &= PBWF + GWI \end{aligned}$$

Exception: If the wastewater flow is pumped, design flows downstream of the pump station shall be based on the maximum capacity of the pump(s).

1. **Peak Base Wastewater Flow (PBWF):** Average base wastewater flow (ABWF) is the average daily dry weather flow contributed from residential, commercial, and industrial users. ABWF is calculated using unit flow rates in Table 1-1. If supporting data indicates the need, a higher unit flow rate should be applied for commercial/industrial users. The calculated ABWF values must be multiplied by a Peaking Factor to account for the variations that occur hour-to-hour and day-to-day.

A Peaking Factor is determined by the equation:

$$\text{Peaking Factor} = 3.15 \times ABWF^{-0.104}$$

where ABWF is in million gallons per day (mgd). The Peaking Factor has a maximum of

4.0 and a minimum of 1.0.

$$PBWF = ABWF \times \text{Peaking Factor}$$

2. **Groundwater Infiltration (GWI):** Groundwater infiltration is groundwater that enters the collection system from defects in the pipes, pipe joints, and sewer structures. The amount of GWI entering the collection system depends on the structural condition of the system, the depth of the pipes, and the elevation of the groundwater table relative to the elevation of the sewer pipes. GWI tends to decrease during the dry-weather seasons and gradually increases as the wet-weather season progresses. GWI is calculated by applying the GWI unit flow rate that corresponds to the tributary area. GWI unit flow rate is shown in Table 1-1.
3. **Rainfall-Dependent Inflow (RDI):** Rainfall-Dependent Inflow is storm water that enters the collection system in direct response to the intensity and duration of individual rainfall events. In addition to being dependent on rainfall events, RDI is sensitive to soil moisture, increasing throughout the wet-weather season as the soil moisture increases. A 20-year storm event shall be used to determine estimated RDI for new sewers. RDI is calculated by applying the RDI unit flow rate that corresponds to the tributary area. RDI unit flow rate is shown in Table 1-1.

Table 1-1 Unit Flow Rates for ABWF, GWI, and RDI*

Average Base Wastewater Flow (ABWF)			
Land Use Category	Land Use Designation**	Unit	Unit Flow Rate (gpd/unit)
Residential			
Single Family	SF	Dwelling Unit	220
Multi-Family	MF	Dwelling Unit	160
Transit-Oriented	CC	Dwelling Unit	160
Commercial	CS, CN, CH	Building Sq. Ft.	0.15
Research/Office Park	RO	Building Sq. Ft.	0.10
Light Industrial	LI	Building Sq. Ft.	0.10
Major Institutional	MISP	Building Sq. Ft.	0.15
School	S	Student	15

Groundwater Infiltration (GWI) = 500 gpd/acre
Rainfall-Dependent Inflow (RDI) = 1,900 gpd/acre

* All rates are based on the 2004 Wastewater Collection System Master Plan.

** Land Use Designations based on Palo Alto's Planning Land Use Designations.

1.02 PIPE CAPACITY

The theoretical capacity of new pipes shall be calculated using Manning's equation. The "n" value (Manning's roughness coefficient) shall be equal to 0.009 for all HDPE sewer pipes.

Manning's Equation:

$$Q \text{ (cfs)} = (1.49 / n) \times A \times R_h^{2/3} \times S^{1/2}$$

Q = Flow (cfs)
n = Manning's roughness coefficient

A	=	Flow Area (ft ²)
R _h	=	Hydraulic Radius (ft)
S	=	Slope (ft/ft)

1.03 PIPE SIZE, SLOPE, DEPTH, AND ALIGNMENT

- A. Pipe Size:** Pipes less than or equal to 10 inches in diameter shall be sized to handle peak flows at 75% of full pipe capacity. Pipes greater than 10 inches in diameter shall be sized to handle peak flows at 90% of full pipe capacity. The diameter for gravity sewer mains shall be 8-inches or larger while sewer laterals shall be 4-inches but no larger than 6-inches. A sewer lateral larger than 6-inches serving a private property shall be considered a private main, even if it crosses the City's right-of-way. When a smaller sewer pipe joins a large one, the top of both pipes (crowns) should be at the same elevation.
- B. Slope:** All sewers shall be designed and constructed to give a mean velocity, when flowing full, of not less than 2 feet per second. The following are the minimum slopes that should be provided for each sanitary sewer segment:

Sewer Size	Minimum Slope (Feet per 100 Feet)
4 inch (laterals)	2.00
6 inch (laterals)	1.00
8 inch	0.34
10 inch	0.25
12 inch	0.19
15 inch	0.14
18 inch	0.11
21 inch	0.09
24 inch	0.08
27 inch	0.07
30 inch	0.06
36 inch	0.04
42 inch	0.04

Where velocities greater than fifteen (15) feet per second are attained, special provisions shall be made to protect against displacement by erosion, shock, and hydraulic jumps at changes in velocity. Sewers on 20 percent slopes or greater shall be anchored securely with concrete anchors, spaced as follows:

- Not over 36 feet on center for grades of 20 to 35 percent;
 - Not over 24 feet on center for grades of 35 to 50 percent;
 - Not over 16 feet on center for grades of 50 percent and over.
- C. Depth:** In general, sewers should be placed below pressure utilities and be sufficiently deep to receive sewage from basement. Crown (top inside surface of the pipe) of any inlet pipe shall not be lower than the elevation of the outlet main crown in the manhole, unless otherwise approved by the Engineer.
- D. Alignment:** The horizontal and vertical alignment of sewers shall be maintained by the use of laser survey equipment. Unless otherwise approved by the Engineer, all sewers shall be constructed straight and at uniform grade between manholes.

1.04 WASTEWATER FLOW CONTROL/BY-PASS

Contractor shall furnish, install, and operate pumps, plugs, conduits, temporary piping, and other equipment to divert the flow of wastewater around the sewer reach in which work is to be performed. Contractor shall maintain uninterrupted sewer service to all properties connected to the sewer being replaced. Piping shall be buried when cross truck-route roadways or as noted on the Drawings. Plugs shall be so designed that all or any portion of the wastewater can be released. Plugs shall be provided with a tag line.

The pumping system shall be of sufficient capacity to manage existing flows plus additional flow that may occur during a rain event. The pumping system shall have automated controls. Bypassed lines larger than 18" diameter shall automatically switch operation to the standby pumps in the event of a primary pump failure. The Contractor shall provide personnel to observe, fuel, and maintain the bypass pumping system at all times when it is operating. An audible alarm shall be provided to signal high level at the bypass point. A high-level setting will be provided to the Contractor by the Engineer for each bypass point. If the City performs bypass pumping, or other pumping, due to contractor's operations, whether because of failure of contractor's pump system or failure of the contractor to install needed pumps, the City will deduct the cost of pumping from contractor's compensation.

Standby pumps and standby power shall be provided with 100 percent redundancy. If pumping is required on a 24-hour basis in a residential or commercial area, Contractor shall get a City permit, construct, and use a temporary power service. If pumping is required on a 24-hour basis in an industrial area, engines shall be equipped in a manner to keep noise to a minimum. Noise level shall conform to the requirements of the City's noise ordinance as stated in the City of Palo Alto Municipal Code.

Bypass pumping shall be performed in such manner as will not damage public or private property or create a nuisance or health menace. The pumped wastewater shall be in an enclosed hose or pipe and shall be redirected into the sanitary sewer system. It shall be adequately protected from traffic. If applicable, the bypass hose or pipe along the sidewalk shall be covered with a ramp to **protect** the pedestrians from tripping and falling. Dumping or free flow of wastewater on private property, gutters, streets, sidewalks, or into storm sewers is prohibited. The Contractor shall not block access to driveways, streets, or other facilities with any flow control activities.

Temporary plugging will be permitted on pipes with diameters of 6-inches or smaller. See Section 1.05, Sewage Spill Contingency Plan for monitoring the manhole upstream of the plugged pipe.

The Contractor shall be liable for all damages associated with this work, including fines imposed on the City for spilled sewage. After the work has been completed, flow shall be restored to normal.

The Contractor shall submit a sewage bypass pumping/ diversion plan for review by the Engineer at least 10 days prior to pipe installation. The Contractor shall notify the Engineer 24 hours prior to commencing the bypass pumping operation. The Contractor's plan for sewage bypass pumping/diversion shall be satisfactory to the Engineer before the Contractor shall be allowed to commence sewage bypass pumping/diversion.

By-pass pumping shall be performed in conformance with all applicable local, state and federal laws and permits issued by jurisdictional regulatory agencies. Permits required by such agencies (e.g., California Department of Fish and Game, Regional Water Quality Control Board, US Fish and Wildlife, Army Corps of Engineers) for by-pass pumping shall be obtained by the Contractor. It is the Contractor's responsibility, while preparing the Bid, to evaluate what permits need to be

obtained and estimate fees and anticipate lead time necessary to procure the required permits to complete the Work. Payment of all costs and expenses for such licenses, permits, and fees shall be included in one or more bid items. No other compensation shall be paid to the Contractor for these items or for delays caused by non-City agencies or conditions set forth in the licenses or permits issued by other agencies.

1.05 SEWAGE SPILL CONTINGENCY PLAN

The Contractor shall submit for Engineer's approval a "Sewage Spill Contingency Plan" consisting of secondary containment, diversion, and pumping capable of handling the flow rate in the subject sewer line. The Contractor is also required to:

- A. Notify the on-site inspector before any main is plugged to facilitate construction work.
- B. Determine the release point* if the main should not be unplugged before an overflow occurs.
- C. Require a job laborer to observe the flow and monitor the rise in elevation of the sewage in the manhole at the release point.
- D. The contractor is to notify the project inspector when the elevation of the sewage is within 1.5' of the rim at the release point manhole.

*Release point is the lowest point in the sewer collection system tributary to the plugged line. The manhole rim and invert elevations, and the peak flow information, can be obtained from the Engineer.

1.06 WASTEWATER MAIN REMOVAL OR ABANDONMENT

Contractor shall plug existing sewer mains to be abandoned at the downstream locations. The abandoned pipeline shall be monitored for a 48-hour period to ensure that there is no flow in the existing main or laterals. Upon verification of abandoned pipe, the sewer main shall be completed filled with CDF conforming to Section 2200,2.05, "Controlled Density Fill".

1.07 MANHOLES

Manholes shall be installed at the following locations: at the end of each sanitary sewer segment, at any changes in grade, size or alignment, at all intersections, and at distances not greater than 500 feet. Greater spacing between manholes may be permitted as approved by the Engineer.

The minimum diameter of manholes shall be 48 inches. A minimum access diameter of 24 inches shall be provided. The flow channel through the manhole shall be made to conform in shape and slope to that of the sanitary sewer mains. All pipes entering the manhole shall be provided with a flexible joint within 12 inches of the edge of the concrete base.

For drop manholes, a drop pipe should be provided for a sewer main entering a manhole at an elevation of 30 inches or more from the flow line of the manhole (refer to standard details). Where the difference in elevation between the incoming sewer and the top of the outlet pipe is less than 30 inches, the invert should be channeled to prevent solid deposition.

Drop manholes should be constructed with an outside drop connection. the entire outside drop connection shall be encased in concrete.

1.08 AERIAL CROSSINGS

Support shall be provided for all joints in pipes utilized for aerial crossings. The supports shall be designed to prevent overturning and settlement. Expansion joints shall be provided between above-ground and below-ground sewers. The impact of flood waters and debris on the pipe shall be considered in the design of aerial crossings.

1.09 SEWERS CROSSING STREAMS

Sewer systems shall be designed to minimize the number of stream crossings. Sewers crossing streams shall be at a sufficient depth below the natural bottom of the stream bed so as to protect the sewer line, and shall be installed in a casing. If jack and bore method is used, steel casing shall be used and design shall be approved by the City. If horizontal directional drilling method is used, the design shall be approved by the City. In general, the cover requirements must be met by the permitting agency:

- One (1) foot of cover is required where sewer pipe is located in bedrock;
- Three (3) feet of cover is required where sewer pipe is located in all other material types. In major streams, more than three feet of cover may be required.
- In paved stream channels, the top of the sewer line should be placed a minimum of one (1) foot below the bottom of the channel pavement.

Less cover will be approved only if the proposed sewer crossing will not interfere with future improvements to the stream channel. Sewers located along streams shall be located outside of the stream bed and sufficiently removed providing for future possible stream widening and to prevent pollution by siltation during construction. Sewers crossing streams should be designed to cross the stream as nearly perpendicular to the stream flow as possible and shall be consistent in grade.

A. Materials: Sewers entering or crossing streams shall be designed and submitted to the City for approval. Sewers shall be constructed to remain watertight and free from changes in alignment or grade. Material used to backfill the trench shall be stone, coarse aggregate, washed gravel, or other materials which will not cause siltation.

B. Siltation and Erosion: Best Management Practice (BMP) methods that will minimize siltation and erosion from the site shall be employed. The design engineer shall include in the Project Specifications the methods(s) to be employed in the construction of sewers in or near streams to provide adequate control of siltation and erosion. Project Specifications shall require that cleanup, grading, seeding, and planting or restoration of all work areas shall begin immediately. Exposed areas shall not remain unprotected for more than seven (7) days.

1.010 PROTECTION OF WATER SUPPLIES

A. Water Supply Interconnections: There shall be no physical connections between a public or private potable water supply system and a sewer collection system, or appurtenance thereto which would permit the passage of any sewage or polluted water into the potable supply. No water pipe shall pass through or come in contact with any part of a sewer manhole.

B. Storm system interconnections: There shall be no physical connections between a public or private development storm drainage system, or appurtenance thereto which would permit the passage of any sewage or polluted water into the storm drain system. No storm drain pipe

shall pass through or come in contact with any part of a sewer manhole.

- C. Relations to Water Works Structures:** Sewers shall meet the requirements of the State Water Resources Control Board "Criteria for the Separation of Water Mains and Sanitary Sewers".

END OF SECTION

**SECTION 2731
VITRIFIED CLAY SEWER PIPE**

1.01 DESCRIPTION

This section covers the installation of new vitrified clay sewer pipe (VCP) for spot repairs. Pipe shall be as specified herein and installed at the locations shown on the Drawings.

1.02 SUBMITTALS

- A. The Contractor shall submit for approval by the Engineer the following information:
- B. Manufacturer's literature on the materials identified below. Literature shall include recommended installation procedures.
- C. Certification by the manufacturer that all pipe and fittings furnished under this specification were manufactured, sampled, tested, and inspected in accordance with ASTM C700 and ASTM C301.

1.03 MATERIALS

- A. **Vitrified Clay Pipe:** ASTM C700 Extra Strength, unglazed; Bell and Spigot Type and Fittings per ASTM C425. Gladding, McBean & Co., or approved equal.
- B. **Couplings:** Rubber or elastomeric PVC flexible couplings with stainless steel screws, nuts, housings, and non-shear bands. Joints, Inc. "Calder Couplings," Fernco Inc. "Flexible Couplings," or approved equal.
- C. **Stoppers:** Vitrified Clay or Plastic.

Each length of vitrified clay pipe shall be marked with the manufacturer's name or trademark, the location of the plant, and the words "Extra Strength" or the symbol "ES."

Wye fittings shall be furnished with spurs already securely fastened by the manufacturer to the barrel of the pipe. There shall be no projection on the inner surface of the pipe barrel. The axis of the spur on the fitting shall be 45-degrees from the longitudinal axis of the pipe. Tee fittings are unacceptable.

Stoppers furnished for installation in branch fittings and ends of pipe left unconnected shall sustain all applied construction and in-place loads, including field pressure tests.

1.04 JOINING AND INSTALLATION

Pipe and fittings shall be handled, joined, and installed in accordance with the printed instructions and recommendations of the pipe manufacturer. Joint contact surfaces shall be cleaned immediately prior to joining. Use joint lubricants and joining methods recommended by the pipe manufacturer.

Unless otherwise specified, lay all pipe straight between changes in alignment and at uniform grade between changes in grade. Pipe bedding shall provide uniform and continuous support of the pipe barrel. Excavate bell holes for each pipe joint.

The laying of the pipe shall be in finished trenches free from water or debris. Start pipe laying at the lowest point and install the pipe so that the spigot ends point in the direction of flow to prevent bedding material from entering the joint. After each pipe has been brought to grade, aligned, and placed in final position, deposit and shovel slice or spade bedding material under the pipe haunches. No wedging or blocking to support the pipe will be permitted.

Every precaution shall be taken to prevent foreign material from entering the pipe during installation. No debris, tools, clothing, or other materials shall be placed in the pipe. Whenever pipe laying is stopped, the open end of the pipe shall be closed with an end board closely fitting the end of the pipe to keep sand and earth out of the pipe. The end board shall have several small holes near the bottom to permit water to enter the pipe and prevent flotation in the event of flooding of the trench.

1.05 TESTING

The pipe shall be tested with low pressure air in accordance with ASTM C828. Wyes shall be plugged during test. Any newly installed or replaced sewer lateral along the pipe shall also be tested by setting the plug at the cleanout location. Tests shall be made in the presence of the Contractor and the Engineer.

If the pipe fails the air test, the Contractor shall locate the source(s) of the leak and repair the defect(s) or relay the pipe, as necessary. The pipe shall then be retested until a satisfactory result is obtained.

Despite any previous testing, any leaks developed before the end of the 1-year guarantee period shall be expeditiously repaired by the Contractor at no expense to the City.

1.06 CLEANING AND VIDEO INSPECTION

After installation, pipe and structures shall be cleaned and video inspected in accordance with the Project Specifications and Section 2739, "Cleaning and Video Inspection of Sewer Pipe" of these Standards. The Contractor shall repair all defects or relay the pipe, as necessary.

END OF SECTION

**SECTION 2733
POLYVINYL CHLORIDE SEWER PIPE**

1.01 SCOPE

This section covers installation of new polyvinyl chloride sewer pipe (PVC) for spot repairs to match existing pipe. Pipelines shall be as specified herein and installed at the locations shown on the Drawings.

1.02 SUBMITTALS

The Contractor shall submit for approval by the Engineer the following information:

- A. Manufacturer's literature on the materials identified below. Literature shall include recommended installation procedures.
- B. Certification by the manufacturer that all pipe and fittings furnished under this specification were manufactured, sampled, tested, and inspected in accordance with the specified standards. The date the pipe was manufactured shall be included in the Certification.

1.03 MATERIALS

Sewer pipe and fittings shall meet the following minimum requirements.

A. PVC Pipe & Fittings:

- 1. PSM SDR 26 PVC Sanitary sewer pipe that meets the requirements of ASTM D3034. Pipe shall have elastomeric gasket joints that are oil resistant and conform to ASTM F477. (For 4 to 12 inch pipes).
- 2. AWWA C900, PR 200, DR 14 (for 4 to 12 inch pipes) unless noted otherwise on the Drawings.
- 3. AWWA C905, PR 235, DR 18 (for 14 inch or larger pipes) unless noted otherwise on the Drawings.

- B. Couplings:** Double Bell Union (Standard). Double bell PVC unions shall be used to connect two plain end PVC pipes of the same OD. Ductile or cast double bell unions utilizing mechanical joints shall be used to connect to ductile iron or cast iron pipe.

PVC pipe and fittings shall be manufactured in a one piece mold with injection PVC compound conforming to ASTM D1784, class 12454 B. Bells shall conform to ASTM D3139 as measured in accordance with ASTM D2122 and gaskets shall conform to ASTM F477.

All PVC pipes shall be white or green. Contractors shall mark all PVC pipes with 3"-wide (minimum) green color marking tape 12" above pipes which says 'Sewer Pipe' across the length of the pipes. Each length of polyvinyl chloride pipe and each PVC fitting shall be marked with:

- 1. The nominal size and OD base.
- 2. PVC.
- 3. Dimension ratio number (for example, DR14).
- 4. The AWWA pressure class or rating (for example, PC200 or PR 200). (If applicable)
- 5. The AWWA designation number (for example, AWWA C900). (If applicable)
- 6. The manufacturer's name or trademark and production record code.

1.04 JOINING AND INSTALLATION

Pipe and fittings shall be handled, joined, and installed in accordance with the printed instructions and recommendations of the pipe manufacturer. Joint contact surfaces shall be cleaned immediately prior to joining. Use joint lubricants and joining methods recommended by the pipe manufacturer. Lubricant used for field assembly of gasketed PVC pipe shall have no detrimental effect on the gasket, joint, fitting or pipe.

Unless otherwise specified, lay all pipe straight between changes in alignment and at uniform grade between changes in grade. Pipe bedding shall provide uniform and continuous support of the pipe barrel. Each length of pipe shall be laid on compacted, standard bedding material as specified and shall have full bearing for its entire length between bell holes excavated in said bedding material to allow for unobstructed assembly of all bell and spigot joints. Do not insert pipe past the reference mark. Stabbing, swinging-in, or popping-on spigot ends of pipe into bell ends will not be permitted. After jointing is accomplished, all annular spaces between pipe and bell holes shall be packed with bedding material, taking care not to damage, move, or lift the pipe from its bedding support.

The laying of the pipe shall be in finished trenches free from water or debris. After each pipe has been brought to grade, aligned, and placed in final position, deposit and shovel-slice or spade bedding material under the pipe haunches. No wedging or blocking to support the pipe will be permitted.

Every precaution shall be taken to prevent foreign material from entering the pipe during installation. No debris, tools, clothing, or other materials shall be placed in the pipe. Whenever pipe laying is stopped, the open end of the pipe shall be closed with an end board closely fitting the end of the pipe to keep sand and earth out of the pipe. The end board shall have several small holes near the bottom to permit water to enter the pipe and prevent flotation in the event of flooding of the trench.

Where the pipe connects with the outside face of a manhole wall or the wall of any other structure, a pipe joint or coupling shall be provided a maximum of 12" from the face of the wall such that slight flexibility or motion can take place in or near the plane of the wall face.

All PVC pipe entering or leaving a concrete structure shall have a rubber sealing gasket, as supplied by the pipe manufacturer, firmly seated perpendicular to the pipe axis, around the pipe exterior and cast into the structure base or centered in the manhole wall as a water stop. The water stop shall be firmly fitted around the pipe exterior. Said water stop may also consist of a manhole coupling with rubber sealing rings cast into the structure base.

1.05 DEFLECTION

The inside diameter of an installed section of flexible pipe shall not be allowed to deflect more than five (5%) percent. All PVC solid wall flexible pipe shall be checked by means of a pipe deflection gauge in the presence of the Engineer after the placement of all trench backfills, aggregate subbase (if specified) but prior to installation of aggregate base and/or asphalt concrete. The deflection standard will also be applied to installed pipelines prior to the expiration of the 12-month warranty period.

The pipe deflection gauge shall be fabricated to permit passage through installed sections of pipelines within the specified tolerances for the applicable plastic pipe and the maximum deflection set forth herein. The pipe deflection gauge shall have at least 9 legs, and the number of legs shall be odd. Any section or sections of plastic pipe that does not permit deflection gauge passage will not be accepted and said section or sections shall be properly repaired or replaced and rechecked as directed by the Engineer. Re-rounding through the use of a vibratory machine will not be permitted.

1.06 TESTING

The installed pipe shall be tested with low pressure air in accordance with ASTM C828. Test shall be made in the presence of the Contractor and the Engineer. If the pipe fails the air test, the Contractor shall locate the source(s) of the leak and repair the defect(s) or relay the pipe, as necessary. The pipe shall then be retested until a satisfactory result is obtained. Despite any previous testing, any leaks developed before the end of the 1-year guarantee period shall be expeditiously repaired by the Contractor at no expense to the City.

1.07 CLEANING AND VIDEO INSPECTION

After installation, pipe and structures shall be cleaned and video inspected in accordance with Section 2739, "Cleaning and Video Inspection of Sewer Pipe." The Contractor shall repair all defects or relay the pipe, as necessary.

END OF SECTION

**SECTION 2735
POLYETHYLENE SEWER PIPE**

1.01 GENERAL

A. Scope: This section covers the installation of new high density polyethylene sewer pipe (HDPE) by pipe bursting. Pipe shall be as specified herein and shall be installed at the locations, and using the methods, indicated on the Drawings.

B. General Bid Requirements (for CIP Projects containing Pipe Bursting)

- 1. Qualifications of Bidders:** All pipe-bursting work shall be performed by an experienced contractor or subcontractor who meets the following qualification:
 - a. The contractor or subcontractor shall have completed at least three projects in the last five years, involving pipe-bursting installation of a combined total of 20,000 feet or more of 8 to 22 inches (O.D. of new pipe) pipes in diameter.
 - b. The contractor or subcontractor shall have completed projects involving pipe-bursting installation of a combined total of 5,000 feet or more of 24 inches (O.D. of new pipe) or larger pipes in diameter. (Note: This requirement is only applicable for project scope involving 24" or larger pipes.)
 - c. The project on-site superintendent and/or on-site foreman shall each have at least 10,000 feet and three years experience involving pipe-bursting installation on 8 inches (O.D. of new pipe) or larger pipes. The on-site superintendent and/or on-site foreman shall not be removed or replaced from the project without written permission from the City. The replacement person shall also meet the required qualification.

The following data shall be submitted, using the City-provided form #2735-1 (use multiple sheets if necessary), with the bid:

Contractor/Subcontractor Pipe-Bursting Experience

- Name of Contractor and/or Subcontractor.
- Name of project and year of construction.
- Project location and project dollar amount.
- Owner, owner contact, and phone number.
- Total footage and size of pipe-bursting experience as described above for 8 to 22 inch (O.D. of new pipe) pipe.
- Total footage and size of pipe-bursting experience as described above for 24 inch (O.D. of new pipe) or larger pipe. (Note: This requirement is only applicable for project scope involving 24" or larger pipes.)

The following data shall be submitted, using the City-provided form #2735-2 (use multiple sheets if necessary), with the bid:

On-site Superintendent and/or Foreman Pipe-Bursting Experience

- Full name.
- Years of pipe-bursting experience.
- Name, location, year, owner, owner contact information of the referenced project(s).
- Total footage of pipe-bursting experience on 8 inch or larger pipe.

2. **Patents:** The Contractor shall assume all costs arising from the use of any pipe-bursting patented materials, equipment, devices, or processes used on or incorporated in the work, and agrees to indemnify and save harmless the City of Palo Alto and its employees, and their duly authorized representatives, from all suits at law, or actions of every nature for, or on account of the use of any patented materials, equipment, devices, or processes.

The City's purchasing manager in conjunction with the City's project manager shall determine whether the Contractor that is otherwise the lowest responsive bidder, meets the experience and qualification criteria and shall notify the Contractor in writing of a determination that it does not meet the criteria. The Contractor may dispute this determination by delivering written notice to the city's purchasing manager within 5 business days of receipt of the City's notice of disqualification. The determination shall be final if the Contractor does not submit a notice requesting a hearing within this time period. The notice shall request a hearing and set forth the grounds on which the Contractor disputes the City's determination. Upon receipt of the Contractor's notice an informal hearing shall be scheduled with the City Manager or designee at which the Contractor will be given the opportunity to present information and the reasons for disputing the determination that it does not meet the qualification and experience criteria. The decision of the City Manager or designee shall be final.

1.02 SUBMITTALS

The Contractor shall submit for approval by the Engineer the following information:

- A. Manufacturer's literature on the materials and equipment identified below.
- B. 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 F714-85. Certification shall be signed by an authorized agent of the manufacturer. A report of test results shall be furnished if requested by the Engineer. The date the pipe was manufactured shall be included in the Certification.
- C. Fusion Certifications by City of Palo Alto – provide names and copies of cards issued to all operators.
- D. Access pit locations.

1.03 MATERIALS AND EQUIPMENT

Sanitary sewer materials shall meet the requirements of this section and Section 2737 Sanitary Sewer Lateral and Section 2300 Polyethylene Pipe Installation for Water, Gas, Wastewater Standard Specifications.

- A. **Service Saddles:** All service saddles shall be electrofusion type saddles by Central, Frialen by Friatec, or approved equal.
- B. **Pipe Bursting Materials:** The pipe shall contain no recycled compound except that of which is generated in the manufacturer's own plant from resin of the same specification, from the same raw material type.
- C. **Pipe and Fittings:** SDR-17 Extra High Molecular Weight, High Density Polyethylene PE 4710, Cell Class PE45574C/E (inner wall shall be white or light in color) per ASTM D3350 in IPS sizes. Performance Pipe "DriscoPlex 4100" or approved equal.

The pipe shall contain no recycled compound except that of which is generated in the manufacturer's own plant from resin of the same specification, from the same raw material type.

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

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

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 SDR17 (inches)
3	3.5	0.206
4	4.5	0.265
5	5.563 5.375	0.327 0.316
6	6.625	0.390
7	7.125	0.419
8	8.625	0.507
10	10.75	0.632
12	12.75	0.750
13	13.375 13.386	0.787
14	14.00	0.824

TABLE 1		
Nominal Size (inches)	Nominal OD (inches)	Minimum Wall Thickness SDR17 (inches)
16	16.00	0.941
18	18.00	1.059
20	20.00	1.176
22	22.00 21.50	1.294
24	24.00	1.412
26	26.00	1.529
28	28.00	1.647
30	30.00	1.765
32	32.00	1.882
34	34.00	2.000
36	36.00	2.118
42	42.00	2.471

D. Pipe Markings

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, the nominal pipe size in inches, the dimensional ratio, and the manufacturer's code identifying the resin manufacturer, lot number, and date of manufacture. All sewer pipes shall have a white or light gray interior and have an exterior color of either black or gray. Additionally, the exterior pipe shall be color identified by three (3) dual longitudinal green stripes. The pipes shall be properly stored and handled in accordance with the manufacturer's recommendations and shall be less than two (2) years old at the time of installation.

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, and date of manufacture.

- E. Electrofusion Couplings:** Electrofusion couplings shall be manufactured by Central, Frialen by Friatec, or approved equal.

F. Equipment

Butt Fusion Machine: McElroy Manufacturing, Inc. or approved equal.

Electrofusion Machine: Central, Friatec, or approved equal.

External and Internal Bead Removers: McElroy Manufacturing, Inc. or approved equal.

Pulling or Pushing Head: Driscopipe, Plexco or approved equal.

1.04 JOINING AND INSTALLATION

Pipe Bursting

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

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

The minimum length of each access pit as measured at the bottom of trench shall be determined by the formula, $\text{Length} = (12 \times \text{Outside Diameter of the liner in feet}) + (2.5 \times \text{Depth of the trench in feet})$.

2. **Joining:** Pipes shall be joined to one another and to plastic fittings by thermal butt-fusion, in accordance with ASTM D2657, or by automatic electrofusion. Operators of fusion equipment must pass qualification testing by the City of Palo Alto Utilities Department prior to performing any fusion work. Time and temperature of fusion shall be per the manufacturer's recommendation. Weld on flanges may be used to join pipes in access pits if approved by the Engineer. Joints shall be stronger than the pipe itself, be properly aligned, and contain no gaps or voids. Bead projections on the inside of the pipe shall be removed. No rubber couplings are allowed on mainlines, unless approved by the Engineer.
3. **Insertion of the new pipe:** The pipe shall be supported on rollers throughout its entire length during insertion. Dragging of the pipe along the ground during insertion will not be permitted.
4. **Pipe Bursting:** All sharp edges shall be removed from the exposed pipe opening. The Contractor shall also expose the main at every lateral connection to a depth equal to 1 x the outside diameter of the main under the invert of the existing main to allow free movement of the bursting head. The maximum length of each pull shall be limited to the distance between two manholes or 500', whichever is lesser.

If a manhole at one end of the pull is not intended to be disturbed, the Contractor shall use the appropriate equipment utilizing a hydraulic or pneumatic head to pull into a manhole without disturbing the surrounding area of the manhole.

The pipe bursting tool shall make a tunnel along the path formerly occupied by the old sewer and shall install the new pipe by pulling, pushing, or a combination of both. The pipe-bursting tool shall be of the type and size recommended by the tool manufacturer for the size of pipe being burst and for the ambient ground conditions. For pipe diameters greater than 16", use lubricating fluids, bentonite, or polymer slurry, injected behind the bursting head, to minimize pipe friction.

When the tool is pulled along the existing pipe, the pipe shall be broken up into small fragments and these fragments driven into the surrounding pipe zone. The tool shall then install the new pipe by pulling it into place. If existing soil conditions prove too difficult to pipe burst through, requiring a "pre-burst" operation prior to starting the pipe bursting, Contractor shall install the main by open cut method.

The new sewer pipe shall be installed in a straight horizontal and vertical line with the invert of the new sewer pipe matching the invert of the existing sewer at the exit of the upstream manhole and the entrance into the downstream manhole regardless of the size and alignment of the existing pipe.

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

A minimum of three working days prior to pipe bursting mains or laterals, the Contractor shall pothole, at minimum, all utility mains crossing the pipe bursting alignment where the invert of the pipe being burst is 6 feet deep or less. In addition, Contractor shall pothole crossings with ACP water mains and primary electric lines where the pipe invert is 8-1/2 feet deep or less.

Potholed utility mains shall be fully exposed during pipe bursting to create a 6 inch (minimum) void space all around crossing main. Void space shall extend 1 foot on each side of pipe bursting (2 feet on either side for ACP water mains). The contractor is responsible for all costs resulting from damage to utilities during pipe bursting operations.

The upsizing method shall not cause excessive disruption to the above ground terrain or improvements except for at the launching and receiving pits.

5. **Service Connections:** After the pipe has been pulled into place and allowed to relax, the Contractor shall reconnect all active lateral connections to the new liner. All existing services shall be reconnected within 24 hours after the liner has been pulled into place.

Electrofusion saddles shall be installed per Utility Standard Details for service connections.

1.05 TESTING

- A. Air pressure setup shall be in accordance with ASTM F1417, Constant Pressure Method. The pipe shall be tested with low pressure air at 3.5 psi for 5 minutes with NO pressure loss. Wyes shall be plugged during test. Tests shall be made in the presence of the Contractor and the City Engineer or Inspector.
- B. If the pipe fails the air test, the Contractor shall locate the source(s) of the leak and repair the defect(s). The pipe shall then be retested.
- C. TV Inspection: After passing the air test, both laterals and mains shall be CCTV per Section 2739, Cleaning and Video Inspection of Sewer Pipe.
- D. Any pipe defects identified before the end of the 1-year guarantee period shall be expeditiously repaired by the Contractor at no expense to the City.

1.06 CLEANING AND VIDEO INSPECTION**A. Initial Cleaning and Video Inspection**

The existing sewer laterals and mains shall be cleaned and video inspected in accordance with Section 2739, "Cleaning and Video Inspection of Sewer Pipe." The Contractor shall verify location of active lateral connections at this time.

B. Final Cleaning and Video Inspection

After installation, pipe and structures shall be cleaned and video inspected in accordance with Project Specifications and the current Standards for Water Gas and Wastewater. Where defects are found, the Contractor shall repair all defects at no additional cost to the City.

END OF SECTION

PIPE-BURSTING (PB) CONTRACTOR / SUBCONTRACTOR EXPERIENCE

(use multiple sheets if necessary)

		Project 1				Project 2			
Name of Contractor / Subcontractor									
Name of Pipe-Bursting Project									
Project Location									
Project Dollar Amount		\$				\$			
Year of Construction									
Owner of Project									
Owner Contact and Phone Number		Name: Phone Number:							
Pipe-bursting into Manhole involved (YES OR NO)									
Size and Footage of Pipes (8-22" Ø)		Size:	Feet:	Size:	Feet:	Size:	Feet:	Size:	Feet:
Size and Footage of Pipes (≥ 24" Ø)		Size:	Feet:	Size:	Feet:	Size:	Feet:	Size:	Feet:
Bypass-pumping Capacity (MGD)		MGD		MGD		MGD		MGD	

	Project 3				Project 4			
Name of Contractor / Subcontractor								
Name of Pipe-Bursting Project								
Project Location								
Project Dollar Amount	\$				\$			
Year of Construction								
Owner of Project								
Owner Contact and Phone Number	Name: Phone Number:							
Pipe-bursting into Manhole involved (YES OR NO)								
Size and Footage of Pipes (8-22" Ø)	Size:	Feet:	Size:	Feet:	Size:	Feet:	Size:	Feet:
Size and Footage of Pipes (≥ 24" Ø)	Size:	Feet:	Size:	Feet:	Size:	Feet:	Size:	Feet:
Bypass-pumping Capacity (MGD)	MGD			MGD			MGD	

PIPE-BURSTING (PB) SUPERINTENDENT AND/OR FOREMAN EXPERIENCE (use multiple sheets if necessary)

On-site Superintendent Qualification

Name of On-Site Superintendent						
Years of Pipe-Bursting Experience	Years					
	Project 1	Project 2	Project 3			
Name of Pipe-Bursting Project						
Project Location						
Year of Construction						
Owner of Project						
Owner Contact and Phone Number	Name:					
	Phone Number:					
	Size:	Feet:	Size:	Feet:	Size:	Feet:
Size and Footage of Pipes (≥ 8" Ø)						

On-site Foreman Qualification

Name of On-Site Foreman						
Years of Pipe-Bursting Experience	Years					
	Project 1	Project 2	Project 3			
Name of Pipe-Bursting Project						
Project Location						
Year of Construction						
Owner of Project						
Owner Contact and Phone Number	Name:					
	Phone Number:					
	Size:	Feet:	Size:	Feet:	Size:	Feet:
Size and Footage of Pipes (≥ 8" Ø)						

**SECTION 2736
CURED-IN-PLACE PIPE (CIPP)**

1.01 GENERAL**A. Scope**

This section covers the installation of cured-in-place pipe (CIPP) rehabilitation of existing sewer pipe. The cured pipe shall be as specified herein and installed at only the locations approved by the engineer and shown on the Drawings.

B. General Bid Requirements:

1. The Contractor, or his/her CIPP Sub-contractor, shall clean and remove all debris, including any degree of root infiltration, using the recommended cleaning method for pipe cleaning as specified in Section 2739, to return host pipe back to CIPP manufacturer's recommended parent host pipe condition for installation of CIPP lining.
2. The Contractor, or his/her CIPP Sub-contractor, shall repair and/or prepare host pipe using methods recommended by the CIPP manufacturer, not limited to chemical grouting or sectional pipe spot repair.
3. The Contractor and his/her CIPP Sub-contractor, must factor in ambient conditions which may affect properties related to the CIPP materials, such as site and weather conditions during installation. Scheduling of CIPP material procurement, proper and feasible accessibility of CIPP on-site mobilization and understanding of proper handling of uninstalled CIPP material properties on site may affect the CIPP installation. Supplier scheduling, material procurement and site assessment responsibilities shall be factored into the proper CIPP installation process.
4. 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.
5. The Contractor, or his/her CIPP Sub-contractor, shall be properly licensed and trained to a cured-in-place pipelining process having of a combined total of 20,000 lineal feet of successful installation in the United States within the last two (2) years, in pipelines ranging from 8 to 48 inches. Documentation of the licensing and details of two (2) years minimum training of the on-site superintendent and foreman of the Contractor, or his/her CIPP Sub-contractor, performing the actual installation, shall be submitted, using the City-provided forms #2736-1 and #2736-2 (use multiple sheets if necessary), with the Bid.

C. Process Description

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 ultra-violet light 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 from

manhole to manhole, and shall provide a structurally sound, jointless, tight-fitting, watertight pipe within a pipe.

D. References

The following documents form a part of these specifications to the extent stated herein and shall be the latest edition thereof.

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 D 2990	Tensile, Compressive, and Flexural Creep and Creep-Rupture of Plastics
ASTM D 3567	Standard Practice for Determining Dimensions of "Fiberglass" (Glass-Fiber-Reinforced Thermosetting Resin) Pipe and Fittings
ASTM D 5813	Cured-in-Place Thermosetting Resin Sewer Pipe
ASTM F 1216	Standard Practice for Rehabilitation of Existing Pipelines and Conduits by the Inversion and Curing of Resin-Impregnated Tube (1991 Revision)
ASTM F 1743	Standard Practice for Rehabilitation of Existing Pipelines and Conduits by Pulled-in-Place Installation of Cured-in-Place Thermosetting Resin Pipe
ASTM F 2019	Standard Practice for Rehabilitation of Existing Pipelines and Conduits by Pulled-in-Place Installation of Glass reinforced Plastic (GRP) Cured-in-Place Thermosetting Resin Pipe (CIPP)
ASTM F 2561	Standard Practice for Rehabilitation of a Sewer Service Lateral and Its Connection to the Main Using a One Piece main and Lateral Cured-in-Place Liner

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

1.02 SUBMITTALS

The Contractor shall submit for approval by the Engineer the following information:

- A. Engineering calculations for the design of the liner thickness. The design calculations shall be checked and approved by a Registered Professional Civil or Mechanical Engineer in the State of

California. Liner design calculations shall be supported by field analysis, technical assumptions, and section 1.03C, Liner Design Criteria, of this specification. Final approval of the design calculations shall be given by the Engineer.

- B. Certification from the installer that all lining materials and resins furnished under this specification were manufactured, samples, tested and inspected in accordance with ASTM F 1216, latest edition, "Standard Practice for Rehabilitation of Existing Pipelines and Conduits by the Inversion and Curing of Resin-Impregnated Tube."
- 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. Independent test laboratory results of field samples taken at locations specified by the Engineer. Prior to construction, the Contractor shall provide the contact information for the third party independent testing laboratory for approval.
- G. The beginning and end of the pipe lining shall be cut flush at the inlet and outlet points in the manhole. The ends shall be sealed to the rehabilitated pipeline. The sealing material shall be compatible with the pipe liner and shall provide a watertight seal.
- H. Air test service connection for water tightness after the main has been installed. Contractor shall provide test process submittals for all sewer lateral connections for reinstatement, based on CIPP manufacturer's recommendations for all active sewer lateral connections (SLC) as specified in Section 1.05..

1.03 MATERIALS

All materials and procedures used in the cured-in-place pipe rehabilitation process shall be equal to or exceed the manufacturer's standards.

- A. **Tube:** The liner tube shall be fabricated to meet performance requirements as specified in section 1.03D, Finished and Cured Liner Properties, of this specification.

Fiber Felt Tube System: 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. The tube shall be free of tears, holes, cuts, foreign materials and other defects and will be subject to inspection by the City.

The finished lining shall consist of an inner plastic coating 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.

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 ensure that the tube will have sufficient length to extend the entire length of run.

B. Resin/Catalyst

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.

Unless otherwise specified or approved by the Engineer, the resin shall be a polyester system for typical residential sewage and shall be able to meet the service conditions specified for the tube system. For commercial, industrial, or other areas with a potential for sewage that affects polyester, epoxy or vinyl ester resin shall be required as determined by the City.

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 1.03D, Finished and Cured Liner Properties. The installer shall provide qualified field personnel to ensure acceptable installation workmanship.

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.

C. Liner Design Criteria

The Cured-In-Place Pipe thickness shall be calculated and designed upon the following physical conditions of the existing host pipe and per ASTM F1216, Appendix X.1:

1. All pipes shall be considered fully deteriorated.
2. 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.
3. Pipes in good condition shall have a minimum of two percent (2%) ovality in the circumference. A higher value of ovality shall be used if the pipe is deteriorated.
4. Factor of safety (N) of 2.0 shall be used for calculations.

Conditions 1 and/or 2 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) and/or tested product values.

D. Finished and Cured Liner Properties

The finished cured-in-place pipe liner shall be white or light gray, 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 one (1) hour per day exposure to five percent (5%) 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. 0% shrinkage allowed.

The cured-in-place pipe system shall conform to and comply with the requirements above, and meet or exceed 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	5,500 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 -lb/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

¹Stiffness factor shall be determined in accordance with ASTM D2412.

²Safety factor not included.

1.04 CURED-IN-PLACE PIPE (CIPP) LINER – MAIN INSTALLATION

The Contractor's operations to furnish and install the lining shall be in strict conformance with the component materials and manufacturer's recommendations. The procurement of the CIPP liner, ambient temperatures, weather, site accessibility and conditions, and mobilization to the project location are to be considered when the Contractor or subcontractor schedules their sequence of work and the quality of the

The host pipeline shall be cleaned and televised prior to CIPP installation. Any debris or root balls encountered will require the use of the appropriate cleaning method for their removal to bring the host pipe to be within the parameters recommended for CIPP installation. Where structural defects are present, the Contractor shall perform chemical grouting or, point repairs to the pipe. All protruding laterals encountered during the pre-installation inspection shall be trimmed to be flush with the pipe interior as practicable.

The Contractor or their CIPP subcontractor shall consider ambient temperatures, weather, and site conditions which may affect physical or chemical properties of the CIPP liner when scheduling work. 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.

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 sealing material compatible with the liner shall be installed at the entrance to each manhole between the tube and the existing pipe to provide a watertight seal.

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.

During the curing process, the Contractor shall keep logs, charts and/or graphs of the liner temperatures at the upstream and downstream manholes to ensure that proper temperatures and cure times have been achieved. These documents may be requested by the Engineer at any time during and after the curing process.

Immediately after curing of the tube and after the City's acceptance of the hydrostatic exfiltration testing, The Contractor shall proceed with the reestablishment of active wastewater connections to the main in conformance with Section 2736, 1.05 "Reinstatement of Sewer Laterals".

1.05 REINSTATEMENT OF SEWER LATERALS

Following the approval of the hydrostatic exfiltration test on the sanitary main, the Contractor shall reinstate all active sewer lateral connections (SLC) within 24-hours. The SLC is the interface between the sewer lateral and the sewer main. All SLC's shall be exposed without excavation using a City-approved remote-controlled cutting device. A backup remote-controlled cutting device shall be kept on-site in case of malfunction. Where a SLC cannot be reestablished using a remote-controlled cutting device, the Contractor shall notify the Engineer and request approval to open-cut and reinstate the SLC.

When the SLC is exposed, the invert of the sewer lateral shall match the bottom of the reinstated lateral opening. After exposing all active SLC's, the Contractor shall perform CCTV inspection of the main and laterals to locate damage or leaks. Laterals shall be inspected at a minimum of 16-inches beyond the SLC.

Any infiltration found during CCTV-inspection shall be addressed by a SLC sealing system requested by the Engineer. Any roots, protrusions, or debris found that will interfere with the SLC sealing method shall be removed by the Contractor. If the inspection reveals an obstruction cannot be removed by conventional sewer cleaning equipment, the Contractor shall be required to make a point repair to excavate and remove the obstruction. The Contractor shall notify the Engineer prior to the commencement of work.

When required, the Contractor shall divert sewage around section or sections of mainline pipe where the SLC sealing is located. The wastewater lateral requiring a SLC sealing system shall be inactive during the time of installation.

The SLC sealing method employed by the Contractor shall be one of the following methods and be compatible with the main CIPP lining system.

A. Chemical Grout:

The lateral connection shall be sealed if the lateral connection does not pass the air test or infiltration is visible. The Contractor shall use pressure inject chemical grout through a lateral packer into the annular space between the lateral grouting plug and the lateral pipe.

Upon complete application of the chemical grout, the Contractor shall complete an air test. If the SLC fails the air test, the Contractor shall repeat the grouting procedure at no additional cost to the City.

Where grout blockage exists from grouting operations, the Contractor shall clear the lateral at no additional cost to the owner.

B. Full-Wrap or "T-Style":

The sealing material shall consist of a cured-in-place resin saturated felt tube that provides a full-wrap tube in the mainline centered at the SLC with the tube extending at least 4-inches into the lateral.

Installation shall conform to Section 7 of ASTM 2561. The installation method shall provide an air-tight seal of the SLC sealing system to the mainline pipe and SLC. Prior to installation, the felt tube shall be saturated with resin at the Work site and stored at the temperature specified by the resin manufacturer. After installation, the felt tube shall be cured as specified by the resin manufacturer. The SLC sealing tube for the lateral shall extend a minimum of 4-inches from the mainline to the lateral.

After installation is complete and the SLC seal has cured, the Contractor shall perform adhesion testing in conformance with Section 2736, Section 1.06 C. The Contractor shall also perform an air pressure test on the cured SLC sealing system in accordance with Section 2736, Section 1.06 D and submit all passing test results

C. "Brim Style":

The sealing material shall consist of cured-in-place resin saturated fiberglass or felt material that provides a brim section in the mainline with the brim centered around the SLC with a tube section extending into the lateral. The length of the tube extending into the lateral shall be a minimum of 4-inches from the mainline.

The fiberglass or felt material and tube shall be saturated with resin at the Work site and stored at the temperature specified by the resin manufacturer. The resin saturated SLC sealing system shall be loaded on an applicator apparatus, attached to a robotic device and positioned in the mainline at the SLC to be sealed.

The robotic device shall be equipped with a CCTV camera which shall be used to align and center the SLC sealing system within the lateral opening. The applicator apparatus shall include a bladder or an approved mechanical device of sufficient length in the mainline and lateral such that the inflated bladder or approved mechanical device extends beyond the end of the SLC seal.

The insertion pressure shall be adjusted to fully deploy the SLC sealing system in the lateral and hold the ends of the SLC seal ends against the pipe walls. The SLC sealing system shall produce a smooth transition between the SLC seal and the pipe walls without a ridge or gap between the SLC seal and the inner diameter of the mainline and the lateral. Insertion pressure shall be maintained for the duration of the curing process. Curing shall be as specified by the resin manufacturer.

After installation is complete and the SLC seal has cured, the Contractor shall perform adhesion testing in conformance with Section 2736, Section 1.06 C. The Contractor shall also perform an air pressure test on the cured SLC sealing system in accordance with Section 2736, Section 1.06 D and submit all passing test results.

1.06 TESTING

- A. Hydrostatic Exfiltration Test:** The Contractor shall perform a hydrostatic exfiltration test on the main after the inversion and curing of the liner but before the reinstatement of the laterals. This test shall be performed to determine if the liner installation is watertight. This test shall be performed in conformance with ASTM F1216. The test shall be conducted for a minimum of one (1) hour.
- B. Pipe Samples Testing:** The Contractor shall prepare a minimum of one (1) CIPP sample for testing for inversion in accordance with ASTM F1216 and ASTM F1743. Sample(s) shall conform to the following two methods:
1. For host pipe diameters 18" and smaller, the sample should be cut from a section of cured CIPP at an intermediate manhole or at the termination point that has been inverted through a like diameter pipe which has been held in place by a suitable heat sink, such as sandbags.
 2. For host pipes larger than 18" in diameter, the sample should be fabricated from material taken from the tube and the resin/catalyst system used and cured in a clamped mold placed in the down tube.

The samples for each of these cases should be large enough to provide a minimum of three specimens. The samples shall be tested by a certified independent third party testing laboratory by the Contractor. The lab shall provide the Engineer for approval with certified test results. The following test procedure shall be performed after the sample is cured and removed:

1. Short-Term Flexural (Bending) Properties – The initial tangent flexural modulus of elasticity and flexural stress shall be measured for gravity and pressure pipe applications in

accordance with ASTM D790 and should meet the short-term flexural modulus and flexural strength values used in the thickness designs of the CIPP previously submitted.

2. Wall thickness at any point shall not be less than 87.5% of the design thickness.
- C. **Lateral Chemical Grout Sealing Air Pressure Test:** The joint testing pressure shall be equal to 0.5 psi per vertical foot to top of pipe depth plus 2 psi. Test pressures shall not exceed 10 psi without approval of the Engineer. If pressure drop is found to be greater than 2 psi within 15 seconds, the application of grout shall be considered unsuccessful and the Contractor shall repeat the grouting procedure and air testing procedure at no additional cost to the City.
- D. **SLC Sealing System Adhesion Testing:** The adhesion testing shall be conducted after the SLC seal has cured in accordance with the manufacturer's specifications, but before the final video inspection is performed. Adhesion testing shall consist of inserting a high velocity, hydraulic cleaning type, 360-degree spinning nozzle and CCTV camera in the mainline pipe and position the nozzle at the SLC seal. The water from the nozzle shall be directed downstream for a minimum of 1 minute, at each edge of the SLC seal in the mainline at the minimum pressure of 1,500 pounds per square inch and a minimum flow rate of 65 gallons per minute.
- E. **SLC Sealing System Air Pressure Test:** The cured SLC sealing systems shall be air pressure tested. Test plugs shall be placed upstream and downstream of the SLC sealing system in the mainline and, upstream of the SLC sealing system in the lateral. The test pressure shall be 4 pounds per square inch of a 3-minute test time during which the pressure shall not drop below 3.5 pounds per square inch. If the SLC sealing system fails this test, the test plug at the upstream end of the lateral may be moved onto the SLC opening and the test conducted again. If the second test passes, the SLC sealing system will be deemed to have passed the test.

1.07 CLEANING AND VIDEO INSPECTION

A. Initial Cleaning and Video Inspection

The existing sewer shall be cleaned and video inspected in accordance with Section 2739 of these Specifications. The Contractor shall verify location of active lateral connections at this time.

B. Final Cleaning and Video Inspection

After CIPP lining is complete and the services have been reinstated, the pipe liner and SLC sealing systems shall be cleaned and video inspected in accordance with Section 2739 of these Specifications. The Contractor shall repair all defects at no additional cost to the City.

1.08 WARRANTY AND QUALITY ASSURANCE

- A. The Contractor shall provide to the City a warranty to be in force and effect for a period of two (2) years 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.
- B. Correction of failed liner or liner 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.

- C. The finished liner shall be continuous over the entire length of run between two manholes and shall be free from visual defects such as foreign inclusions, dry spots, pinholes, and delamination. The finished liner shall meet or exceed the requirements of Section 1.03D, Finished and Cured Liner Properties.
- D. Wrinkles in the finished liner pipe which exceed five percent (5%) of the pipe diameter are unacceptable. Where this is visible in CCTV inspection footage, the Contractor shall mill down the wrinkled segment below the spring line to be flush with the internal diameter of the newly installed liner. Additionally, any wrinkles that traverse the invert and impede flow shall be removed. Repair of the removed sections shall be proposed by the Contractor and approved by the Engineer.
- E. 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.
- F. Where SLC sealing systems are installed and fail either the adhesion or the second air pressure test, the Contractor shall be required to remove and replace or repair the SCL sealing system
- G. The Contractor shall be required to perform post-construction CCTV inspection where chemical grout is applied.

END OF SECTION

CURED-IN-PLACE PIPE (CIPP) CONTRACTOR / SUBCONTRACTOR EXPERIENCE
(use multiple sheets if necessary)

Name of Contractor/Subcontractor: _____

	Project 1	Project 2
Name of CIPP Project		
Year of Construction		
Project Location		
Owner of Project		
Owner Contact and Phone Number	Name: Phone Number: Size:	Name: Phone Number: Size:
Size and Footage of Pipes ($\geq 8'' \varnothing$)	Footage:	Footage:

	Project 3	Project 4
Name of CIPP Project		
Year of Construction		
Project Location		
Owner of Project		
Owner Contact and Phone Number	Name: Phone Number: Size:	Name: Phone Number: Size:
Size and Footage of Pipes ($\geq 8'' \varnothing$)	Footage:	Footage:

CURED-IN-PLACE PIPE (CIPP) SUPERINTENDENT AND/OR FOREMAN EXPERIENCE
(use multiple sheets if necessary)

Name of Contractor/Subcontractor: _____

On-site Superintendent Qualification

Name of Superintendent						
Years of CIPP Experience	Years					
	Project 1		Project 2		Project 3	
Name of CIPP Project						
Project Location						
Owner of Project						
Owner Contact and Phone Number	Name:		Name:		Name:	
	Phone Number:		Phone Number:		Phone Number:	
	Size:		Size:		Size:	
Size and Footage of Pipes (≥ 8" Ø)	Footage:		Footage:		Footage:	

On-site Foreman Qualification

Name of Foreman						
Years of CIPP Experience	Years					
	Project 1		Project 2		Project 3	
Name of CIPP Project						
Project Location						
Owner of Project						
Owner Contact and Phone Number	Name:		Name:		Name:	
	Phone Number:		Phone Number:		Phone Number:	
	Size:		Size:		Size:	
Size and Footage of Pipes (≥ 8" Ø)	Footage:		Footage:		Footage:	

**SECTION 2737
SANITARY SEWER LATERAL**

1.01 SCOPE

This section covers installation of sewer laterals. Laterals shall be installed as specified herein and at the locations shown on the Drawings.

1.02 SUBMITTALS

The Contractor shall submit for approval by the Engineer the following information:

- A. Manufacturer's literature on the materials identified below. Literature shall include recommended installation procedures.
- B. Certification by the manufacturer that all pipe and fittings furnished under this specification were manufactured, sampled, tested, and inspected in accordance with the standards specified herein. The date the pipe and/or fittings were manufactured shall also be included in the Certification.

1.03 MATERIALS

Sanitary sewer lateral materials shall meet the requirements of this section, Section 2735 (Polyethylene Sewer Pipe), and Section 2300 (Polyethylene Pipe Installation for Water, Gas and Wastewater).

- 1. **HDPE Pipe:** HDPE, SDR 17, 345434C, D, or E as described in ASTM D3350. The HDPE pipe shall have a white or light gray interior by Performance Pipe "DriscoPlex 4100" or approved equal.
- 2. **Flexible Couplings:** Neoprene flexible, shielded, non-shear coupling made with 300 series stainless steel clamp band, housing, screws, shield and eyelet. Fernco Inc. "PROFLEX", or approved equal. **Note:** All connections shall be made with butt fusion or electrofusion as specified in Section 2735 (Polyethylene Sewer Pipe) and Section 1.04 of this specification. Couplings will only be allowed with prior approval of the Engineer for special circumstances.
- 3. **T Cone Plugs:** Expandable pipe plug with no metal parts by ETCO Specialty Products, Inc., or approved equal.
- 4. **Cleanout Box:** Christy F08 curb valve box with F08C cast iron lid or G05T (for driveways and approaches) with G05CT cast iron lid, or approved equal.
- 5. **Elastomeric Sealant:** High performance, one part, polyurethane sealant. Vulkem 921 by Tremco, or approved equal.

Any pipe, fittings, or appurtenances that do not conform to the above specifications shall be rejected and shall be removed immediately from the work site by the Contractor.

1.04 JOINING AND INSTALLATION

- A. The Contractor is responsible for verifying an existing lateral's horizontal and vertical alignment.
- B. All new laterals shall be installed perpendicular to the main, at uniform slope, and without any changes in lateral horizontal alignment or grade, unless otherwise approved by the Engineer. Pipe bedding shall provide uniform and continuous support of the pipe barrel.

- C. Lateral replacement by pipe bursting is allowed if the existing lateral meets the horizontal and vertical alignment standards and the City-owned portion of the lateral is free of cross-bores. If the existing lateral connection point at the main is more than five feet offset from the cleanout, as measured on the field along the main, the Contractor shall abandon the existing lateral and install a new lateral. The new lateral will be permitted to be installed at an angle to the main to avoid utility conflicts or to establish a higher cleaning velocity. Pipe bursting requirements are specified in Section 2735 Polyethylene Sewer Pipe.
- D. All ACP laterals shall be replaced by open cut.
- E. Pipe and fittings shall be handled, joined, and installed in accordance with the instructions and recommendations of the pipe manufacturer.

1.05 LATERAL CONNECTIONS

A. Lateral Connections to Mains

MAIN MATERIAL	CONNECTION METHOD	STANDARD DETAIL
HDPE	ELECTROFUSION SADDLE	WWD-05 DETAIL C
VCP	CUT IN NEW VCP WYE	WWD-05 DETAIL A
SDR26 PVC	CUT IN NEW PVC WYE	WWD-05 DETAIL A
C900 PVC	STRAPPED RUBBER SADDLE	WWD-05 DETAIL B
PCC / RCP	TAP-TITE OR INSERTA-TEE	WWD-06

1. Upon Engineer's approval, "Tap-tite" or "Inserta Tee" can be used on existing C900 and C905 PVC, SDR26 PVC, and VCP mains 10-inch and larger.
2. Existing PVC and ABS laterals in a condition acceptable to the City shall be reconnected to new HDPE main using Electrofusion Saddle and Flexible Coupling. The assessment of the lateral condition will be performed by CPA Wastewater Operations.
3. Special fittings for connection to sewer liner will be reviewed on a case by case basis.

B. Lateral Connections to Manholes

1. Manholes shall be core drilled in order to connect new laterals to manhole. Hammering of a hole(s) is unacceptable.
2. Lateral crowns (top inside surface of the pipe) shall not be lower than the elevation of the outlet main crown in the manhole, unless otherwise approved by the Engineer.

An appropriate manhole water stop gasket shall be used on all plastic pipe entering manholes. For PVC and HDPE pipe, water stop gasket shall be Newby Rubber, Inc., Mission Rubber, or approved equal.

3. Channel bottoms shall be worked to provide a smooth flowing transition from the new laterals to the outlet channel. See Section 2738 (Precast Concrete Manholes) for outside drop piping requirement.
4. Pipe penetrations shall be sealed with a non-shrink grout.

A. Cleanouts

1. A sanitary sewer cleanout shall be provided in the planting strip or in the case where the sidewalk and curb are integral, at the back of sidewalk.
2. A T Cone Plug shall be used to plug the cleanout. T-Cone Plugs shall not be over tightened. Plugs shall be tightened just enough to hold the plug in place and prevent inflow into the pipe.

B. Inspection: All lateral connections shall be inspected and approved by the Utilities Inspector. Applicants or developers shall schedule the inspection of new lateral connections at least one week in advance.

1.06 SEWER LATERAL ABANDONMENT PROCEDURE

A. Excavate and disconnect the existing lateral at the main.

1. Plug the existing wye or tee with mechanical plug or stopper. Damaged or broken wye/tee connections and all tapped/saddle connections shall be removed and replaced with a new section of pipe in kind.
2. For lined mains (CIPP, deformed and reformed, sliplining), remove the abandoned lateral at the joint of the factory wye or tee, or at the closest joint of the lateral to the main. Install mechanical plug or stopper at wye or tee and at the downstream end of the abandoned lateral. Fill the abandoned lateral with at least 2 feet of CDF at both ends of the abandoned lateral.

B. The cleanout and riser shall be cut and plugged at least 3-feet below the finished grade. In non-paved areas, the voids shall be filled with suitable material compacted to a relative compaction of 90% and concrete plugged. For paved areas, the remaining voids shall be filled with CDF, or other flowable compaction fill and be concrete plugged, and the pavement shall be restored. Where the cleanout is located in sidewalk, curb, or gutter, the surface shall be restored to match existing.

C. Backfill and restore surface paving or landscape per Water, Gas & Wastewater Standards.

D. Abandonment of sewer laterals shall be witnessed by CPA Utilities Inspector.

1.07 TESTING

- A.** The pipe shall be tested with low pressure air in accordance with ASTM F1216, Constant Pressure Method. The pipe shall be tested with low pressure air at 3.5 psi for 5 minutes with NO pressure loss. Wyes shall be plugged during test. Tests shall be made in the presence of the Inspector.
- B.** If the pipe fails the air test, the Contractor shall locate the source(s) of the leak and repair the defect(s) or relay the pipe, as necessary. The pipe shall then be retested until a satisfactory result is obtained, at no expense to the City.
- C.** New laterals and/or reconnected laterals shall be video inspected per Section 2739 Cleaning and Video Inspection of Sewer Pipe.

- D. Despite any previous testing or CCTV inspection, any pipe defects developed before the end of the 1-year guarantee period shall be expeditiously repaired by the Contractor at no expense to the City.

END OF SECTION

**SECTION 2738
PRECAST CONCRETE MANHOLES**

1.01 SCOPE

This section covers the installation of new precast sanitary sewer manholes. Manholes shall be as specified herein and installed at the locations shown on the Drawings.

1.02 SUBMITTALS

The Contractor shall submit for approval by the Engineer the following:

- A. Manufacturer's literature on the materials identified below. Literature shall include recommended installation procedures.
- B. Certification by the manufacturer that all precast sections furnished under this specification were manufactured, sampled, tested, and inspected in accordance with ASTM C 478 or ASTM C 361.
- C. Mix design of the concrete used for the manhole base.

1.03 MATERIALS

The precast concrete manhole materials are as follows:

- A. **Precast Sections:** ASTM C 478. Forterra, Old Castle Precast, or approved equal. For greater than 72-inch ID: ASTM C 361, Class D-25. Flush Bell design, centrifugally spun or wet cast. Ameron, Concrete Pipe & Products, or approved equal.
- B. **Precast Manhole Base:** ASTM C 478. Forterra, Old Castle Precast, or approved equal.
- C. **Sealant:** Ram-Nek, K.T. Snyder Company, Inc., or approved equal.
- D. **Frame and Cover:** Rexus II 24" manhole frame and cover with spring bar lock as manufactured by Pam Saint-Gobain, or approved equal. When manhole lid is located within a traffic lane, the hinge shall be located on the downstream side of the flow of traffic. See standard detail WWD-10 for casting imprint and additional details.
- E. **Concrete:** Section 90 Class II Concrete. CalTrans Standard Specification.
- F. **Mortar:** Section 51-1.02F, CalTrans Standard Specification. Mortar shall be non-shrink as manufactured by Sika, or approved equal.
- G. **Water Stops:** Molded plastic or rubber waterstops by Mission Rubber, Newby Rubber, or approved equal.
- H. **Drop Manholes:** Drop manholes shall be installed whenever a pipe entering a manhole has an invert elevation 30 inches or more above the top of the outlet pipe in the manhole.

1.04 MANHOLE INSTALLATION

Manhole bases shall be poured in a dry trench, using Class 2 concrete. Concrete will be sampled at the Engineer's discretion. Upon Engineer's approval, precast manhole bases may be used on straight runs and terminal manholes only. No field modifications of precast manhole bases shall be allowed.

During the pouring of the manhole base, precautions shall be taken to ensure that the sewer pipes entering and leaving the manhole do not move from the installed alignment and grade. Plugs shall be placed in open pipes to prevent concrete from entering the lines. Water stops shall be used on all plastic pipes entering the manhole to prevent groundwater from leaking through the manhole wall. Water stop shall be molded plastic or molded rubber.

The channels shall be shaped in flowing curves as indicated on the drawings to ensure good hydraulic characteristics for the flow of wastewater. A smooth, clean, hand rubbed finish shall be given to the surfaces of the manhole base and to any joint mortar work. Transitions between different sizes of pipes shall be smooth and regular. Cracks, joints, holes, etc., shall be sealed with Sika or approved equal non-shrink grout or sealing compounds to ensure watertight manholes.

No more than twelve (12) vertical inches of grade rings shall be used to adjust the level of the manhole frame (12 inches maximum between the top of the tapered manhole section and the bottom of the manhole frame). Manholes shall be plumb.

Backfill shall be placed uniformly around the outside of the manhole so as to not create differential forces and the possibility of dislodging the manhole sections.

1.04 NEW MANHOLE TESTING

The Contractor shall conduct an exfiltration test or vacuum test on each manhole constructed. No testing is required on shallow manholes that are 24" or less in depth. The test shall be conducted by the Contractor in the presence of the City Inspector or Engineer.

Exfiltration tests shall consist of plugging incoming and outgoing sewer lines and filling the manhole with water up to the rim. After initial absorption (15 minutes), if the water loss exceeds one inch in depth in five minutes, the manhole shall have failed the test. Each manhole which fails the test shall be carefully inspected to determine the problem and then resealed and retested until the water loss is less than one inch in five minutes.

Vacuum tests shall consist of drawing a vacuum on a sealed manhole and measuring the time for the vacuum to drop to a predetermined level. The actual test procedure shall be provided by the manufacturer of the test equipment and approved by the Engineer. Each manhole which fails the test shall be carefully inspected to determine the problem and then resealed and retested until the manhole passes the vacuum test (3.5 psi for 5 minutes).

1.05 EXISTING MANHOLE REHABILITATION

A. Existing Structures

Contractor shall find, uncover and recover (if required) missing structures as noted on the plans or stated herein. Contractor shall utilize sonde's, TV equipment, metal detectors, excavation equipment, and other equipment needed to locate the sanitary sewer structure. Contractor shall expose and document the location.

B. Seal Manhole

Sealing manhole structures consists of cleaning, filling voids, grouting joints, stopping leaks, and coating the interior of the manhole with a sealer. The sealer shall penetrate the existing concrete and form crystalline structures within the pores of the concrete that will seal the concrete.

1. Patch holes and cracks using Perco Patch by Perco Industries or Patch 'n Plug by Xypex.
2. Stopping leaks shall be done by chemical injection through interior wall of the manhole or rapid-setting cement-based water-stop mortar to stop the infiltration. Chemical injection shall be used per manufacturer's recommendations for the existing site conditions.
3. The seal coating shall be an acrylic modified cementitious coating that is self-curing, suitable for spray or brush application. The seal coating shall be Brush bond as manufactured by Perco Industries or Xypex Concentrate as produced by Xypex.

C. Coat Manhole

Coat manholes with a monolithic ultra high-build epoxy lining to rebuild, eliminate infiltration, provide corrosion protection, and repair voids. Procedures for surface preparation, cleaning, application and testing are described herein. All application procedures shall follow the manufacturer's guidelines and meet the following minimum requirements:

1. Surface Preparation
 - a. Clean Surface – Clean the surface by removing any laitance, dust, unsound, looser, or contaminated material, plaster, oil, paint, grease, corrosion deposits or bacteriological growths. Chemical cleaning aids may be used with water blast equipment, however, Engineer must approve detergents or degreasers proposed by the contractor and must be suitable for the water temperature used in any pressure washer system employed. Where breaking out mortar is not required, roughen the surface and remove any laitance by mechanical means, low-pressure hot water blast (minimum 3500 psi pump pressure at 4 gpm), or high-pressure cold water blast (>5000 psi pump pressure at 4 gpm) with or without sand injection as is appropriate, abrasive (sand) blasting, acid etching and water cleaning, or shotblasting to a sound profile surface. Follow surface cleaning procedures with a soaking rinse of chlorinated water to destroy remaining biologics and neutralize the surface. The chlorine solution shall be rinsed with fresh water after not less than fifteen minutes dwell time. Test the wet surface pH with universal pH indicator paper with a range of pH 0-10, or other suitable test instrument. Acceptable surface pH for epoxy grouting repairs and lining shall be not less than 6 or more than 9.
 - b. Stop Leaks/Fill Voids – Seal leaks with epoxy grout on the surface that is coated. Fill any voids with epoxy patching material or grout according to the manufacturer's recommendations. For flowing or weeping water conditions, rapid setting cementitious "plug" materials may be used instead of epoxy grouts. Exterior injection of a gel type chemical grout shall be used, if necessary.
2. Apply Coating: After the surface is properly prepared to apply the coating, apply the epoxy liner by trowel or spray. The epoxy liner thickness shall be a minimum of 125 mils over the entire surface. Manholes shall be coated from the frame and cover to the pipe in the channel. If the pipe does not go through the manhole, the coating shall extend to at least the springline of the pipe. The applicator shall be certified by the coating manufacturer to apply the coating.

The Contractor shall provide a third part NACE certified inspector to inspect each phase of the work. The inspector shall verify that the surface preparation, coating application, and final product meet the requirements specified herein and the manufacturer's requirements. A manufacturer's representative shall also be available for consultation and site visits, if required by the City.

D. Drill Holes

Drill a hole or enlarge existing hole to 1.25" in diameter through the manhole cover.

E. Modify Channel

Chip and/or rework channels within the manhole to improve the flow through the manhole and to the new pipes and to allow better access for video equipment. Channels shall be chipped to sound material and approximate contour. Chipped areas shall be smoothed out using a cementitious patching material.

F. Frame and Cover

Replace existing frame and cover and reset with a concrete ring as described in the Standard Details.

G. Realign Frame and Cover

Realign existing frame and cover and reset with a concrete ring as described in the Standard Details.

H. Raise Manhole

Add one 48" barrel section up to 3 feet and/or 24" rings up to the 12 inches to raise the manhole's frame and cover to grade, if not noted on the plans or described herein. Reset frame and cover with a concrete ring as described in the Standard Details.

1.06 CONNECTIONS TO EXISTING MANHOLES

Preferred method of connections to existing manholes is core drilling. Hammering of holes is acceptable but limited to a maximum size of sixty-pound jackhammers. A water stop shall be used on all plastic pipe entering manholes. All pipe penetrations shall be sealed with a non-shrink grout. Channel bottoms shall be reworked to provide a smooth flowing transition from the new pipes to the outlet pipe.

1.07 EXISTING MANHOLE TESTING

The Contractor shall conduct a vacuum test on each rehabilitated manhole and/or each manhole in which a new main is connected as part of a capital improvement project. Each test shall be conducted as described in Section 1.05 of this Specification. The test shall be conducted by the Contractor in the presence of the City Inspector or Engineer.

Each rehabilitated manhole which fails the test shall be carefully inspected to determine the problem, resealed as needed, and retested until the manhole passes the vacuum test. For existing manholes in which a new main is connected, Contractor shall test the manhole once the penetration has been sealed, and report back to the City Inspector or Engineer the test results. If the existing manhole fails

the test, the City may direct the Contractor to rehabilitate and retest the manhole as part of additional work.

1.08 MANHOLE ABANDONMENT

Where a manhole is to be abandoned within the street, the Contractor shall break the bottom of the manhole and remove the frame, cover, taper and barrel sections. The manhole shall be filled with 1-1/2 sack slurry. Where a manhole is to be abandoned within native soil, the Contractor shall break the bottom of the manhole and remove the frame, cover, taper and barrel sections and fill the manhole with $\frac{3}{4}$ " gravel up to 3-feet below grade and fill the upper 3-feet with native soil compacted to 95% or better. Pipe connections to the manhole are to be plugged

END OF SECTION

**SECTION 2739
CLEANING AND VIDEO INSPECTION OF SEWER PIPE**

1.01 SCOPE

This section covers the cleaning and video inspection of sewer pipelines and video processing software and equipment. 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 or manhole and on the pipe or manhole inside wall, down to the parent material.

1.02 SUBMITTALS

- A. Contractor shall submit NASSCO PACP and/or LACP certificates, as applicable, for the video operator coding the video.
- B. Each of the Contractor's crews, upon completion of their first 1000 LF, shall submit one copy of the DVD for review and acceptance prior to continuing work.
- C. One copy DVD discs, and download color video and audio information to the City's server of all sewer reaches inspected shall be submitted to the City. Work will not be considered complete until these items have been received and approved by the Engineer.

1.03 PRE-QUALIFICATIONS

Camera Operator Experience: Each camera operator shall have a minimum of 1 year of experience in projects televising sanitary sewer mains and laterals and commenting on observed defects. Each camera technician shall be NASSCO PACP and/or LACP certified.

1.04 MATERIALS**A. Cleaning Equipment**

- 1. HydroJetting
 - a. High-Velocity or Hydro-cleaning Equipment shall be truck mounted for ease of operation. The equipment shall have a minimum of six hundred (600) feet of high pressure hose with a selection of two or more high velocity nozzles. Nozzles shall be capable of producing a scouring action from 15 degrees to 45 degrees in all designated line sizes. The equipment shall carry its own water tank capable of holding corrosive or caustic cleaning or sanitizing chemicals, auxiliary engines and pumps, and hydraulically driven hose reel. All controls shall be located so that the equipment can be operated above ground. Equipment shall include a high-velocity gun for washing and scouring manhole walls and floor. The gun shall be capable of producing flows from a fine spray to a solid stream.
- 2. Mechanical Cleaning
 - a. Rodding Machines – Root cutters and porcupines shall be attached to the winches and be used as necessary to remove roots, grease, and other debris. The attachments shall be suitable for the type of pipe that is being cleaned. A power rodding machine shall be either a sectional or continuous-rod type capable of holding

a minimum of 750 feet (230 m) of rod. The machine shall be fully enclosed and have an automatic safety clutch or relief valve.

- b. Bucket Machines – Bucket machines shall be used in pairs with sufficient power to perform the work in an efficient manner. Machines shall be belt operated or have an overload shutoff device. Machines with a direct drive that could cause damage to the pipe will not be allowed. Bucket machines shall not be used on any host or rehabilitated pipeline that is lined with a plastic pipe or material.
- c. Chemicals – Chemicals made for sanitary sewer use and acceptable to the City's Water Quality Control Plant may be used to remove grease and kill roots.

B. Video Inspection

- 1. Push Camera – The push camera shall have a sonde transmitter. The equipment will be used in a wastewater pipes with an internal diameter of less than six (6) inches. Small diameter push camera shall be able to access building cleanouts that are two (2) inches in diameter.

Both cameras must be able to be traced throughout the entirety of the inspection. The equipment must have the ability to be located above grade using the sonde locator.

The footage counter for each push-camera must be accurate to 0.5 feet per 100 feet over the length of the particular section of pipeline being inspected. At the City's request, the footage counter shall be replaced if the footage counter produces inspection footage that is outside the acceptable accuracy.

The equipment lighting illuminate the entire pipe, but shall not oversaturate the footage of pipe.

- 2. Mainline Camera and Lateral Launch – CCTV system equipment shall include television cameras, a television monitor, cables, power sources, and other equipment. The mainline camera equipment shall include a multi-angle television camera capable of spanning 360 degrees circumference and 270-degrees on the horizontal axis to televise sewer lines 6-inches in diameter or larger; the purpose of the rotating head camera is to view all service connections, upstream and downstream manhole structures, and to locate all defects, as well as questionable problem areas; focal distance shall be adjustable through a range of one (1) inch to infinity. The television camera shall be color format and specifically designed and constructed for operation in connection with sewer inspection and for operation in sewers less than 100% humidity conditions. Lighting and camera quality shall produce a clear, in-focus picture of the entire periphery of the pipe for a minimum distance of six feet. Other required equipment includes television monitor, cables, power sources, lights, and other equipment necessary to do the work. The remote-reaching footage counter shall be accurate to 0.5 feet per 100 feet over the length of the particular section of pipeline being inspected. The camera equipment shall have a sonde transmitter and have the ability to be located above grade.
- 3. Video Processing System – The video processing system shall be the software system Granite XP, as used by the City, or a compatible database format system with ICOMMM that can use the existing generic connector to convert to a Granite XP format. Video format shall be .MP4 and files shall be exported in PACP database format. Contractor shall provide a composite PACP video report that includes comment/defect code and footage with each associated still picture. Verify compatibility with RedZone Robotics (925) 824-3200.

4. Video Codeset – Video codeset shall be PACP 4.2, 4.4, or 6.0 formatted data.

1.05 VIDEO INSPECTION AND CLEANING

For existing wastewater pipelines to be replaced by pipe bursting, the Contractor shall video inspect wastewater pipelines prior to commencing pipe bursting to verify if a cross-bore or sags are present. Refer to Section 2739, 1.05 B Obstructions and Cleaning.

For new wastewater pipelines, post-installation clean and video-inspection shall be performed. New wastewater pipelines are the pipelines installed as a part of the capital improvement project.

A. Video Inspection

1. Wastewater Main Video Inspection – Depth of flow shall not exceed twenty percent (20%) of the inside pipe diameter as measured in the manhole when performing video inspection. In the event the depth of flow of the reach being televised exceeds twenty percent (20%) of the inside pipe diameter, the Contractor shall monitor the sanitary pipes to be inspected to determine video inspection schedule or to provide the necessary flow control or reschedule the inspection for a time when such flow is reduced to permit proceeding with the work. If nighttime work is necessary, the Contractor shall obtain a "Noise Exception Permit" from the CPA Planning & Development Services (285 Hamilton Avenue, Palo Alto, CA 94301).

The video shall start outside the manhole and end inside the end structure capturing video of both structures prior to setting the start footage, and after the footage is stopped. The camera shall be moved through the pipeline in either direction at a uniform rate, stopping when necessary to ensure proper documentation of the sewer's condition. In no case shall the television camera be pulled or propelled at a speed greater than thirty (30) feet per minute. The camera height shall be adjusted such that the camera lens is always centered in the pipe being inspected. The equipment shall have an accurate footage counter, which shall display on the monitor the exact distance of the camera from the centerline of the starting manhole. Unless otherwise approved by the Engineer, footage measurements shall begin at the centerline of the upstream manhole.

The video inspection shall follow PACP and/or LACP formatting that includes the documentation that describes the inspection location and other parameters associated with the inspection. Data of significance includes, but is not limited to, the locations of service connections, types of upstream and downstream manhole structures, and any pipe defects. Footage shall be imbedded in the video (Granite XP) or burned on the video in addition to other footage indicators or recorded events. If the recordings 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-televisé the sanitary sewer and provide a new recording of good quality at no cost to the City. No payment will be made for recordings that do not meet the requirements of these specifications.

2. Wastewater Lateral Video Inspection – Where inspection cannot be completed using a lateral launcher, the Contractor shall use a push camera to complete the inspection. The push camera is inserted at a cleanout and is moved downstream toward the wastewater main.

If branched laterals are encountered, the Contractor shall attempt to locate cleanout of the branched lateral to access for inspection.

If a cleanout is not available, the Contractor may request City-approval to perform push camera inspections through a roof vent. The contractor must provide the appropriate

equipment to perform push camera inspection from the roof vent. This includes ladders, harnesses, and any other equipment required to safely perform the push camera inspection. The Contractor is responsible for any damages occurred during inspection through a roof vent and the safety of their employees. The Contractor shall not enter the property of the occupant nor access the roof vent without the presence of the City Inspector.

B. Obstructions and Cleaning

Where an obstruction such as roots, debris, deposits, fat, oil or grease is encountered and prevent the camera inspection equipment from capturing complete footage of the wastewater pipe, the Contractor shall perform high-velocity hydraulic cleaning to attempt to remove the obstruction. The Contractor shall attempt a minimum of 2 passes with the hydraulic nozzle unless otherwise approved by the Engineer.

For wastewater mains that cannot be cleaned by hydraulic cleaning from one manhole, the equipment shall be moved and set up at the other manhole and cleaning shall be re-attempted to remove the debris. If successful removal of the debris cannot be performed or the equipment fails to traverse the entire pipeline section, it shall be assumed that a major blockage exists. Where there is a major blockage preventing its removal, the Contractor shall notify the Engineer and remove the obstruction by a method approved by the City.

For wastewater laterals, obstructions shall be attempted to be removed by hydraulic cleaning shall only be performed in the downstream direction toward the wastewater main. If the obstruction cannot be removed by hydraulic cleaning, the Contractor shall notify and provide a still-image of the obstruction to the Engineer. The obstruction shall be removed by excavation, repair, or other means approved by the Engineer.

If a sag prevents the complete inspection of a wastewater pipe, the Contractor shall inspect from the downstream point of connection and from the upstream access point to verify that a sag is present. Where the sag is present, the Contractor shall be required to remove the section of pipe that has a sag and replace it to the nearest joint. If the method of pipeline replacement is pipe bursting and total number of sags along a wastewater main, between two manholes, are encountered exceed three (3), the Contractor shall replace the wastewater main by open trench excavation.

Where roots or a root ball are encountered that cannot be removed by hydraulic cleaning, the Contractor shall excavate at the location of the roots or root ball and perform a point repair of the pipeline if pipe bursting or lining shall be performed. Roots shall not be a reason for reverse set-up. Special attention should be used during the cleaning operation to ensure complete removal of roots from joints of pipelines that are 33-inches or smaller. For pipes 36-inches in diameter or larger, the Contractor shall remove 90 – 95% of roots from pipe joints.

Where a protruding lateral prohibits the Contractor from performing a lateral launch, the Contractor shall notify the City Inspector and provide a still-image of the protruding lateral to Utilities Engineering. The still-image will be forwarded to Utilities Operations and its removal will be scheduled. The Contractor will be notified when the protruding lateral is removed.

If a suspected crossbore is encountered, the Contractor shall notify the Engineer and provide a still-image of the crossbore encountered to the City. Utilities Operations will be notified to schedule the necessary repairs and the Contractor shall be notified of when the repairs are completed.

Mechanical cleaning is not permitted on plastic pipes and will only be permitted after the pipe has

been cleared of crossbore.

Debris removed from the pipeline(s) as a result of cleaning shall be removed from the downstream manhole receiving flow from the pipeline(s) cleaned. Prior to analysis and disposal, debris shall be captured using a filtering device. Such materials collected at the downstream manhole shall become the responsibility of the Contractor, removed from the site by the Contractor in a closed container, and disposed of in accordance with Federal, State, and local laws and regulations at an appropriately classed landfill. The debris collected by the Contractor shall not be dumped into streets, ditches, catch basins, or storm sewers. Flushing of the material from manhole reach to manhole reach is prohibited.

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

END OF SECTION

**SECTION 2740
RECORD DRAWINGS AND SURVEY DATA COLLECTION**

1.01 RECORD DRAWINGS

The Contractor shall maintain on a daily basis a complete set of record drawings. Drawings shall include actual locations of utility crossings, field dimensions, and changes in the work. Drawings shall be marked "Record Drawings", shall be legible, and shall be available for City review at all times. Prior to final acceptance of the project, completed "Record Drawings" shall be submitted to the Engineer for final review and approval.

The Contractor shall meet with the City Inspector at the end of each work day to agree on the work performed in terms of quantities for each bid item. The Engineer will review the record drawings with each partial payment request. Payment may be withheld pending updating of the record drawings. The cost to prepare the record drawings shall be included in one or more bid items and no extra compensation shall be paid to the Contractor.

1.02 RECORD DRAWING DATA

A. Sanitary Sewer Rehabilitation Projects: The Contractor shall collect and provide the following data with the Record Drawings:

1. Each lateral connection to main: Measure distance from the center of the upstream manhole to each service lateral connection to the sewer main.
2. New manholes: Measure the distance to the downstream manhole (center to center).
3. Each manhole: Measure the depth from the manhole rim to the bottom of the invert channel (i.e. measure invert through).
4. New cleanouts:
 - a. Measure the distance from the center of the cleanout box to the left property line, and the distance to the right property line. The left and right directions are determined by standing on the sidewalk and facing the property.
 - b. Measure the distance from the cleanout box to the new sewer main.
 - c. Measure the distance from the cleanout box to a) the face of curb (FC) if the cleanout is in a landscaping strip between the curb and the sidewalk, or b) the back of sidewalk (BSW) if the cleanout is behind the sidewalk (toward property from sidewalk).
 - d. Measure the distance from the center of the cleanout box to the center of the water meter box. Also record whether the cleanout is left (L) or right (R) of the water meter box when facing the property.

B. Water/Gas Main Replacement Projects: The Contractor shall collect and provide the following data with the Record Drawings:

1. Each service connection to main: Measure distance from closest valve to each service connection to the main.
2. New meters: Measure the distance from the meter to the new main.

3. New valves: All valves shall be tied to two existing permanent physical features in the field. The horizontal distance between the valve and each permanent physical feature shall be less than 100 feet.
4. HDPE Fusion Number: Fusion number shall be noted on the Contractor's record drawing at the approximate location (within 1-foot) of the fusion (for gas projects only).

C. Submittal of Record Drawings for Review: Up-to-date Record Drawings, including Record Drawing Data, shall be submitted monthly with each partial payment request in accordance with Section 800 Additional Provisions. Record Drawings will be returned to Contractor within 5 working days after submittal of partial payment. After arranging a pickup time with the Engineer, Contractor can pick up Record Drawings at the City Offices at 1007 Elwell Court or request that the Engineer deliver the Record Drawings to the field if time allows.

Table 1: Required Attribute Data for Utility Features (to be included on the full size redline record drawings) for CIP and Development Service Projects

1. Mains: Required Data

Pipe Diameter
 Pipe Material
 Pipe SDR or Pipe Class
 Pipe Install Date (date pipe went in the ground)
 Pipe Installed Method
 Pipe Length
 Pipe Manufacturer
 Pipe Manufacturer Code
 Pipe Depth
 Pipe Installer Name
 Pipe Test Date and Time
 Pipe Pressure Test Data (if applicable)
 Abandon Date or Removal Date (if applicable)

2. Services/Laterals: Required Data

Pipe Diameter
 Pipe Material
 Pipe SDR or Pipe Class
 Pipe Function Type
 Pipe Install Date (date pipe went in the ground)
 Pipe Installed Method
 Pipe Length
 Pipe Manufacturer
 Pipe Manufacturer Code
 Pipe Depth
 Pipe Installer Name
 Service Connection Method to Mains
 Abandon Date or Removal Date (if applicable)

3. Manholes: Required Data

Manhole Install Date (date MH went in the ground)
Manhole Installer Name
Manhole Material
Manhole Type
Manhole Depth
Abandon Date or Removal Date (if applicable)

4. Cleanouts: Required Data

Cleanout Install Date (date CO went in the ground)
Cleanout Installer Name
Backflow Device
Abandon Date or Removal Date (if applicable)

5. Other Features: Required Data

Pipe Fitting Type
Pipe Fitting Connection Type
Pipe Fitting Size
Pipe Fitting Manufacture
Pipe Fitting Manufacture Code
Pipe Fitting Depth
Gas Riser Manufacture
Gas Riser Dimensions
Gas Riser Type
Gas Riser Dimensions
Gas Riser Pipe SDR
EFV Equipment Manufacture
EFV Size ID
EFV Trip Point
EFV Model

6. Valves: Required Data

Valve Install Date (date valve went in the ground)
Valve Installer Name
Valve Application
Valve Type
Valve Manufacturer
Valve Model
Valve Serial
Operable
Valve Actuator Type
Valve Access Type
Valve Function Type
Valve Lid Type
Valve Depth (valve cover to top of nut)
Abandon Date or Removal Date (if applicable)

7. Meters (installed by CPA Operations): Required Data

Meter Install Date (date meter went in the ground)
Meter Installer Name
Meter Number
Meter Type
Meter Location
Meter Box Model
Backflow Device
Abandon Date or Removal Date (if applicable)

1.03 BASIS OF SURVEY CONTROL

The City of Palo Alto has established a GPS Control Network and survey control monuments throughout the City to be used as the official survey control benchmarks. All surveying and engineering related work shall use these monuments in order for the projects to be incorporated into the City's GIS mapping. To satisfy the City of Palo Alto horizontal coordinate & vertical datums, the surveyor must tie the requested work to the City GPS control monuments prepared by Bestor Engineers in 1994 and submit your northings and eastings in the City's coordinate system. The City will not accept deliverables in other coordinates systems and/or own local ("project") coordinate systems.

The coordinates shown on the record of survey are based on the North American Datum of 1983 [NAD 83(1992 epoch)] in the California State Plane Coordinate System, (zone 3) in units of survey feet. Vertical elevations are based upon the NGVD 29 as per the USC&GS adjustment of 1967. Additional information concerning elevations and secondary vertical control benchmarks to be used for vertical control only is on file and available at the City of Palo Alto Public Works engineering surveying office. The data provided by Public Works is intended to be used as a reference.

Horizontal and vertical control reference point data is available upon request. Copies of full size of the Record of Survey and Survey Control Monument maps prepared by Bestor Engineers, Inc. dated February 1994 are available at the Utilities Engineering Office.

Per submittal requirement prior to construction commencement, the contractor shall submit coordinate text files (PNEZD) of all survey control monuments needed to perform the survey work for the City to validate its accuracy and delivery in the City's coordinate system.

A California Licensed Land Surveyor is responsible to setup all control points needed to perform the survey work. The accuracy for all survey data shall be +/- 0.5 in; with an exception of gas meter risers on private properties to be +/- 0.5 ft. For CIP pipeline replacement projects, all survey data collected shall be certified by a California Licensed Land Surveyor.

Per submittal requirement prior to construction commencement, the contractor shall submit coordinate text files (PNEZD) of all necessary survey control monuments for the City to validate its accuracy and delivery in the City's coordinate system. Use CPAU WGW Engineering's "feature codes" for naming convention and refer to the feature capture-positions in the 'Feature Codes and Feature Capture-Positions' table at the end of this section.

In addition, the Contractor shall submit the GPS data set collected for the installation work during the first week of construction for the City to validate its accuracy. The completeness and accuracy of GPS survey data shall be verified by the City before the issuance of each payment to the contractor.

For CIP projects, the City of Palo Alto may require the Contractor, at Contractor's own expense, to reopen or uncover GPS surveyed infrastructure/objects and perform new survey if the accuracy of the originally submitted data is not in compliance with these specifications or the data is not collected in open-hole. The Contractor will be required to perform surface restoration, at the Contractor's own expense, following the additional survey.

When applicable, survey data shall be collected within the entire width of the street and on private properties to include all features identified in Table 2. The extents of the survey area shall cover the full intersections to curb returns. The consultant/contractor shall obtain approval from business/home owners or occupants to access private properties for collecting required survey data. No additional compensation will be made for delays due to private property accessing issues. The Consultant/contractor shall provide necessary traffic control to meet the CPA Transportation Department's standards. No additional compensation will be made for traffic control on major streets.

1.04 SURVEY DATA COLLECTION

A. Deliverables

1. Prior to construction commencement - Northing and easting coordinate text files (PNEZD) of all control survey points needed to perform the survey work in .csv format, including feature code of each point in the spreadsheet.
2. Northing and easting coordinate text files (PNEZD) of survey points for all new utility features installed during the first week of construction in .csv format, including feature code and description (if applicable - in same column), of each point in the spreadsheet.
3. Survey data .csv format with bench marks, surveyed points, and feature codes shall be submitted monthly with each partial payment request in accordance with Section 800 Additional Provisions for Utilities Contractors. Payment will be made on the percentage of total project completed, submitted and accepted.

B. Data to be collected (See table 2 for feature capture-position)

1. Sanitary Sewer Rehabilitation Projects
 - a. Collect horizontal and vertical data for:
 - i. Sanitary sewer manholes.
 1. Lid (center)
 2. Depth
 3. Invert elevations for each pipe
 4. In/out directions for each pipe relative to magnetic North.
 - ii. Lateral connections to mains (at the top of the pipes, to be collected **in open holes** during construction [i.e. prior to backfilling]).
 - iii. Changes in pipe alignment (at the top of the pipes, to be collected **in open holes** during construction [i.e. prior to backfilling]).
 - b. Collect horizontal data for:
 - i. Lateral cleanouts
2. Water Main Replacement Projects
 - a. Collect horizontal and vertical data for:

- i. Water valves, including all main line valves, service valves, fire hydrant valves, and blow off valves.
 - ii. Service connections to mains (at the top of the pipes, to be collected **in open holes** during construction [i.e. prior to backfilling]).
 - iii. Tapping tees for all water connections (at the top of the tee, to be collected **in open holes** during construction [i.e. prior to backfilling]).
 - iv. Main and service reconnection points (at the top of the fitting or pipe, to be collected **in open holes** during construction [i.e. prior to backfilling]).
 - v. Changes in pipe alignment (at the top of the pipes, to be collected **in open holes** during construction [i.e. prior to backfilling]).
 - vi. Fittings, including couplings, reducers, elbows, sleeves, caps and line stops (at the top of the fittings, to be collected **in open holes** during construction [i.e. prior to backfilling]).
 - vii. Anode boxes (typically installed near fire hydrants).
 - b. Collect horizontal data for:
 - i. Fire hydrants
 - ii. Air release valves
 - iii. Water meters
 - iv. Sewer manholes (for data validation purpose)
3. Gas Main Replacement Projects
- a. Collect horizontal and vertical data for:
 - i. Gas valves, including all main line, service, and excess flow valves.
 - ii. Service connections to mains (at the top of the pipes, to be collected **in open holes** during construction [i.e. prior to backfilling]).
 - iii. Tapping tees for all gas connections (at the top of the tee, to be collect **in open holes** during construction [i.e. prior to backfilling]).
 - iv. Changes in pipe alignment (at the top of the pipes, to be collected **in open holes** during construction [i.e. prior to backfilling]).
 - v. Fittings, including couplings, transition fittings, reducers, elbows, end caps, etc., to be collected **in open holes** during construction [i.e. prior to backfilling]).
 - b. Collect horizontal data for:
 - i. Anode boxes
 - ii. Gas meters
 - iii. Gas meter curbs
 - iv. Gas risers (end of riser or at ground penetration)
 - v. Sewer manholes (for data validation purpose)
4. Miscellaneous Development Service Projects and Survey Contracts
- a. Collect horizontal and vertical data for:
 - i. Sanitary sewer manholes.
 - a. Lid (center)
 - b. Depth
 - c. Invert elevations for each pipe
 - d. In/out directions for each pipe relative to magnetic North.
 - ii. Storm drain manholes, catch basins, culverts and inlets.
 - a. Lid (center); catch basin, culvert, inlet (top center at inlet)
 - b. Depth
 - c. Invert elevations for each pipe

- d. In/out directions for each pipe relative to magnetic North.
- iii. All gas and water valves.
- iv. Street Surface along the crown of the pavement (i.e. along the approximate centerline of the street width) at grade breaks and every 50' maximum.
- b. Collect horizontal data for: *(collect data at center of manholes, lids, and boxes unless otherwise noted.)*
 - i. Electrical/Fiber Optic/Telephone manholes and boxes
 - ii. Fire hydrants
 - iii. Anode boxes
 - iv. Air release valves
 - v. Water and gas meters
 - vi. Lateral cleanouts
 - vii. Main cleanouts
 - viii. Lampholes
 - ix. Flush inlets
 - x. Gas risers (at ground penetration)
 - xi. Front and back of sidewalk, face of curb, lip of gutter and edge of pavement on both sides. For linear alignment collect data at both ends of the block. For non-linear alignment collect data at every turning point.
 - xii. Monuments

See Table 2 for each feature description, feature code and feature capture-position for the survey data that is being requested.

Table 2: Feature Codes and Feature Capture-Positions

Feature Description	Feature Code	Feature Capture-Position
SURVEY REFERENCE POINT		
Benchmark	BM	
Back Site Point	BSPT	
ROAD FEATURES		
Back of Curb	BOC	Back of curb
Back of Rolling Curb	BORC	Back of rolling curb
Bridge, Edge	BREDGE	Edges of bridge outline
Back of Sidewalk	BSW	End pts. on straight alignment & every turning pt.
Back of Valley Gutter	BVG	At flow line
Crown of Street	CROWN	End pts. on straight alignment & every turning pt.
Ditch	DITCH	At flow line
Driveway	DWY	Edge of driveway both sides
Edge of Pavement	EOP	Both ends of the block and every turning pt.
Fence	FENCE	End pts. on straight alignment & every turning pt.
Flow Line	FL	End pts. on straight alignment & every turning pt.
Face of curb	FOC	End pts. on straight alignment & every turning pt.
Lip of Gutter	LOG	End pts. on straight alignment & every turning pt.
Loop Detector	LOOPDE	As needed
Street Monument	MONSTR	Center of lid/cover
Swale at Flow Line	SWALE	As needed
Traffic Speed Control	TRSPCN	As needed
Traffic Speed Donut	TRSPDON	As needed
Street Turn Around	TURNARO	As needed
Guard Rail	GUARDR	As needed

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Parking Lot	PARKING	Edges of parking lot
Speed Bumps	SPEEDB	As needed
BUILDING		
Building	BLDG	Building corners
WATER		
Air Relief Valve	WTARV	Center of valve
Detector Check Valve	WTDCV	Center of valve
Fire Hydrant	WTFH	Center of hydrant
Water Main	WMAIN	End pts. on straight alignment & every turning pt.
Water Main Tapping Tee	WTTEE	Service connection point to main
Water Service	WTSVC	End pts. on straight alignment & every turning pt.
Water Service Saddle	WTSDL	Center top of main at service connection
Water Valve - Main	WTVMAIN	Center of lid/cover and stem
Water Valve - Service	WTVSVC	Center of lid/cover and stem
Water Valve - Fire Hydrant	WTVFH	Center of lid/cover and stem
Water Valve - Blow-Off	WTVBO	Center of lid/cover and stem
Water Meter	WTM	Center of meter
Miscellaneous Fittings:		
Coupling	WTCPL	Center of fitting
Horizontal Elbow	WTELB	Center of fitting (point of turn)
Vertical Elbow	WTELBV	Center of fitting (point of turn)
Reducer	WTRDC	Center of fitting
Sleeve	WTSLV	Center of fitting
Cap	WTCAP	Center of fitting
Line Stop	WTLS	Center of fitting
Anode Box	WTANOBX	Center of lid/cover
GAS		
Existing Anode Box	ANOBX	Center of lid/cover
Gas Meter	GM	Center of meter
Gas Meter Curb	GMCURB	Center of meter
Gas Riser	GRISER	Front of riser perpendicular to main
Gas Main	GMAIN	End pts. on straight alignment & every turning pt.
Gas Main Tapping Tee	GTEE	Service connection point to main
Gas Service	GSVC	End pts. on straight alignment & every turning pt.
Gas Valve - Main	GVMAN	Center of lid/cover and stem
Gas Valve - Service	GVSVC	Center of lid/cover and stem
Miscellaneous Fittings:		
Coupling	GCPL	Center of fitting
Horizontal Elbow	GELB	Center of fitting (point of turn)
Vertical Elbow	GELBV	Center of fitting (point of turn)
Reducer	GRDC	Center of fitting
Sleeve	GSLV	Center of fitting
Cap	GCAP	Center of fitting
Line Stop	GLS	Center of fitting
WASTEWATER		
Wastewater Main	WWMAIN	End pts. on straight alignment & every turning pt.
Wastewater Main Tapping Tee	WWTEE	Lateral connection point to main
Wastewater Lateral	WWLAT	End pts. on straight alignment & every turning pt.
Wastewater Clean Out	WWCO	Center of lid/cover
Wastewater Flushing Inlet	WWFI	Center of lid/cover
Wastewater Lamp Hole	WWLH	Center of lid/cover

Wastewater Manhole	WWMH	Center of lid/cover, depth, invert elevations and in/out directions relative to magnetic north
ELECTRIC		
Electrical Vault 1,2,3,4 Lids	ELVLT	Center of vault
Electrical Manhole	EMH	Center of lid/cover
Fiber Optic Manhole	FMH	Center of lid/cover
Fiber Optic Vault	FVAULT	Center of vault
Telephone MH	TELMH	Center of lid/cover
Telephone Vault	TELVAULT	Center of vault
STORM DRAIN		
Box Culvert	BOXCLV	Center line
Catch Basin	CB	Center of grate, depth, invert elevations and in/out directions relative to magnetic north
SD Headwall	SDHW	As needed
SD Inlet	SDIN	As needed
SD Manhole	SDMH	Center of lid/cover, depth, invert elevations and in/out directions relative to magnetic north

1.05 CONSTRUCTION STAKING FOR CIP PROJECTS

The Contractor shall be responsible for construction staking of open trench construction and marking proposed pipeline alignment per project plans for CIP projects. All survey work for construction staking shall be performed by a California Licensed Land Surveyor. The surveyor is responsible to setup all control points needed to perform the survey work.

END OF SECTION

**SECTION 2741
LEGACY CROSS BORE INSPECTION GUIDELINES**

PART 1 – GENERAL**1.01 DESCRIPTION**

This section covers the video inspection of sewer laterals installed by trenchless methods to locate cross bore and submission of Lateral Assessment and Certification Program (LACP) as per National Association of Sewer Service Companies (NASSCO) Standards.

LACP reports shall only be submitted for the City-owned portion of the lateral (lower sewer lateral). Only video shall be submitted for the private sewer lateral (upper sewer lateral).

“Cross bore” is an unintended conflict between natural gas service pipelines and sanitary sewer laterals.

1.02 RELATED WORK

Section 01500 Traffic Control

Section 02200 Excavation, Backfill and Restoration

PART 2 -- MATERIALS**2.01 EQUIPMENT****A. CAMERA**

The equipment shall include full-color video cameras, video monitor cable, power sources, and all necessary equipment to perform a complete CCTV video inspection of sanitary sewer laterals. The camera equipment shall meet the California Division of Occupational Safety and Health for Electrical Sewer Inspection Camera Sections 2340.11 (Water Safety) and 2540.2 (Fire Safety) for performing inspections within wastewater facilities.

1. LATERAL LAUNCHER

The lateral launcher shall have a sonde transmitter. The equipment shall perform remote-controlled inspections in most sewer laterals with wastewater main pipelines having an internal diameter equal to six (6) inches to no larger than forty-two (42) inches. The equipment should be capable of working within large diameter pipes which often require special procedures for flow control, lighting, and camera travel.

2. PUSH CAMERA

The push camera shall have a sonde transmitter. The equipment will be used in a wastewater pipeline or sewer lateral with an internal diameter of less than six (6) inches. Small diameter push camera shall have the ability to enter through building cleanouts that are two (2) inches in diameter.

Both cameras used must be able to be traced throughout the entirety of the inspection. The equipment must have the ability to be physically located from above grade through a sonde locator.

The footage counter for both cameras must be calibrated during video inspection and must be accurate to 0.5 feet per 100 feet. At the City's request, the Contractor may be required to

replace the footage counter to capture accurate counter readings. The travel speed should be a uniform rate of no more than thirty (30) feet per minute. The equipment should be slower when recording features and defects of the City-owned sewer lateral (lower sewer lateral).

The lighting of the equipment shall fully illuminate the entire pipe but shall not oversaturate the footage of pipe. The operator shall ensure that the camera and video show a correct reflection of the true colors within the pipe and on the video display. The camera lens shall be kept clear of condensation and debris and shall be able to operate in one hundred percent (100%) humidity.

B. WATER JETTER

1. The Contractor shall perform water jetting services if a blockage prevents complete inspection of the pipe. Water jetting will be initiated via the cleanout.
2. The equipment should not have a saw or a cutting head attached.
3. The equipment must have a minimum capability of providing a 2,000 pounds per square inch (psi) force of water pressure.
4. The equipment must have a minimum of 1,500 gallon water tank.

C. HYDRO – EXCAVATION

1. The equipment must have a minimum capability of providing a 2,500 psi force of water with rotating digging tips.
2. The equipment must have a minimum of 1,500 gallon water tank.

D. Cleanout plug wrench

1. Contractor shall utilize a cleanout plug wrench to remove cleanout lids and avoid damage to cleanout plugs. The Contractor shall be responsible for repairing any damages caused by their forces to cleanouts.

PART 3 – QUALIFICATIONS, TESTING, AND INSPECTION

3.01 OPERATOR QUALIFICATIONS

The Contractor shall have participated in a minimum of 1,000 sewer lateral inspections associated with a gas cross bore inspection and 50,000 feet of wastewater mainline inspections associated with a gas cross bore inspection.

The lower sewer lateral shall be assessed by a certified NASSCO Lateral Assessment and Certification Program (LACP) trained operator or technician.

3.02 INSPECTION

A. HEALTH

1. The Contractor performing the push-camera inspection shall wear proper PPE such as disposable gloves and safety glasses.

B. LATERAL LAUNCHER

2. The lateral launcher must have a capability of traversing a minimum of 120 feet.
3. The video inspection must begin from the wastewater main pipeline to the foundation of the structure or extend three (3) feet beyond the furthest gas riser.

C. PUSH CAMERA

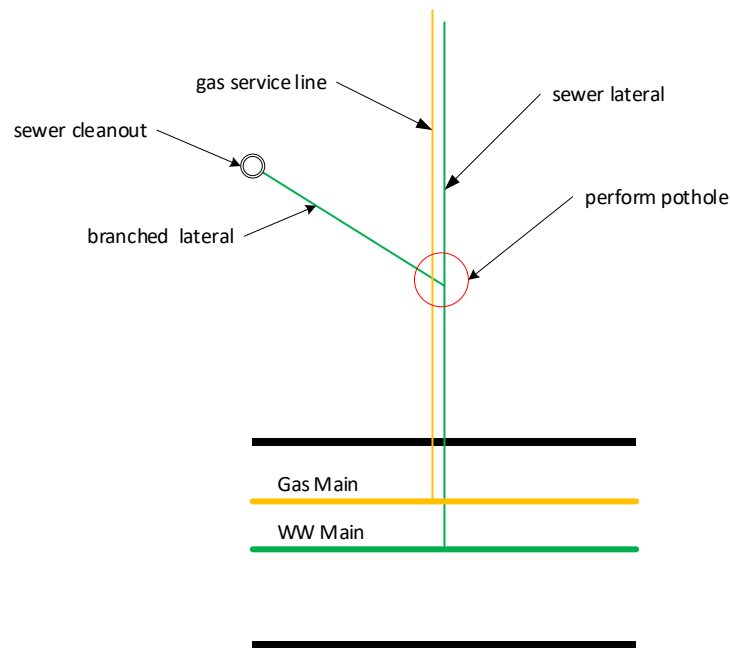
1. Where inspection cannot be completed using a lateral launcher, the Contractor will use a push camera to complete the inspection. The push camera is inserted at cleanout and travels toward the wastewater main pipeline.
2. If branched laterals are encountered and identified as a location that cross the gas service pipeline, the push camera will be initiated via an accessible cleanout to successfully clear the branch lateral.
3. If a cleanout is not available, the Contractor may request City-approval to perform push camera inspections through a roof vent.
 - a. The Contractor must provide the appropriate equipment to perform the push camera from one to two stories above the grade. This includes ladders, harness, and any other equipment required to safely perform the push camera inspection.
 - b. The Contractor is responsible for any damages occurred during inspection through a roof vent and the safety of their employees.
 - c. The Contractor shall not enter the property of the occupant nor access the roof vent of the house or the building without the approval from the Project Engineer and the presence of the City Inspector.
4. If a backwater valve is encountered in the sewer lateral, the Contractor may attempt to inspect the sewer lateral by using a small diameter push camera, only if equipment damage is unlikely and not limited by the backwater valve design configuration.

D. WATER JETTING AND MECHANICAL CLEANING

1. If an obstruction such as roots, debris, deposits, fat, oil, and grease prevent lateral launching or using a push camera, the Contractor will perform hydro flushing as needed to allow passage of inspection camera and to capture acceptable quality video.
2. The Contractor will be responsible for providing all backpressure and backflow preventive measures and equipment.
3. The Contractor will be responsible for all damages associated with sewer backup caused by their cleaning activities.
4. The Contractor shall immediately notify the City in the event of any Sanitary Sewer Overflow (SSO) associated with their cleaning activities. The Contractor is responsible for all costs associated with proper cleanup of SSO.
5. The City will not be responsible for pre-cleaning of the wastewater main. Therefore, the Contractor may be required to pre-clean the wastewater main prior to sewer lateral inspection.

E. HYDRO – EXCAVATION

1. If sag sections of sewer lateral are found during video inspection or if the sewer lateral cannot be inspected in the potential cross bore area:
 - a. The Contractor must locate the alignment of the sewer lateral and gas service line using sonde devices and pipe locator, respectively.
 - b. If the shortest distance between the gas service line and the sewer lateral is within three (3) feet, the Contractor will perform potholing to determine if a potential cross bore exists.
2. Where gas pipelines cross branched laterals or wyes, the Contractor shall pothole at the downstream point of connection to perform video inspection of the branched lateral when a push camera cannot be used to complete video inspection, see Figure 1.



Gas service line cross branched laterals

Figure 1

3. The Contractor shall only perform the potholing in the presence of the City Inspector.
 4. The Contractor shall follow all established safety procedure as per CAL OSHA for digging around underground utilities.
- F. SURFACE MARKING**
1. The Contractor shall place marking chalk or paint on paved surface and flags or feathers on an unpaved surface. The Contractor shall remove the markings placed by their forces.
 2. Surface markings shall be placed at a maximum of five (5) foot intervals and at all locations where there is a change in horizontal direction exceeding fifteen degrees (15°) when locating the alignment of the sewer laterals and gas service pipelines.

3. All Underground Service Alert (USA) markings requested by the Contractor shall be removed by the Contractor.

G. PIPE CONDITION

1. If severe pipe conditions exist such as root balls, broken pipe, and offset joints that prohibit complete video inspection, the Contractor shall notify the City Inspector who shall determine if it is on the City-owned lateral side or private lateral side.
 - a. Lower sewer lateral side - The Contractor and City Inspector shall notify CPAU Engineering for repair.
 - b. Upper sewer lateral side – The Contractor and City Inspector shall notify CPAU Engineering to provide notice to the property owner or representative.
2. Where a sag is encountered, the Contractor shall video inspect the sewer lateral from the downstream point of connection and from the upstream access point to verify that a sag is present. The Contractor shall pothole at the location of the sag to determine if a cross bore exists.
3. Where a root ball is encountered, the Contractor shall hydro-flush the sewer pipe if it is within 3-feet of the location of a gas pipe, to the satisfaction of the City Inspector. If the root ball cannot be removed, the Contractor shall attempt to perform a reverse inspection. Where a reverse inspection cannot be performed by the Contractor, the Contractor will be required to hydro-excavate to determine if there is a cross bore at the location of the root ball.
4. If depth of flow exceeds 20% of the inside pipe diameter, the Contractor shall monitor the sanitary pipes. If there is evidence the sanitary has low-flow conditions ($\leq 20\%$) and upon City approval, the Contractor would be permitted to adjust working hours. If high-flow conditions ($> 20\%$) persist, the Contractor will be requested to provide the necessary flow control. Where flow control is required, the Contractor shall not plug pipes with diameter of 12-inches or larger.
5. Where a protruding lateral prohibits the Contractor from performing lateral launch, the Contractor shall notify the City Inspector and provide a still-image of the protruding lateral to CPAU Engineering. The still-image will be forwarded to CPAU Operations and its removal will be scheduled. The Contractor will be notified when the protruding lateral is removed.

H. INSPECTOR

1. The City Inspector will be on site during all sewer lateral inspections.
2. The City Inspector will determine the necessary distance to safely clear the sewer lateral of any potential cross bore.
3. The completion of a sewer lateral inspection will be left up to the discretion of the City Inspector. If a sewer lateral inspection is complete, the Contractor shall not move to the next inspection until instructed by the City Inspector.
4. The Inspector will verify the correct property to be inspected based on the package provided to the Contractor.

I. PROXIMITY CLEARANCE

1. Upon City approval, the Contractor will be permitted to clear sanitary pipes by proximity if other methods of inspection are unable to be performed.

J. EFFORT EXHAUSTED

1. The Contractor must exhaust all efforts as directed by the Engineer to determine if a cross bore exists when existing conditions prevent the full inspection of the complete lateral.
2. If all attempts to video inspect the sewer lateral are unsuccessful and a proximity clearance cannot be performed, the Contractor shall report the reason for effort exhausted to the City after the last inspection attempt.
3. The Contractor will NOT be compensated for effort exhausted.

K. IDENTIFIED CROSS BORES

1. If an apparent cross bore is discovered, the Contractor shall take a still-image of the cross bore location and submit it to the City Inspector for it to be included as a part of the daily report. The Inspector will notify CPAU Engineering.
2. The Contractor shall mark the surface location of the apparent cross bore with marking paint.
 - a. If the gas pipe conflicting with the sewer pipe does not impede the inspection camera and does not damage the gas pipe, the Contractor can continue inspection of the sewer pipe until the video inspection is successfully completed.
 - b. If the gas pipe conflicting with the sewer pipe impedes the inspection camera, the Contractor shall stop video inspection and notify the City Inspector.
3. CPAU Engineering will inform CPAU Operations and Maintenance to investigate the cross bore.
4. Where a cross bore is found, CPAU Operations and Maintenance will schedule the necessary repairs.
5. After the cross bore is repaired, the Contractor remobilize and resume the video inspection work until it's successfully completed.

L. REPORTING

1. The Contractor shall encode the condition assessment as per the NASSCO Standard of the City-owned sewer lateral (lower sewer lateral) and electronic images of the sewer lateral condition must be uploaded using GraniteNet Software. The report will also include documentation of the footage traveled during sewer lateral inspection.
2. The Contractor shall provide a report for cross bores and reasons for incomplete inspection.
3. If there are wyes or branched laterals encountered during inspections, the Contractor shall document the inspection footage traveled in each wye or branched lateral.
4. A video of the inspection for each sewer lateral must be submitted by the Contractor. The video must be in 19 x 20 MP4 file format.
5. All reports must be in PDF format.

6. All lateral launch and push camera videos and corresponding reports for the main lateral shall be named the following:

Video Name: "StreetName_House#_FID_MMDDYYYY"

Report Name: "StreetName_House#_FID_MMDDYYYY"

For branched laterals or wyes from the main lateral requiring inspection (each address), the videos and reports shall be labeled the following:

"StreetName_House#_FID_BL# or W#_MMDDYYYY"

7. All report shall be submitted at the end of each week to CPAU Engineering for review.

M. QUALITY ASSURANCE (QA)/QUALITY CONTROL(QC)

1. The Contractor shall provide experienced work crews for data capture.
2. Frequent lens washing and lighting adjustments shall be included in order to obtain acceptable video quality
3. Videos submitted for payment that exceed the maximum travel speed will be rejected. The Contractor will be directed to re-inspect the sewer lateral at no additional cost to the City.
4. The Contractor will provide coding of all City-owned sewer laterals at the time of video inspection by a NASSCO LACP certified personnel.
5. The camera operator shall assess and shall indicate the status of the City-owned lateral (lower sewer lateral) using GraniteNet software.
6. In the event that the CPAU Engineering personnel discover a gas cross bore during the video review, the Contractor will be instructed to re-inspect the sewer lateral at no additional cost to the City.
7. The City shall reserve the right to cease all Contractor activities when quality of work is found to be unsatisfactory.
8. The Contractor shall indicate footage of sewer pipe inspected in deliverables. Footage counter shall be displayed at the beginning and at the end.
9. The Contractor QC personnel shall review one hundred percent (100%) of all video inspections.

PART 4 – SUBMITTALS

3.01 DELIVERABLES

- A. The Contractor will provide the following deliverables on a weekly basis. The deliverables must be submitted to the CPAU Engineering on the following Monday by 12:00 p.m.
 1. Video
 - a. Acceptable individual video footage for each lower sewer lateral and each upper sewer lateral. Video files must be submitted through a "cloud" storage online application.
 - b. Sanitary pipe inspection videos shall only be submitted for sanitary pipes that were

cleared of cross bore by the City Inspector at the time of inspection.

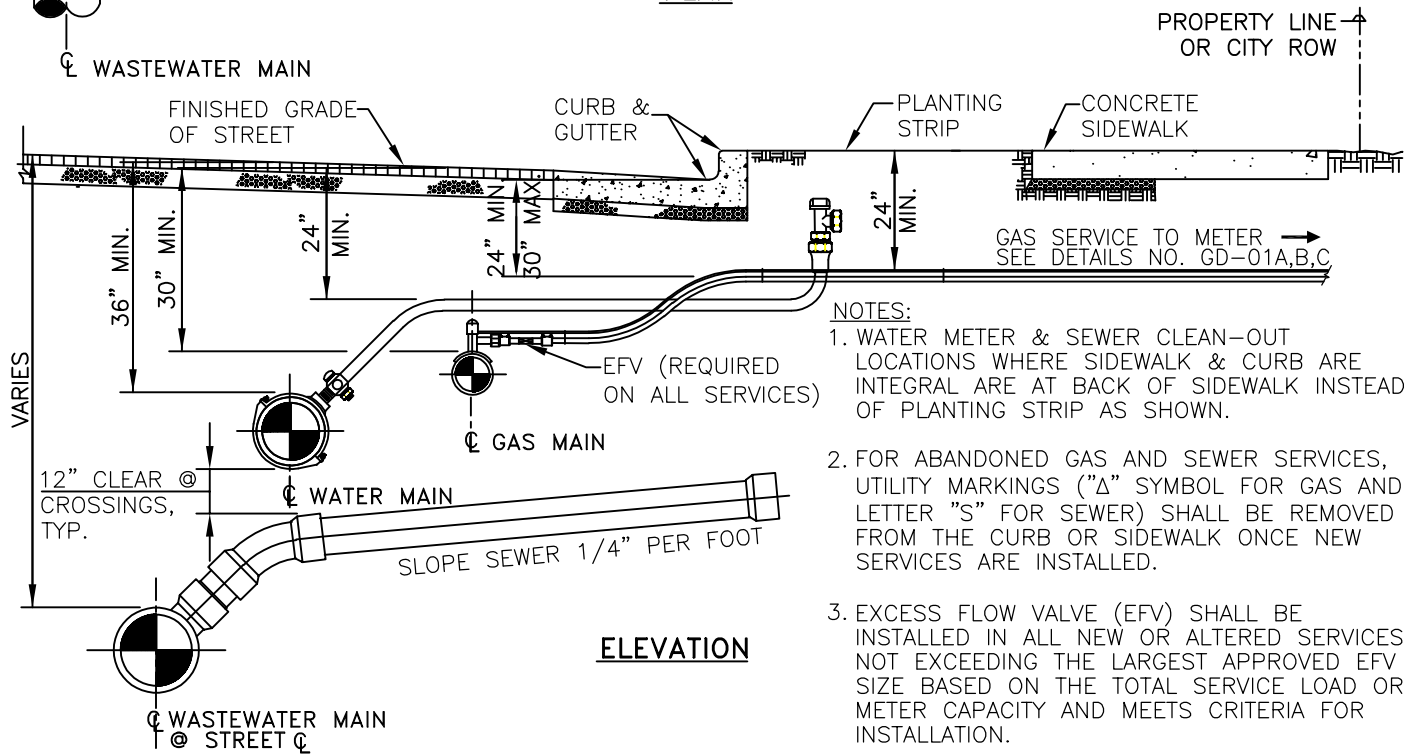
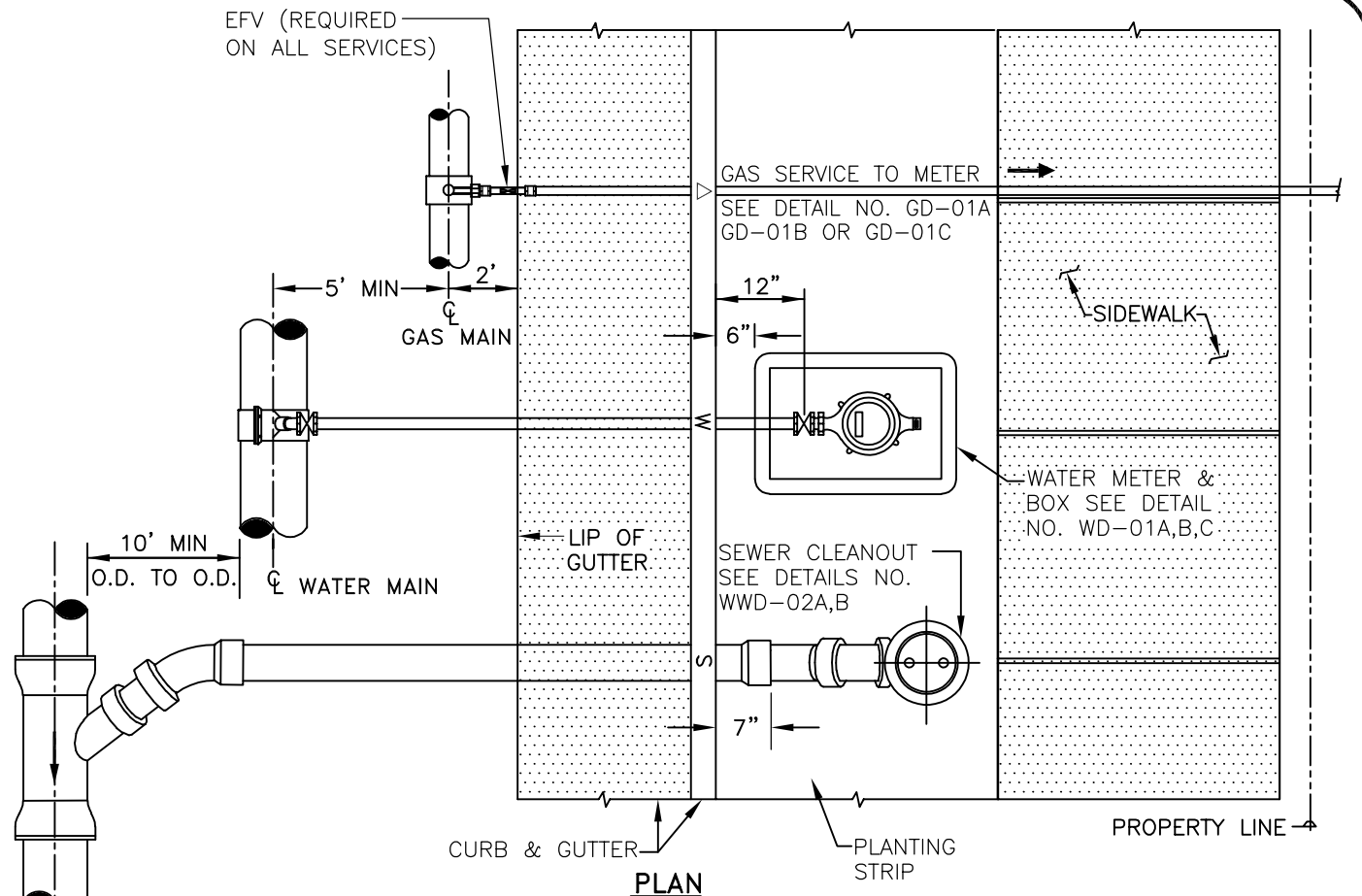
2. Forms

- a. GraniteNet Form for each inspected lower sewer lateral. If a defect is identified in the lower sewer lateral, an electronic image must be included on the GraniteNet Form of the defect.
 - b. WWOPS -LACP Checklist form for each lower sewer lateral.
 - c. ICOM 3 form for each lower sewer lateral.
 - d. Private upper sewer lateral cross bore inspection form.
3. Weekly cross bore Phase II spreadsheet. The spreadsheet will be provided by the City and must be completed by the Contractor.
4. Weekly invoices for progress payment. All invoices must be in CPAU Engineering approved format. The progress payment will be made at the end of each month.
- B. The Contractor must submit the latest calibration report of their equipment. The equipment must be calibrated at least annually but may be calibrated at shorter intervals.
- C. Upon the City's request, the Contractor shall submit maintenance records for equipment used for the inspection of sanitary pipes. The maintenance records include, but not limited to, truck, generator, camera, etc.

END OF SECTION

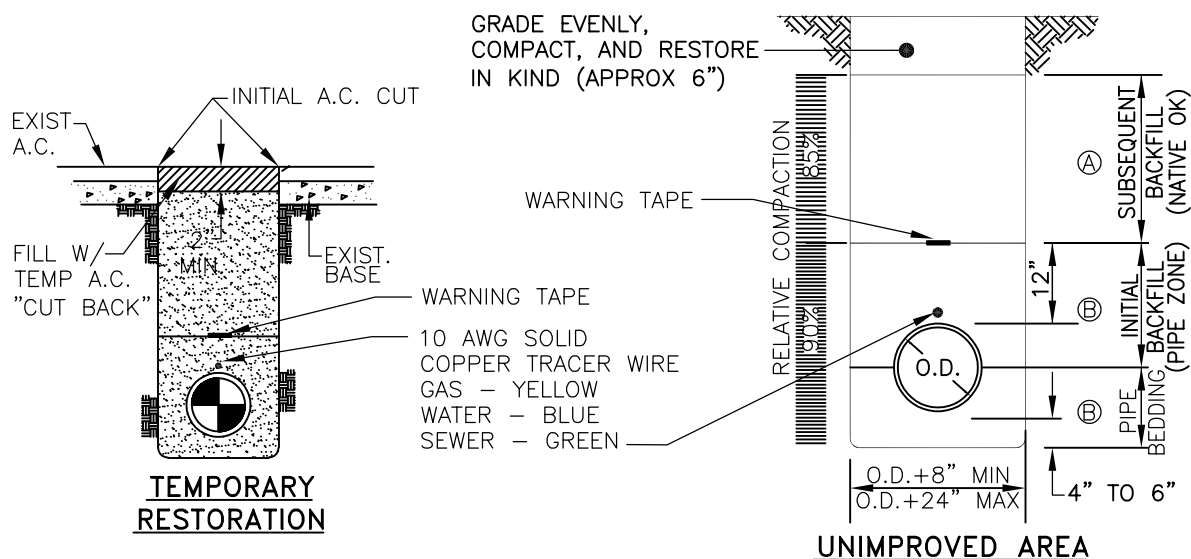
**Table of Contents
Appendix A
General WGW Utility Standard Details**

<u>Detail No.</u>	<u>Title</u>
WGW-01	Water, Gas & Wastewater Utility Configurations
WGW-02	Trench Backfill
WGW-02B	Joint Gas Service Trench with Electrical
WGW-03	Trench Backfill for Shallow Water Mains
WGW-04	Pipe Bedding
WGW-05A	Residential Bollard
WGW-05B	Commercial Bollard
WGW-06	Gas/Water Valve Concrete Collar and Steel Rebar in Existing Street



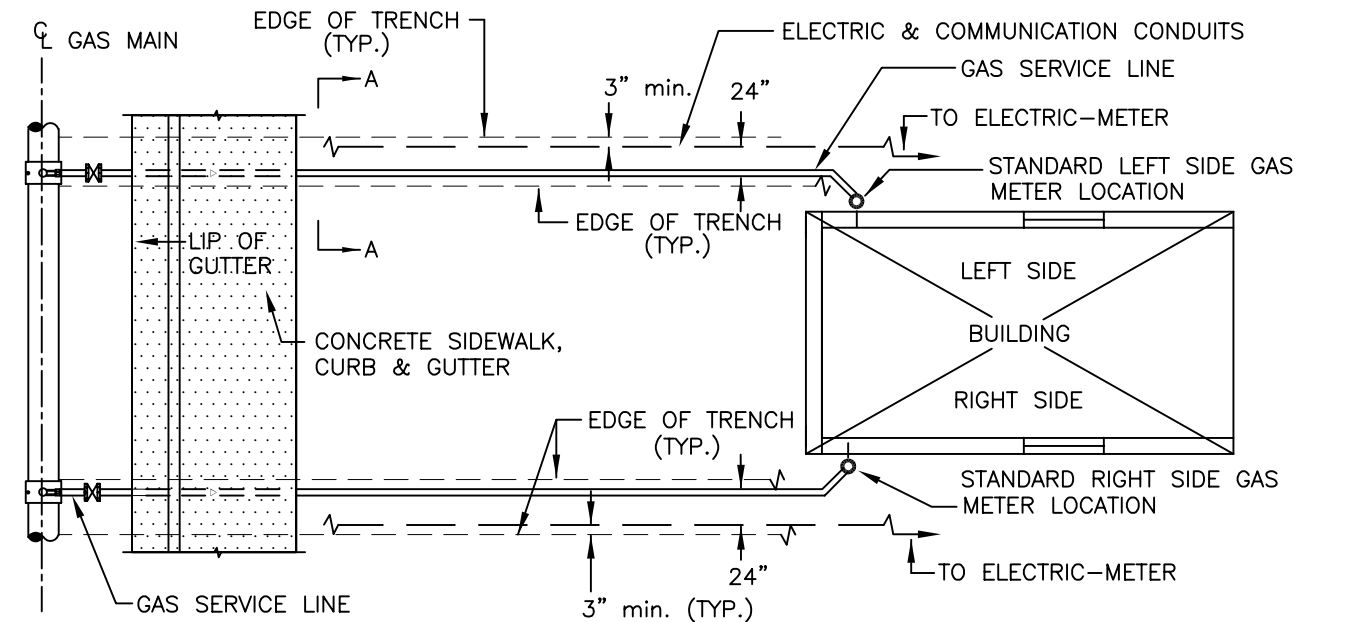
- NOTES:**
1. WATER METER & SEWER CLEAN-OUT LOCATIONS WHERE SIDEWALK & CURB ARE INTEGRAL ARE AT BACK OF SIDEWALK INSTEAD OF PLANTING STRIP AS SHOWN.
 2. FOR ABANDONED GAS AND SEWER SERVICES, UTILITY MARKINGS ("Δ" SYMBOL FOR GAS AND LETTER "S" FOR SEWER) SHALL BE REMOVED FROM THE CURB OR SIDEWALK ONCE NEW SERVICES ARE INSTALLED.
 3. EXCESS FLOW VALVE (EFV) SHALL BE INSTALLED IN ALL NEW OR ALTERED SERVICES NOT EXCEEDING THE LARGEST APPROVED EFV SIZE BASED ON THE TOTAL SERVICE LOAD OR METER CAPACITY AND MEETS CRITERIA FOR INSTALLATION.

BY	DATE	WATER, GAS & WASTEWATER UTILITY CONFIGURATIONS STANDARD DETAIL	APPROVED:	SCALE:
DRAWN	J.J.		FEBRUARY 26, 2020	NONE
CHECKED	J.J.		<i>Silvia Santos</i> 50674	DWG. NO.
REVIEWED	R.I.		SILVIA LEE SANTOS ENGINEERING MANAGER	STD. GW-01
CITY OF PALO ALTO, CALIFORNIA		REVISION:	APPENDIX A	
		FEBRUARY 26, 2020		

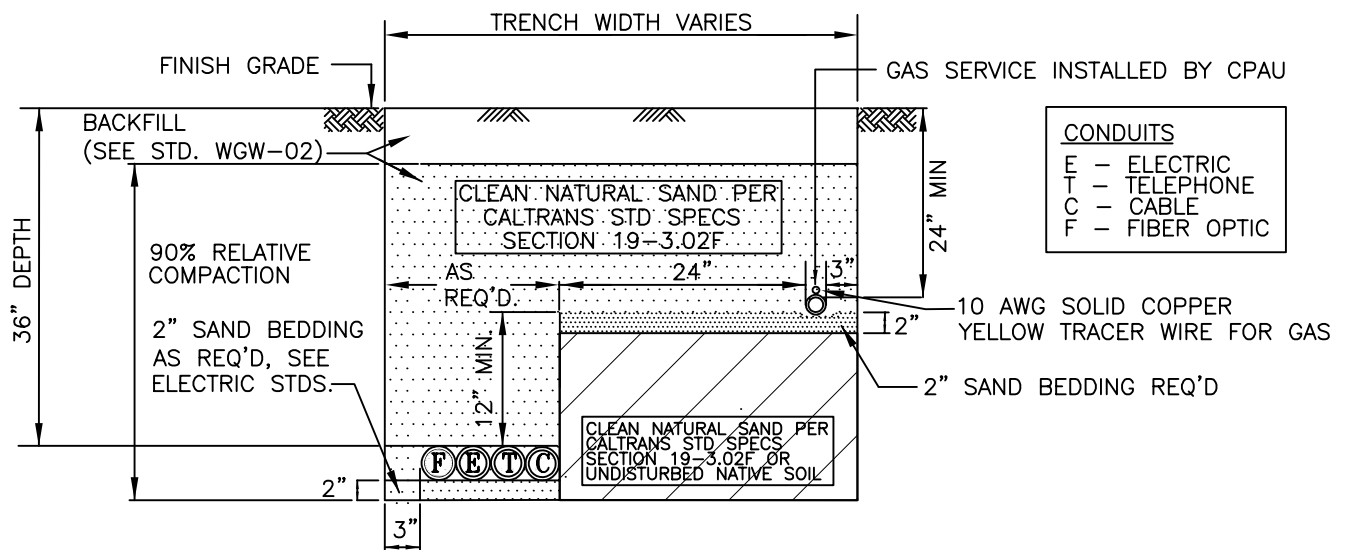


1. FINAL TRENCH RESTORATION SHALL BE COMPLETED WITHIN 10 WORKING DAYS FROM THE LAST DAY PIPE WAS INSTALLED ON ANY PARTICULAR CONTINUOUS SECTION.
2. IF TRENCH IS LOCATED 3 FEET OR LESS FROM EDGE OF PAVEMENT, SURFACE COURSE PAVEMENT SHALL BE REMOVED AND REPLACED FROM TRENCH TO EDGE OF PAVEMENT.
3. TRENCH WIDTH TO BE INCREASED WHEN SHORING IS USED.
4. IF WATER IS PRESENT, WRAP GEOTEXTILE FABRIC, MIRIFI 600X OR EQUAL. OVERLAP 12" ON TOP OF PIPE AND 24" AT ENDS. IF DIRECTED BY CITY, CONSTRUCT DAM TO PREVENT WATER FLOWING ALONG THE TRENCH.
5. ANY REQUIRED JETTING OF SAND SHALL BE APPROVED BY THE CITY ENGINEER PRIOR TO BACKFILL.

BY	DATE	TRENCH BACKFILL STANDARD DETAIL	APPROVED: FEBRUARY 26, 2020	SCALE: NONE
DRAWN E.L.	9/92		 50674 SILVIA LEE SANTOS ENGINEERING MANAGER R.E. NO.	DWG. NO. STD. WGW-02
CHECKED J.J.	02/20	CITY OF PALO ALTO, CALIFORNIA	REVISION: FEBRUARY 26, 2020	APPENDIX A
REVIEWED J.J.	02/20			



PLAN

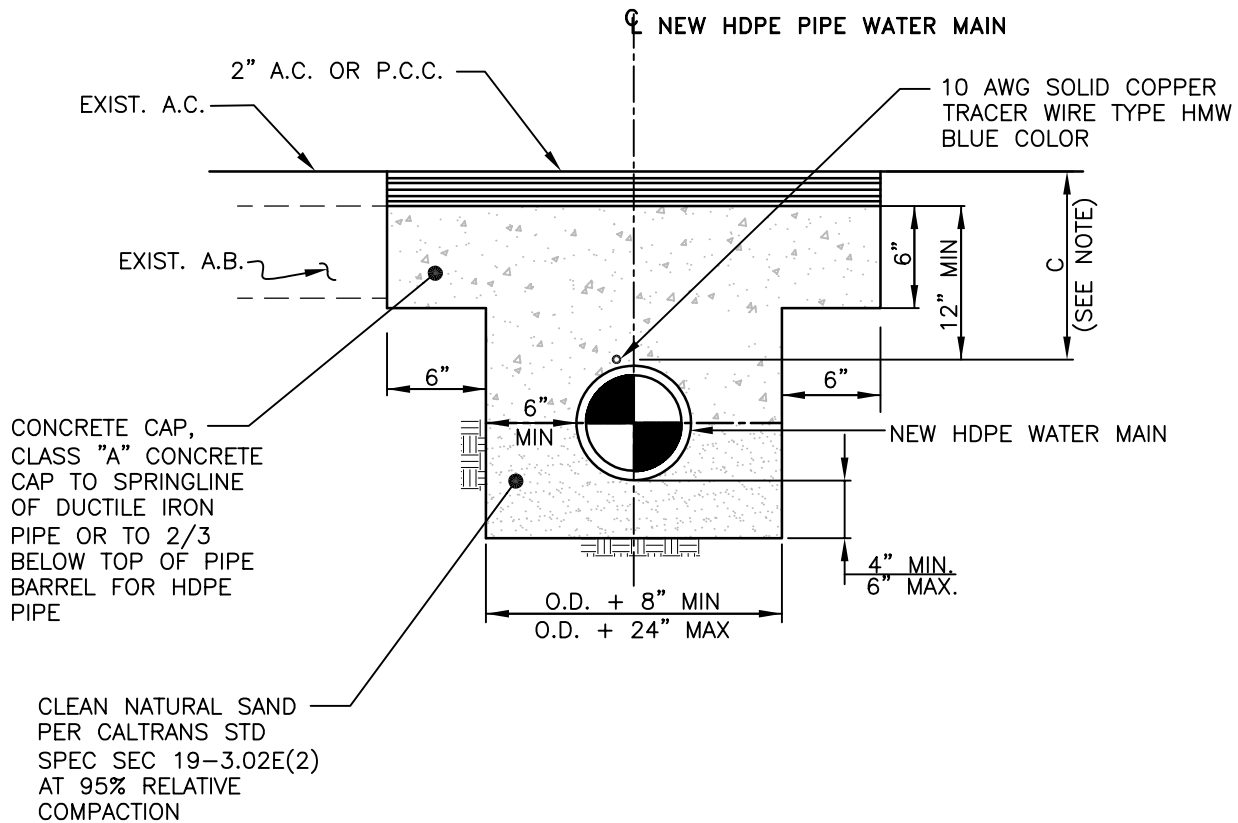


SECTION A-A

NOTES:

1. NO WET UTILITY INSIDE JOINT TRENCH
 - A. WATER, SEWER, AND STORM.
2. INSPECTION AND APPROVAL
 - A. JOINT TRENCH WITH ELECTRIC IS ONLY ALLOWED FOR RESIDENTIAL SERVICES. THE APPLICANT SHALL REQUEST JOINT TRENCH INSTALLATION APPROVAL AND INSPECTIONS FROM BOTH UTILITIES ELECTRIC AND WGW UNDERGROUND INSPECTORS.
 - B. ALL UTILITY COVER AND SEPARATION REQUIREMENTS MUST BE MET FOR THE ENTIRE LENGTH OF THE TRENCH.

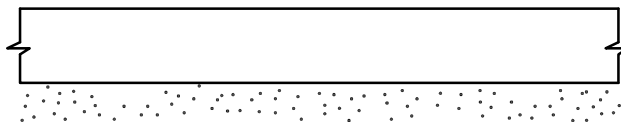
BY	DATE	JOINT GAS SERVICE TRENCH WITH ELECTRICAL ALLOWED FOR RESIDENTIAL SERVICES ONLY STANDARD DETAIL CITY OF PALO ALTO, CALIFORNIA	APPROVED: FEBRUARY 26, 2020	SCALE: NONE
DRAWN J.N.	12/18		<i>Silvia Lee Santos</i> 50674	DWG. NO.
CHECKED J.J.	02/20		SILVIA LEE SANTOS R.E. NO.	STD. WGW-02B
REVIEWED J.J.	02/20		REVISION: FEBRUARY 26, 2020	APPENDIX A



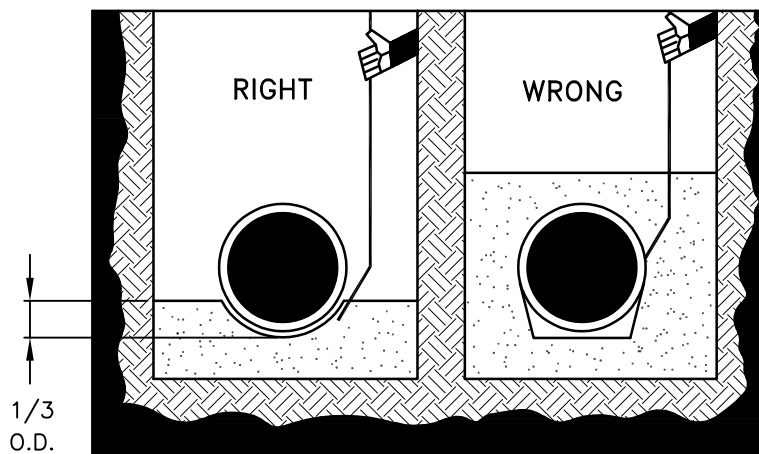
NOTE:

THIS DETAIL APPLIES WHERE DIMENSION "C" IS LESS THAN 3 FEET, OR AS REQUIRED BY THE PROJECT ENGINEER. CLASS 52 DUCTILE IRON PIPE MAY BE USED WHEN THERE IS SOIL CONTAMINATION.

BY	DATE	TRENCH BACKFILL FOR SHALLOW WATER MAINS STANDARD DETAIL	APPROVED: FEBRUARY 26, 2020	SCALE: NONE
DRAWN E.L.	9/92		 50674	DWG. NO.
CHECKED J.J.	02/20		SILVIA LEE SANTOS ENGINEERING MANAGER R.E. NO.	STD. WGW-03
REVIEWED R.I.	02/20		CITY OF PALO ALTO, CALIFORNIA	REVISION: FEBRUARY 26, 2020

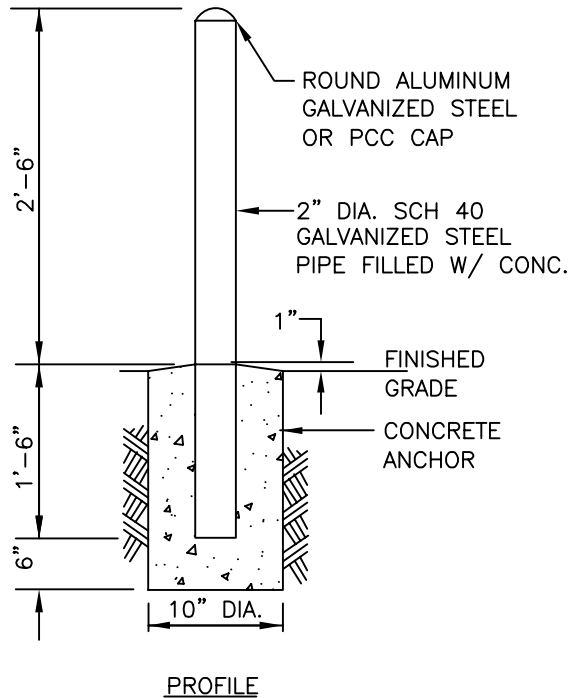
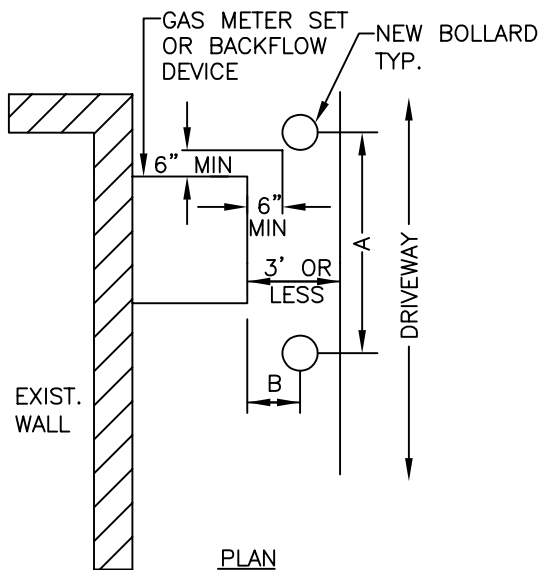


PROVIDE UNIFORM AND CONTINUOUS SUPPORT OF
PIPE FOR ALL CLASSES OF BEDDING.



PLACE BACKFILL TO SPRINGLINE AND SHOVEL SLICE TO FORM DENSE
COMPACTED HAUNCH SUPPORT TO 1/3 THE OUTSIDE DIAMETER OF THE
PIPE.

BY	DATE	PIPE BEDDING STANDARD DETAIL	APPROVED: FEBRUARY 26, 2020 <i>Silvia Lee Santos</i> SILVIA LEE SANTOS ENGINEERING MANAGER	SCALE: NONE
DRAWN	R.F.	9/92	50674 R.E. NO.	DWG. NO.
CHECKED	J.J.	02/20		STD. WGW-04
REVIEWED	R.I.	02/20	REVISION: FEBRUARY 26, 2020	APPENDIX A
CITY OF PALO ALTO, CALIFORNIA				



GENERAL BOLLARD SPACING

A (IN)	B (IN)
18	12
24	15
30	18
42	24

$$A \leq (B-3)*2$$

A = BOLLARD SPACING C-C (IN)

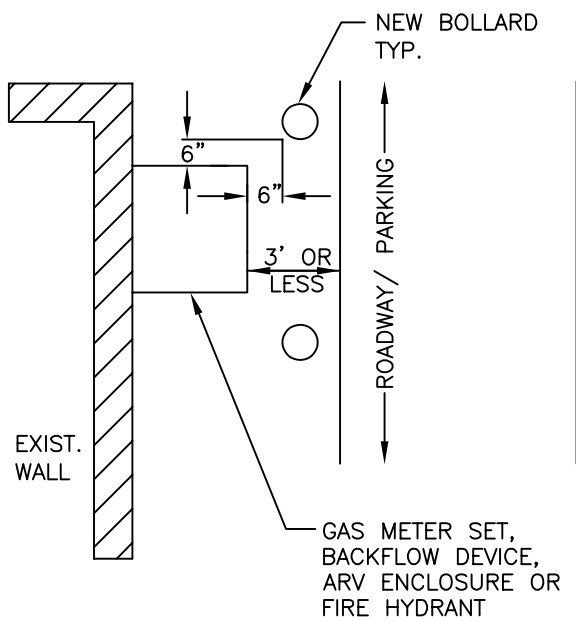
B = PERPENDICULAR CLEARANCE (IN)

NOTE: FOR NARROW DRIVEWAYS WHERE RESIDENTIAL VEHICLE HAZARDS EXIST PARALLEL TO THE LINE OF BOLLARDS; A = 30 INCHES, B = 7 INCHES.

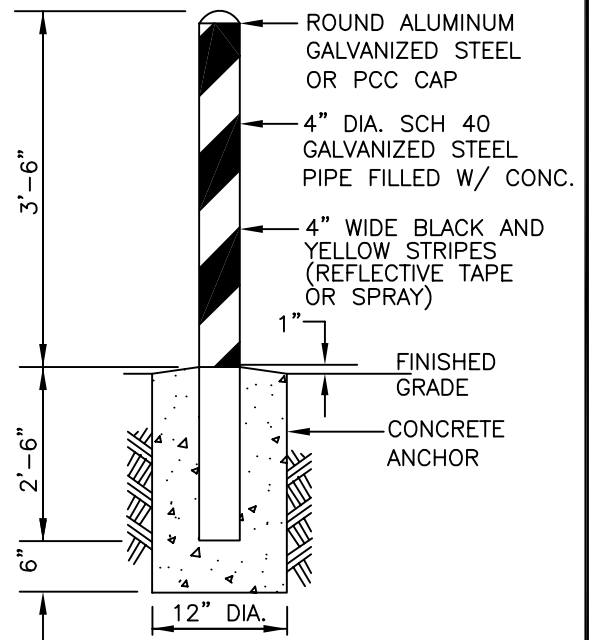
NOTES:

1. WHEN FIELD CONDITIONS DO NOT PERMIT EXACT COMPLIANCE WITH THESE REQUIREMENTS, ALTERNATIVES MAY BE PROPOSED. ALTERNATIVE METER GUARD ARRANGEMENTS MUST SUFFICIENTLY PROTECT THE METER SET AND ENSURE ADEQUATE DISTANCE FOR MAINTENANCE AND METER READING. A METER GUARD MAY BE USED IN CONJUNCTION WITH MAN-MADE BARRIERS SUCH AS WING-WALLS, PLANTERS, FENCES, ETC., TO PROVIDE PROTECTION; THESE BARRIERS MAY BE A 6" OR HIGHER CURB, LARGE TREE, PERMANENTLY INSTALLED PLANTER, BARRIER POST(S), FENCE, OR OTHER SIMILAR PERMANENT STRUCTURE.
2. ANY GAS METER/BACKFLOW DEVICE WITHIN THREE (3) FEET OF POTENTIAL VEHICULAR ACCESS SHALL BE PROTECTED BY EITHER COMMERCIAL OR RESIDENTIAL BOLLARDS DEPENDING ON APPLICATION.

BY	DATE	RESIDENTIAL BOLLARD STANDARD DETAIL	APPROVED:	SCALE:
DRAWN J.J.	8/92		FEBRUARY 26, 2019	NONE
CHECKED J.J.	02/20		<i>Silvia Lee Santos</i> SILVIA LEE SANTOS ENGINEERING MANAGER	DWG. NO. STD. GWG-05A
REVIEWED J.J.	02/20		REVISION: FEBRUARY 26, 2019	APPENDIX A



PLAN

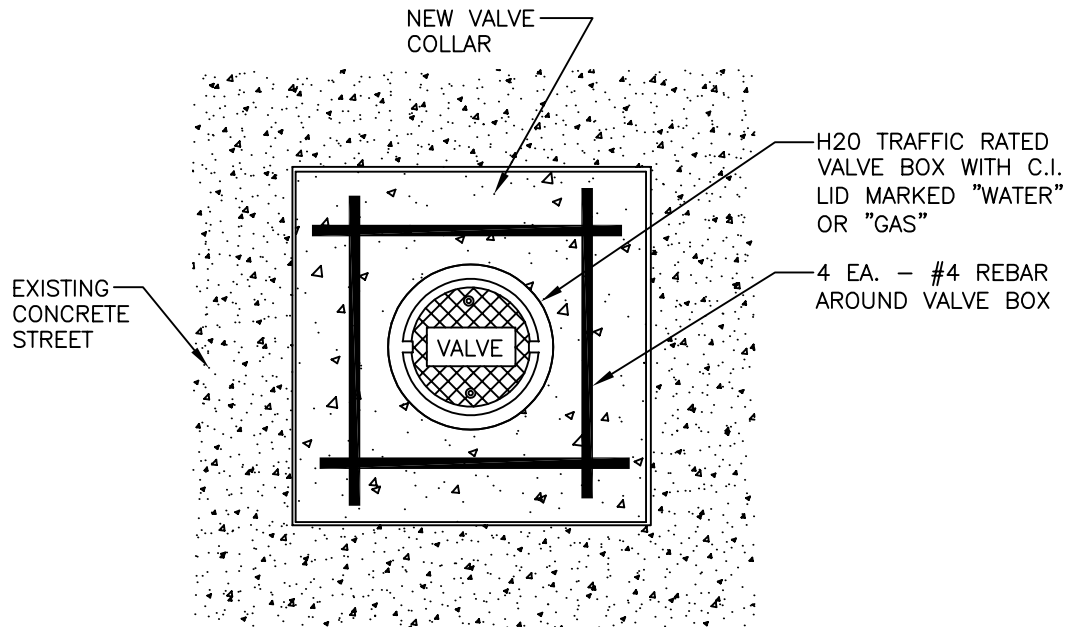


PROFILE

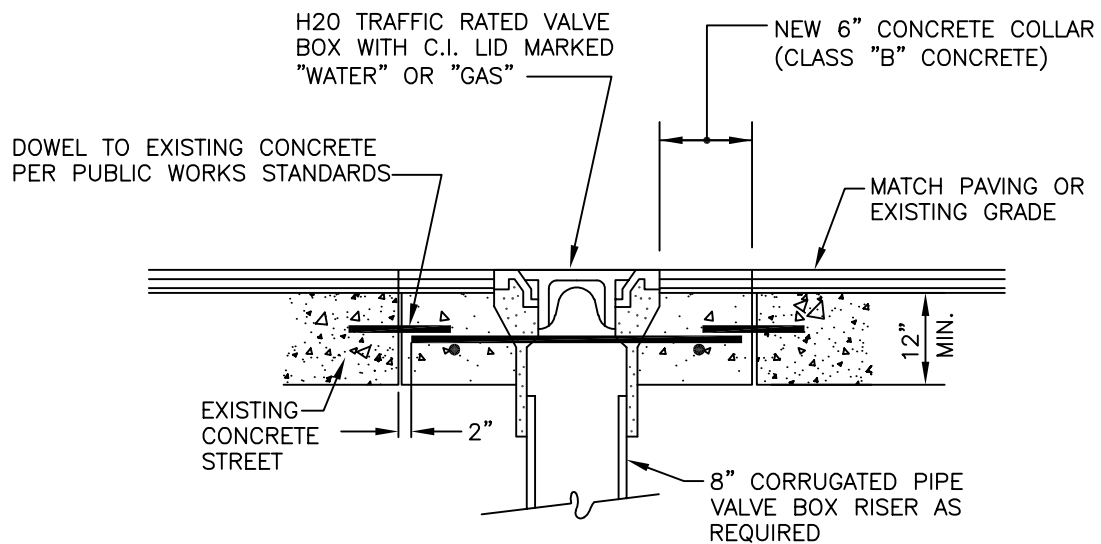
NOTE:

ANY GAS METER/BACKFLOW DEVICE/AIR RELIEF VALVE ENCLOSURE/FIRE HYDRANT WITHIN THREE (3) FEET OF POTENTIAL VEHICULAR ACCESS SHALL BE PROTECTED BY EITHER COMMERCIAL OR RESIDENTIAL BOLLARDS DEPENDING ON APPLICATION.

BY		DATE	COMMERCIAL BOLLARD STANDARD DETAIL	APPROVED: FEBRUARY 26, 2020	SCALE: NONE
DRAWN	J.J.	8/92		<i>Silvia Santos</i>	DWG. NO.
CHECKED	J.J.	02/20		SILVIA LEE SANTOS ENGINEERING MANAGER	50674 R.E. NO.
REVIEWED	J.J.	02/20		REVISION: FEBRUARY 26, 2020	STD. GWG-05B
CITY OF PALO ALTO, CALIFORNIA					APPENDIX A



PLAN

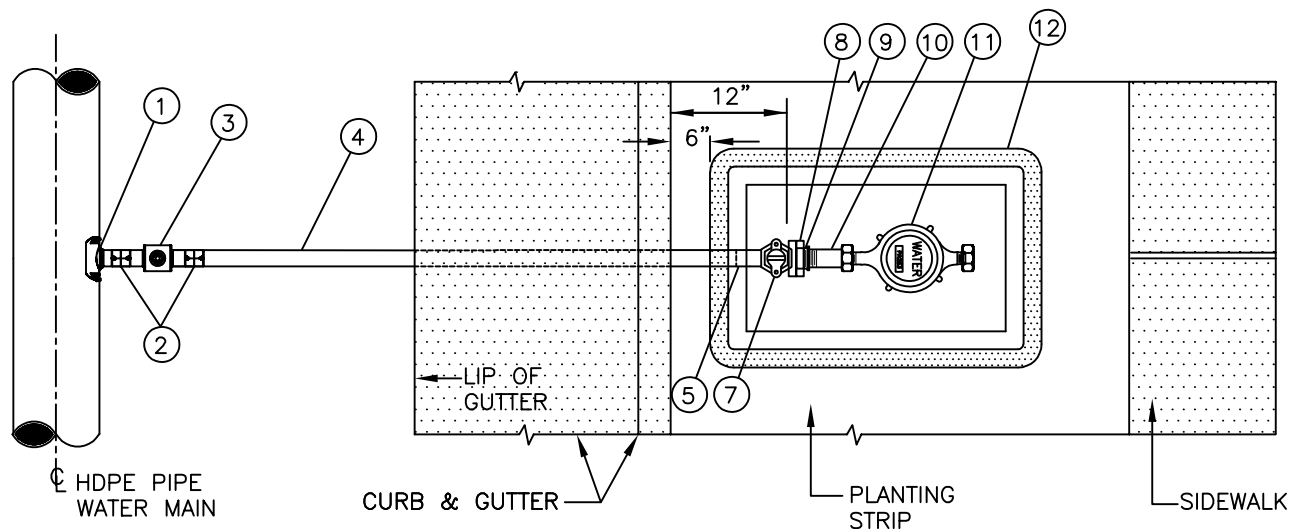


PROFILE

BY	DATE	GAS/WATER VALVE CONCRETE COLLAR AND STEEL REBAR IN EXISTING STREET STANDARD DETAIL	APPROVED:	SCALE: NONE
DRAWN R.E.	12/04		FEBRUARY 26, 2020	
CHECKED J.J.	02/20		<i>Silvia Lee Santos</i> 50674 SILVIA LEE SANTOS R.E. NO. ENGINEERING MANAGER	
REVIEWED J.J.	02/20		REVISION: FEBRUARY 26, 2020	
CITY OF PALO ALTO, CALIFORNIA				DWG. NO. STD. WGW-06
				APPENDIX A

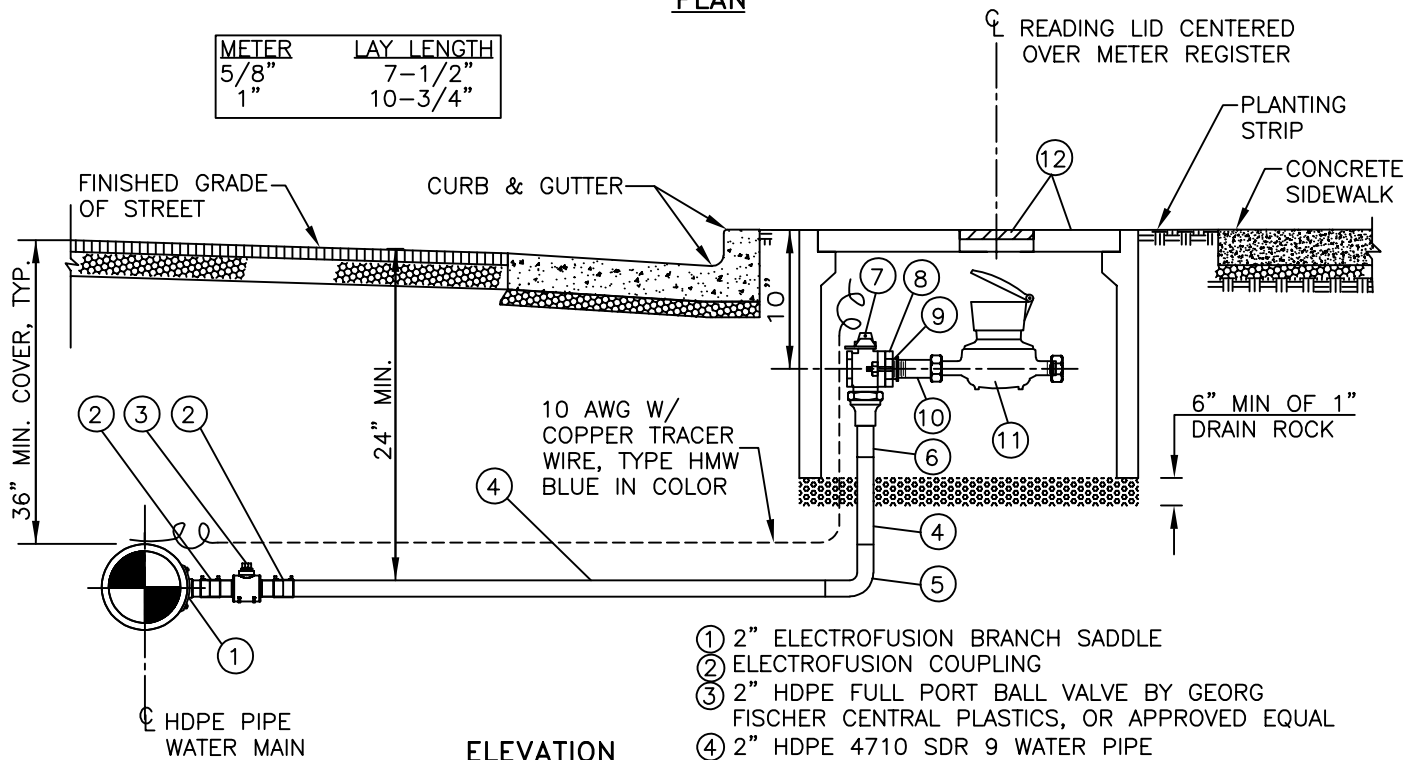
Table of Contents
Appendix B
Water Standard Details

<u>Detail No.</u>	<u>Title</u>
WD-01A	2" HDPE Water Service (HDPE Main) with 5/8" or 1" Meter
WD-01B	2" HDPE Water Service (Non-HDPE Main) with 5/8" or 1" Meter
WD-01C	1" Copper Water Service Connection (Contaminated Soils)
WD-02A	2" HDPE Water Service (HDPE Main) with 1-1/2" or 2" Meter
WD-02B	2" HDPE Water Service (Non-HDPE Main) with 1-1/2" or 2" Meter
WD-02C	2" Copper Water Service (Contaminated Soils)
WD-03A	4" Thru 10" HDPE (HDPE Main) Domestic/Fire Service Connection
WD-03B	4" Thru 10" HDPE (Non-HDPE Main) Domestic/Fire Service Connection
WD-04	4" and 6" Water Meter Set with 2" By-Pass
WD-05A	2" HDPE Water Service (HDPE Main) with Two 5/8" or 1" Meters
WD-05B	2" HDPE Water Service (Non-HDPE Main) with Two 5/8" or 1" Meters
WD-06A	2" Water Service Manifold (HDPE Main) with Two or Four 5/8" or 1" Meters
WD-06B	2" Water Service Manifold (Non-HDPE Main) with Two or Four 5/8" or 1" Meters
WD-07A	2" HDPE Water Service Tap HDPE Fire Service
WD-07B	2" HDPE Water Service Tap Existing Non-HDPE Fire Service
WD-08	Combination Fire/ Domestic Water Service Connection
WD-09	Combination Fire/Domestic Water Service Connection (Multiple Meters)
WD-10	Armorcast Meter Box (30"x48") with Multiple Headers
WD-11A	3" or Larger Reduced Pressure Principle Assembly – RPPA
WD-11B	Parallel Reduced Pressure Principle Assembly
WD-11C	Reduced Pressure Principle Assembly – RPPA (3/4"-2")
WD-12A	Reduced Pressure Detector Assembly RPDA For Fire Services and Sprinklers
WD-12B	Reduced Pressure Detector Assembly RPDA For Inside Installation
WD-12C	Residential Double Check Valve Assembly - DCVA (1"-2")
WD-13	Thrust Block Table
WD-14	Gate Valve Assembly
WD-15	Fire Hydrant Assembly with HDPE Pipe
WD-16	Fire Hydrant or Service Abandonment
WD-17	Vertical Bends HDPE Pipe Connecting to Non-HDPE Pipe
WD-17A	Vertical Bends PVC or DI Pipe Connecting to Non-HDPE Pipe
WD-18	Valve Tie-Back During Construction
WD-19	2" Blow-Off Valve for Dead End HDPE Mains Up to 12"
WD-19A	2" Blow-Off Valve for Dead End Non-HDPE Mains Up to 12"
WD-20	Cut & Cap Existing Main
WD-21	Air Release Valve
WD-22	New Gate Valve (Installation on Exist. Main)



PLAN

METER	LAY LENGTH
5/8"	7-1/2"
1"	10-3/4"



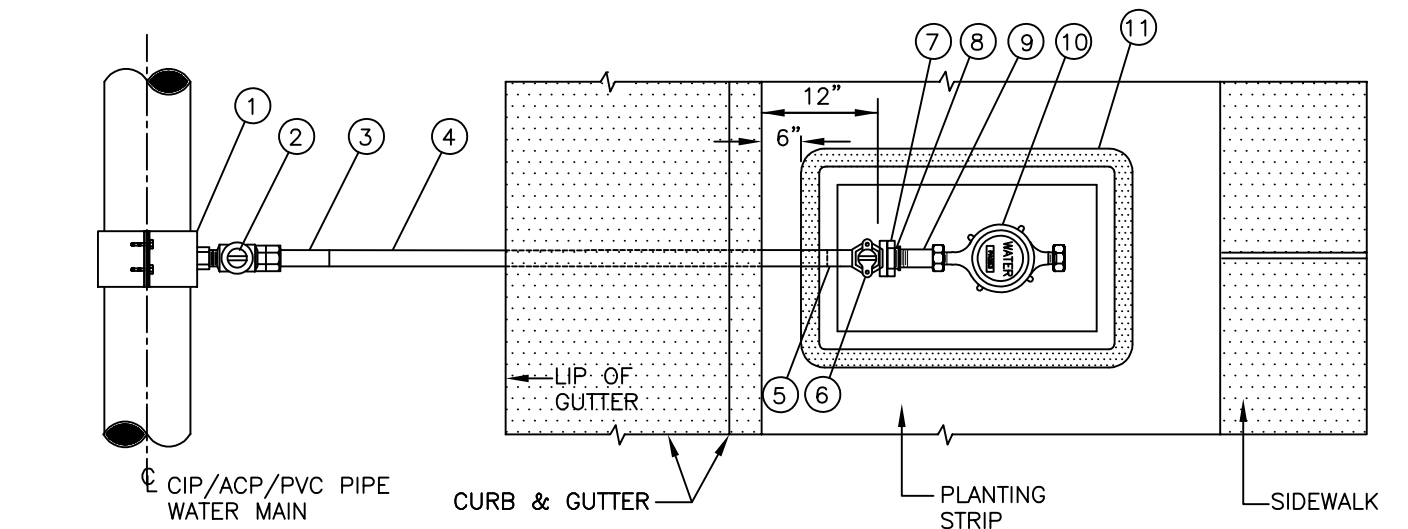
ELEVATION

NOTES:

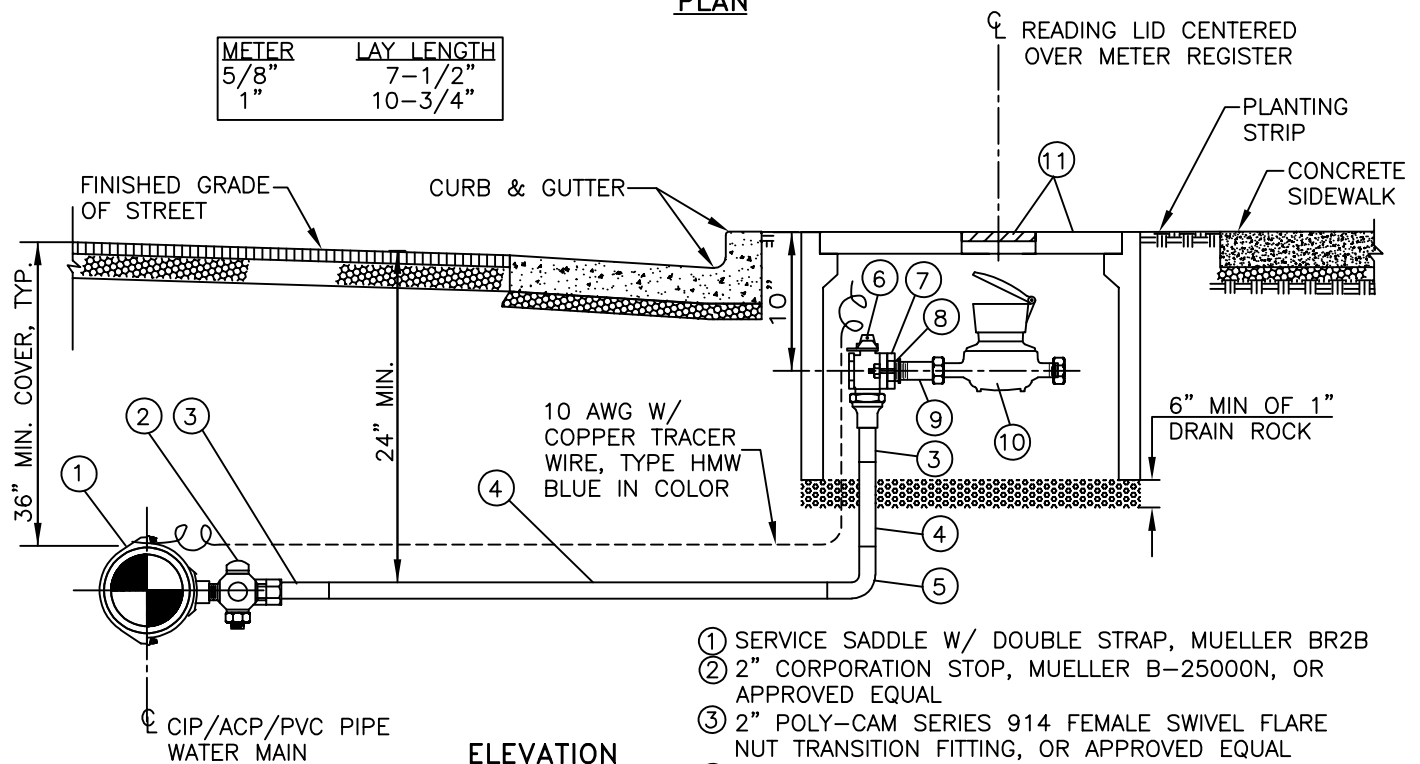
1. METER LOCATION WHERE SIDEWALK & CURB ARE INTEGRAL IS AT BACK OF SIDEWALK INSTEAD OF BACK OF CURB AS SHOWN.
2. METER BOX TO BE LOCATED IN THE CITY RIGHT-OF-WAY OR P.U.E. NEAR TO WATER MAIN
3. AVOID VEHICLE TRAVEL AREAS WHEN POSSIBLE. FOR INSTALLATION IN AREAS SUBJECT TO VEHICULAR TRAFFIC METER BOX SHALL HAVE 20K (TIER 22) LOAD RATING.
4. LIDS SHALL HAVE "WATER" MARKED ON THEM AND MAGNET IMBEDDED IN COVER.

- 1 2" ELECTROFUSION BRANCH SADDLE
- 2 ELECTROFUSION COUPLING
- 3 2" HDPE FULL PORT BALL VALVE BY GEORG FISCHER CENTRAL PLASTICS, OR APPROVED EQUAL
- 4 2" HDPE 4710 SDR 9 WATER PIPE
- 5 BUTT FUSION SWEEP OR 90° ELL
- 6 2" POLY-CAM SERIES 914 FEMALE SWIVEL FLARE NUT TRANSITION FITTING, OR APPROVED EQUAL
- 7 2" ANGLE METER STOP, MUELLER B-24277N, OR APPROVED EQUAL
- 8 FORD CF31-77 2" FL X 2" FIP TRANSITION
- 9 1" X 2" BRASS BUSHING FOR 1" METER OR 3/4" X 2" BRASS BUSHING FOR 5/8" METER
- 10 STRAIGHT METER COUPLING
- 11 5/8" OR 1" BADGER DISC METER (CITY PROVIDED)
- 12 ARMORCAST 11"x21"x12" POLYMER CONCRETE METER BOX & COVER W/DROP-IN LID (PART #A6000492TACPA)

BY	DATE	2" HDPE WATER SERVICE (HDPE MAIN) WITH 5/8" OR 1" METER STANDARD DETAIL	APPROVED: FEBRUARY 26, 2020	SCALE: NONE
DRAWN J.J.	02/19		<i>Silvia Lee Santos</i> SILVIA LEE SANTOS ENGINEERING MANAGER	DWG. NO. STD. WD-01A
CHECKED J.J.	02/20		REVISION: FEBRUARY 26, 2020	APPENDIX B
REVIEWED R.I.	02/20	CITY OF PALO ALTO, CALIFORNIA		



METER	LAY LENGTH
5/8"	7-1/2"
1"	10-3/4"

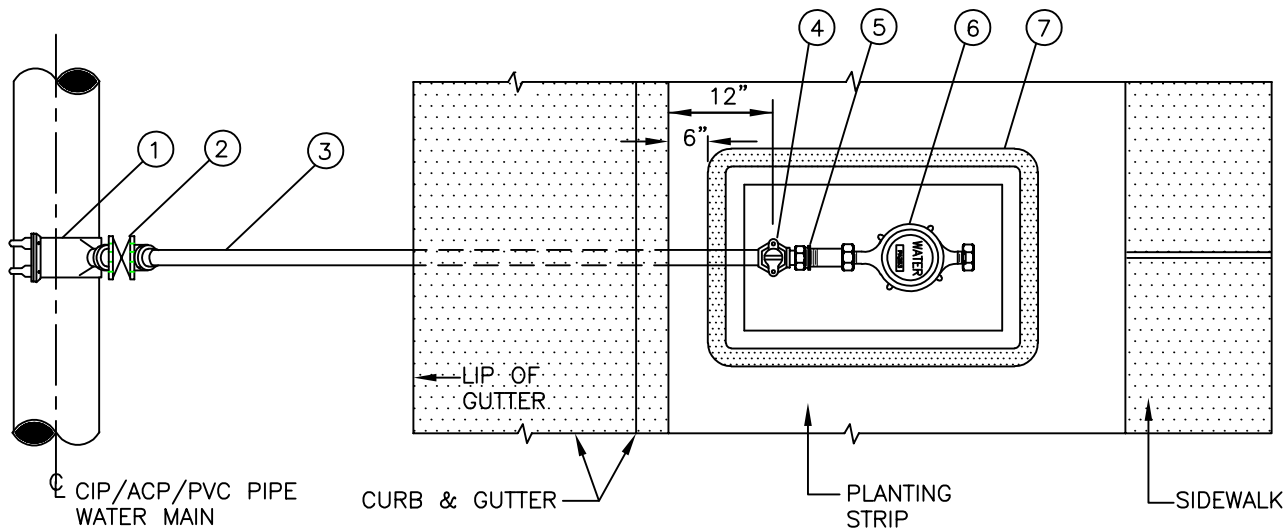


NOTES:

1. METER LOCATION WHERE SIDEWALK & CURB ARE INTEGRAL IS AT BACK OF SIDEWALK INSTEAD OF BACK OF CURB AS SHOWN.
2. METER BOX TO BE LOCATED IN THE CITY RIGHT-OF-WAY OR P.U.E. NEAR TO WATER MAIN
3. AVOID VEHICLE TRAVEL AREAS WHEN POSSIBLE. FOR INSTALLATION IN AREAS SUBJECT TO VEHICULAR TRAFFIC METER BOX SHALL HAVE 20K (TIER 22) LOAD RATING.
4. LIDS SHALL HAVE "WATER" MARKED ON THEM AND MAGNET IMBEDDED IN COVER.

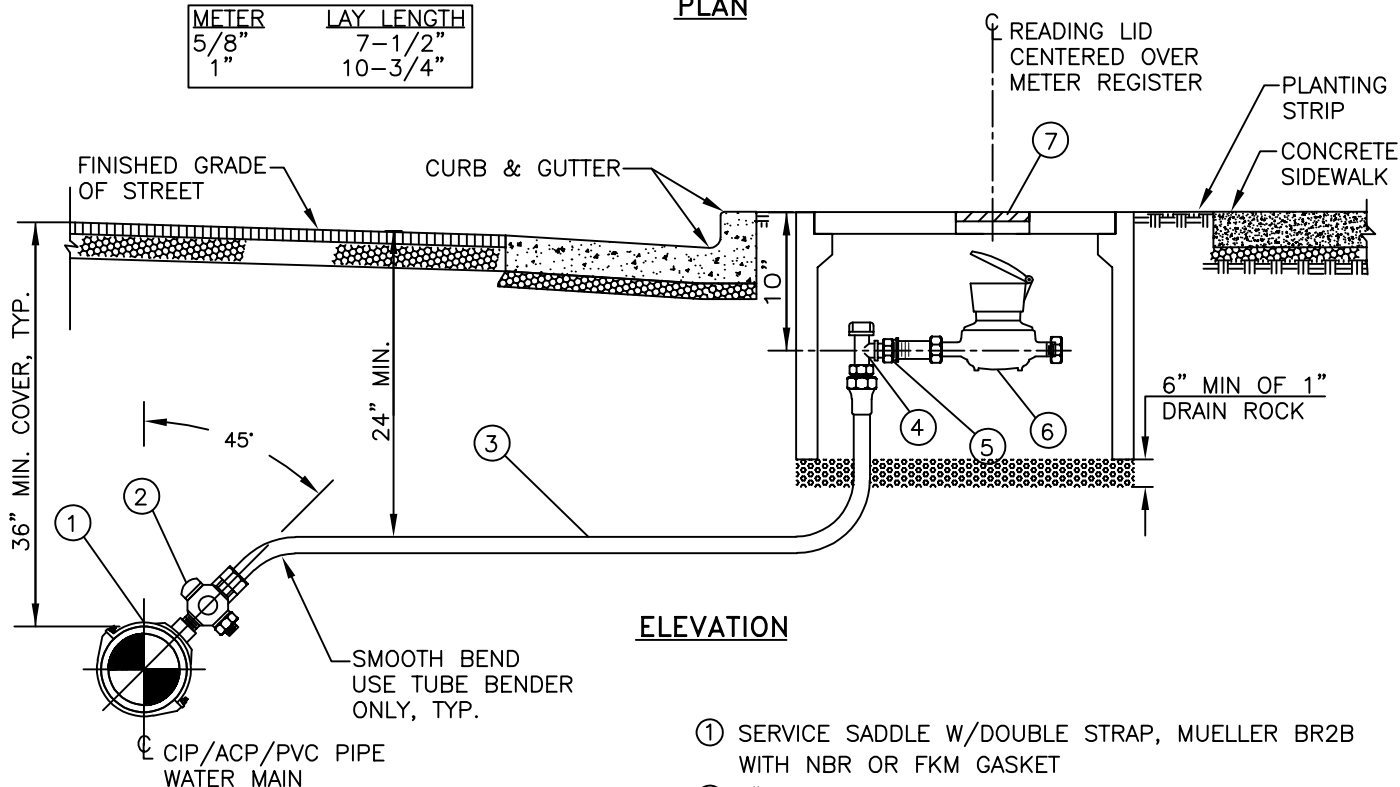
- 1 SERVICE SADDLE W/ DOUBLE STRAP, MUELLER BR2B
- 2 2" CORPORATION STOP, MUELLER B-2500N, OR APPROVED EQUAL
- 3 2" POLY-CAM SERIES 914 FEMALE SWIVEL FLARE NUT TRANSITION FITTING, OR APPROVED EQUAL
- 4 2" HDPE 4710 SDR 9 WATER PIPE
- 5 BUTT FUSION SWEEP OR 90° ELL
- 6 2" ANGLE METER STOP, MUELLER B-24277N, OR APPROVED EQUAL
- 7 FORD CF31-77 2" FL X 2" FIP TRANSITION
- 8 1" X 2" BRASS BUSHING FOR 1" METER OR 3/4" X 2" BRASS BUSHING FOR 5/8" METER
- 9 STRAIGHT METER COUPLING
- 10 5/8" OR 1" BADGER DISC METER (CITY PROVIDED)
- 11 ARMORCAST 11"x21"x12" POLYMER CONCRETE METER BOX & COVER W/DROP-IN LID (PART #A6000492TACPA)

BY	DATE	2" HDPE WATER SERVICE (NON-HDPE MAIN) WITH 5/8" OR 1" METER STANDARD DETAIL	APPROVED: FEBRUARY 26, 2020	SCALE: NONE
DRAWN	J.J. 02/19		<i>Silvia Santos</i> SILVIA LEE SANTOS ENGINEERING MANAGER	DWG. NO. STD. WD-01B
CHECKED	J.J. 02/20		50674 R.E. NO.	
REVIEWED	R.I. 02/20		REVISION: FEBRUARY 26, 2020	APPENDIX B
		CITY OF PALO ALTO, CALIFORNIA		



METER	LAY LENGTH
5/8"	7-1/2"
1"	10-3/4"

PLAN



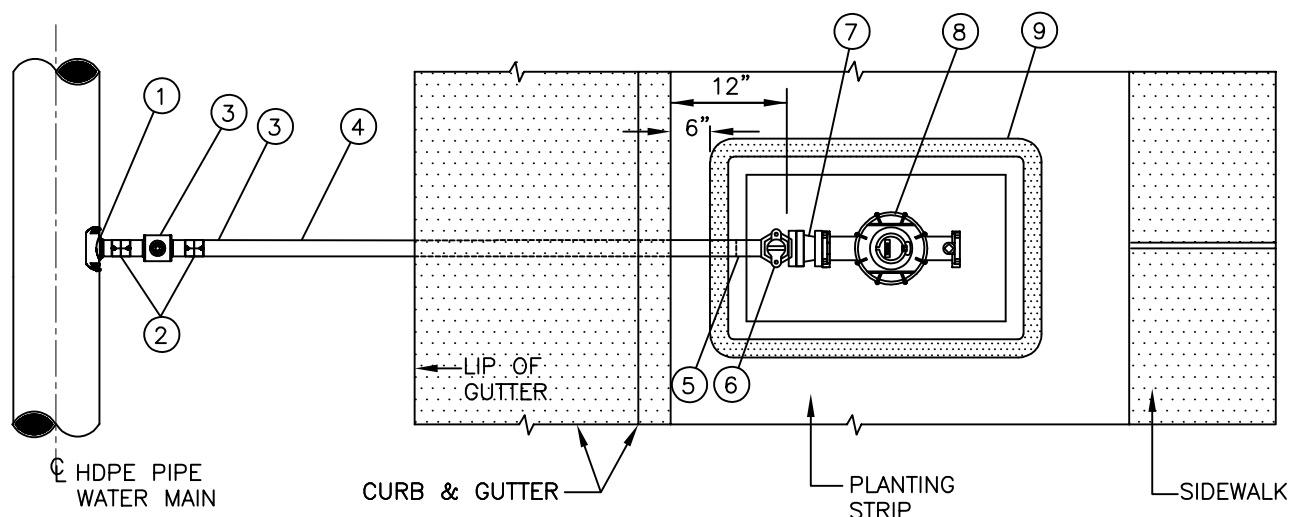
ELEVATION

NOTES:

1. METER LOCATION WHERE SIDEWALK & CURB ARE INTEGRAL IS AT BACK OF SIDEWALK INSTEAD OF BACK OF CURB AS SHOWN.
2. METER BOX TO BE LOCATED IN THE CITY RIGHT-OF-WAY OR P.U.E. NEAR TO WATER MAIN
3. AVOID VEHICLE TRAVEL AREAS WHEN POSSIBLE. FOR INSTALLATION IN AREAS SUBJECT TO VEHICULAR TRAFFIC METER BOX SHALL HAVE 20K (TIER 22) LOAD RATING.
4. LIDS SHALL HAVE "WATER" MARKED ON THEM AND MAGNET IMBEDDED IN COVER.

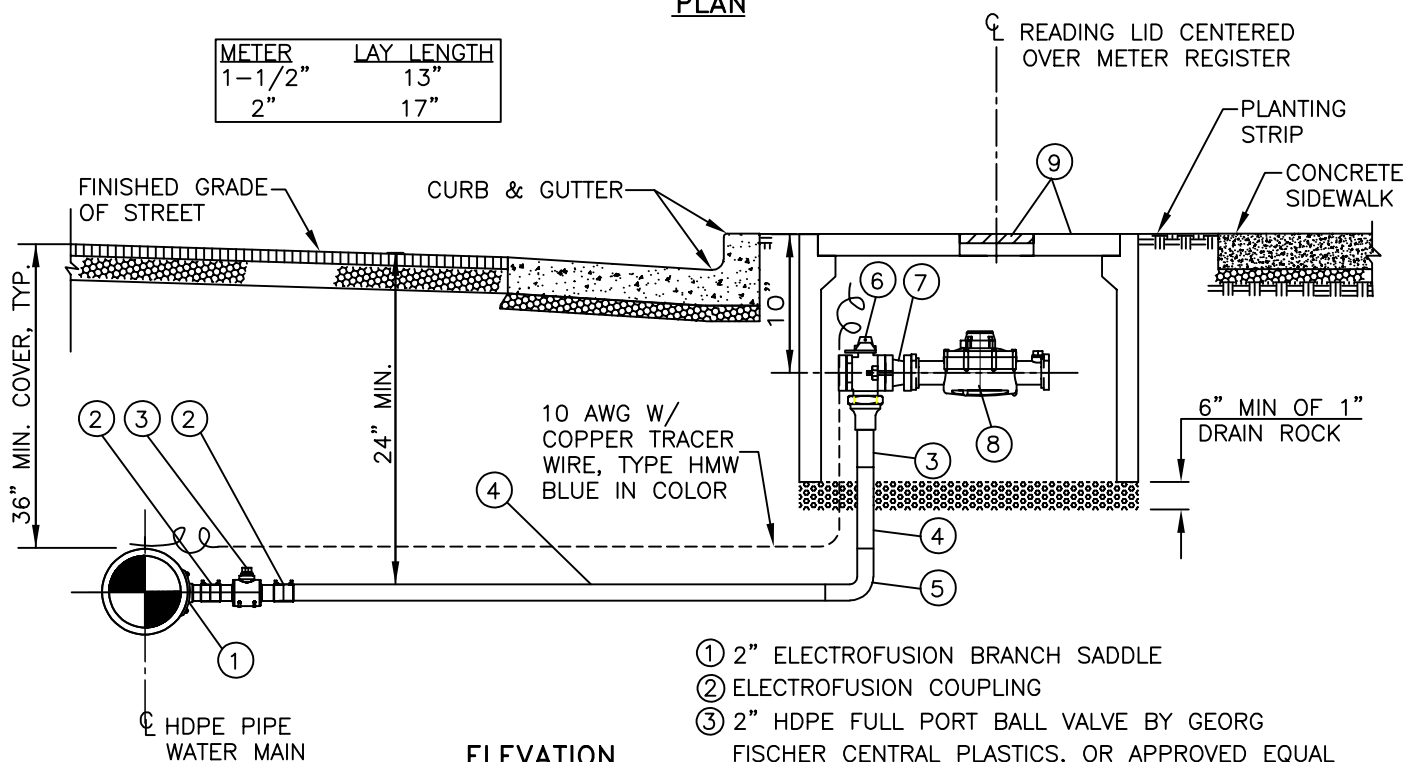
- ① SERVICE SADDLE W/DOUBLE STRAP, MUELLER BR2B WITH NBR OR FKM GASKET
- ② 1" CORPORATION STOP, MUELLER B-25000N
- ③ 1" COPPER PIPE TYPE "K"
- ④ 1" ANGLE METER STOP, MUELLER B-24255N
- ⑤ 3/4"x1" BRASS BUSHING, (5/8" METER ONLY)
- ⑥ 5/8" OR 1" BADGER DISC METER (CITY PROVIDED)
- ⑦ ARMORCAST 11"x21"x12" POLYMER CONCRETE METER BOX AND COVER ASSEMBLY W/ DROP-IN LID (PART #A6000492TACPA).

BY	DATE	1" COPPER WATER SERVICE CONNECTION (CONTAMINATED SOILS) STANDARD DETAIL	APPROVED: FEBRUARY 26, 2020	SCALE: NONE
DRAWN J.J.	2/92		<i>Silvia Santos</i> 50674	DWG. NO.
CHECKED J.J.	2/20		SILVIA LEE SANTOS ENGINEERING MANAGER R.E. NO.	STD. WD-01C
REVIEWED R.I.	2/20	CITY OF PALO ALTO, CALIFORNIA	REVISION: FEBRUARY 26, 2020	APPENDIX B



PLAN

METER	LAY LENGTH
1-1/2"	13"
2"	17"



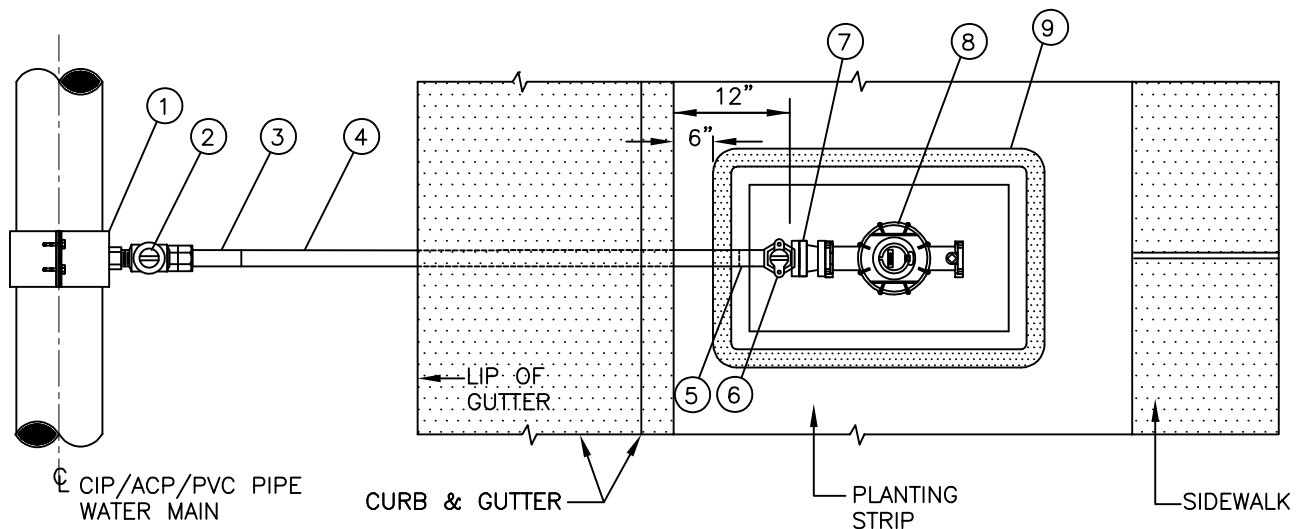
ELEVATION

NOTES:

1. METER LOCATION WHERE SIDEWALK & CURB ARE INTEGRAL IS AT BACK OF SIDEWALK INSTEAD OF BACK OF CURB AS SHOWN.
2. METER BOX TO BE LOCATED IN THE CITY RIGHT-OF-WAY OR P.U.E. NEAR TO WATER MAIN
3. AVOID VEHICLE TRAVEL AREAS WHEN POSSIBLE. FOR INSTALLATION IN AREAS SUBJECT TO VEHICULAR TRAFFIC METER BOX SHALL HAVE 20K (TIER 22) LOAD RATING.
4. LIDS SHALL HAVE "WATER" MARKED ON THEM AND MAGNET IMBEDDED IN COVER.

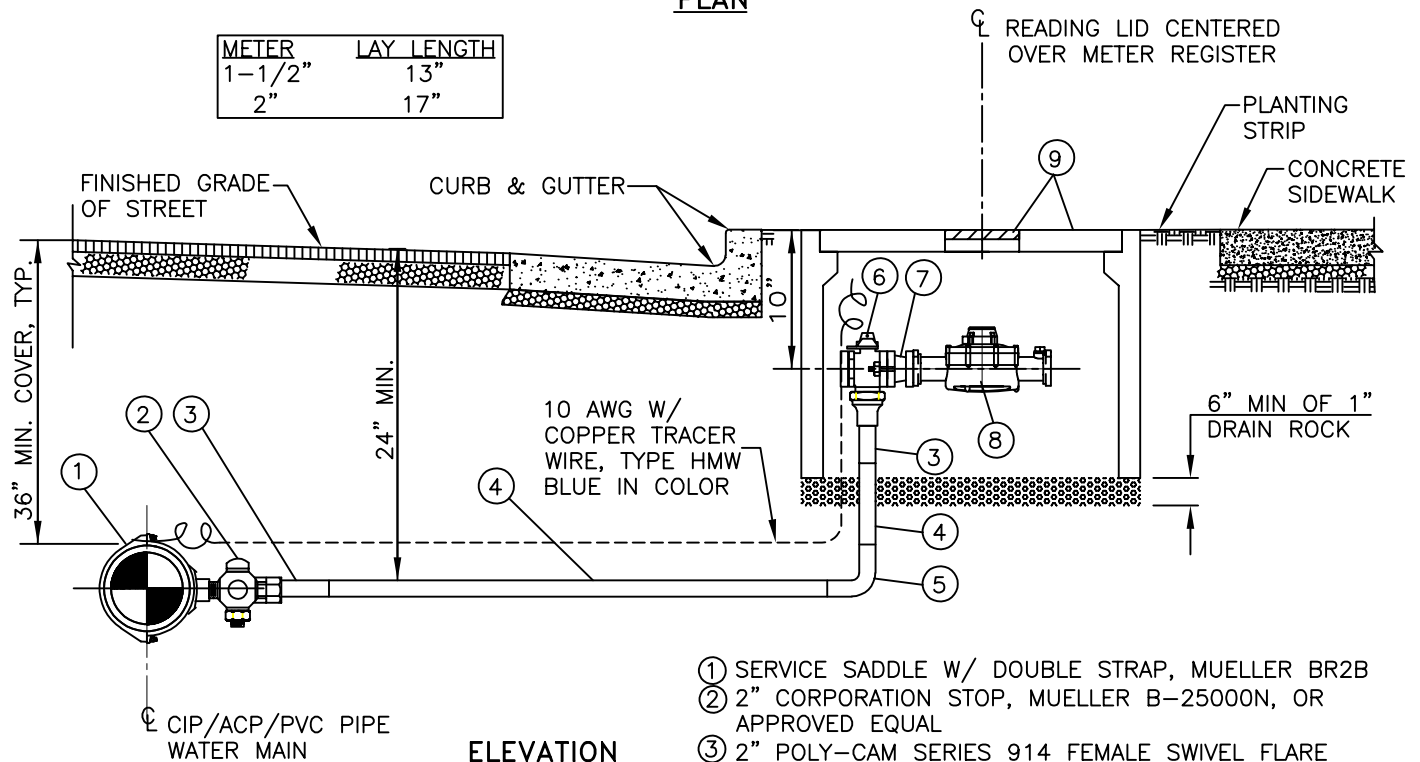
- ① 2" ELECTROFUSION BRANCH SADDLE
- ② ELECTROFUSION COUPLING
- ③ 2" HDPE FULL PORT BALL VALVE BY GEORG FISCHER CENTRAL PLASTICS, OR APPROVED EQUAL
- ④ 2" HDPE 4710 SDR 9 WATER PIPE
- ⑤ BUTT FUSION SWEEP OR 90° ELL
- ⑥ 2" ANGLE METER STOP, MUELLER B-24277N, OR APPROVED EQUAL
- ⑦ FORD METER ADAPTER A67-NL 2" FLANGE X 1-1/2" FLANGE FOR 1-1/2" METER
- ⑧ 1-1/2" X 2" BADGER DISC METER (CITY PROVIDED)
- ⑨ ARMORCAST 17"x30"x12" POLYMER CONCRETE METER BOX & COVER W/DROP-IN LID (PART # A60001640TAPCX12CPA)

BY	DATE	2" HDPE WATER SERVICE (HDPE MAIN) WITH 1-1/2" OR 2" METER STANDARD DETAIL	APPROVED: FEBRUARY 26, 2020	SCALE: NONE
DRAWN	J.J. 02/19		<i>Silvia Lee Santos</i> SILVIA LEE SANTOS ENGINEERING MANAGER	DWG. NO. STD. WD-02A
CHECKED	J.J. 02/20		REVISION: FEBRUARY 26, 2020	APPENDIX B
REVIEWED	R.I. 02/20		CITY OF PALO ALTO, CALIFORNIA	



PLAN

METER	LAY LENGTH
1-1/2"	13"
2"	17"



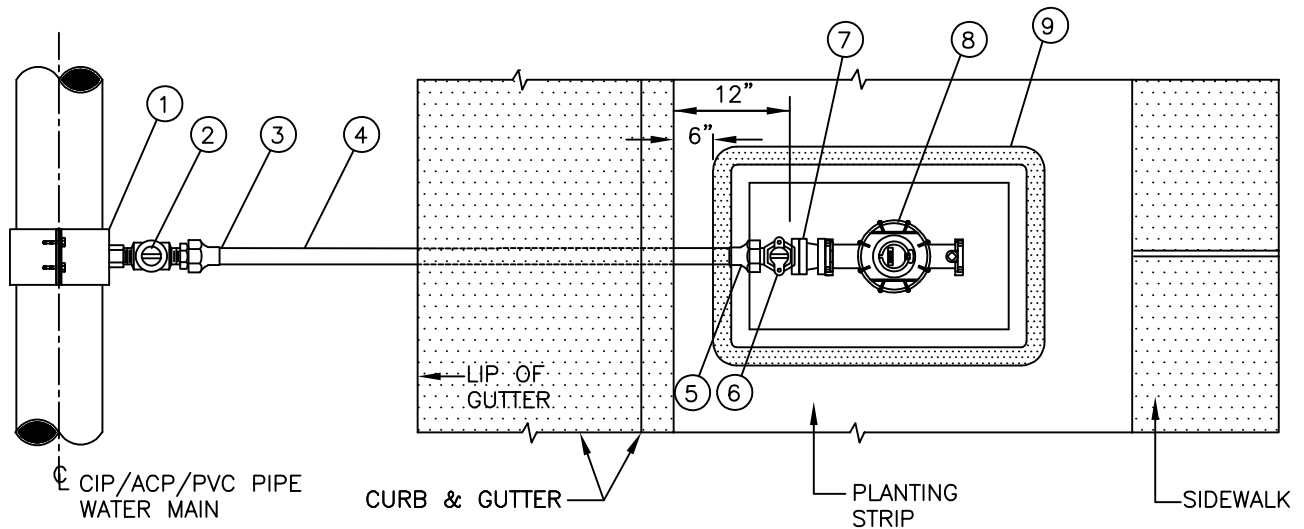
ELEVATION

NOTES:

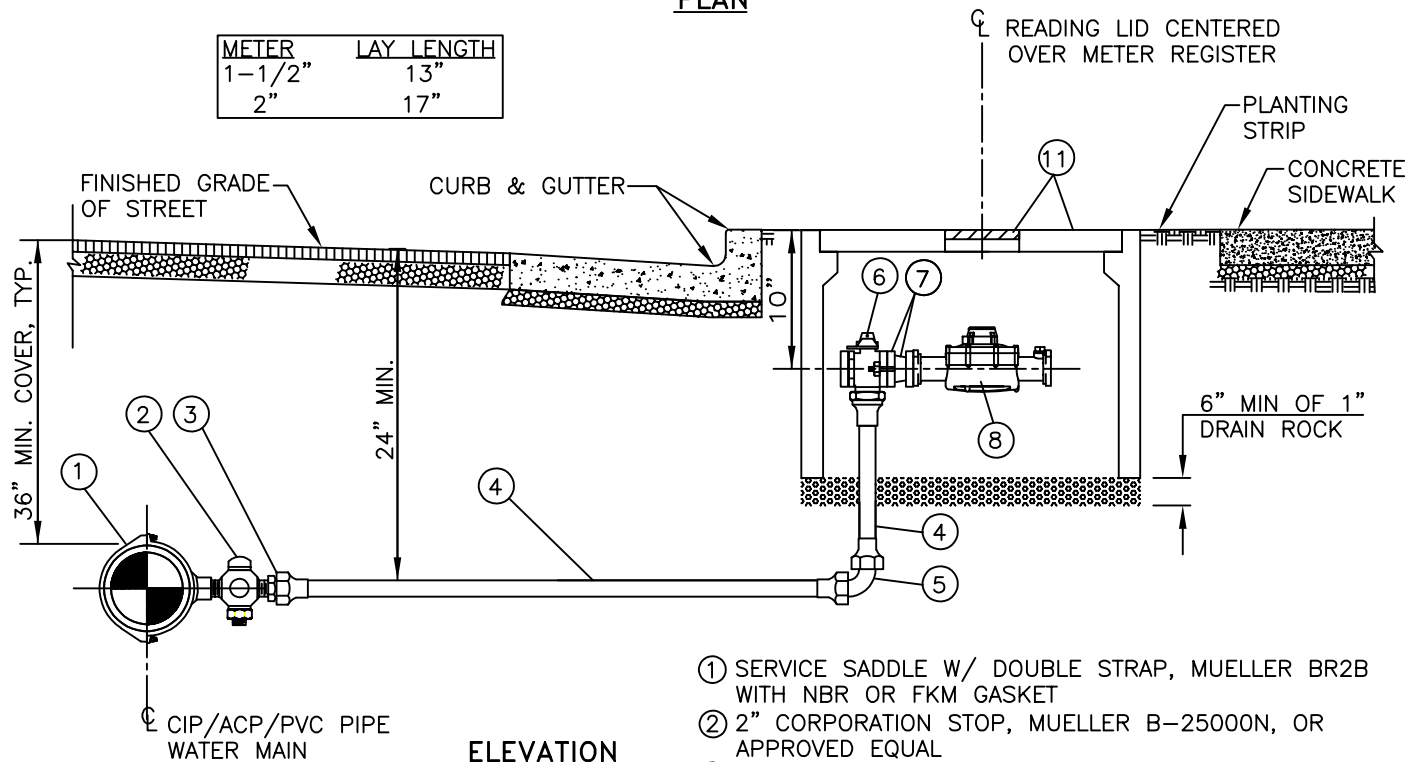
1. METER LOCATION WHERE SIDEWALK & CURB ARE INTEGRAL IS AT BACK OF SIDEWALK INSTEAD OF BACK OF CURB AS SHOWN.
2. METER BOX TO BE LOCATED IN THE CITY RIGHT-OF-WAY OR P.U.E. NEAR TO WATER MAIN
3. AVOID VEHICLE TRAVEL AREAS WHEN POSSIBLE. FOR INSTALLATION IN AREAS SUBJECT TO VEHICULAR TRAFFIC METER BOX SHALL HAVE 20K (TIER 22) LOAD RATING.
4. LIDS SHALL HAVE "WATER" MARKED ON THEM AND MAGNET IMBEDDED IN COVER.

- ① SERVICE SADDLE W/ DOUBLE STRAP, MUELLER BR2B
- ② 2" CORPORATION STOP, MUELLER B-2500N, OR APPROVED EQUAL
- ③ 2" POLY-CAM SERIES 914 FEMALE SWIVEL FLARE NUT TRANSITION FITTING, OR APPROVED EQUAL
- ④ 2" HDPE 4710 SDR 9 WATER PIPE
- ⑤ BUTT FUSION SWEEP OR 90° ELL
- ⑥ 2" ANGLE METER STOP, MUELLER B-24277N, OR APPROVED EQUAL
- ⑦ FORD METER ADAPTER A67-NL 2" FLANGE X 1-1/2" FLANGE FOR 1-1/2" METER
- ⑧ 1-1/2" X 2" BADGER DISC METER (CITY PROVIDED)
- ⑨ ARMORCAST 17"x30"x12" POLYMER CONCRETE METER BOX & COVER W/DROP-IN LID (PART #A60001640TAPCX12CPA)

BY	DATE	2" HDPE WATER SERVICE (NON-HDPE MAIN) WITH 1-1/2" OR 2" METER STANDARD DETAIL	APPROVED: FEBRUARY 26, 2020	SCALE: NONE
DRAWN	J.J. 02/19		<i>Silvia Lee Santos</i> SILVIA LEE SANTOS ENGINEERING MANAGER	DWG. NO. STD. WD-02B
CHECKED	J.J. 02/20		50674 R.E. NO.	
REVIEWED	R.I. 02/20		REVISION: FEBRUARY 26, 2020	APPENDIX B
		CITY OF PALO ALTO, CALIFORNIA		



METER	LAY LENGTH
1-1/2"	13"
2"	17"



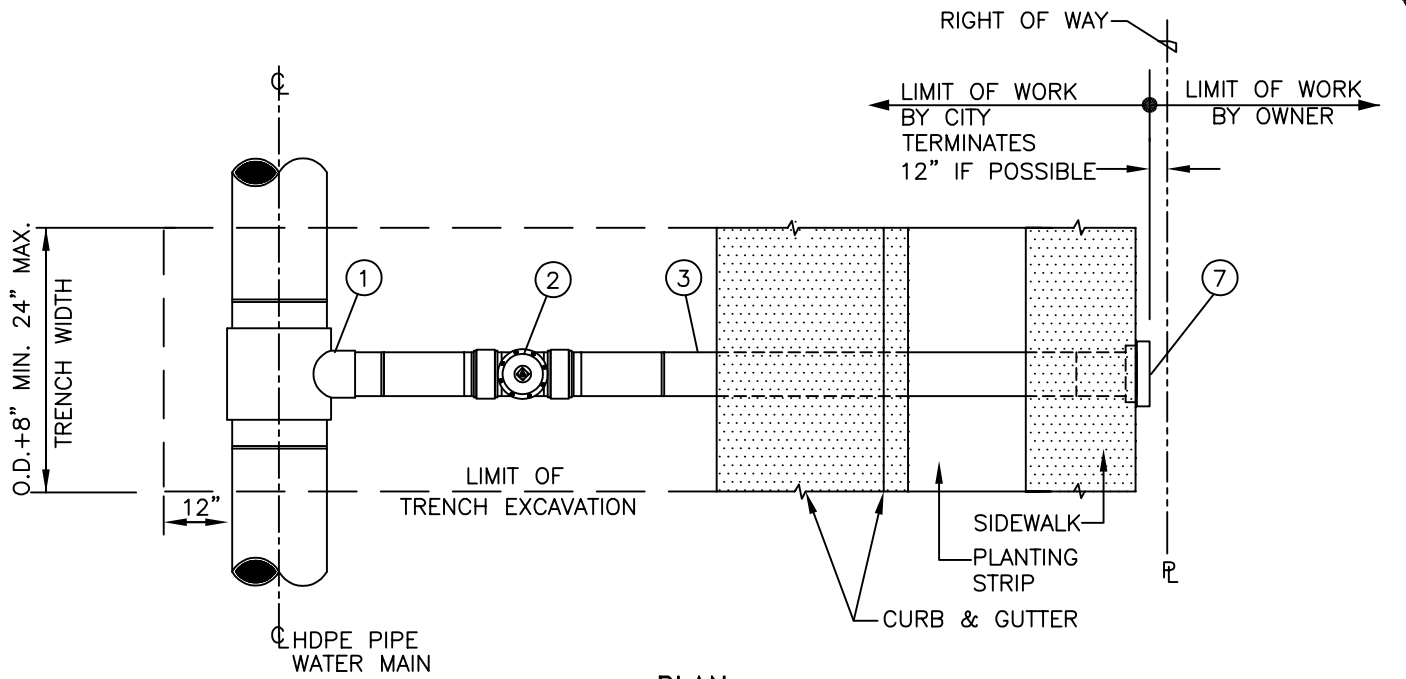
NOTES:

1. METER LOCATION WHERE SIDEWALK & CURB ARE INTEGRAL IS AT BACK OF SIDEWALK INSTEAD OF BACK OF CURB AS SHOWN.
2. METER BOX TO BE LOCATED IN THE CITY RIGHT-OF-WAY OR P.U.E. NEAR TO WATER MAIN
3. AVOID VEHICLE TRAVEL AREAS WHEN POSSIBLE. FOR INSTALLATION IN AREAS SUBJECT TO VEHICULAR TRAFFIC METER BOX SHALL HAVE 20K (TIER 22) LOAD RATING.
4. LIDS SHALL HAVE "WATER" MARKED ON THEM AND MAGNET IMBEDDED IN COVER.

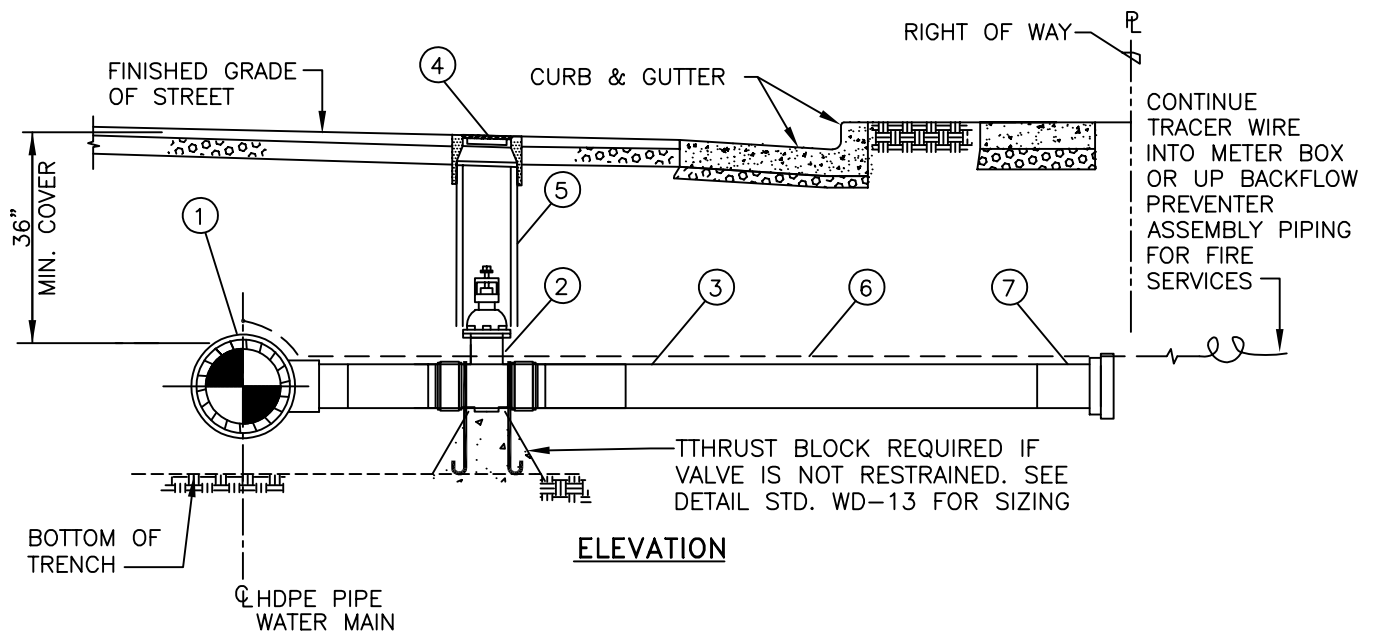
- ① SERVICE SADDLE W/ DOUBLE STRAP, MUELLER BR2B WITH NBR OR FKM GASKET
- ② 2" CORPORATION STOP, MUELLER B-25000N, OR APPROVED EQUAL
- ③ 2" COUPLING CONNECTOR, BRASS MIPTxCU
- ④ 2" COPPER PIPE TYPE "K"
- ⑤ 2" 90° ELL, BRASS
- ⑥ 2" ANGLE METER STOP, MUELLER B-24277N, OR APPROVED EQUAL
- ⑦ FORD METER ADAPTER A67-NL 2" FLANGE X 1-1/2" FLANGE FOR 1-1/2" METER
- ⑧ 1-1/2" X 2" BADGER DISC METER (CITY PROVIDED)
- ⑨ ARMORCAST 17"x30"x12" POLYMER CONCRETE METER BOX & COVER W/DROP-IN LID (PART # A60001640TAPCX12CPA)

BY	DATE	2" COPPER WATER SERVICE (CONTAMINATED SOILS) STANDARD DETAIL	APPROVED: FEBRUARY 26, 2020	SCALE: NONE
DRAWN J.J.	02/19		<i>Silvia Lee Santos</i> 50674	DWG. NO.
CHECKED J.J.	02/20		SILVIA LEE SANTOS ENGINEERING MANAGER	STD. WD-02C
REVIEWED R.I.	02/20		REVISION: FEBRUARY 26, 2020	APPENDIX B

CITY OF PALO ALTO, CALIFORNIA



PLAN



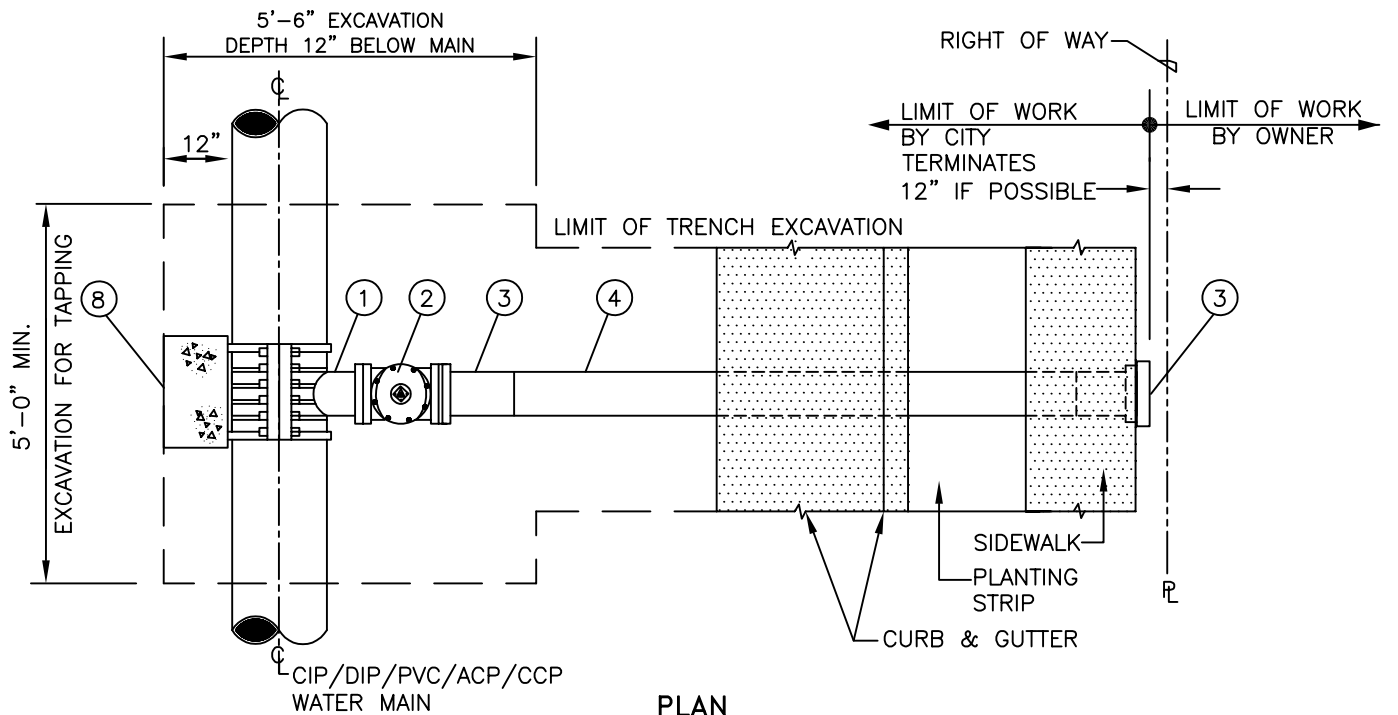
ELEVATION

NOTES:

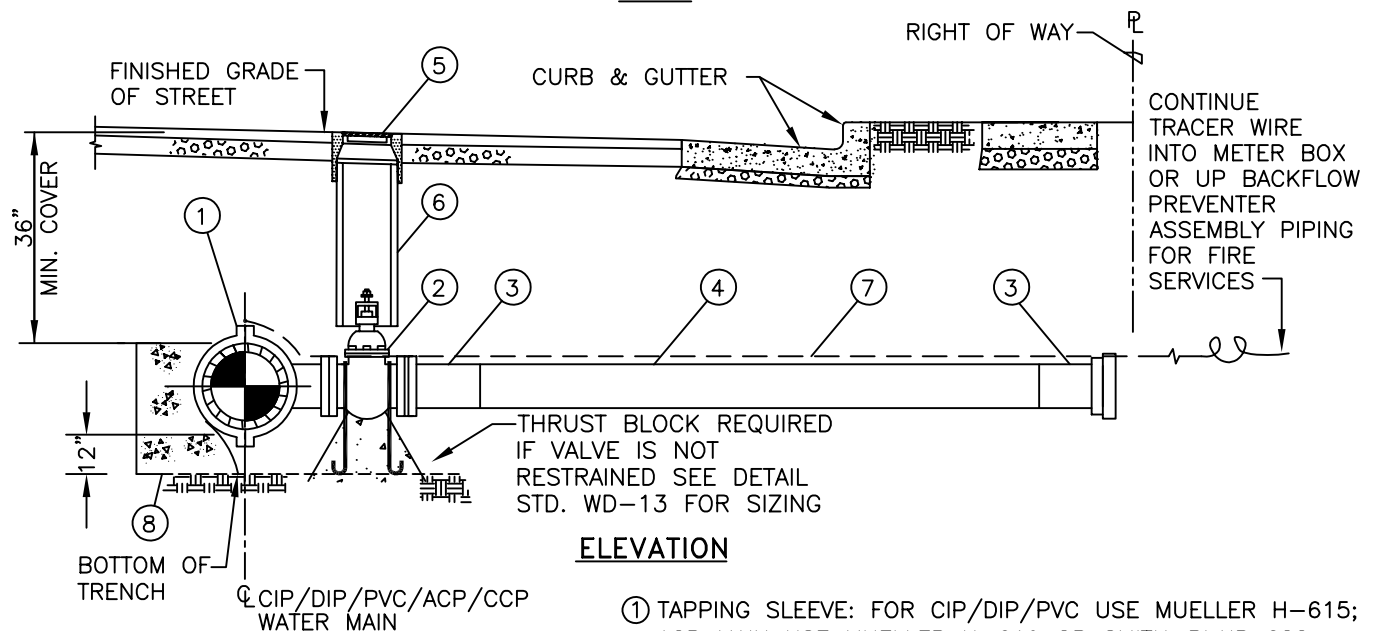
1. METER AND REDUCED PRESSURE PRINCIPLE ASSEMBLY REQUIRED FOR DOMESTIC AND IRRIGATION CONNECTIONS.
2. REDUCED PRESSURE DETECTOR ASSEMBLY REQUIRED FOR FIRE SERVICE.

- ① BUTT FUSION HDPE TEE
- ② RESILIENT SEATED GATE VALVE, AMERICAN AVK PEXPE
- ③ 4710 HDPE SDR 11 WATER PIPE
- ④ TRAFFIC VALVE BOX, OLDCASTLE PRECAST/CHRISTY G05TBOX WITH G05CT H-20 RATED NON-LOCKING LID
- ⑤ 8" CORRUGATED PIPE VALVE BOX RISER AS REQUIRED
- ⑥ TRACER WIRE 10 AWG SOLID COPPER, BLUE. CONCRETE
- ⑦ TRANSITION COUPLING MJxPE

BY	DATE	4" THRU 10" HDPE (HDPE MAIN) DOMESTIC/FIRE SERVICE CONNECTION STANDARD DETAIL CITY OF PALO ALTO, CALIFORNIA	APPROVED: FEBRUARY 26, 2020	SCALE: NONE
DRAWN J.J.	8/92		<i>Silvia Lee Santos</i> 50674	DWG. NO.
CHECKED J.J.	2/20		SILVIA LEE SANTOS ENGINEERING MANAGER R.E. NO.	STD. WD-03A
REVIEWED R.I.	2/20		REVISION: FEBRUARY 26, 2020	APPENDIX B



PLAN



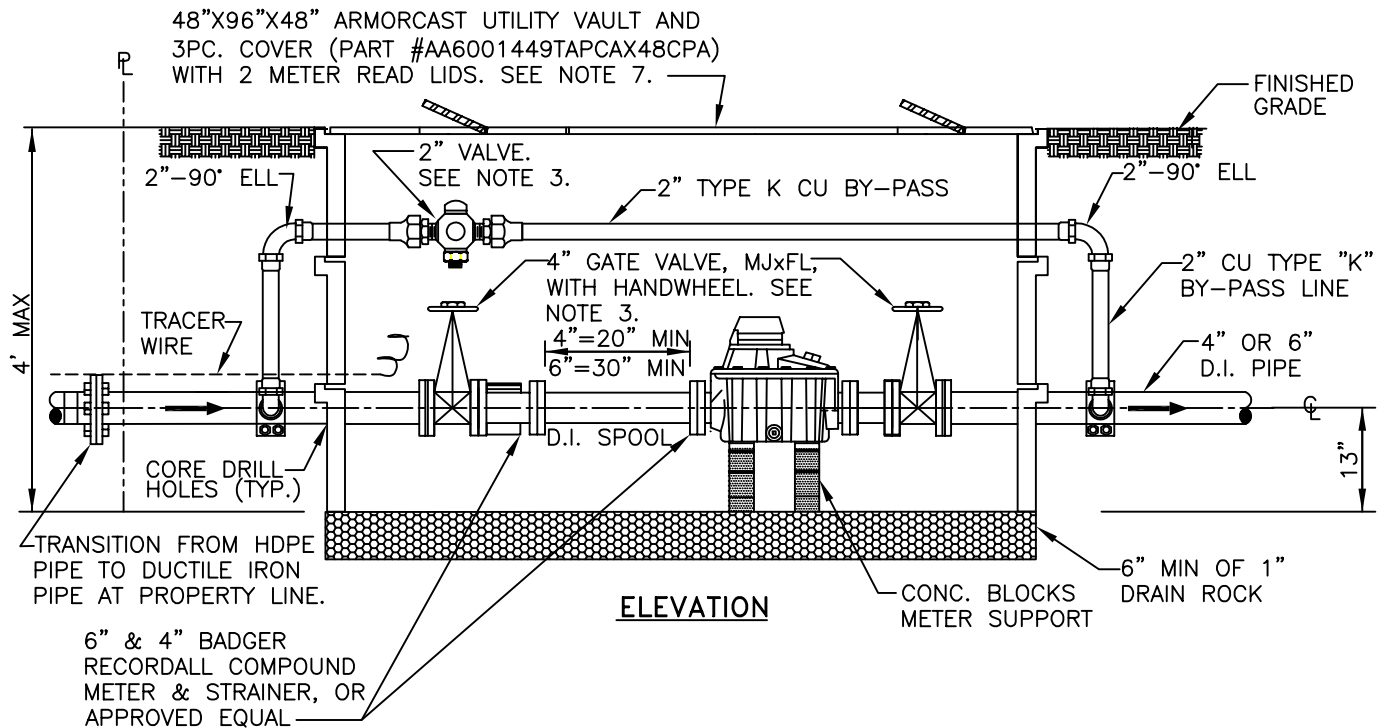
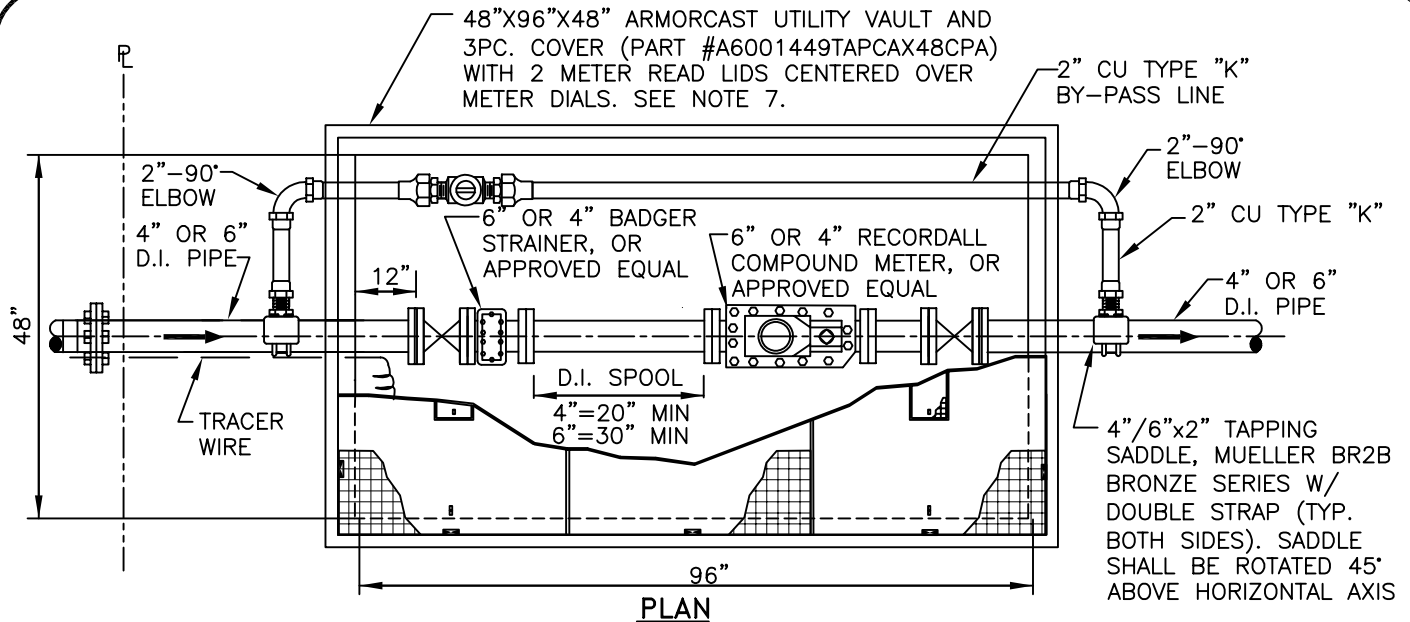
ELEVATION

NOTES:

1. NO TAP TO BE MADE WITHIN 24" OF A JOINT OR FITTING ON CIP OR DIP MAINS.
2. TAP ON ACP OR PVC MAINS SHALL BE MADE 3' MIN. FROM ANY JOINT, COUPLING, OR FITTING.
3. METER AND REDUCED PRESSURE PRINCIPLE ASSEMBLY REQUIRED FOR DOMESTIC AND IRRIGATION CONNECTIONS.
4. REDUCED PRESSURE DETECTOR ASSEMBLY REQUIRED FOR FIRE SERVICE.

- ① TAPPING SLEEVE: FOR CIP/DIP/PVC USE MUELLER H-615; ACP MAIN USE MUELLER H-619 OR SMITH-BLAIR 622; CCP MAIN USE SMITH-BLAIR OR JCM 415
- ② TAPPING GATE VALVE FLxMJ MUELLER A-2361
- ③ TRANSITION COUPLING MJxPE
- ④ 4710 HDPE SDR 11 WATER PIPE
- ⑤ TRAFFIC VALVE BOX, OLDCASTLE PRECAST/CHRISTY G05TBOX WITH G05CT H-20 RATED NON-LOCKING LID
- ⑥ 8" CORRUGATED PIPE VALVE BOX RISER AS REQUIRED
- ⑦ TRACER WIRE 10 AWG SOLID COPPER, BLUE. CONCRETE
- ⑧ THRUST BLOCK, SEE STANDARD DETAIL WD-13 FOR SIZING

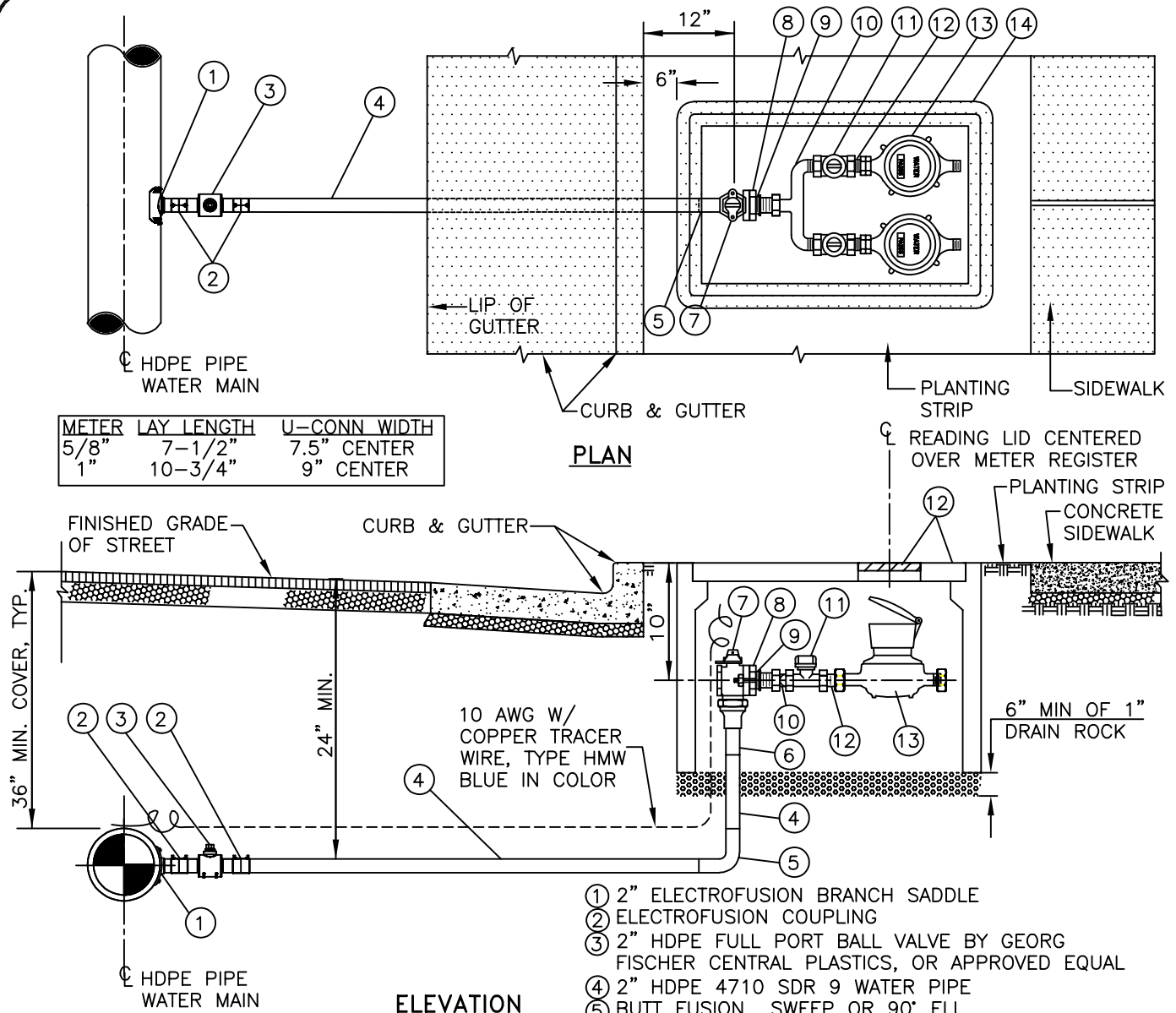
BY	DATE	4" THRU 10" HDPE (NON-HDPE MAIN) DOMESTIC/FIRE SERVICE CONNECTION STANDARD DETAIL CITY OF PALO ALTO, CALIFORNIA	APPROVED: FEBRUARY 26, 2020	SCALE: NONE
DRAWN J.J.	8/92		<i>Silvia Lee Santos</i> 50674	DWG. NO.
CHECKED J.J.	2/20		SILVIA LEE SANTOS R.E. NO.	STD. WD-03B
REVIEWED R.I.	2/20		REVISION: FEBRUARY 26, 2020	APPENDIX B



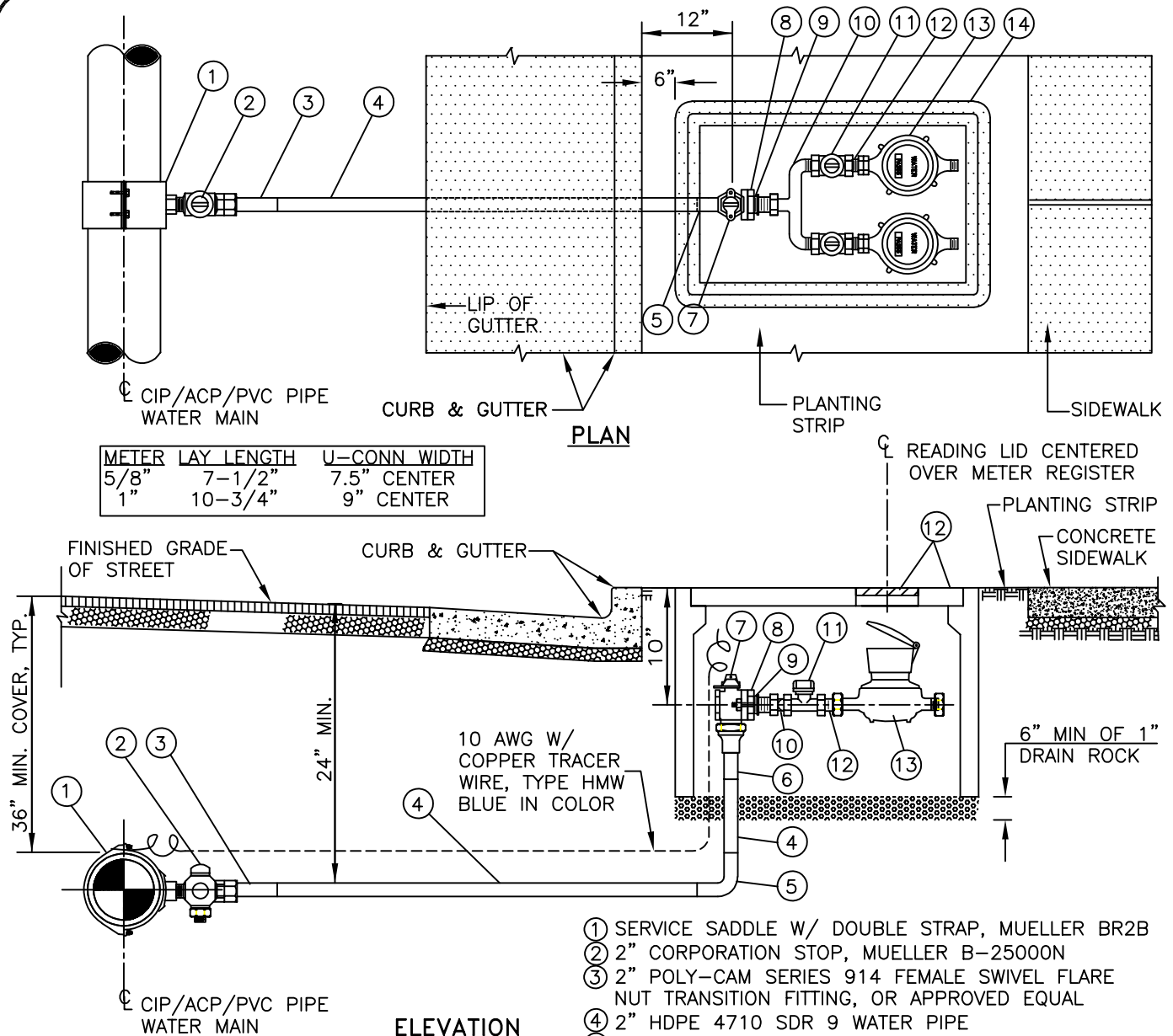
NOTES:

- FOR WATER PIPE CONNECTION TO MAIN, SEE STANDARD DETAIL WD-03A.
- BYPASS LINE SERVICE SADDLE CLAMPS FOR DIP LINE SHALL BE MUELLER BR2B BRONZE SERIES WITH DOUBLE STRAP.
- 2" BALL STRAIGHT CURB VALVE SHALL BE MUELLER B-20287N, OR APPROVED EQUAL. 4" AND 6" GATE VALVES SHALL BE MUELLER A-2361 SERIES, OR APPROVED EQUAL.
- WATER METERS SHALL NOT BE INSTALLED MORE THAN 4 FEET DEEP.
- CUSTOMER TO SUPPLY, INSTALL, AND MAINTAIN VAULT TO GRADE PER CITY SPECIFICATIONS.
- VAULT SHALL BE LOCATED ON PRIVATE PROPERTY NEXT TO THE PROPERTY LINE IN A PUBLIC UTILITY EASEMENT.
- BOX & LID SHALL HAVE MIN. 10K RATING (TIER 5) FOR SIDEWALK AND PLANTING STRIP APPLICATIONS AND A MIN. 20K RATING (TIER 22) FOR DRIVEWAY AND PARKING LOT APPLICATIONS.

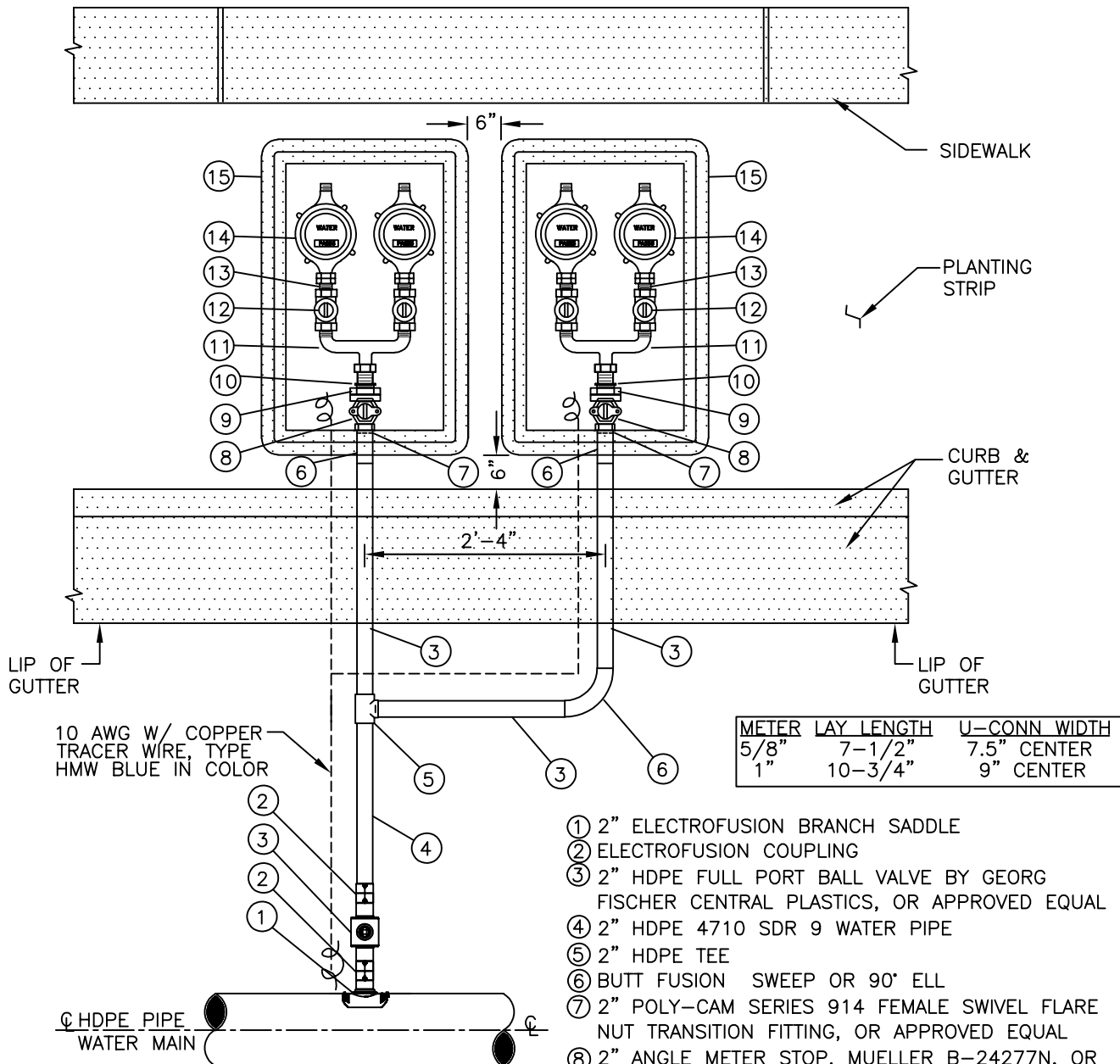
BY	DATE	4" AND 6" WATER METER SET WITH 2" BY-PASS STANDARD DETAIL	APPROVED: FEBRUARY 26, 2019	SCALE: NONE
DRAWN	J.J. 09/91		<i>Silvia Lee Santos</i> SILVIA LEE SANTOS ENGINEERING MANAGER	DWG. NO. STD. WD-04
CHECKED	J.J. 02/20		50674 R.E. NO.	
REVIEWED	R.I. 02/20		REVISION: FEBRUARY 26, 2019	APPENDIX B
		CITY OF PALO ALTO, CALIFORNIA		



BY	DATE	2" HDPE WATER SERVICE (HDPE MAIN) WITH TWO 5/8" OR 1" METERS STANDARD DETAIL	APPROVED: FEBRUARY 26, 2020	SCALE: NONE
DRAWN J.J.	02/19		<i>Silvia Santos</i> 50674	DWG. NO.
CHECKED J.J.	02/20		SILVIA LEE SANTOS ENGINEERING MANAGER	STD. WD-05A
REVIEWED R.I.	02/20		REVISION: FEBRUARY 26, 2020	APPENDIX B



BY		DATE	2" HDPE WATER SERVICE (NON-HDPE MAIN) WITH TWO 5/8" OR 1" METERS STANDARD DETAIL	APPROVED: FEBRUARY 26, 2020 <i>Silvia Santos</i> SILVIA LEE SANTOS ENGINEERING MANAGER	SCALE: NONE
DRAWN	J.J.	02/19			
CHECKED	J.J.	02/20		50674 R.E. NO.	DWG. NO. STD. WD-05B
REVIEWED	R.I.	02/20		REVISION: FEBRUARY 26, 2020	APPENDIX B



PLAN

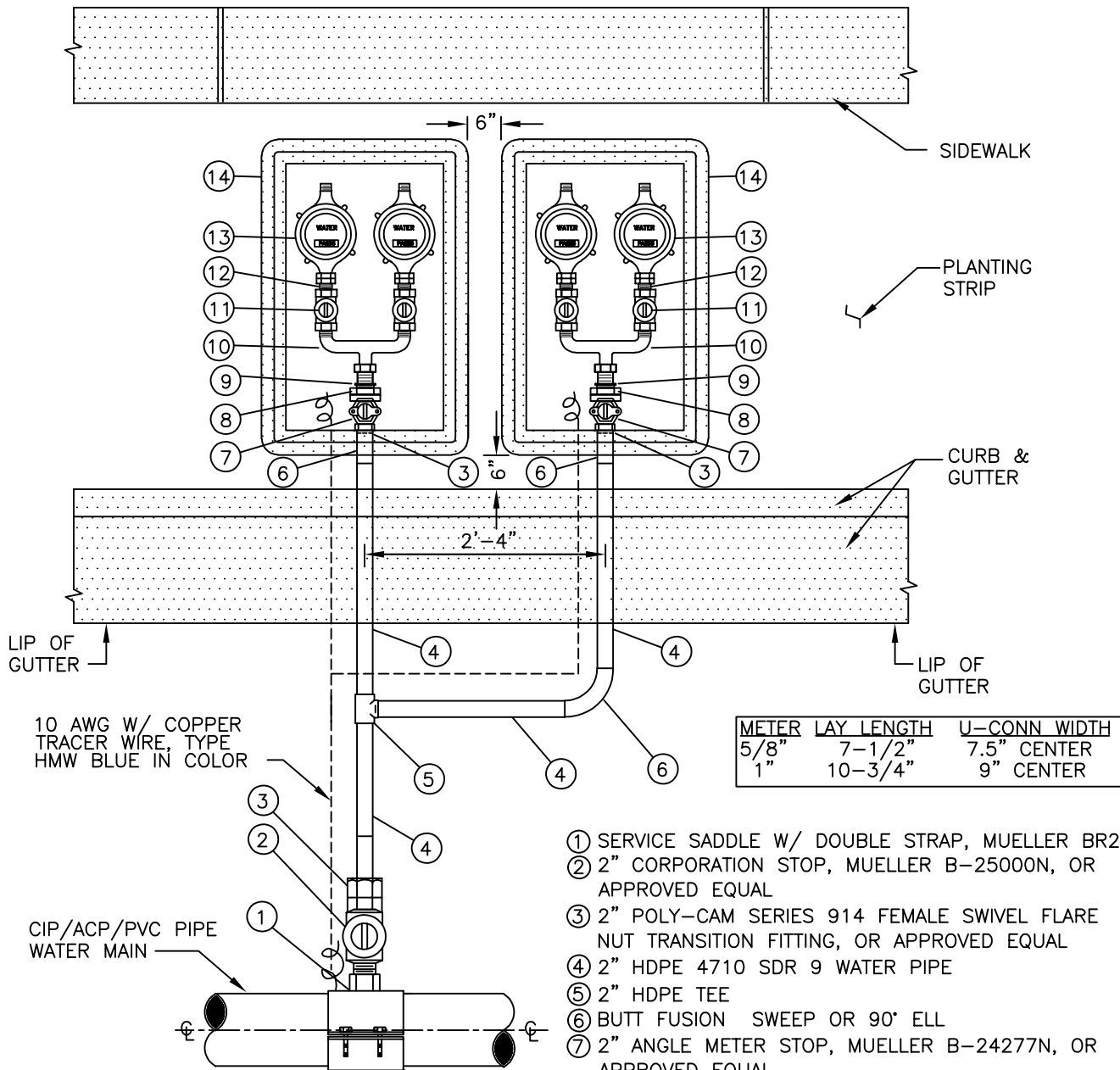
NOTES:

- METER LOCATION WHERE SIDEWALK & CURB ARE INTEGRAL IS AT BACK OF SIDEWALK INSTEAD OF BACK OF CURB AS SHOWN.
- METER BOX TO BE LOCATED IN THE CITY RIGHT-OF-WAY OR P.U.E. NEAR TO WATER MAIN
- AVOID VEHICLE TRAVEL AREAS WHEN POSSIBLE. FOR INSTALLATION IN AREAS SUBJECT TO VEHICULAR TRAFFIC METER BOX SHALL HAVE 20K (TIER 22) LOAD RATING.
- LIDS SHALL HAVE "WATER" MARKED ON THEM AND MAGNET IMBEDDED IN COVER.

- 2" ELECTROFUSION BRANCH SADDLE
- ELECTROFUSION COUPLING
- 2" HDPE FULL PORT BALL VALVE BY GEORG FISCHER CENTRAL PLASTICS, OR APPROVED EQUAL
- 2" HDPE 4710 SDR 9 WATER PIPE
- 2" HDPE TEE
- BUTT FUSION SWEEP OR 90° ELL
- 2" POLY-CAM SERIES 914 FEMALE SWIVEL FLARE NUT TRANSITION FITTING, OR APPROVED EQUAL
- 2" ANGLE METER STOP, MUELLER B-24277N, OR APPROVED EQUAL
- FORD CF31-77 2" FL X 2" FIP TRANSITION
- 1" X 2" BRASS BUSHING FOR 1" METERS OR 3/4" X 2" BRASS BUSHING FOR 5/8" METERS
- 3/4" OR 1" U-CONNECTOR SERIES 708UMM MNPT X MNPT BY AY MCDONALD OR APPROVED EQUAL
- BALL STRAIGHT METER VALVE, MUELLER B-20287N
- STRAIGHT METER COUPLING
- 5/8" OR 1" BADGER DISC METER (CITY PROVIDED)
- ARMORCAST POLYMER CONCRETE METER BOX & COVER W/DROP-IN LID. FOR 5/8" METERS USE 17"x30"x12" (PART # A6001640TAPCX12CPA). FOR 1" METERS USE 24"x36"x12" (PART # A6001974TAPCX12CPA)

BY	DATE	2" WATER SERVICE MANIFOLD (HDPE MAIN) WITH TWO OR FOUR 5/8" OR 1" METERS STANDARD DETAIL	APPROVED: FEBRUARY 26, 2020	SCALE: NONE
DRAWN J.J.	02/19		<i>Silvia Santos</i> 50674	DWG. NO.
CHECKED J.J.	02/20		SILVIA LEE SANTOS ENGINEERING MANAGER R.E. NO.	STD. WD-06A
REVIEWED R.I.	02/20		REVISION: FEBRUARY 26, 2020	APPENDIX B

CITY OF PALO ALTO, CALIFORNIA



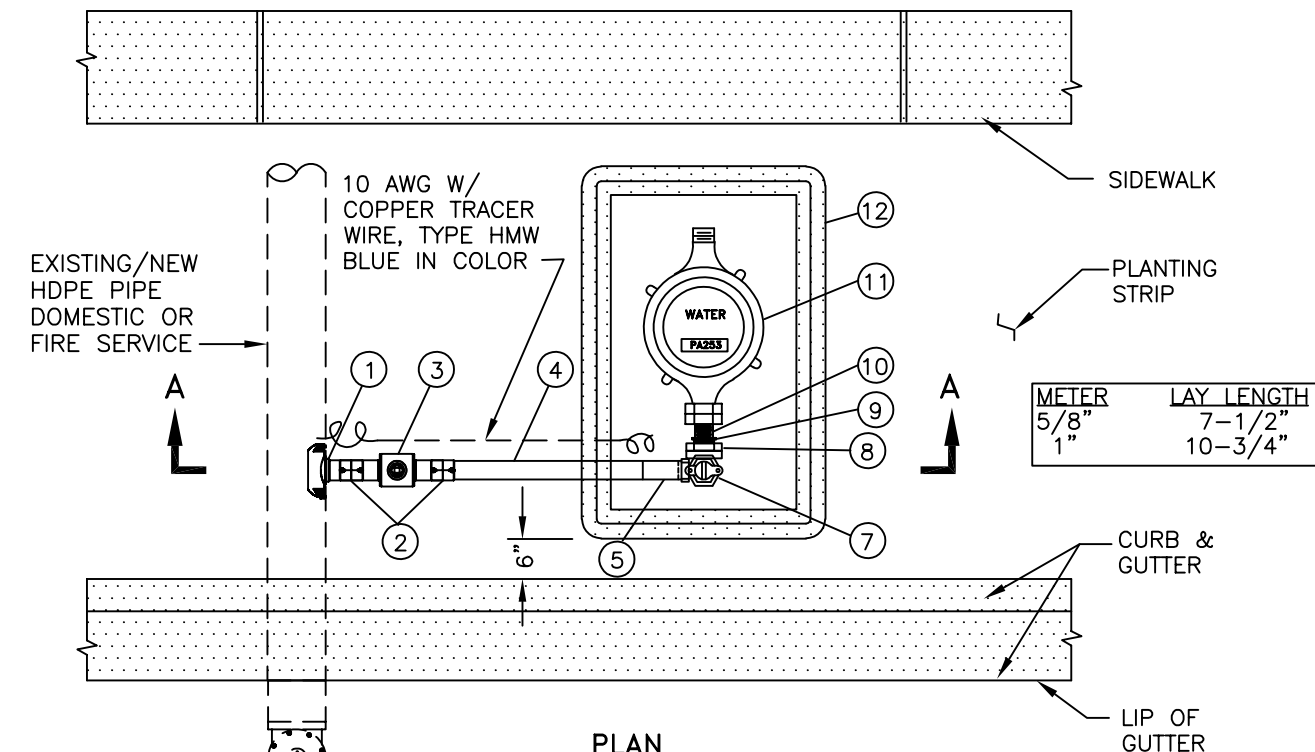
PLAN

NOTES:

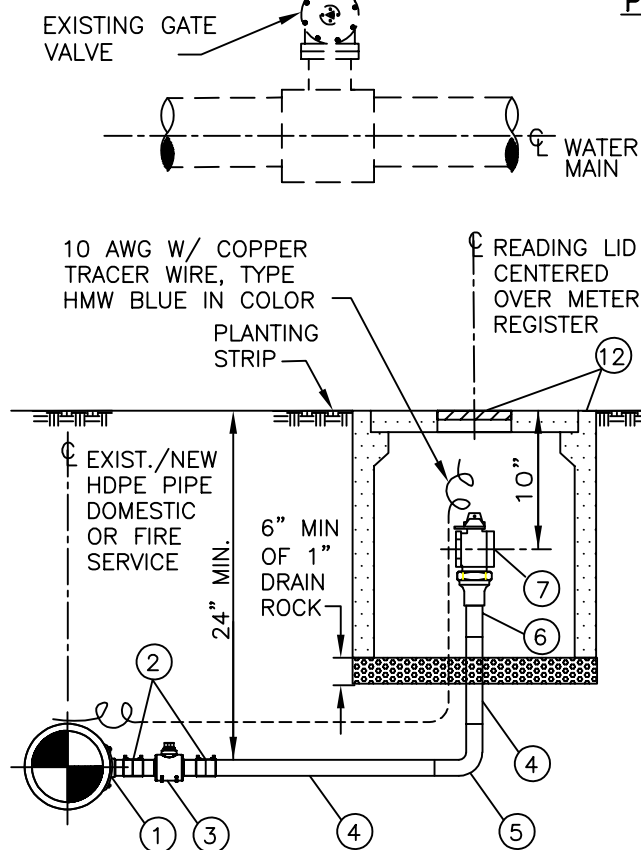
- METER LOCATION WHERE SIDEWALK & CURB ARE INTEGRAL IS AT BACK OF SIDEWALK INSTEAD OF BACK OF CURB AS SHOWN.
- METER BOX TO BE LOCATED IN THE CITY RIGHT-OF-WAY OR P.U.E. NEAR TO WATER MAIN
- AVOID VEHICLE TRAVEL AREAS WHEN POSSIBLE. FOR INSTALLATION IN AREAS SUBJECT TO VEHICULAR TRAFFIC METER BOX SHALL HAVE 20K (TIER 22) LOAD RATING.
- LIDS SHALL HAVE "WATER" MARKED ON THEM AND MAGNET IMBEDDED IN COVER.

- SERVICE SADDLE W/ DOUBLE STRAP, MUELLER BR2B
- 2" CORPORATION STOP, MUELLER B-25000N, OR APPROVED EQUAL
- 2" POLY-CAM SERIES 914 FEMALE SWIVEL FLARE NUT TRANSITION FITTING, OR APPROVED EQUAL
- 2" HDPE 4710 SDR 9 WATER PIPE
- 2" HDPE TEE
- BUTT FUSION SWEEP OR 90° ELL
- 2" ANGLE METER STOP, MUELLER B-24277N, OR APPROVED EQUAL
- FORD CF31-77 2" FL X 2" FIP TRANSITION
- 1" X 2" BRASS BUSHING FOR 1" METERS OR 3/4" X 2" BRASS BUSHING FOR 5/8" METERS
- 3/4" OR 1" U-CONNECTOR SERIES 708UMM MNPT X MNPT BY AY MCDONALD OR APPROVED EQUAL
- BALL STRAIGHT METER VALVE, MUELLER B-20287N
- STRAIGHT METER COUPLING
- 5/8" OR 1" BADGER DISC METER (CITY PROVIDED)
- ARMORCAST POLYMER CONCRETE METER BOX & COVER W/DROP-IN LID. FOR 5/8" METERS USE 17"x30"x12" (PART # A6001640TAPCX12CPA). FOR 1" METERS USE 24"x36"x12" (PART # A6001974TAPCX12CPA)

BY	DATE	2" WATER SERVICE MANIFOLD (NON-HDPE MAIN) WITH TWO OR FOUR 5/8" OR 1" METERS STANDARD DETAIL	APPROVED: FEBRUARY 26, 2020	SCALE: NONE
DRAWN J.J.	02/19		 50674 SILVIA LEE SANTOS ENGINEERING MANAGER R.E. NO.	DWG. NO. STD. WD-06B
CHECKED J.J.	02/20			
REVIEWED R.I.	02/20			
CITY OF PALO ALTO, CALIFORNIA			REVISION: FEBRUARY 26, 2020	APPENDIX B



PLAN



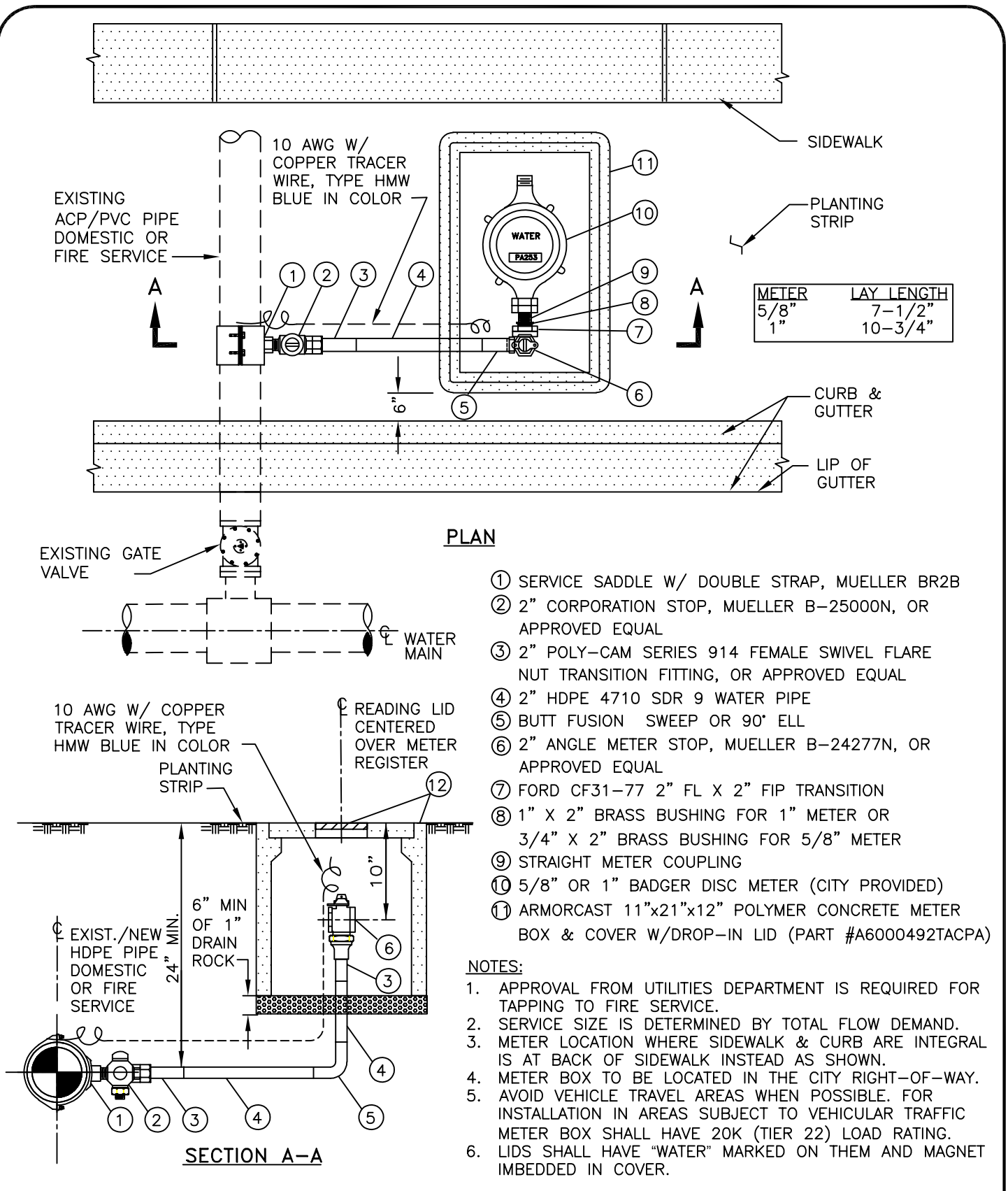
SECTION A-A

- ① 2" ELECTROFUSION BRANCH SADDLE
- ② ELECTROFUSION COUPLING
- ③ 2" HDPE FULL PORT BALL VALVE BY GEORG FISCHER CENTRAL PLASTICS, OR APPROVED EQUAL
- ④ 2" HDPE 4710 SDR 9 WATER PIPE
- ⑤ BUTT FUSION SWEEP OR 90° ELL
- ⑥ 2" POLY-CAM SERIES 914 FEMALE SWIVEL FLARE NUT TRANSITION FITTING, OR APPROVED EQUAL
- ⑦ 2" ANGLE METER STOP, MUELLER B-24277N, OR APPROVED EQUAL
- ⑧ FORD CF31-77 2" FL X 2" FIP TRANSITION
- ⑨ 1" X 2" BRASS BUSHING FOR 1" METER OR 3/4" X 2" BRASS BUSHING FOR 5/8" METER
- ⑩ STRAIGHT METER COUPLING
- ⑪ 5/8" OR 1" BADGER DISC METER (CITY PROVIDED)
- ⑫ ARMORCAST 11"x21"x12" POLYMER CONCRETE METER BOX & COVER W/DROP-IN LID (PART #A6000492TACPA)

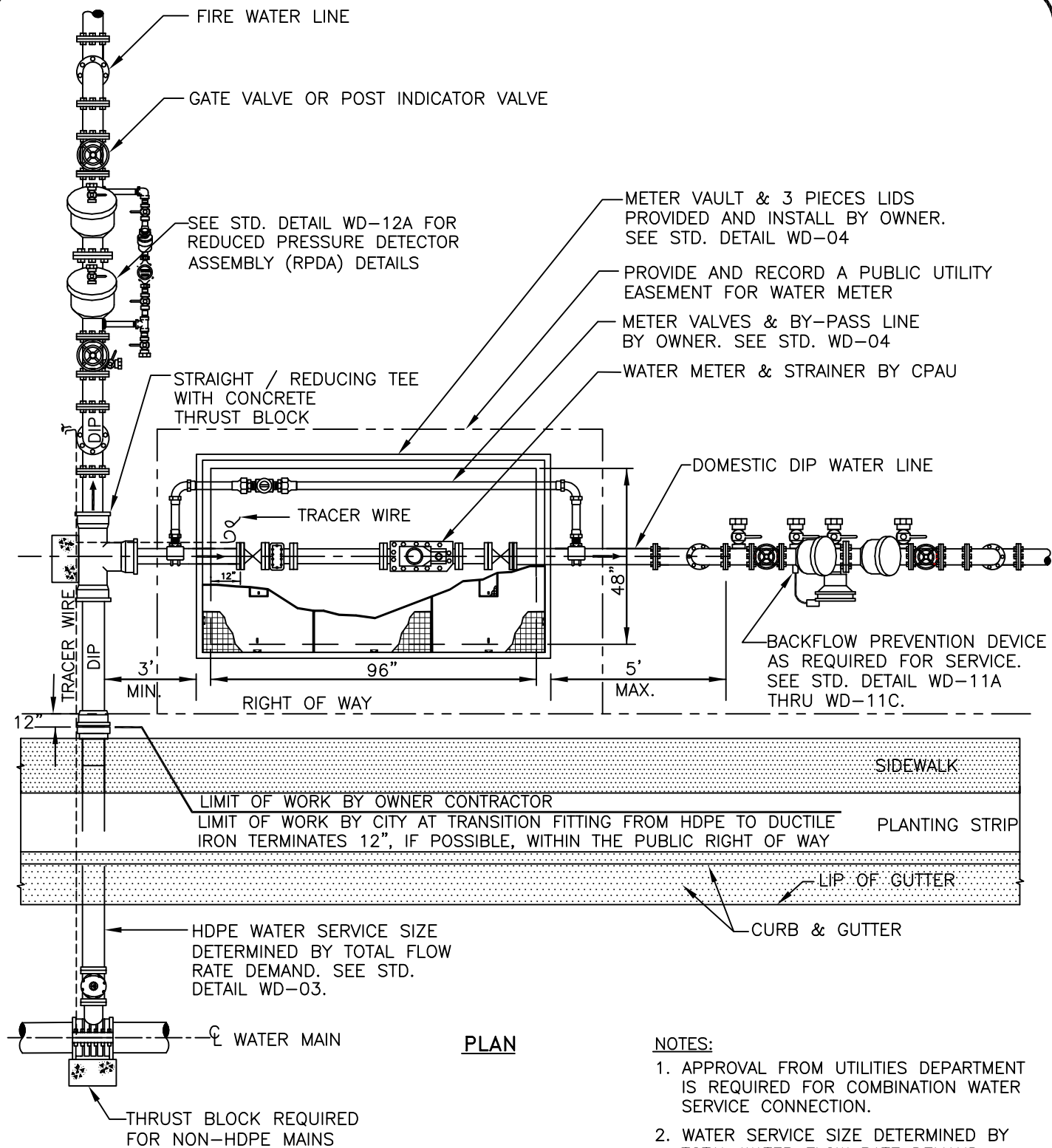
NOTES:

1. APPROVAL FROM UTILITIES DEPARTMENT IS REQUIRED FOR TAPPING TO FIRE SERVICE.
2. SERVICE SIZE IS DETERMINED BY TOTAL FLOW DEMAND.
3. METER LOCATION WHERE SIDEWALK & CURB ARE INTEGRAL IS AT BACK OF SIDEWALK INSTEAD AS SHOWN.
4. METER BOX TO BE LOCATED IN THE CITY RIGHT-OF-WAY.
5. AVOID VEHICLE TRAVEL AREAS WHEN POSSIBLE. FOR INSTALLATION IN AREAS SUBJECT TO VEHICULAR TRAFFIC METER BOX SHALL HAVE 20K (TIER 22) LOAD RATING.
6. LIDS SHALL HAVE "WATER" MARKED ON THEM AND MAGNET IMBEDDED IN COVER.

BY	DATE	2" HDPE WATER SERVICE TAP HDPE DOMESTIC OR FIRE SERVICE STANDARD DETAIL	APPROVED:	SCALE:
DRAWN	J.J. 02/19		FEBRUARY 26, 2020	NONE
CHECKED	J.J. 02/20		<i>Silvia Lee Santos</i> SILVIA LEE SANTOS ENGINEERING MANAGER	DWG. NO. STD. WD-07A
REVIEWED	R.I. 02/20	CITY OF PALO ALTO, CALIFORNIA	REVISION: FEBRUARY 26, 2020	APPENDIX B



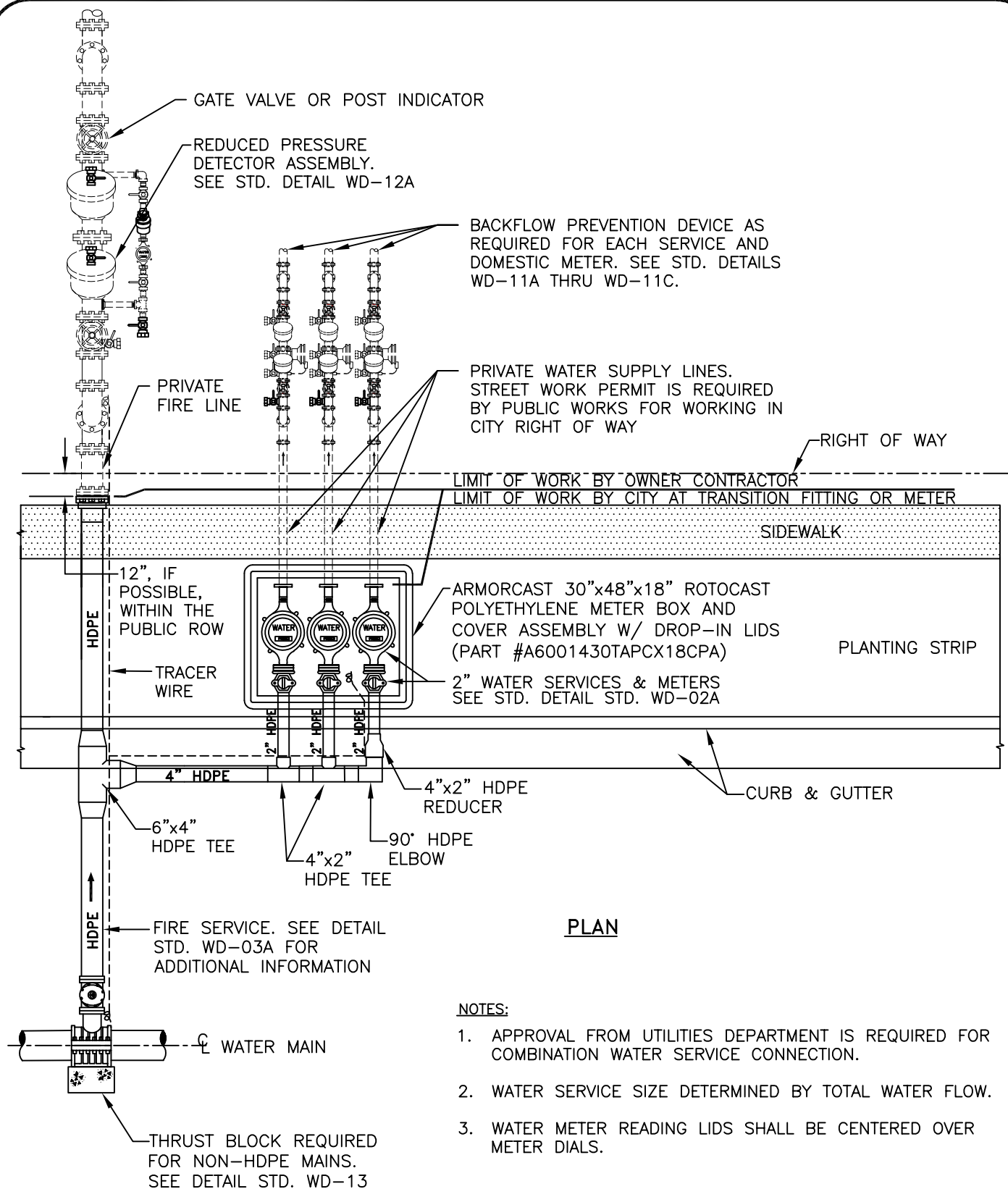
BY	DATE	2" HDPE WATER SERVICE TAP EXISTING NON-HDPE FIRE SERVICE STANDARD DETAIL	APPROVED: FEBRUARY 26, 2020	SCALE: NONE
DRAWN J.J.	02/19		 SILVIA LEE SANTOS ENGINEERING MANAGER	DWG. NO. STD. WD-07B
CHECKED J.J.	02/20			
REVIEWED R.I.	02/20	CITY OF PALO ALTO, CALIFORNIA	REVISION: FEBRUARY 26, 2020	APPENDIX B



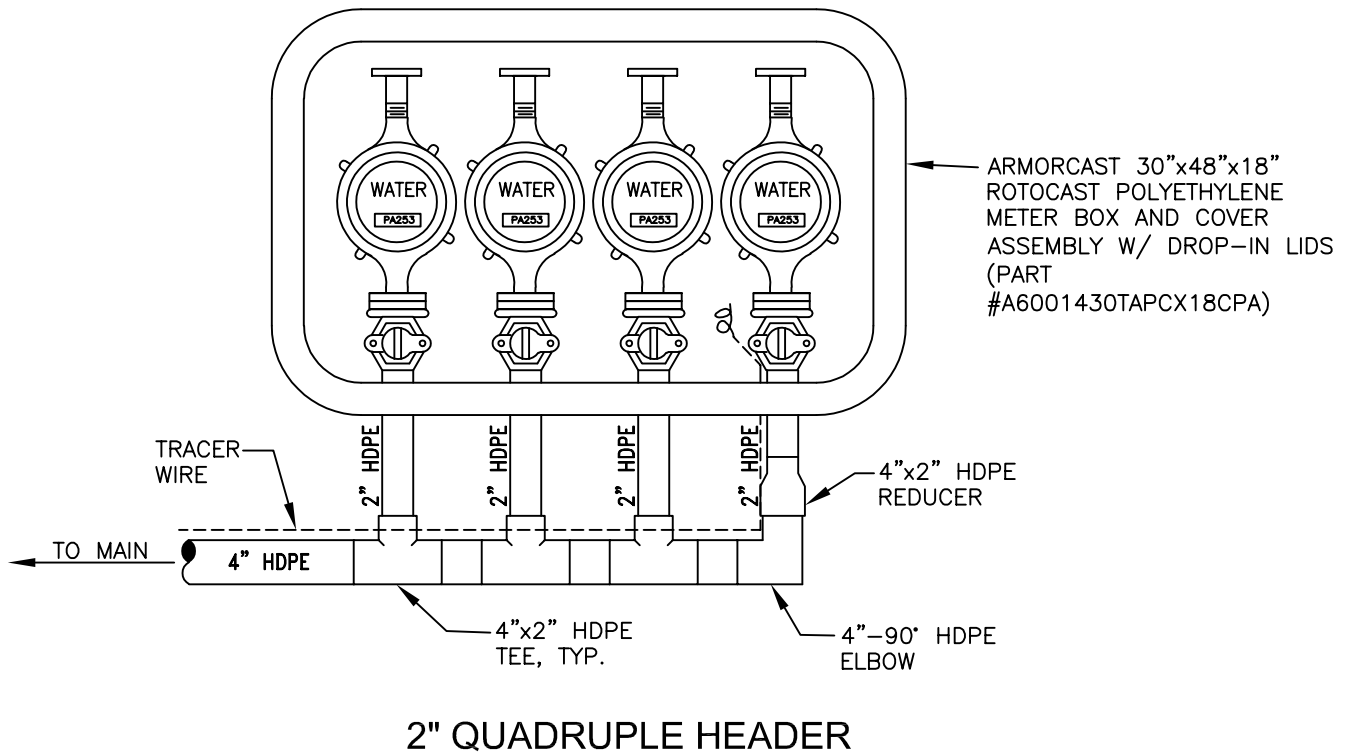
NOTES:

1. APPROVAL FROM UTILITIES DEPARTMENT IS REQUIRED FOR COMBINATION WATER SERVICE CONNECTION.
2. WATER SERVICE SIZE DETERMINED BY TOTAL WATER FLOW RATE DEMAND.
3. ALL WATER DEVICES SHALL BE INSTALLED ON THE OWNER'S PROPERTY.

BY	DATE	COMBINATION FIRE/DOMESTIC WATER SERVICE CONNECTION STANDARD DETAIL	APPROVED:	SCALE:
			FEBRUARY 26, 2020	NONE
DRAWN J.J.	9/92		<i>Silvia Lee Santos</i>	DWG. NO.
CHECKED J.J.	02/20		SILVIA LEE SANTOS 50674 ENGINEERING MANAGER R.E. NO.	STD. WD-08
REVIEWED R.I.	02/20	CITY OF PALO ALTO, CALIFORNIA	REVISION:	APPENDIX B
			FEBRUARY 26, 2020	

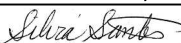


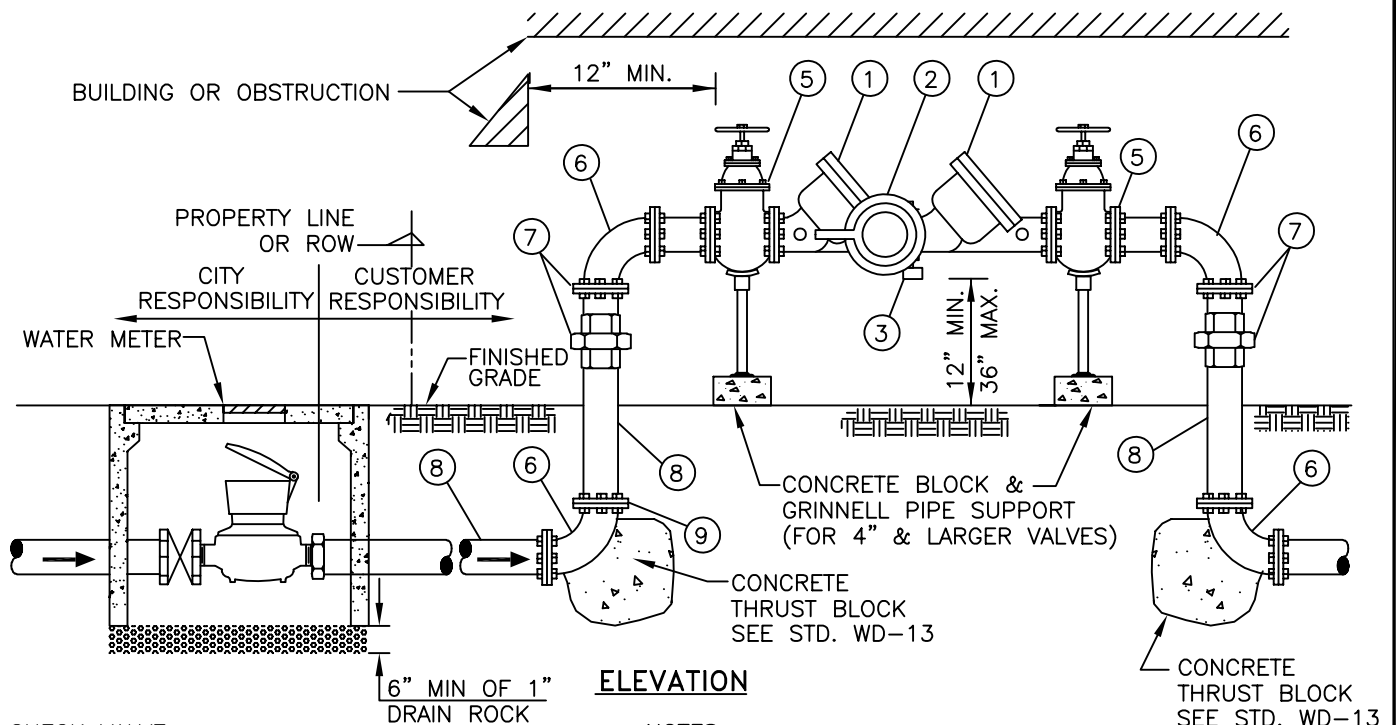
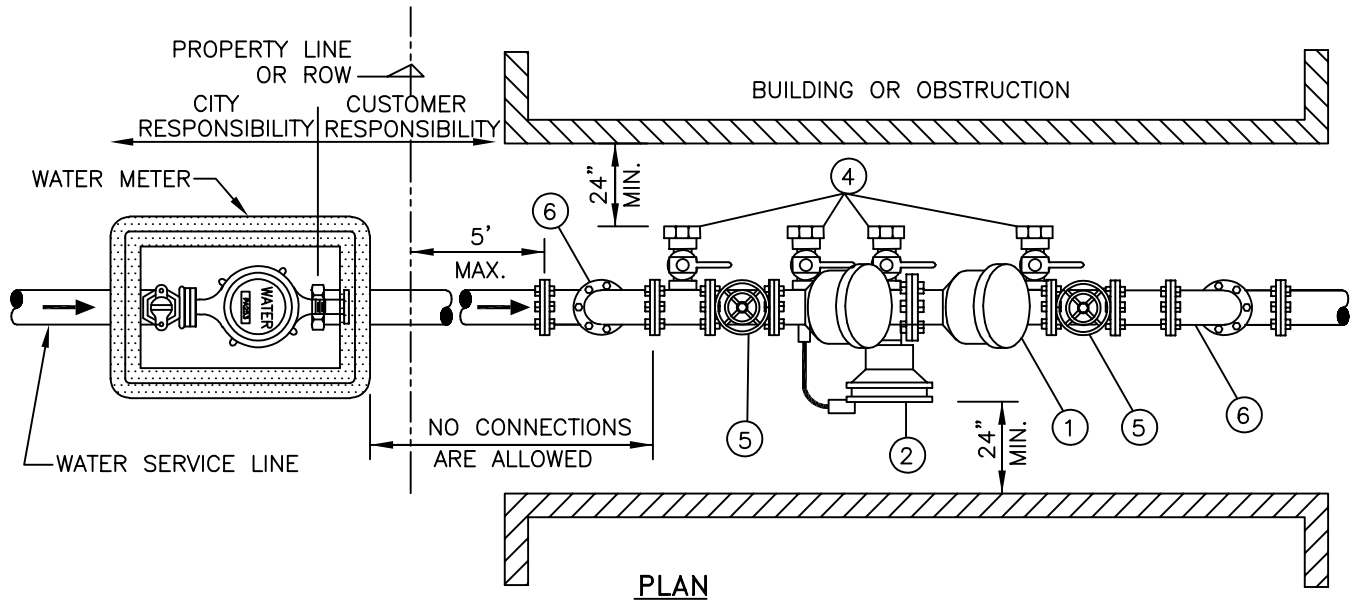
BY	DATE	COMBINATION FIRE/DOMESTIC WATER SERVICE CONNECTION (MULTIPLE METERS) STANDARD DETAIL	APPROVED: FEBRUARY 26, 2020	SCALE: NONE
DRAWN R.E.	6/97		<i>Silvia Santos</i> 50674	DWG. NO.
CHECKED J.J.	02/20		SILVIA LEE SANTOS ENGINEERING MANAGER R.E. NO.	STD. WD-09
REVIEWED R.I.	02/20		REVISION: FEBRUARY 26, 2020	APPENDIX B
		CITY OF PALO ALTO, CALIFORNIA		



NOTES:

1. APPROVAL FROM UTILITIES DEPARTMENT IS REQUIRED FOR COMBINATION WATER SERVICE CONNECTION.
2. WATER SERVICE SIZE DETERMINED BY TOTAL WATER FLOW RATE DEMAND.
3. WATER METER READING LID SHALL BE CENTERED OVER EACH METER DIAL.
4. ALL BACKFLOW PREVENTION DEVICES SHALL BE INSTALLED ON THE OWNER'S PROPERTY.
5. METER BOX & LIDS SHALL HAVE MINIMUM TIER 5 RATING FOR SIDEWALK AND PLANTING STRIP APPLICATIONS & MINIMUM TIER 22 RATING FOR DRIVEWAY AND PARKING LOT APPLICATIONS. METER BOXES NOT TO BE INSTALLED IN STREET.

BY	DATE	ARMORCAST METER BOX (30"x48") WITH MULTIPLE HEADERS STANDARD DETAIL	APPROVED: FEBRUARY 26, 2020	SCALE: NONE
DRAWN R.E.	6/97		 50674 SILVIA LEE SANTOS ENGINEERING MANAGER	DWG. NO. STD. WD-10
CHECKED J.J.	02/20		REVISION: FEBRUARY 26, 2020	APPENDIX B
REVIEWED R.I.	02/20	CITY OF PALO ALTO, CALIFORNIA		

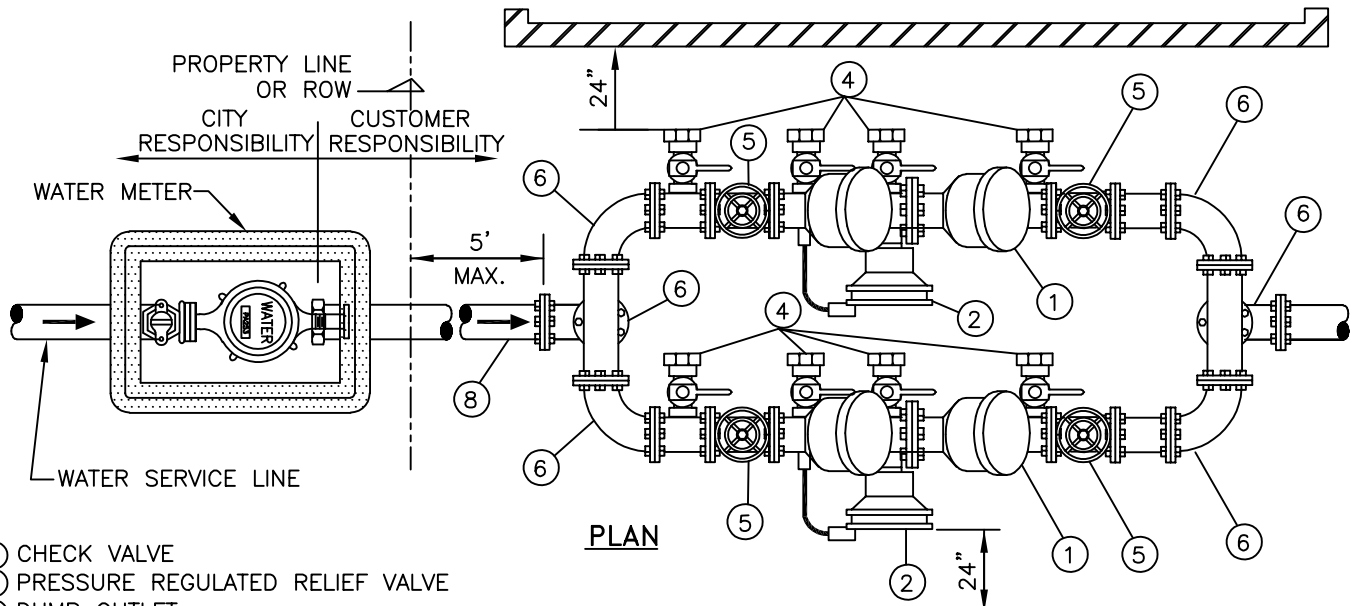


- ① CHECK VALVE
- ② PRESSURE REGULATED RELIEF VALVE
- ③ DUMP OUTLET
- ④ TEST COCK WITH CAP, 4 REQUIRED
- ⑤ GATE VALVE OR BALL VALVE
- ⑥ 90° BEND, FLANGED
- ⑦ FLANGE OR UNION
- ⑧ DUCTILE IRON OR COPPER PIPE
- ⑨ BURIED JOINTS, FLANGES & CORTEN BOLTS OR MEGALUGS SHALL BE PLASTIC WRAPPED

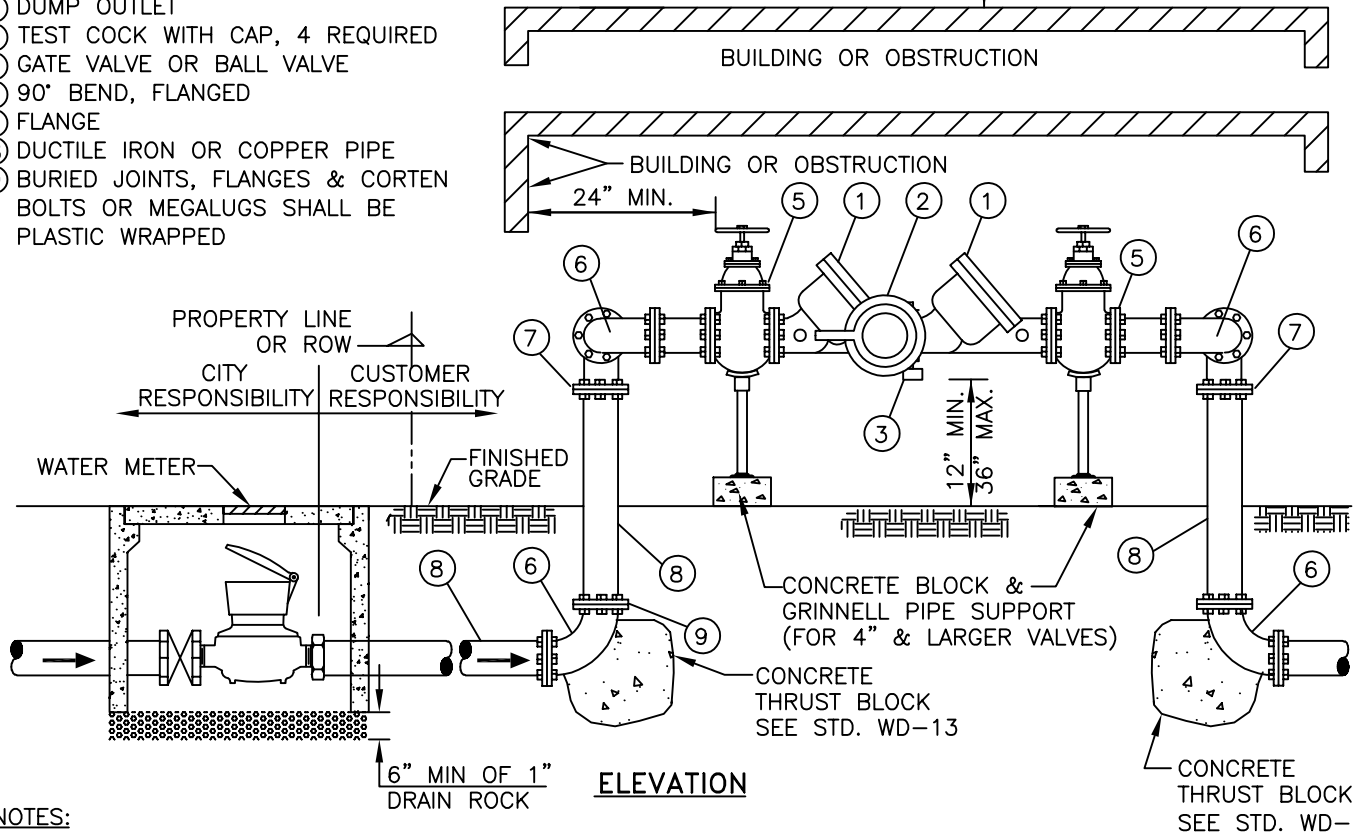
NOTES:

1. ALL RPPA DEVICES SHALL BE AS APPROVED BY USC FOUNDATION FOR CROSS-CONNECTION CONTROL AND HYDRAULIC RESEARCH, AND APPROVED BY THE WATER-GAS-WASTEWATER UTILITIES DEPARTMENT.
2. THE DEVICE SHALL BE INSTALLED ON THE OWNER'S PROPERTY, DIRECTLY BEHIND THE CITY-OWNED WATER METER, WITHIN 5' OF THE PROPERTY LINE.
3. INSPECTION BY THE UTILITIES INSPECTOR IS REQUIRED FOR SUPPLY PIPE BETWEEN THE METER AND THE VALVES.

BY	DATE	3" OR LARGER REDUCED PRESSURE PRINCIPLE ASSEMBLY – RPPA STANDARD DETAIL	APPROVED: FEBRUARY 26, 2020	SCALE: NONE
DRAWN J.J.	8/92		<i>Silvia Lee Santos</i> 50674	DWG. NO.
CHECKED J.J.	02/20		SILVIA LEE SANTOS ENGINEERING MANAGER	STD. WD-11A
REVIEWED R.I.	02/20		REVISION: FEBRUARY 26, 2020	APPENDIX B



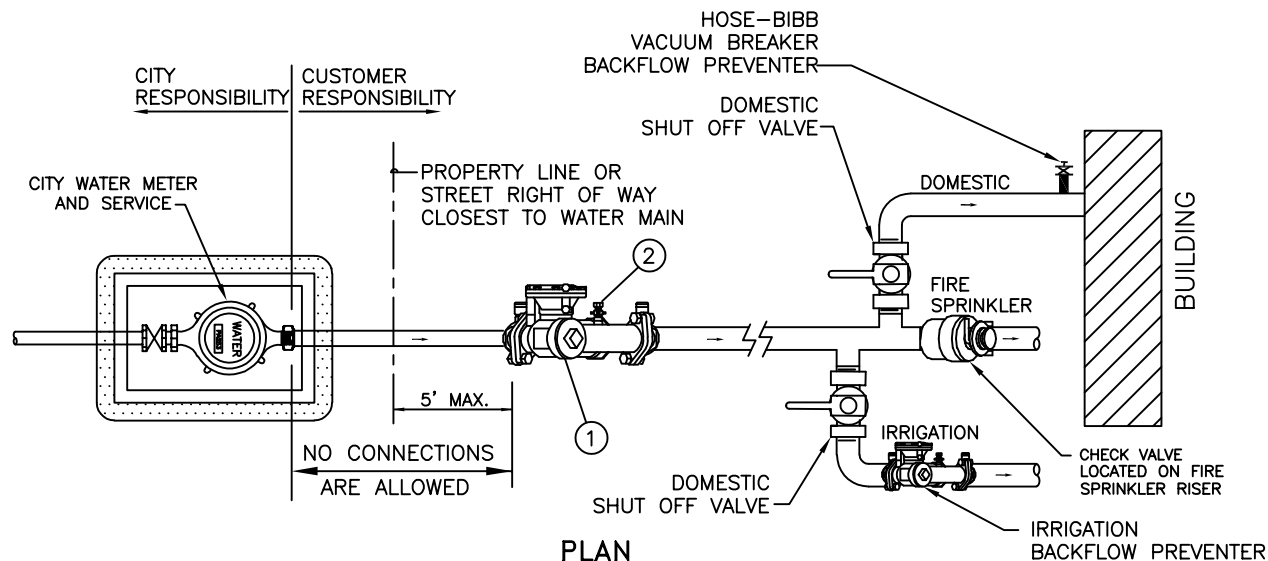
- ① CHECK VALVE
- ② PRESSURE REGULATED RELIEF VALVE
- ③ DUMP OUTLET
- ④ TEST COCK WITH CAP, 4 REQUIRED
- ⑤ GATE VALVE OR BALL VALVE
- ⑥ 90° BEND, FLANGED
- ⑦ FLANGE
- ⑧ DUCTILE IRON OR COPPER PIPE
- ⑨ BURIED JOINTS, FLANGES & CORTEN BOLTS OR MEGALUGS SHALL BE PLASTIC WRAPPED



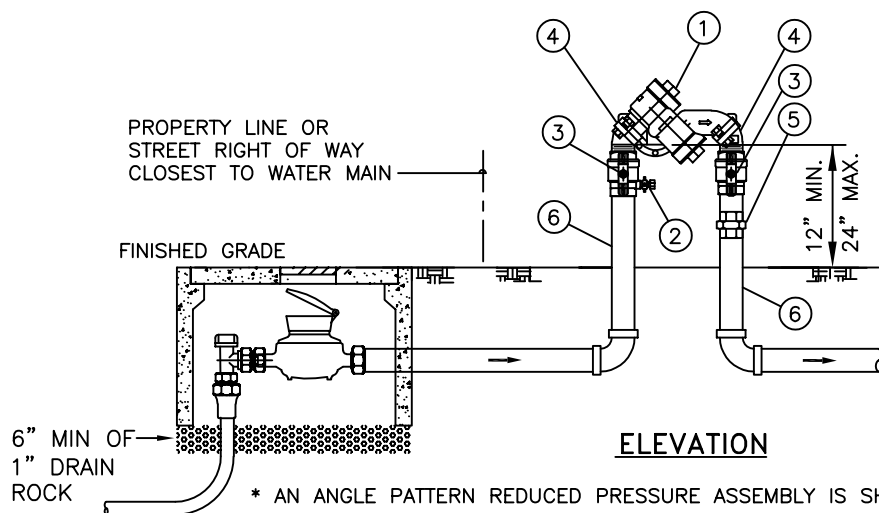
NOTES:

1. PARALLEL RPPA ASSEMBLIES SHALL BE USED IN ALL LOCATIONS WHERE WATER SERVICE CAN NOT BE INTERRUPTED DURING NORMAL WORKING HOURS.
2. FOR INSTALLATION AND MATERIAL REQUIREMENTS, REFER TO STD. DETAIL STD. WD-11A.
3. ALL DEVICES SHALL BE APPROVED BY THE WATER-GAS-WASTEWATER UTILITIES DEPARTMENT.
4. THE DEVICE SHALL BE INSTALLED ON THE OWNER'S PROPERTY, DIRECTLY BEHIND THE CITY-OWNED WATER METER.
5. INSPECTION BY UTILITIES INSPECTOR IS REQUIRED FOR SUPPLY PIPE BETWEEN THE METER AND THE VALVES.

BY	DATE	PARALLEL REDUCED PRESSURE PRINCIPLE ASSEMBLY STANDARD DETAIL	APPROVED: FEBRUARY 26, 2020	SCALE: NONE
DRAWN J.J.	02/19		<i>Silvia Lee Santos</i> 50674	DWG. NO.
CHECKED J.J.	02/20		SILVIA LEE SANTOS ENGINEERING MANAGER	STD. WD-11B
REVIEWED R.I.	02/20		REVISION: FEBRUARY 26, 2020	APPENDIX B
		CITY OF PALO ALTO, CALIFORNIA		



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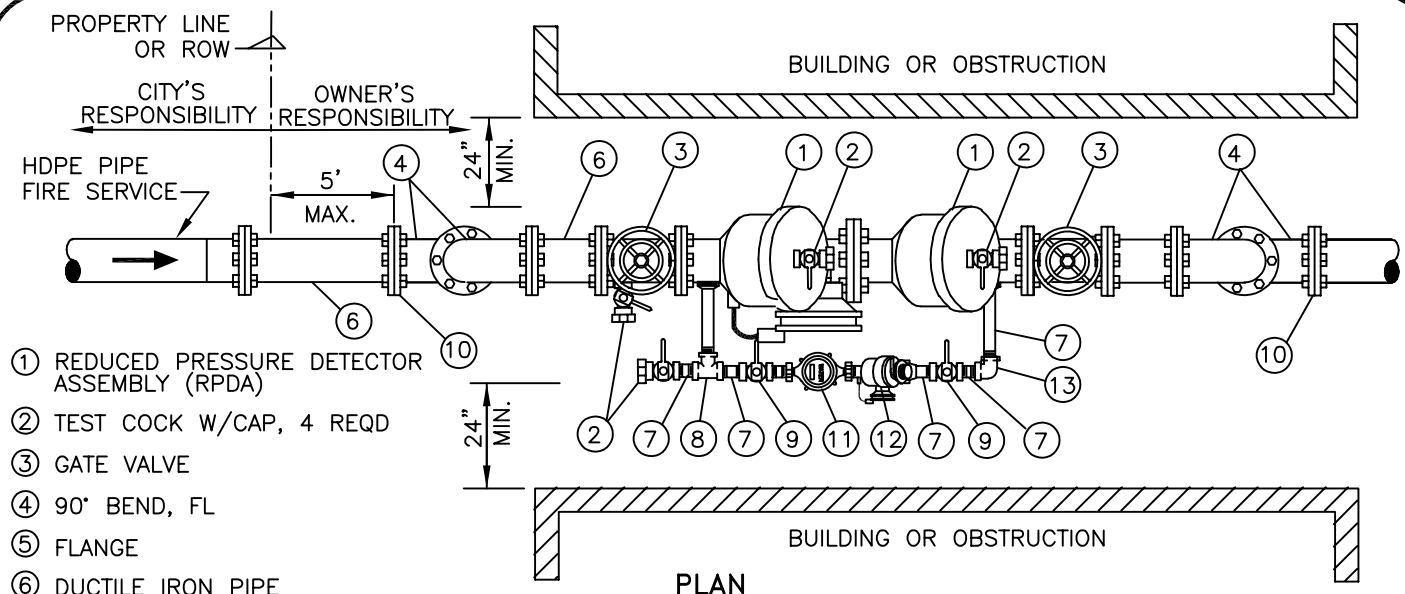
ELEVATION

- ① APPROVED REDUCED PRESSURE BACKFLOW PREVENTER *
- ② TEST COCK
- ③ GATE VALVE OR BALL VALVE
- ④ SOLDER OR THREADED BRASS 90° ELBOW (ON HORIZONTAL PATTERN ASSEMBLIES)
- ⑤ SOLDER OR THREADED BRASS UNION
- ⑥ TYPE "K" COPPER OR BRASS PIPE

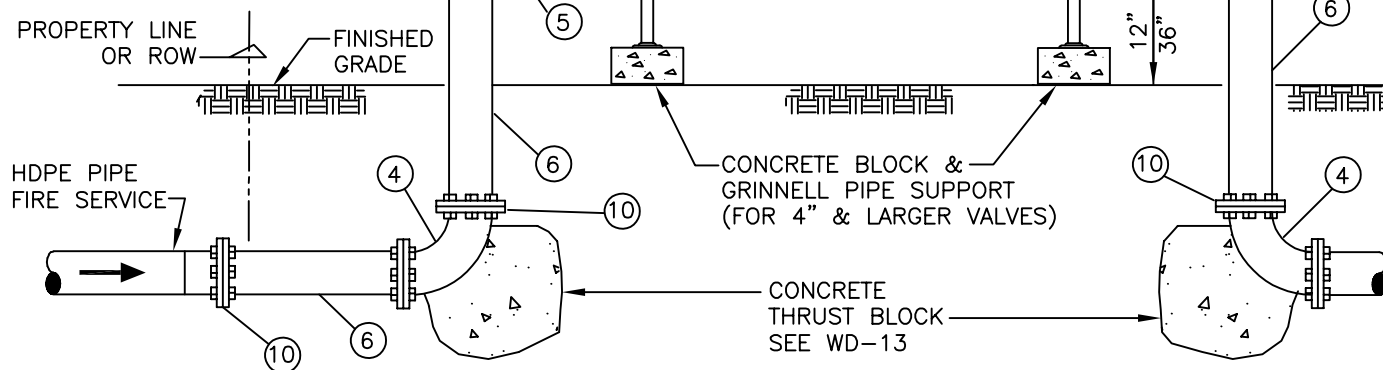
NOTES:

1. BACKFLOW PREVENTERS SHALL BE INSTALLED PER THE C.P.A. UTILITIES RULES & REGULATION AND THE CURRENT STATE OF CALIFORNIA OF PUBLIC HEALTH REGULATIONS CONTAINED IN TITLE 17 OF THE ADMINISTRATIVE CODE.
2. ALL DEVICES MUST BE LISTED AND APPROVED BY THE FOUNDATION FOR CROSS CONNECTION CONTROL AND HYDRAULIC RESEARCH AT USC AND WGW UTILITIES DEPARTMENT.
3. ALL DEVICES AND COMPONENTS MUST BE CERTIFIED LEAD FREE.
4. BACKFLOW DEVICE AND PIPING SIZE SHALL BE THE SAME SIZE AS THE WATER SERVICE SUPPLY PIPE. IT IS THE OWNER'S PLUMBER RESPONSIBILITY TO PROPERLY SIZE THE WATER SYSTEM AS THESE DEVICES REDUCE THE INLET WATER PRESSURE TO THE BUILDING.
5. THE DEVICE SHALL BE INSTALLED ON THE OWNER'S PROPERTY DIRECTLY BEHIND THE METER WITHIN 5' OF THE PROPERTY LINE OR STREET RIGHT OF WAY CLOSEST TO WATER MAIN.
6. THE DEVICE MUST BE INSPECTED BY BUILDING INSPECTION AND TESTED BY A LICENSED CERTIFIED TESTER REGISTERED WITH THE CITY. SUBMIT TEST RESULTS TO WGW UTILITIES OPERATIONS PROJECT COORDINATOR.
7. DEVICE SHALL BE TESTED IMMEDIATELY AFTER INSTALLATION, RELOCATION, OR REPAIR PRIOR TO BEING INTO SERVICE.
8. BACKFLOW MUST BE EASILY ACCESSIBLE TO FACILITATE ANNUAL TESTING AND MAINTENANCE.
9. PROVIDE 12" MINIMUM CLEARANCE TO OBSTRUCTIONS.

BY	DATE	REDUCED PRESSURE PRINCIPLE ASSEMBLY – RPPA (3/4"–2") STANDARD DETAIL	APPROVED: FEBRUARY 26, 2020	SCALE: NONE
DRAWN J.J.	7/16		<i>Silvia Santos</i> 50674	DWG. NO.
CHECKED J.J.	02/20		SILVIA LEE SANTOS ENGINEERING MANAGER	STD. WD-11C
REVIEWED R.I.	02/20		REVISION: FEBRUARY 26, 2020	APPENDIX B



- ① REDUCED PRESSURE DETECTOR ASSEMBLY (RPDA)
- ② TEST COCK W/CAP, 4 REQD
- ③ GATE VALVE
- ④ 90° BEND, FL
- ⑤ FLANGE
- ⑥ DUCTILE IRON PIPE
- ⑦ 3/4" BRASS NIPPLE TO SUIT
- ⑧ 3/4" TEE, BRASS
- ⑨ FULL PORT BALL VALVE
- ⑩ BURIED JOINTS TO BE PLASTIC WRAPPED FLANGE & CORTEN BOLTS OR MEGALUG
- ⑪ 5/8"x3/4" DETECTOR METER & COUPLINGS. (FURNISHED BY CITY)
- ⑫ 3/4" REDUCED PRESSURE DETECTOR ASSEMBLY (RPDA)
- ⑬ 3/4" 90° ELBOW, BRASS

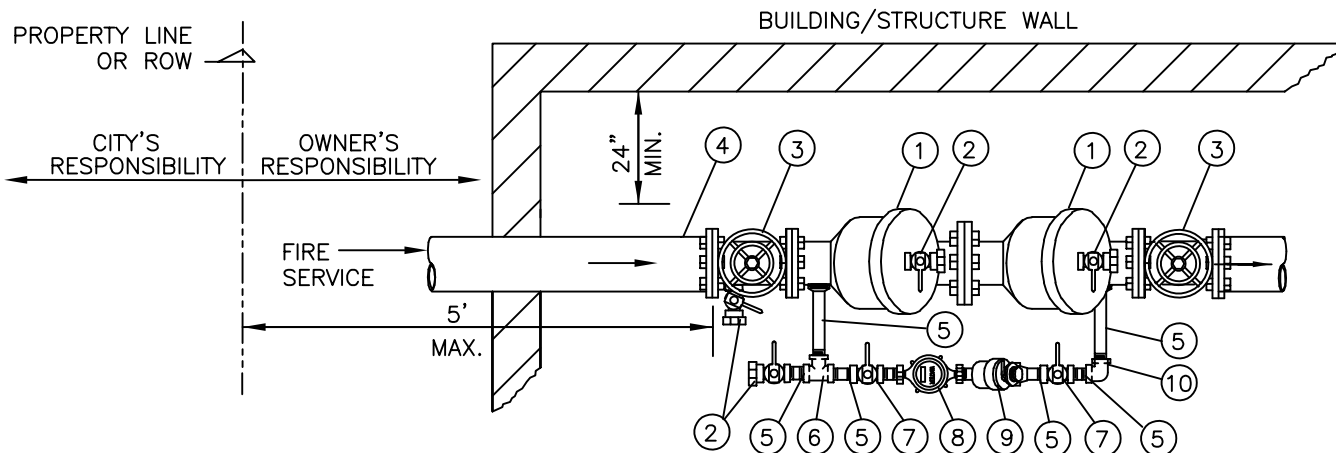


ELEVATION

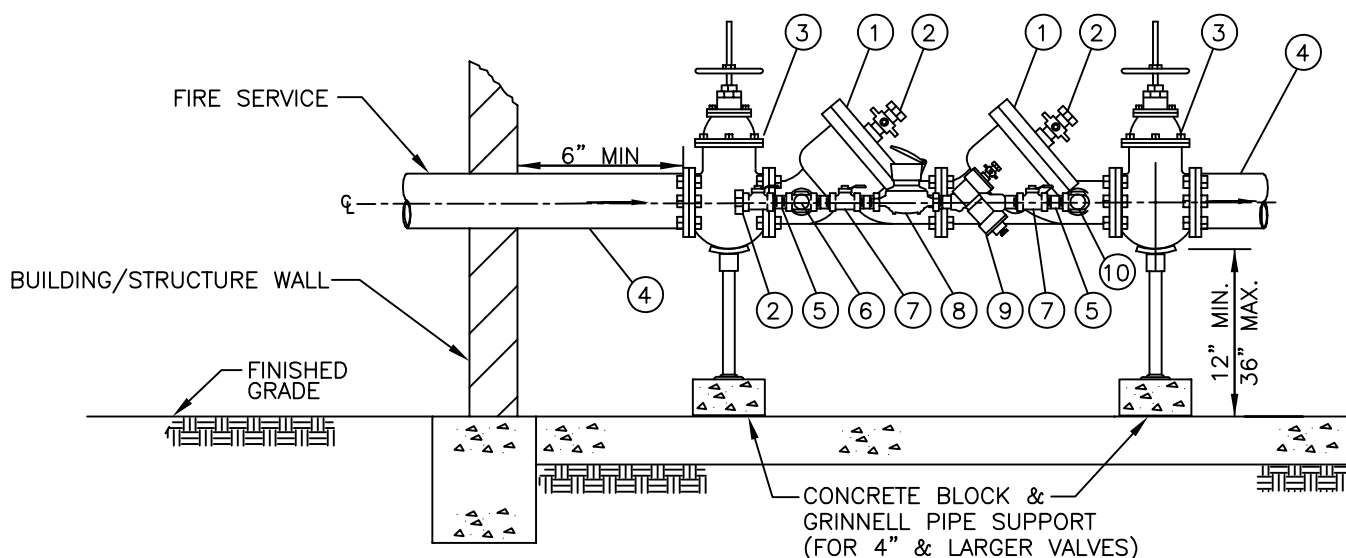
NOTES:

1. ALL RPDA DEVICES SHALL BE AS APPROVED BY USC FOUNDATION FOR CROSS-CONNECTION CONTROL AND HYDRAULIC RESEARCH, AND APPROVED BY WATER-GAS-WASTEWATER UTILITIES DEPARTMENT.
2. THE DEVICE SHALL BE INSTALLED ON THE OWNER'S PROPERTY, DIRECTLY BEHIND THE CITY-OWNED METER, WITHIN 5' OF THE PROPERTY LINE.
3. INSPECTION BY THE UTILITIES INSPECTOR IS REQUIRED FOR SUPPLY PIPE BETWEEN METER AND THE VALVES.
4. DOUBLE CHECK DETECTOR ASSEMBLIES MAY ONLY BE USED ON EXISTING FIRE SPRINKLER SYSTEMS AND WITH THE PRIOR APPROVAL OF WATER-GAS-WASTEWATER UTILITIES DEPARTMENT.

BY	DATE	REDUCED PRESSURE DETECTOR ASSEMBLY – RPDA FOR FIRE SERVICES AND SPRINKLERS STANDARD DETAIL CITY OF PALO ALTO, CALIFORNIA	APPROVED:	SCALE:
DRAWN J.J.	9/92		FEBRUARY 26, 2020	NONE
CHECKED J.J.	02/20		 SILVIA LEE SANTOS ENGINEERING MANAGER	DWG. NO.
REVIEWED R.I.	02/20		REVISION:	STD. WD-12A
			FEBRUARY 26, 2020	APPENDIX B



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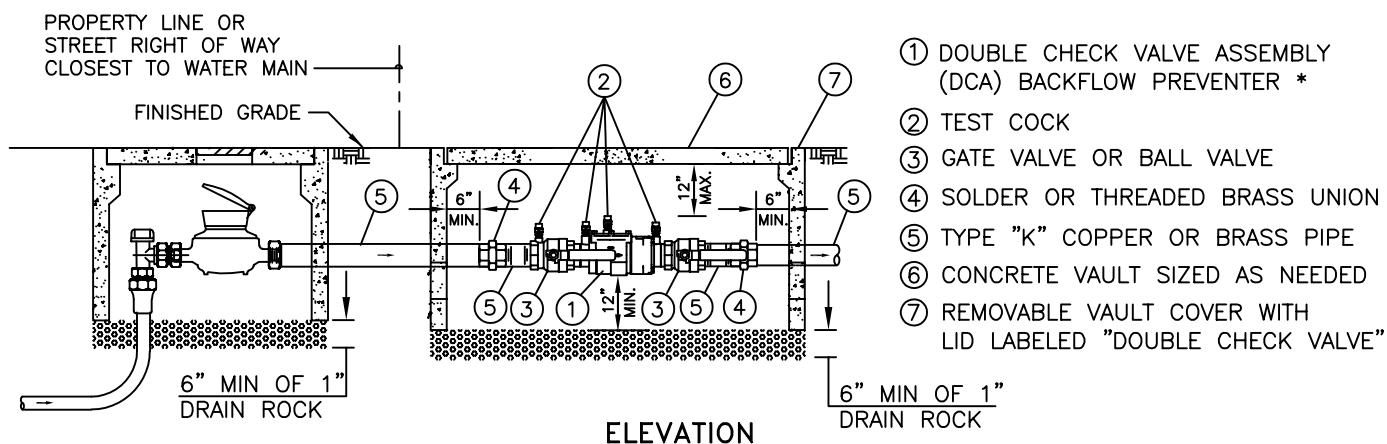
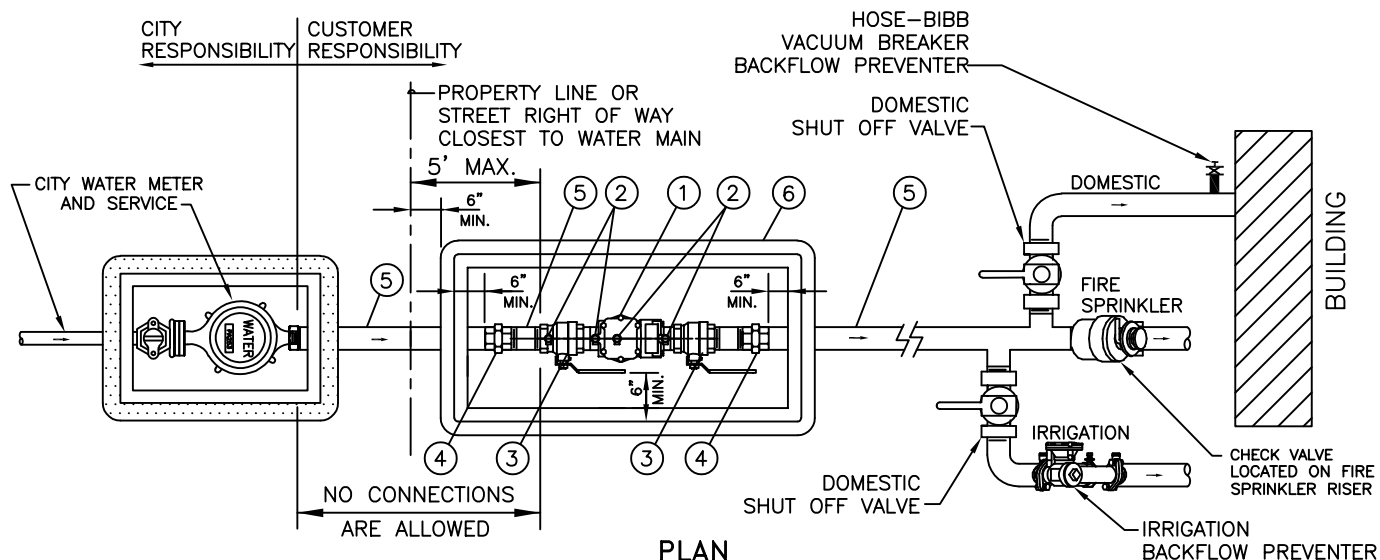
ELEVATION

- ① REDUCED PRESSURE DETECTOR ASSEMBLY (RPDA)
- ② TEST COCK WITH CAP, 4 REQUIRED
- ③ GATE VALVE
- ④ DUCTILE IRON PIPE
- ⑤ 3/4\"/>

NOTES:

1. ALL RPDA DEVICES SHALL BE AS APPROVED BY USC FOUNDATION FOR CROSS-CONNECTION CONTROL AND HYDRAULIC RESEARCH, AND APPROVED BY WATER-GAS-WASTEWATER UTILITIES DEPARTMENT.
2. THE DEVICE SHALL BE INSTALLED ON THE OWNER'S PROPERTY, DIRECTLY BEHIND THE CITY-OWNED METER, WITHIN 5' OF THE PROPERTY LINE.
3. INSPECTION BY THE UTILITIES INSPECTOR IS REQUIRED FOR SUPPLY PIPE BETWEEN METER AND THE VALVES.

BY	DATE	REDUCED PRESSURE DETECTOR ASSEMBLY – RPDA FOR INSIDE INSTALLATION STANDARD DETAIL	APPROVED: FEBRUARY 26, 2020	SCALE: NONE
DRAWN C.W.	10/04		 50674	DWG. NO.
CHECKED J.J.	02/20		SILVIA LEE SANTOS ENGINEERING MANAGER R.E. NO.	STD. WD-12B
REVIEWED R.I.	02/20		CITY OF PALO ALTO, CALIFORNIA	REVISION: FEBRUARY 26, 2020



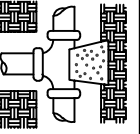
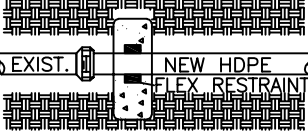
* A FEBCO MODEL LF850 DOUBLE CHECK VALVE ASSEMBLY IS SHOWN FOR ILLUSTRATION PURPOSES

NOTES:

1. BACKFLOW PREVENTERS SHALL BE INSTALLED PER THE C.P.A. UTILITIES RULES & REGULATION AND THE CURRENT STATE OF CALIFORNIA OF PUBLIC HEALTH REGULATIONS CONTAINED IN TITLE 17 OF THE ADMINISTRATIVE CODE.
2. ALL DCVA DEVICES MUST BE LISTED AND APPROVED BY THE FOUNDATION FOR CROSS CONNECTION CONTROL AND HYDRAULIC RESEARCH AT USC AND WGW UTILITIES DEPARTMENT.
3. ALL DEVICES AND COMPONENTS MUST BE CERTIFIED LEAD FREE.
4. BACKFLOW DEVICE AND PIPING SIZE SHALL BE THE SAME SIZE AS THE WATER SERVICE SUPPLY PIPE. IT IS THE OWNER'S PLUMBER RESPONSIBILITY TO PROPERLY SIZE THE WATER SYSTEM AS THESE DEVICES REDUCE THE INLET WATER PRESSURE TO THE BUILDING.
5. THE DEVICE SHALL BE INSTALLED ON THE OWNER'S PROPERTY DIRECTLY BEHIND THE METER WITHIN 5' OF THE PROPERTY LINE OR STREET RIGHT OF WAY CLOSEST TO WATER MAIN.
6. THE DEVICE MUST BE INSPECTED BY BUILDING INSPECTION AND TESTED BY A LICENSED CERTIFIED TESTER REGISTERED WITH THE CITY. SUBMIT TEST RESULTS TO WGW UTILITIES OPERATIONS PROJECT COORDINATOR.
7. DEVICE SHALL BE TESTED IMMEDIATELY AFTER INSTALLATION, RELOCATION, OR REPAIR PRIOR TO BEING INTO SERVICE.
8. BACKFLOW MUST BE EASILY ACCESSIBLE TO FACILITATE ANNUAL TESTING AND MAINTENANCE.
9. PROVIDE 12" MINIMUM CLEARANCE BETWEEN CENTERLINE OF DOUBLE CHECK VALVE ASSEMBLY AND FLOOR OF BOX.

BY	DATE	RESIDENTIAL DOUBLE CHECK VALVE ASSEMBLY – DCVA (1"–2") STANDARD DETAIL	APPROVED:	SCALE:
DRAWN	J.J.		FEBRUARY 26, 2020	NONE
CHECKED	J.J.		<i>Silvia Santos</i> 50674 SILVIA LEE SANTOS R.E. NO. ENGINEERING MANAGER	DWG. NO. STD. WD–12C
REVIEWED	R.I.		REVISION: FEBRUARY 26, 2020	APPENDIX B
		CITY OF PALO ALTO, CALIFORNIA		

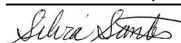
THRUST BLOCK TABLE

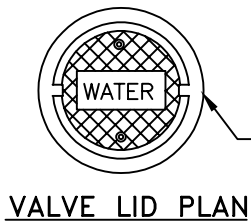
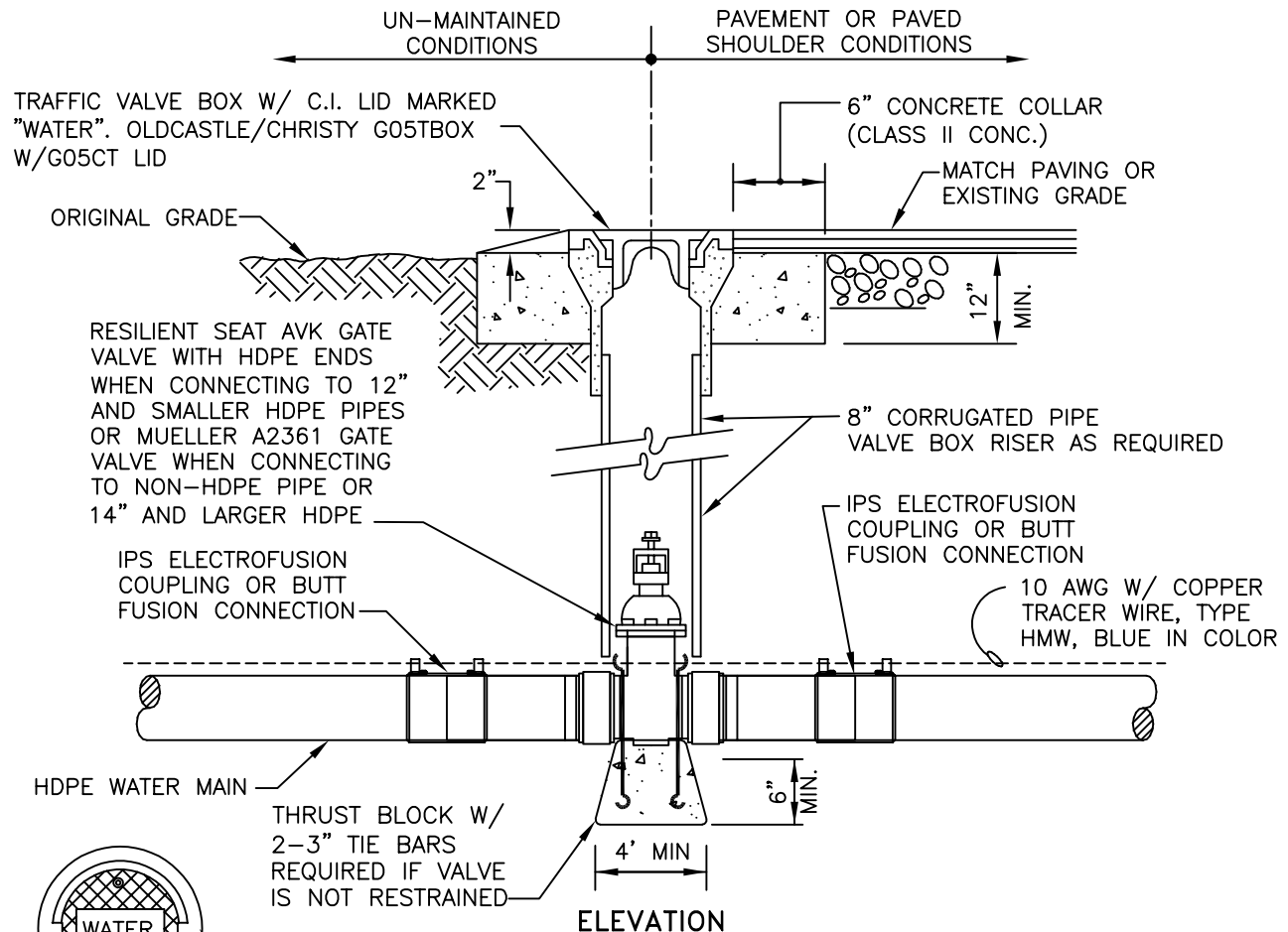
TYPE OF FITTING		90° BEND & BURIES	45° BEND	11 1/4" OR 22 1/2" BEND	TEE OR DEAD END	AT CONNECTION OF NEW HDPE PIPE WITH EXISTING NON-HDPE PIPE	
TYPICAL PLAN VIEW							
REQUIRED BEARING TOTAL AREA IN SQUARE FEET							MINIMUM CAPACITY OF FLEX RESTRAINTS
MAIN SIZE	4"	2	2	1	2	2	4,000# *
	6"	4	2	1	2.5	4	8,000# *
	8"	6.5	3.5	2	4.5	6.5	12,000#
	10"	10	5	3	7.0	10	18,000#
	12"	14	8	4	10	14	25,000#
	14"	19	11	5	14	19	31,000#
	16"	25	14	7	18	25	40,000#
	18"	32	17	9	22	32	50,000#
	20"	39	21	11	27	39	62,000#

* MINIMUM TWO FLEX RESTRAINTS INSTALLED SYMMETRICALLY

THRUST BLOCK NOTES:

- THRUST BLOCKS TO BE CONSTRUCTED OF CLASS II CONCRETE (6 SACK). PER CALTRANS SPEC 90-1.02I(2)(a), CONCRETE MUST CONTAIN A MINIMUM OF 590 POUNDS OF CEMENTITIOUS MATERIAL PER CUBIC YARD.
- THRUST BLOCKS TO BE POURED AGAINST UNDISTURBED SOIL.
- JOINTS TO BE KEPT FREE OF CONCRETE. ALLOW WORKING ROOM AROUND NUTS & BOLTS. PLACE BITUMASTIC AROUND NUTS & BOLTS.
- ABRUPT CHANGES IN VERTICAL ALIGNMENT SHALL BE ANCHORED AS SPECIFIED IN REVERSE AND VERTICAL BENDS STANDARD DETAIL STD. WD-17.
- AREAS GIVEN ARE FOR CLASS 200 PIPE AT TEST PRESSURE OF 150 PSI IN SOIL WITH 2,000 PSI BEARING CAPACITY. CHANGES SUBJECT TO FIELD CONDITIONS AND APPROVAL OF THE ENGINEER.
- TAPPING SLEEVES SHALL HAVE THRUST BLOCKS SIZED THE SAME AS TEES.

BY	DATE	THRUST BLOCK TABLE STANDARD DETAIL	APPROVED: FEBRUARY 26, 2020	SCALE: NONE
DRAWN E.L.	5/92		 SILVIA LEE SANTOS ENGINEERING MANAGER	DWG. NO. STD. WD-13
CHECKED J.J.	02/20		50674 R.E. NO.	
REVIEWED R.I.	02/20	CITY OF PALO ALTO, CALIFORNIA	REVISION: FEBRUARY 26, 2020	APPENDIX B



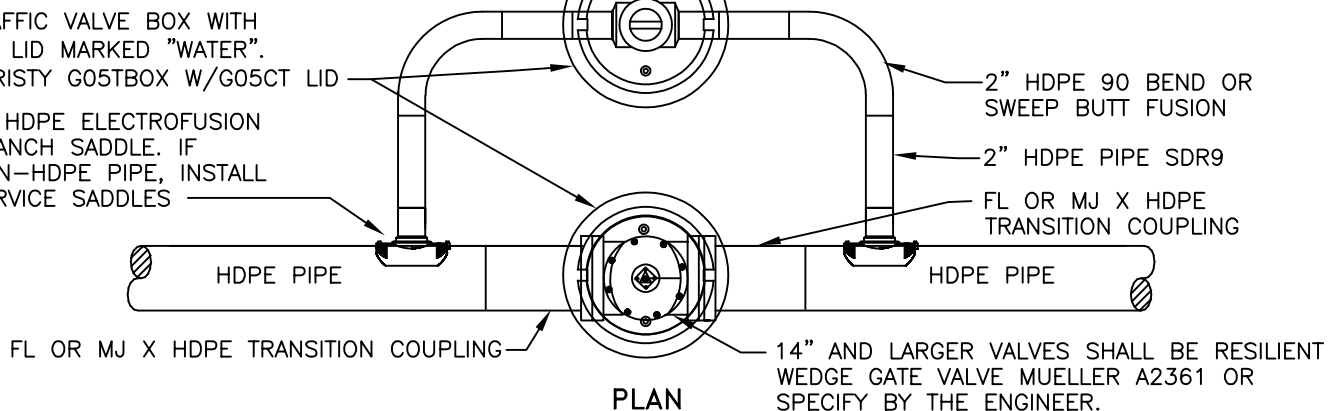
CAST IRON NON-LOCKING TYPE LID OLDCASTLE/CHRISTY G05CT

2" HDPE BALL VALVE W/ SQUARE NUT

INSTALL PLATE IN VALVE BOX INDICATING VALVE SHALL BE "HAND TURN" ONLY WITH ONE QUARTER TURN

TRAFFIC VALVE BOX WITH C.I. LID MARKED "WATER". CHRISTY G05TBOX W/G05CT LID

2" HDPE ELECTROFUSION BRANCH SADDLE. IF NON-HDPE PIPE, INSTALL SERVICE SADDLES



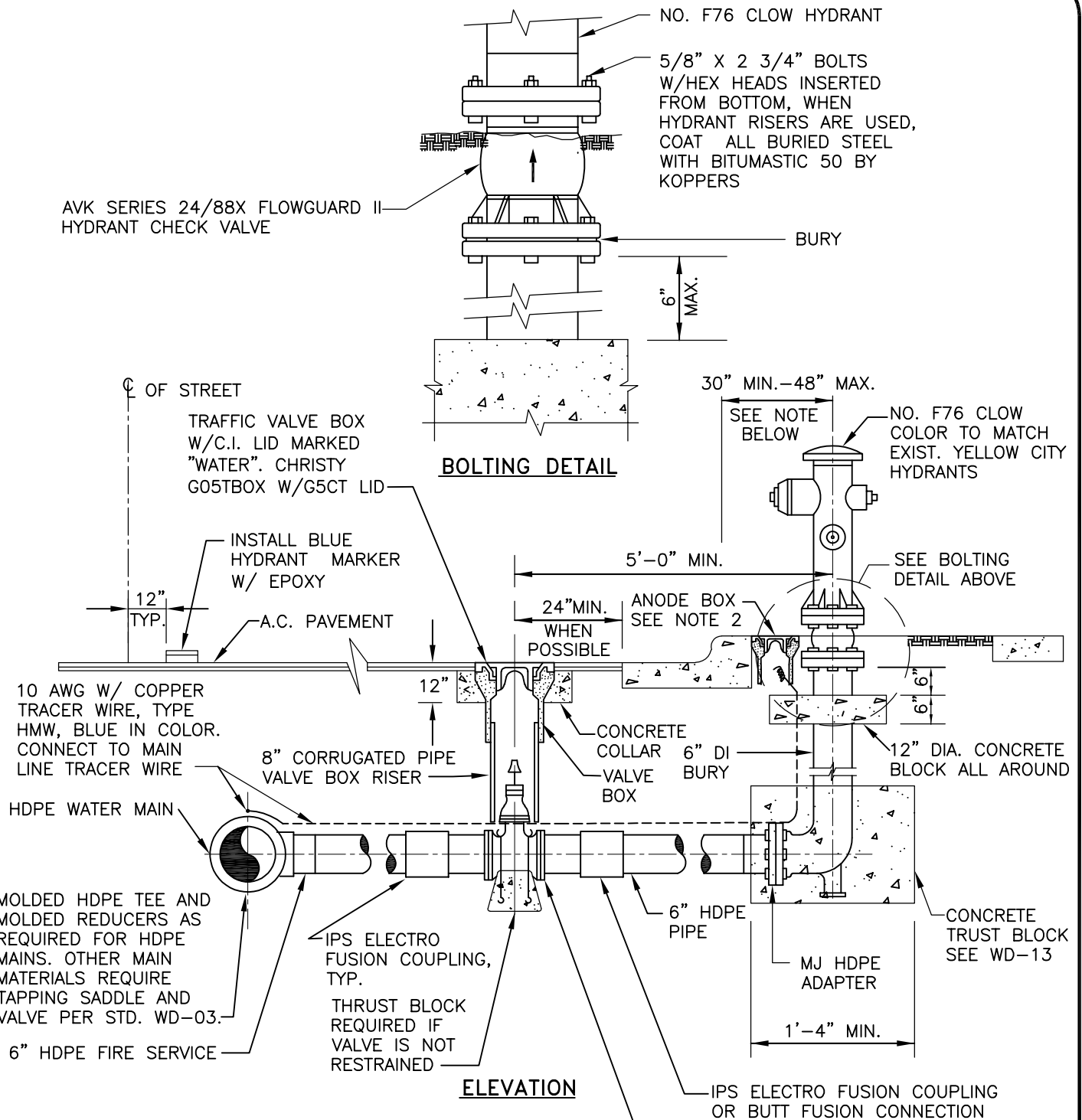
2" BYPASS FOR 14" AND LARGER VALVES *

NOTE:

A 2" HDPE BYPASS WITH FULL PORT HDPE VALVE IS REQUIRED FOR ANY TYPE OF VALVE, 14" AND LARGER AND ANY TYPE OF MAIN PIPE MATERIAL.

BY	DATE	GATE VALVE ASSEMBLY STANDARD DETAIL	APPROVED: FEBRUARY 26, 2020	SCALE: NONE
DRAWN J.J.	02/19		<i>Silvia Lee Santos</i> 50674	DWG. NO.
CHECKED J.J.	02/20		SILVIA LEE SANTOS R.E. NO.	STD. WD-14
REVIEWED R.I.	02/20		REVISION: FEBRUARY 26, 2020	APPENDIX B

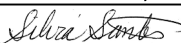
CITY OF PALO ALTO, CALIFORNIA



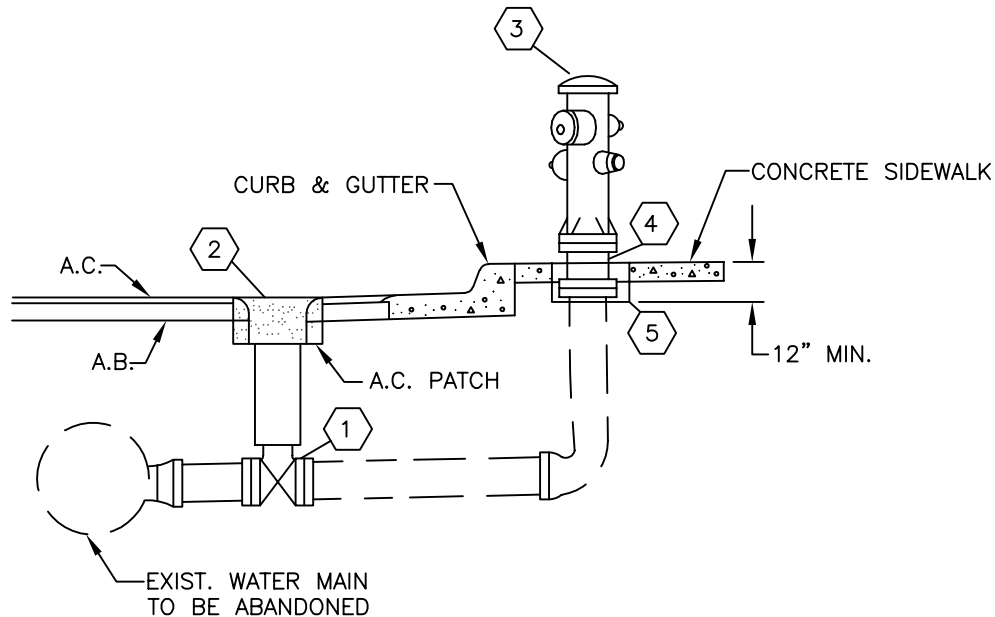
NOTES:

1. CENTER OF BURY LOCATION WHERE SIDEWALK & CURB ARE INTEGRAL IS 12" FROM BACK OF SIDEWALK INSTEAD OF BACK OF CURB, AS SHOWN.
2. 2. INSTALL 5#-10# ANODE ON ALL ISOLATED TRACER WIRE SYSTEMS AS DIRECTED BY THE CITY.

6" RESILIENT SEAT AVK GATE VALVE WITH HDPE ENDS WHEN CONNECTING TO HDPE OR MUELLER A-2361 SERIES GATE VALVE WHEN CONNECTING TO OTHER MAIN MATERIALS

BY	DATE	FIRE HYDRANT ASSEMBLY WITH HDPE PIPE STANDARD DETAIL	APPROVED: FEBRUARY 26, 2020	SCALE: NONE
DRAWN A.P.	7/09		 50674 SILVIA LEE SANTOS ENGINEERING MANAGER	DWG. NO. STD. WD-15
CHECKED J.J.	02/20		REVISION: FEBRUARY 26, 2020	APPENDIX B

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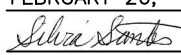


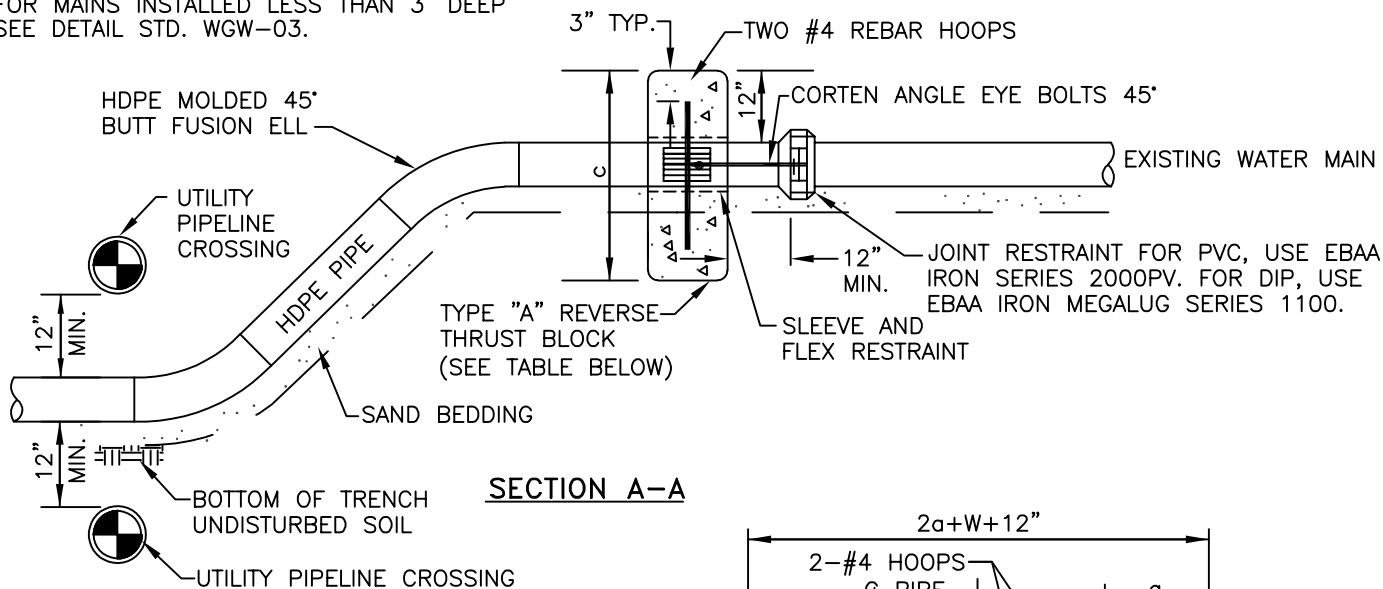
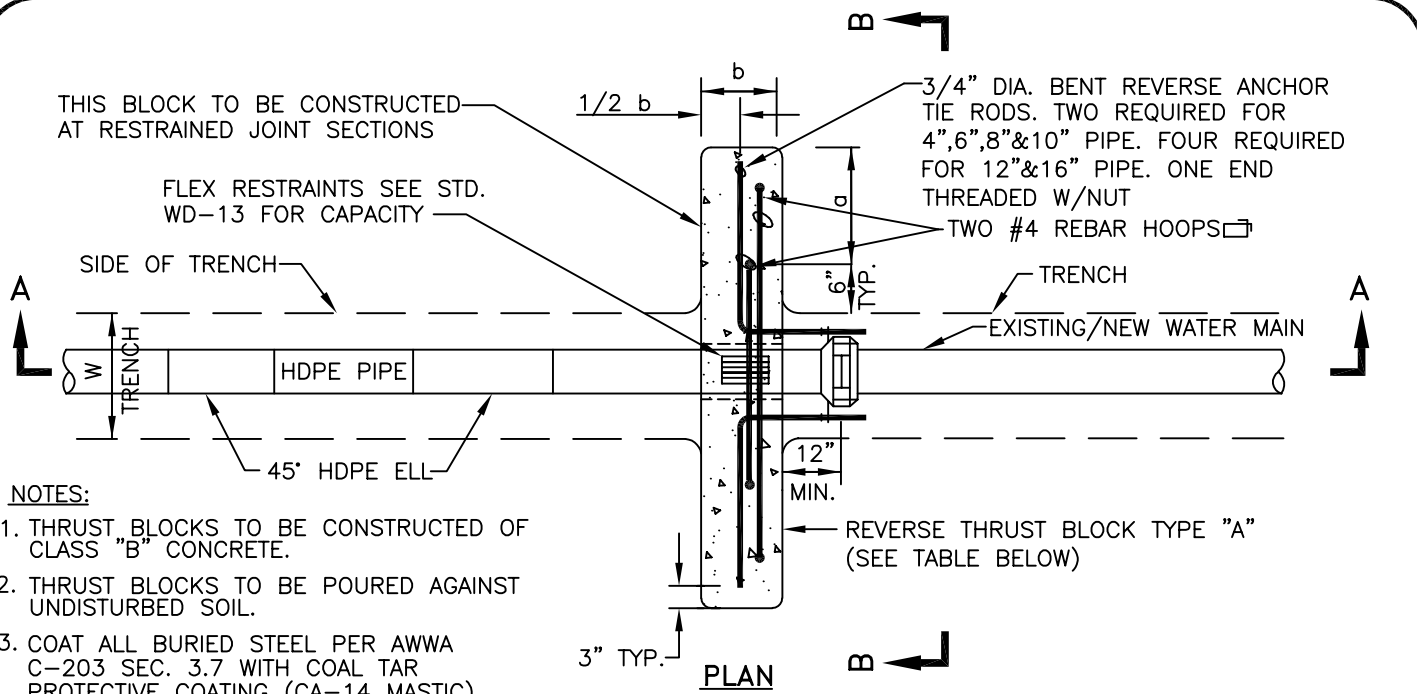
PROCEDURE FOR FIRE HYDRANT ABANDONMENT

- ① CLOSE VALVE TO HYDRANT.
- ② REMOVE VALVE BOX AND FILL RISER WITH CLEAN SAND. JET SAND AND BACKFILL HOLE WITH A.C. PATCH.
- ③ REMOVE HYDRANT AND SALVAGE TO CITY OF PALO ALTO CORPORATION YARD WATER-GAS-WASTEWATER REPAIR SHOP.
- ④ REMOVE 6" SNAP RING AND CUT BURY 12" BELOW EXISTING GRADE.
- ⑤ FILL BURY WITH SAND TO CUT RIM, JET SAND; THEN FILL 12" ± REMAINDER WITH CLASS "B" CONCRETE OR OTHER MATERIAL TO MATCH EXISTING GROUND SURFACE.

FIRE SERVICE ABANDONMENT PROCEDURE (IF NECESSARY)

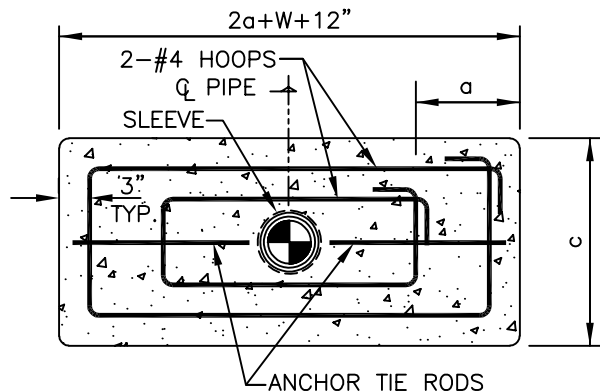
1. NOTIFY ALL AFFECTED WATER CUSTOMERS OF THE SERVICE INTERRUPTION. COORDINATE WATER SHUTDOWN WITH AFFECTED CUSTOMERS AND UTILITIES ENGINEERING/OPERATIONS STAFF. SHUTDOWN PLAN MUST BE APPROVED BY THE CITY PRIOR TO SHUTDOWN.
2. EXCAVATE THE EXISTING FIRE HYDRANT OR SERVICE AT THE MAIN AND SHUT DOWN THE MAIN.
3. FOR HYDRANT LATERAL OR WATER SERVICE WITH TAPPING SADDLE, REMOVE THE TAPPING SADDLE AND INSTALL A MUELLER REPAIR CLAMP. ANY LEAKS, FAILURES, OR DEFECTIVE REPAIRS SHALL BE PROMPTLY REPAIRED BY THE CONTRACTOR.
4. FOR SERVICES WITH A TEE, REMOVE THE TEE AND REPLACE WITH HDPE OR PVC C-900 STRAIGHT PIPE SECTION.
5. REMOVE THE FIRE HYDRANT AND SALVAGE TO THE CITY OF PALO ALTO CORPORATION YARD WGWW REPAIR SHOP.
6. BACKFILL, COMPACT AND PAVE HOLE AT THE MAIN PER TRENCH BACKFILL STANDARD DETAIL STD. WD-01.

BY	DATE	FIRE HYDRANT OR SERVICE ABANDONMENT STANDARD DETAIL CITY OF PALO ALTO, CALIFORNIA	APPROVED:	FEBRUARY 26, 2020	SCALE:	NONE
DRAWN	E.L.		 SILVIA LEE SANTOS ENGINEERING MANAGER	50674	DWG. NO.	STD. WD-16
CHECKED	J.J.			R.E. NO.		
REVIEWED	R.I.			REVISION:		
			FEBRUARY 26, 2020		APPENDIX B	

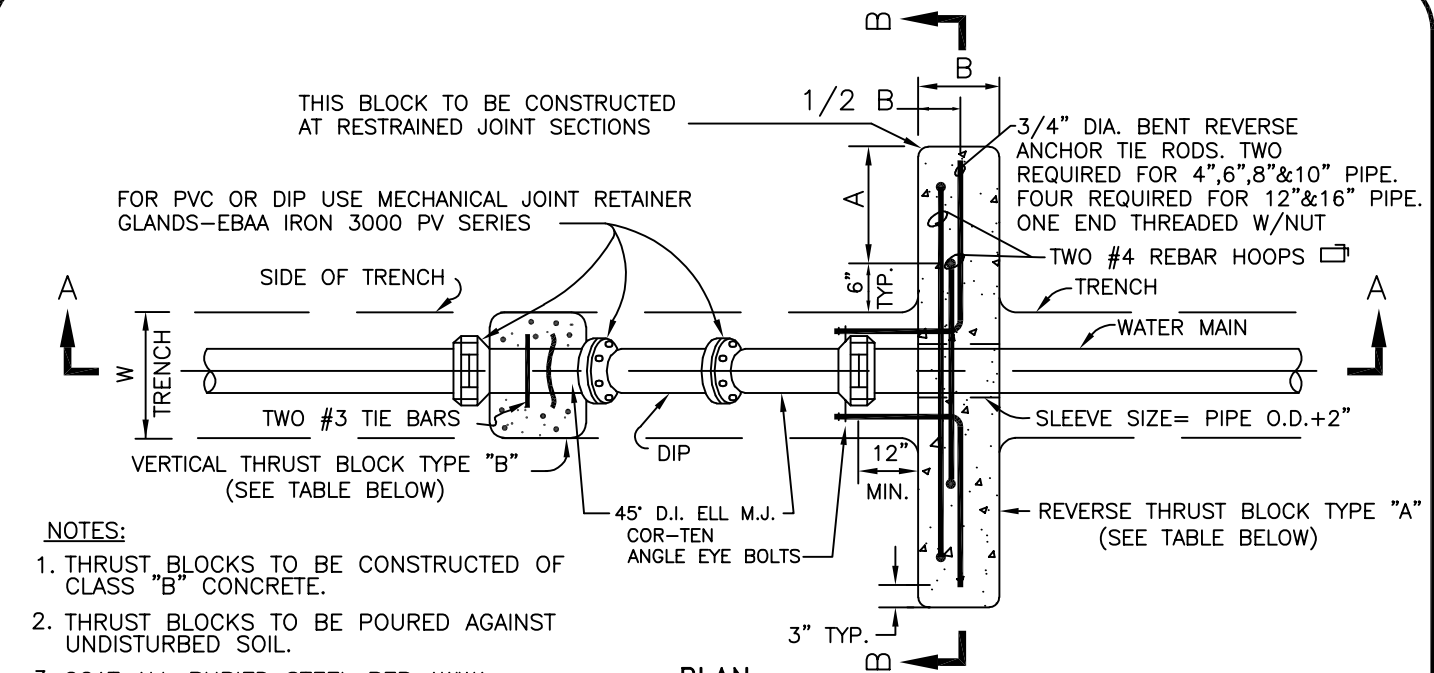


THRUST BLOCK TABLE				
PIPE SIZE	DIMENSIONS			TYPE "A" VOLUME
	a	b	c	
4" & 6"	1'-0"	1'-6"	2'-8"	0.75 C.Y.
8" & 10"	1'-6"	1'-6"	3'-0"	1.00 C.Y.
12" & 16"	2'-0"	2'-0"	3'-10"	1.90 C.Y.

BOTTOM OF TRENCH

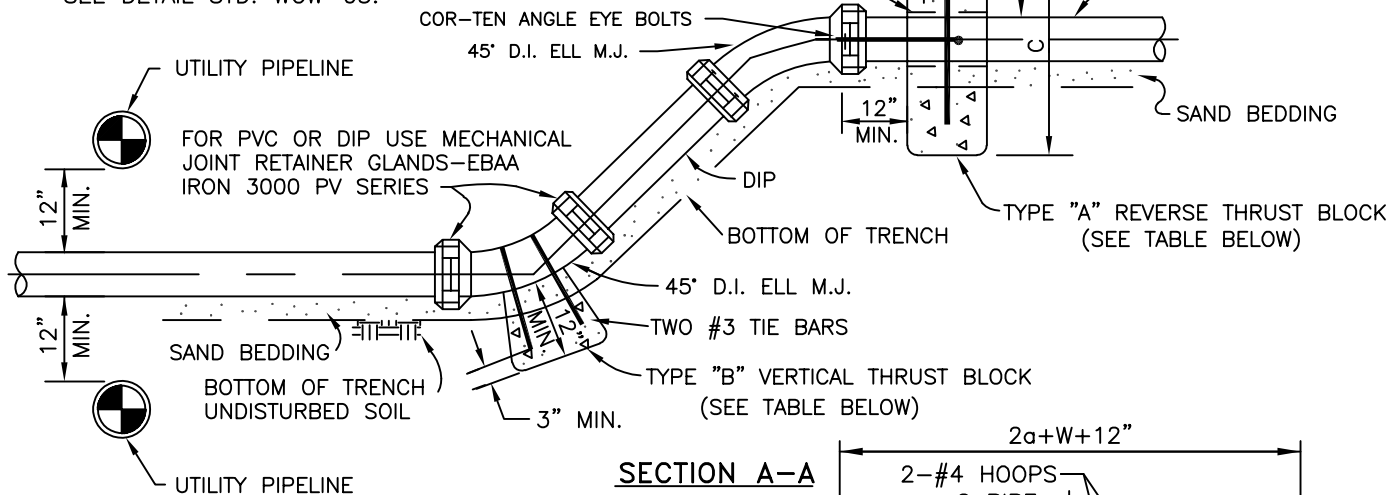


BY	DATE	VERTICAL BENDS HDPE PIPE CONNECTING TO NON-HDPE PIPE STANDARD DETAIL	APPROVED: FEBRUARY 26, 2020	SCALE: NONE
DRAWN E.L.	5/92		<i>Silvia Santos</i> 50674	DWG. NO.
CHECKED J.J.	02/20		SILVIA LEE SANTOS ENGINEERING MANAGER	STD. WD-17
REVIEWED R.I.	02/20	CITY OF PALO ALTO, CALIFORNIA	REVISION: FEBRUARY 26, 2020	APPENDIX B

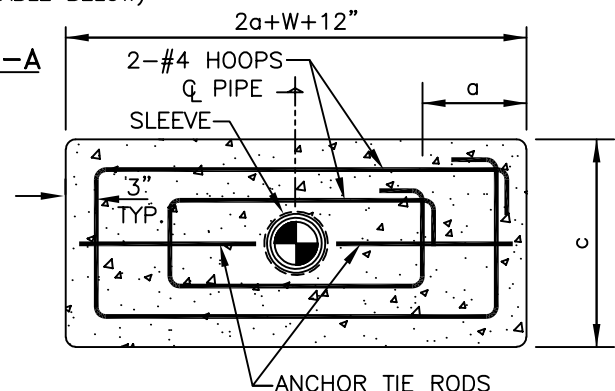


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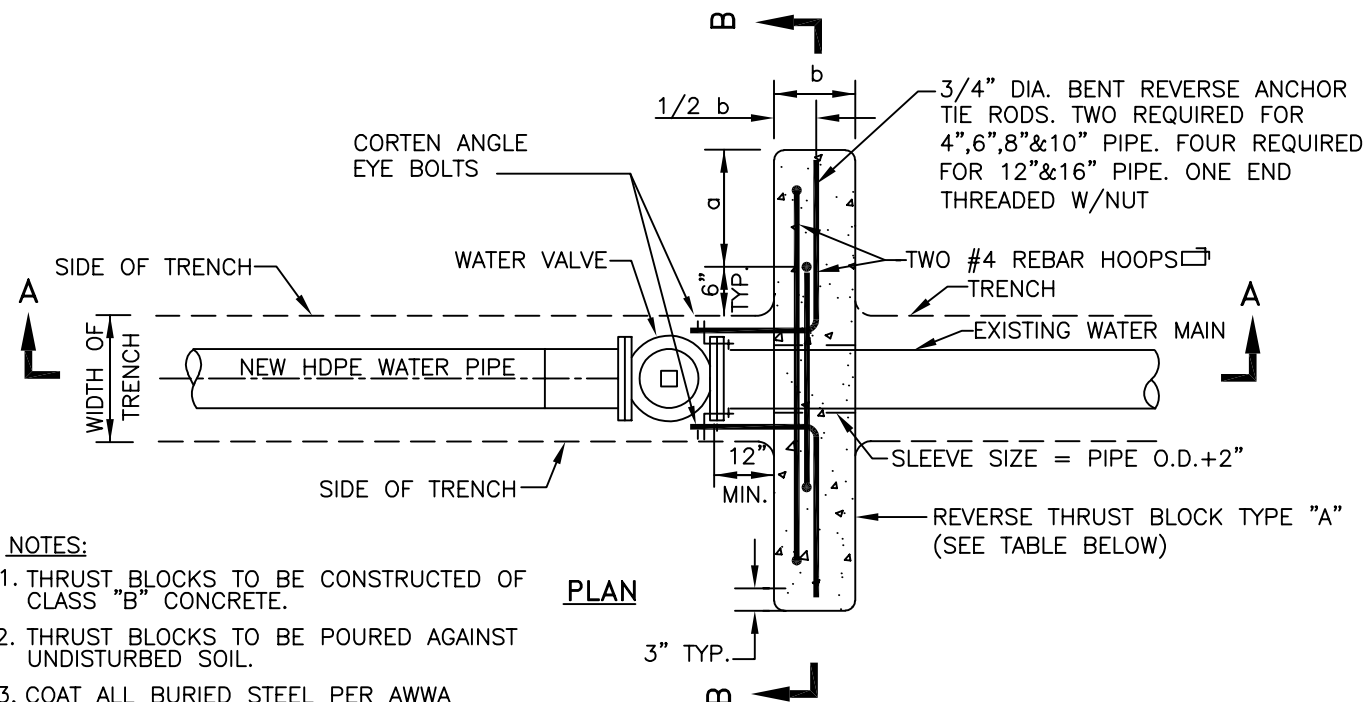
1. THRUST BLOCKS TO BE CONSTRUCTED OF CLASS "B" CONCRETE.
2. THRUST BLOCKS TO BE POURED AGAINST UNDISTURBED SOIL.
3. COAT ALL BURIED STEEL PER AWWA C-203 SEC. 3.7 WITH COAL TAR PROTECTIVE COATING (CA-14 MASTIC).
4. FOR MAINS INSTALLED LESS THAN 3' DEEP SEE DETAIL STD. WGW-03.



THRUST BLOCK TABLE				
PIPE SIZE	DIMENSIONS			TYPE "A" VOLUME
	a	b	c	
4" & 6"	1'-0"	1'-6"	2'-8"	0.75 C.Y.
8" & 10"	1'-6"	1'-6"	3'-0"	1.00 C.Y.
12" & 16"	2'-0"	2'-0"	3'-10"	1.90 C.Y.

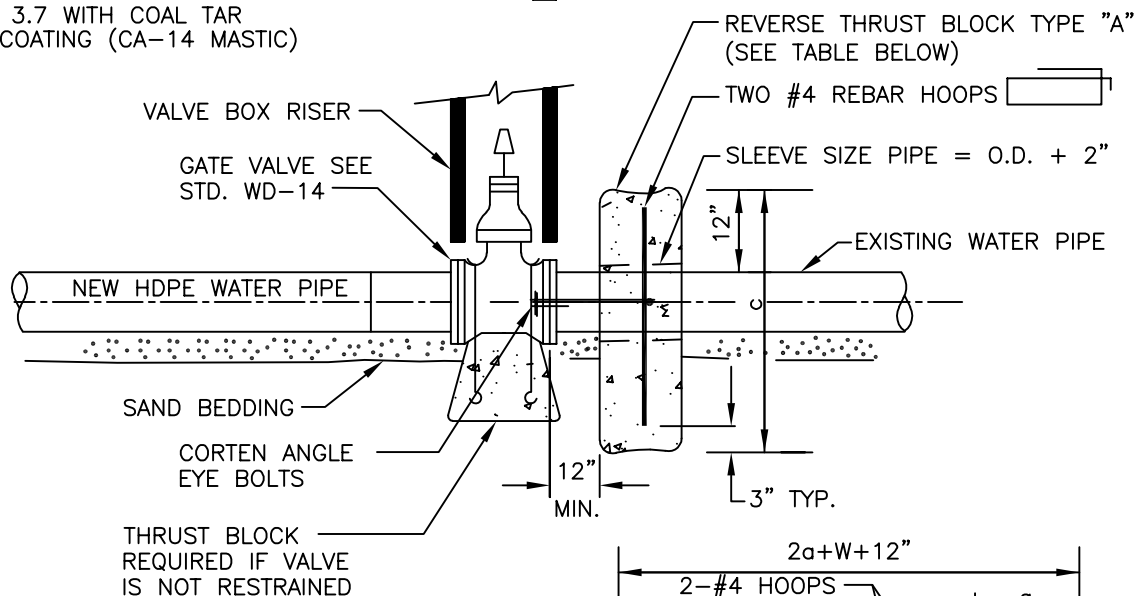


BY	DATE	VERTICAL BENDS PVC OR DI PIPE CONNECTING TO NON-HDPE PIPE STANDARD DETAIL	APPROVED: FEBRUARY 26, 2020	SCALE: NONE
DRAWN J.J.	02/19		<i>Silvia Santos</i> 50674	DWG. NO.
CHECKED J.J.	02/20		SILVIA LEE SANTOS ENGINEERING MANAGER R.E. NO.	STD. WD-17A
REVIEWED R.I.	02/20	CITY OF PALO ALTO, CALIFORNIA	REVISION: FEBRUARY 26, 2020	APPENDIX B

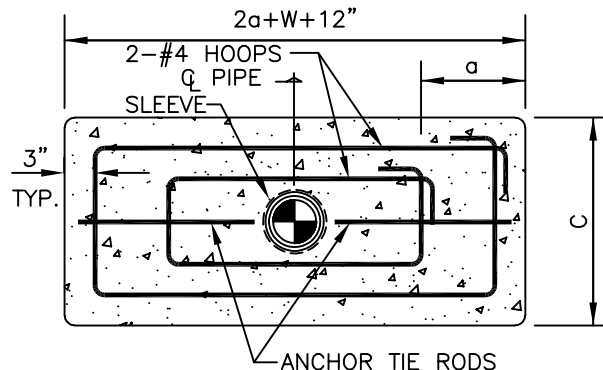


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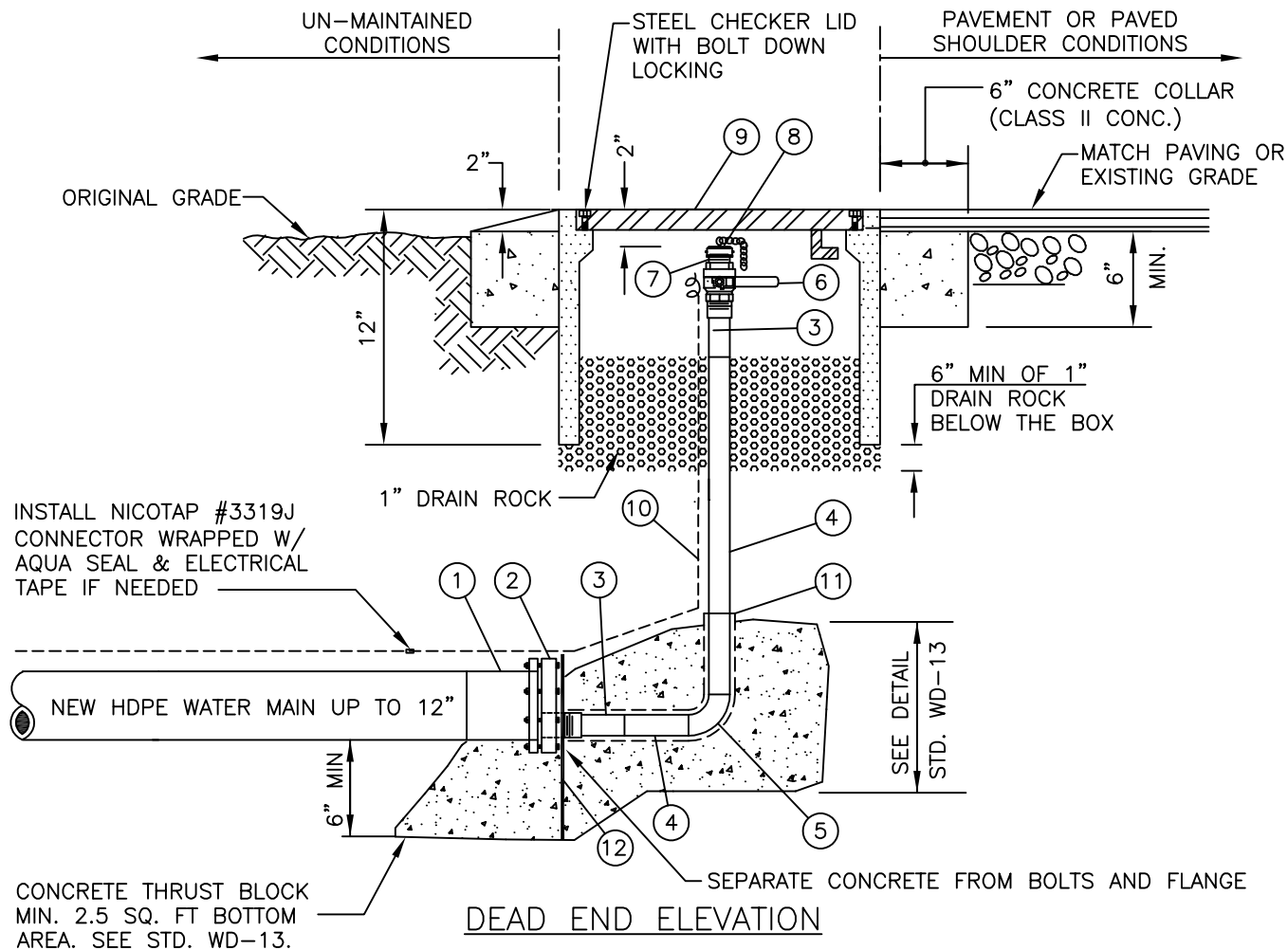
1. THRUST BLOCKS TO BE CONSTRUCTED OF CLASS "B" CONCRETE.
2. THRUST BLOCKS TO BE POURED AGAINST UNDISTURBED SOIL.
3. COAT ALL BURIED STEEL PER AWWA C-203 SEC. 3.7 WITH COAL TAR PROTECTIVE COATING (CA-14 MASTIC)



THRUST BLOCK TABLE				
PIPE SIZE	DIMENSIONS			TYPE "A" VOLUME
	a	b	c	
4" & 6"	1'-0"	1'-6"	2'-8"	0.75 C.Y.
8" & 10"	1'-6"	1'-6"	3'-0"	1.00 C.Y.
12" & 16"	2'-0"	2'-0"	3'-10"	1.90 C.Y.



BY		DATE	VALVE TIE-BACK DURING CONSTRUCTION STANDARD DETAIL	APPROVED: FEBRUARY 26, 2020	SCALE: NONE	
DRAWN	E.L.	5/92		 SILVIA LEE SANTOS ENGINEERING MANAGER	50674 R.E. NO.	DWG. NO.
CHECKED	J.J.	02/20			STD. WD-18	
REVIEWED	R.I.	02/20	CITY OF PALO ALTO, CALIFORNIA	REVISION: FEBRUARY 26, 2020	APPENDIX B	

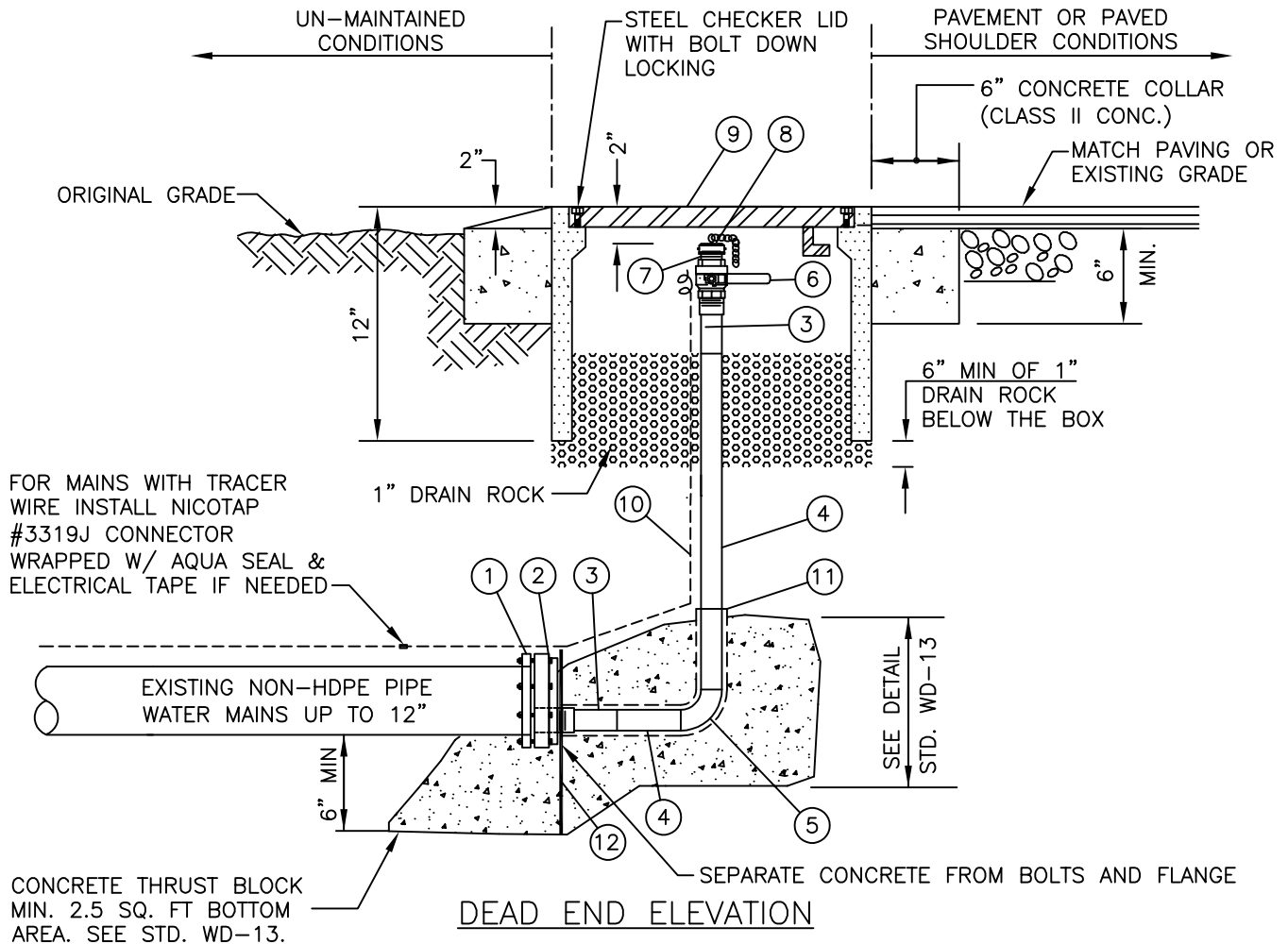


NOTES:

1. MINIMUM BLOW OFF PIPE DIAMETER SHALL BE 2" FOR MAINS UP TO 12". DESIGN OF BLOW OFF ASSEMBLIES FOR MAINS LARGER THAN 12" REQUIRES APPROVAL OF THE ENGINEERING MANAGER.
2. FOR INSTALLATION IN AREAS SUBJECT TO VEHICULAR TRAFFIC THE BLOW OFF BOX SHALL HAVE 20K (TIER 22) LOAD RATING AND SHALL BE ADJUSTED TO FINISH GRADE.
3. IN UNIMPROVED AREAS THE BLOW OFF BOX SHALL BE INSTALLED 2" ABOVE GRADE.
4. LIDS SHALL HAVE "WATER" MARKED ON THEM.

- 1 PEXFL TRANSITION COUPLING BUTT FUSION
- 2 BLIND FLANGE WITH 2" IPS THREADED TAP (OFFSET TO 6 O'CLOCK POSITION NEAR THE PIPE INVERT)
- 3 2" POLY-CAM SERIES 710 TRANSITION WITH MALE NPT OR APPROVED EQUAL
- 4 2" HDPE 4710 SDR 9 WATER PIPE
- 5 BUTT FUSION SWEEP OR 90° ELL
- 6 2" BALL VALVE, 1/4 TURN THREADED BRASS, FEMALE BOTH ENDS
- 7 2" NPT (MALE) X 2-1/2" MHT (MALE) BRASS FIRE
- 8 HOSE ADAPTER WITH CAP (SET AT 2" BELOW BOX LID)
- 9 CONCRETE TRAFFIC BOX 11x17x12, H20 LOAD OLD CASTLE/CHRISTY B1017 WITH BOLT DOWN LOCKING STEEL CHECKER PLATE LID
- 10 TRACER WIRE TYPE HMW 10 AWG COPPER BLUE COLOR
- 11 3" PLASTIC SLEEVE
- 12 PLASTIC BARRIER, FOAM BOARD OR BUILDING PAPER BOND BREAKER

BY	DATE	2" BLOW-OFF VALVE DEAD END HDPE MAINS UP TO 12" STANDARD DETAIL	APPROVED: FEBRUARY 26, 2020	SCALE: NONE
DRAWN J.J.	2/19		<i>Silvia Lee Santos</i> SILVIA LEE SANTOS ENGINEERING MANAGER	DWG. NO. STD. WD-19
CHECKED J.J.	2/20		50674 R.E. NO.	
REVIEWED R.I.	2/20	CITY OF PALO ALTO, CALIFORNIA	REVISION: FEBRUARY 26, 2020	APPENDIX B

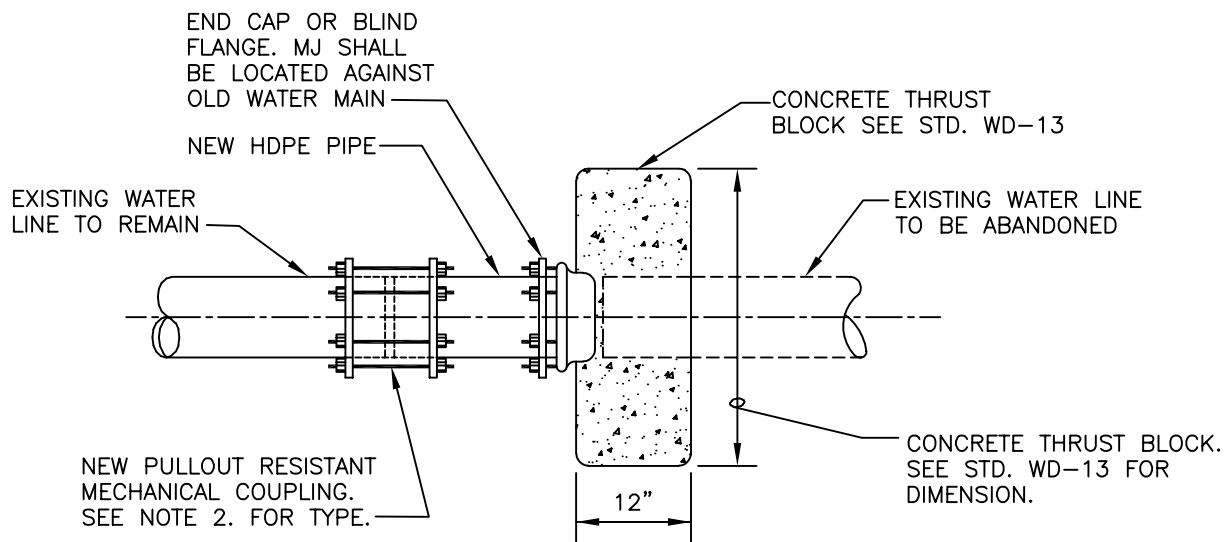


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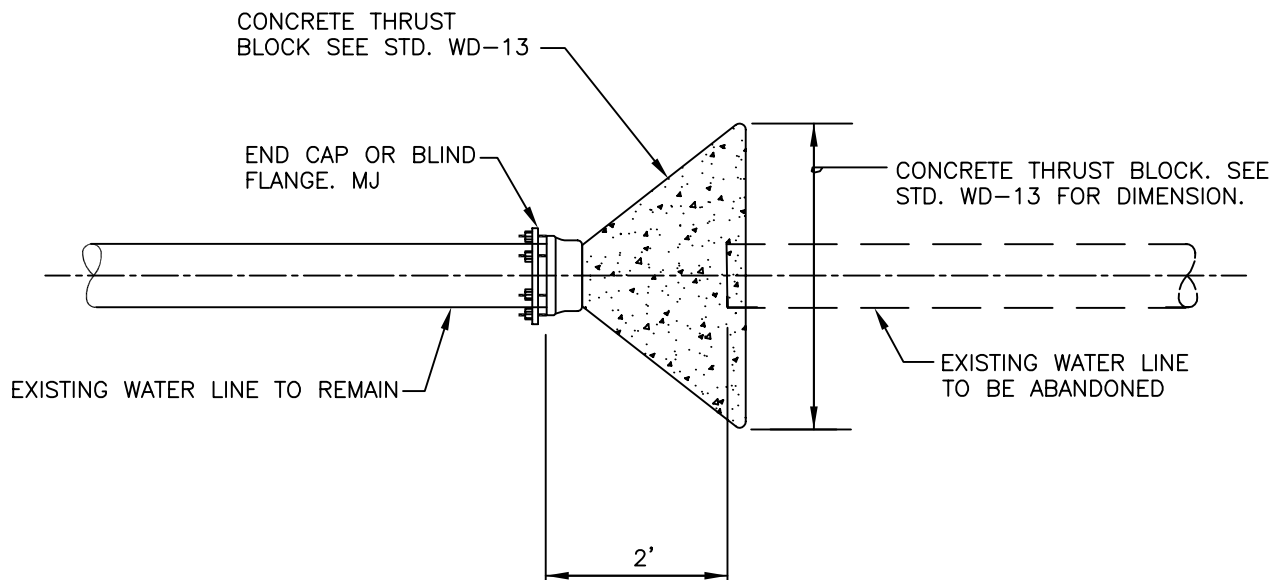
1. MINIMUM BLOW OFF PIPE DIAMETER SHALL BE 2" FOR MAINS UP TO 12". DESIGN OF BLOW OFF ASSEMBLIES FOR MAINS LARGER THAN 12" REQUIRES APPROVAL OF THE ENGINEERING MANAGER.
2. FOR INSTALLATION IN AREAS SUBJECT TO VEHICULAR TRAFFIC THE BLOW OFF BOX SHALL HAVE 20K (TIER 22) LOAD RATING AND SHALL BE ADJUSTED TO FINISH GRADE.
3. IN UNIMPROVED AREAS THE BLOW OFF BOX SHALL BE INSTALLED 2" ABOVE GRADE.
4. LIDS SHALL HAVE "WATER" MARKED ON THEM.

- ① MJxFL ADAPTER AND MEGA-LUG RETAINER GLAND
- ② MJ CAP OR BLIND FLANGE WITH 2" IPS THREADED TAP (OFFSET 6 O'CLOCK POSITION NEAR THE PIPE INVERT)
- ③ 2" POLY-CAM SERIES 710 TRANSITION WITH MALE NPT OR APPROVED EQUAL
- ④ 2" HDPE 4710 SDR 9 WATER PIPE
- ⑤ BUTT FUSION SWEEP OR 90° ELL
- ⑥ 2" BALL VALVE, 1/4 TURN THREADED BRASS, FEMALE BOTH ENDS
- ⑦ 2" NPT (MALE) X 2-1/2" MHT (MALE) BRASS FIRE
- ⑧ HOSE ADAPTER WITH CAP (SET AT 2" BELOW BOX LID)
- ⑨ CONCRETE TRAFFIC BOX 11x17x12, H20 LOAD OLD CASTLE/CHRISTY B1017 WITH BOLT DOWN LOCKING STEEL CHECKER PLATE LID
- ⑩ TRACER WIRE TYPE HMW 10 AWG COPPER BLUE COLOR
- ⑪ 3" PLASTIC SLEEVE
- ⑫ PLASTIC BARRIER, FOAM BOARD OR BUILDING PAPER BOND BREAKER

BY	DATE	2" BLOW-OFF VALVE DEAD END NON-HDPE MAINS UP TO 12" STANDARD DETAIL	APPROVED: FEBRUARY 26, 2020	SCALE: NONE
DRAWN J.J.	2/19		<i>Silvia Lee Santos</i> SILVIA LEE SANTOS ENGINEERING MANAGER	DWG. NO. STD. WD-19A
CHECKED J.J.	2/20		50674 R.E. NO.	
REVIEWED R.I.	2/20	CITY OF PALO ALTO, CALIFORNIA	REVISION: FEBRUARY 26, 2020	APPENDIX B



OPTION NO. 1



OPTION NO. 2

NOTES:

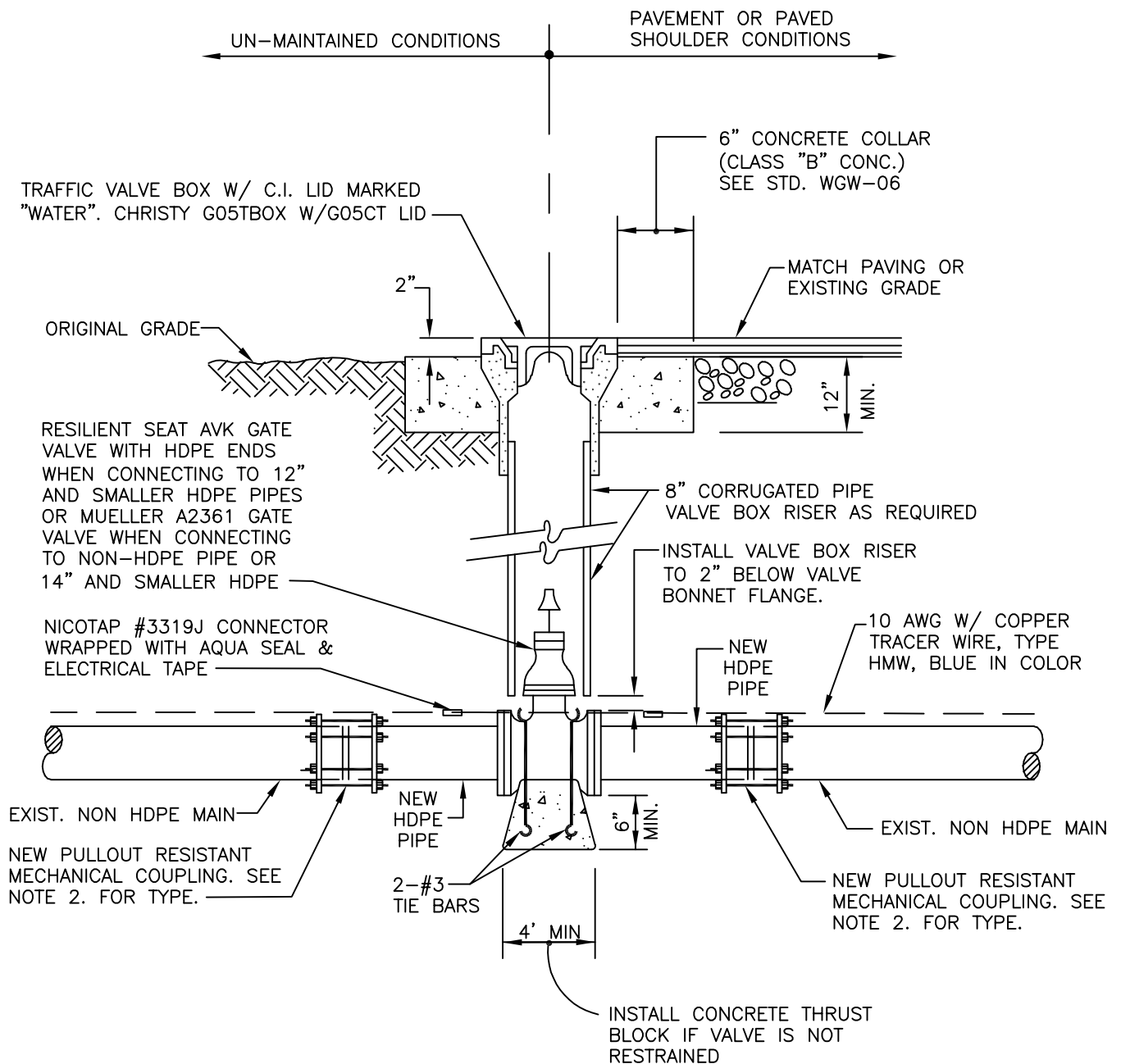
1. COUPLINGS SHALL BE ASSEMBLED AND INSTALLED ACCORDING TO THE STANDARDS RECOMMENDED BY THE MANUFACTURER.
2. MECHANICAL COUPLINGS FOR JOINING HDPE TO ACP AND PVC MAIN, USE SMITH & BLAIR QUANTUM COUPLING. FOR JOINING HDPE TO CIP OR DIP MAIN, USE KRAUSZ HYMAX GRIP OR SMITH & BLAIR QUANTUM COUPLING. FOR JOINING HDPE TO HDPE MAIN, USE ELECTROFUSION COUPLINGS.

BY	DATE	CUT & CAP EXISTING MAIN STANDARD DETAIL	APPROVED: FEBRUARY 26, 2020	SCALE: NONE
DRAWN E.L.	5/92		<i>Silvia Lee Santos</i> SILVIA LEE SANTOS ENGINEERING MANAGER	DWG. NO. STD. WD-20
CHECKED J.J.	02/20	CITY OF PALO ALTO, CALIFORNIA	REVISION: FEBRUARY 26, 2020	APPENDIX B
REVIEWED R.I.	02/20			

-
- Technical drawing of a toilet security enclosure, showing a side view (top) and a top view (bottom).
- Side View (Top):**
- Overall width: 22"
 - Overall height: 24"
 - Internal height: 22"
 - Components labeled: 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19.
 - Labels: "CONCRETE PEDESTAL", "EYE BOLT EMBEDDED IN CONCRETE FOR PADLOCK IN THE ENCLOSURE INTEGRATED SECURITY BOX".
- Top View (Bottom):**
- Overall width: 30"
 - Overall depth: 20"
 - Internal width: 18"
 - Internal depth: 8"
 - Height: 4"
 - Component labeled: 20.
 - Labels: "CONCRETE PEDESTAL", "8\" x 18\"", "E PACKED", "WHITE ROCK".
- Other Labels:**
- 1: Circular access point (manhole).
 - 2: Pipe fitting.
 - 3: Pipe fitting.
 - 4: HDPE PIPE.
 - 5: Pipe fitting.
 - 6: Pipe fitting.
 - 7: Pipe fitting.
 - 8: Pipe fitting.
 - 19: Pipe fitting.
 - 20: Pipe fitting.

1. VALVES SHALL HAVE STAINLESS STEEL FLOAT WITH THE MINIMUM INLET/OUTLET SIZE OF 1 INCH FOR HDPE MAIN SIZES UP TO 12 INCH.
2. FOR 14 INCH AND LARGER HDPE MAINS AIR VALVES ASSEMBLIES SHALL BE A MINIMUM OF 2 INCHES.
3. ENGINEERING DESIGN REQUIRED FOR MAINS LARGER THAN 14 INCH.
4. AIR RELEASE VALVE ENCLOSURES WITHIN THREE (3) FEET OF POTENTIAL VEHICULAR ACCESS SHALL BE PROTECTED BY COMMERCIAL BOLLARDS PER STD. GWG-05B.

BY	DATE	AIR RELEASE VALVE STANDARD DETAIL	APPROVED: FEBRUARY 26, 2020 	SCALE: NONE
DRAWN J.J.	02/20		50674 SILVIA LEE SANTOS ENGINEERING MANAGER R.E. NO.	DWG. NO. STD. WD-21
CHECKED J.J.	02/20	CITY OF PALO ALTO, CALIFORNIA	REVISION: FEBRUARY 26, 2020	APPENDIX B
REVIEWED R.I.	02/20			



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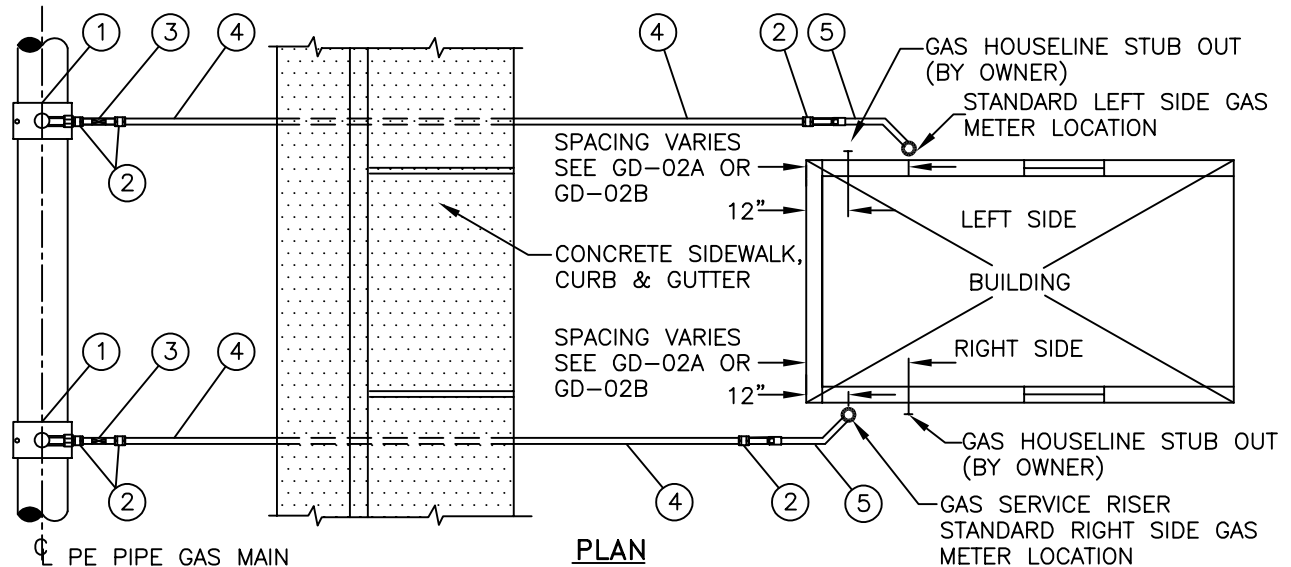
1. COUPLINGS SHALL BE ASSEMBLED AND INSTALLED ACCORDING TO THE STANDARDS RECOMMENDED BY THE MANUFACTURER.
2. MECHANICAL COUPLINGS FOR JOINING HDPE TO ACP AND PVC MAIN, USE SMITH & BLAIR QUANTUM COUPLING. FOR JOINING HDPE TO CIP OR DIP MAIN, USE KRAUSZ HYMAX GRIP OR SMITH & BLAIR QUANTUM COUPLING. FOR JOINING HDPE TO HDPE MAIN, USE ELECTROFUSION COUPLINGS.
3. INSTALL 5#-10# ANODE ON ALL ISOLATED TRACER WIRE SYSTEMS WHERE DIRECTED BY THE CITY OF PALO ALTO.

BY	DATE	NEW GATE VALVE (INSTALLATION ON EXIST. MAIN) STANDARD DETAIL	APPROVED: FEBRUARY 26, 2020	SCALE: NONE
DRAWN B.C.	8/04		<i>Silvia Santos</i> 50674	DWG. NO.
CHECKED J.J.	02/20		SILVIA LEE SANTOS ENGINEERING MANAGER R.E. NO.	STD. WD-22
REVIEWED R.I.	02/20	CITY OF PALO ALTO, CALIFORNIA	REVISION: FEBRUARY 26, 2020	APPENDIX B

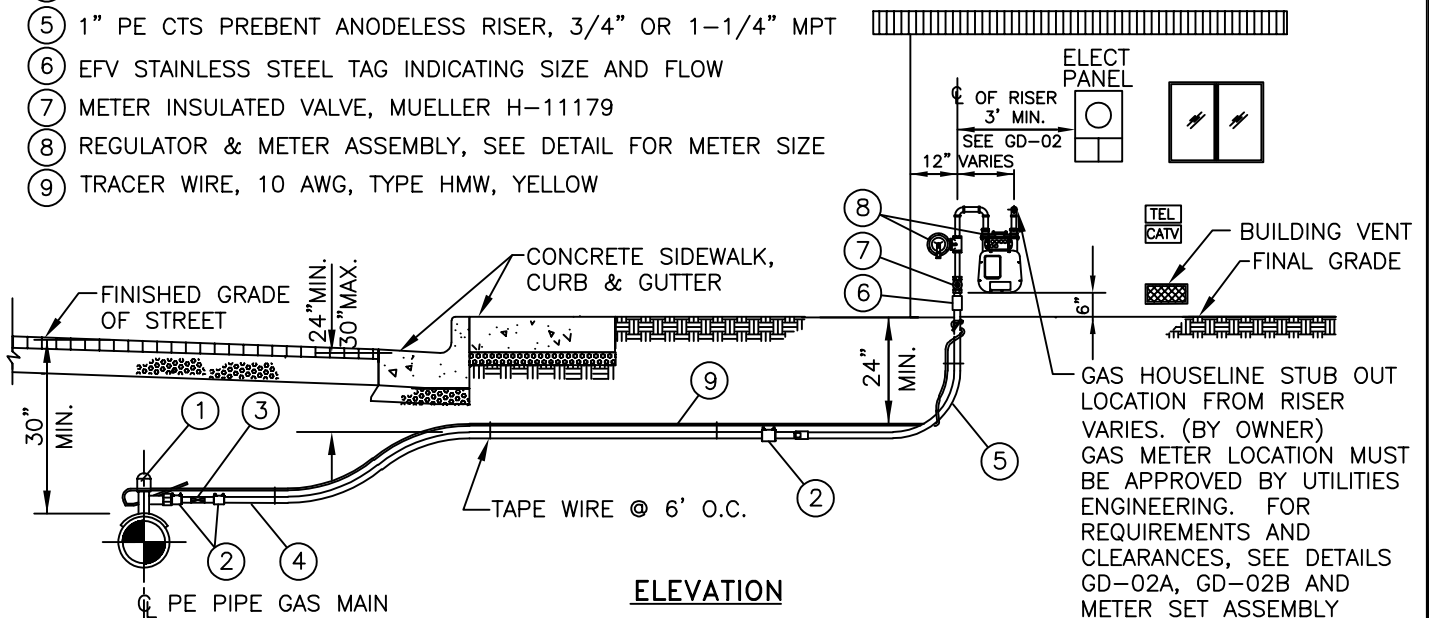
**Table of Contents
Appendix C
Gas Standard Details**

<u>Detail No.</u>	<u>Title</u>
GD-01A	1" Gas Service with 1" EFV
GD-01B	1" Gas Service with 1-1/4" EFV
GD-01C	2" Gas Service with EFV
GD-01D	2" Gas Service without EFV
GD-02A	Residential Diaphragm Gas Meter Clearance 250-800 SCFH
GD-02B	Residential Diaphragm Gas Meter Clearance 1,000 SCFH
GD-02C	Residential Rotary Gas Meter Clearance 1,100-1,500 SCFH
GD-03A	Residential Meter Set Assembly 250-800 SCFH
GD-03B	Residential Meter Set Assembly 250-800 SCFH
GD-04A	Residential Manifold Meter Set Assembly w/o Bypass 500 SCFH
GD-04B	Residential Manifold Meter Set Assembly w/o Bypass 500 SCFH
GD-04C	Residential Manifold Meter Set Assembly w/ Bypass 1,000 SCFH
GD-04D	Residential Manifold Meter Set Assembly w/ Bypass 1,000 SCFH
GD-05A	Residential/Commercial Manifold Meter Set Assembly Up To 1,250 SCFH
GD-05B	Residential/Commercial Manifold Meter Set Assembly Up To 1,250 SCFH
GD-06A	Residential/Commercial Manifold Meter Set Assembly 1,500 - 3,000 SCFH
GD-06B	Residential/Commercial Manifold Meter Set Assembly 1,500 - 3,000 SCFH
GD-07A	Residential/Commercial Manifold Meter Set Assembly 3,000 - 5,000 SCFH
GD-07B	Residential/Commercial Manifold Meter Set Assembly 3,000 - 5,000 SCFH
GD-08A	Residential/Commercial Manifold Meter Set Assembly 5,000 to 15,000 SCFH
GD-08B	Residential/Commercial Manifold Meter Set Assembly 5,000 to 15,000 SCFH
GD-08C	Residential/Commercial Manifold Meter Set Assembly 5,000 to 15,000 SCFH
GD-09A	Residential/Commercial/Industrial Rotary Meter Set Assembly 800–2,000 SCFH
GD-09B	Residential/Commercial/Industrial Rotary Meter Set Assembly 800–2,000 SCFH
GD-09C	Residential/Commercial/Industrial Rotary Meter Set Assembly 800–2,000 SCFH
GD-10A	Commercial Meter Set Assembly 250 - 425 SCFH
GD-10B	Commercial Meter Set Assembly 250 – 425 SCFH
GD-11A	Commercial Meter Set Assembly 630-800 SCFH
GD-11B	Commercial Meter Set Assembly 630-800 SCFH
GD-12A	Commercial Meter Set Assembly 1,000 SCFH
GD-12B	Commercial Meter Set Assembly 1,000 SCFH
GD-13A	Commercial/Industrial Rotary Meter Set Assembly 2,000-3,000 SCFH
GD-13B	Commercial/Industrial Rotary Meter Set Assembly 2,000-3,000 SCFH
GD-14A	Commercial/Industrial Rotary Meter Set Assembly 5,000 & 7,000 SCFH
GD-14B	Commercial/Industrial Rotary Meter Set Assembly 5,000 & 7,000 SCFH
GD-14C	Commercial/Industrial Rotary Meter Set Assembly 5,000 & 7,000 SCFH
GD-15A	Commercial/Industrial Rotary Meter Set Assembly 5,000-7,000 SCFH
GD-15B	Commercial/Industrial Rotary Meter Set Assembly 5,000-7,000 SCFH
GD-15C	Commercial/Industrial Rotary Meter Set Assembly 5,000-7,000 SCFH

GD-16A	Commercial/Industrial Rotary Meter Set Assembly 11,000 SCFH
GD-16B	Commercial/Industrial Rotary Meter Set Assembly 11,000 SCFH
GD-17A	Commercial/Industrial Rotary Meter Set Assembly 11,000/16,000 SCFH
GD-17B	Commercial/Industrial Rotary Meter Set Assembly 11,000/16,000 SCFH
GD-17C	Commercial/Industrial Rotary Meter Set Assembly 11,000/16,000 SCFH
GD-18A	Industrial Rotary Meter Set Assembly 23,000 SCFH
GD-18B	Industrial Rotary Meter Set Assembly 23,000 SCFH
GD-18C	Industrial Rotary Meter Set Assembly 23,000 SCFH
GD-19A	Industrial Ultrasonic Meter Set Assembly 16,000-25,000 SCFH
GD-19B	Industrial Ultrasonic Meter Set Assembly 16,000-25,000 SCFH
GD-19C	Industrial Ultrasonic Meter Set Assembly 16,000-25,000 SCFH
GD-19D	Industrial Ultrasonic Meter Set Assembly 16,000-25,000 SCFH
GD-20A	Industrial Ultrasonic Meter Set Assembly 23,000-45,000 SCFH
GD-20B	Industrial Ultrasonic Meter Set Assembly 23,000-45,000 SCFH
GD-20C	Industrial Ultrasonic Meter Set Assembly 23,000-45,000 SCFH
GD-20D	Industrial Ultrasonic Meter Set Assembly 23,000-45,000 SCFH
GD-20E	Industrial Ultrasonic Meter Set Assembly 23,000-45,000 SCFH
GD-21	Curb Gas Meter 250-630 SCFH
GD-22	Multiple Curb Gas Meters 250-630 SCFH
GD-23A	Utility Box (Curb Location) Meter Set Assembly 250 SCFH
GD-23B	Utility Box (Curb Location) Meter Set Assembly 250 SCFH
GD-23C	Utility Box (Curb Location) Meter Set Assembly 400-630 SCFH
GD-23D	Utility Box (Curb Location) Meter Set Assembly 400-630 SCFH
GD-24A	Commercial Rotary Meter Set Assembly 800-1,100 Utility Box (Curb Location)
GD-24B	Commercial Rotary Meter Set Assembly 800-1,100 Utility Box (Curb Location)
GD-25A	Commercial Rotary Meter Set Assembly 1,500-2,000 SCFH Utility Box (Curb Location)
GD-25B	Commercial Rotary Meter Set Assembly 1,500-2,000 SCFH Utility Box (Curb Location)
GD-25C	Commercial Rotary Meter Set Assembly 1,500-2,000 SCFH Utility Box (Curb Location)
GD-26A	Commercial/Industrial Rotary Meter Set Assembly 2,000-3,000 SCFH Utility Box (Curb)
GD-26B	Commercial/Industrial Rotary Meter Set Assembly 2,000-3,000 SCFH Utility Box (Curb)
GD-26C	Commercial/Industrial Rotary Meter Set Assembly 2,000-3,000 SCFH Utility Box (Curb)
GD-27A	Commercial/Industrial Rotary Meter Set Assembly 5,000-7,000 SCFH Utility Box (Curb)
GD-27B	Commercial/Industrial Rotary Meter Set Assembly 5,000-7,000 SCFH Utility Box (Curb)
GD-27C	Commercial/Industrial Rotary Meter Set Assembly 5,000-7,000 SCFH Utility Box (Curb)
GD-28A	Gas Service Regulator Vent Extension Assembly
GD-28B	Gas Service Regulator Vent Extension Assembly



- ① ELECTROFUSION TAPPING TEE, MAIN SIZE X 1" CTS
- ② 1" ELECTROFUSION COUPLING
- ③ 1" CTS EFV, UMAC MODEL 41, SERIES 1,800 OR 2,600
- ④ 1" PE SDR 11.5 PIPE GAS SERVICE
- ⑤ 1" PE CTS PREBENT ANODELESS RISER, 3/4" OR 1-1/4" MPT
- ⑥ EFV STAINLESS STEEL TAG INDICATING SIZE AND FLOW
- ⑦ METER INSULATED VALVE, MUELLER H-11179
- ⑧ REGULATOR & METER ASSEMBLY, SEE DETAIL FOR METER SIZE
- ⑨ TRACER WIRE, 10 AWG, TYPE HMW, YELLOW

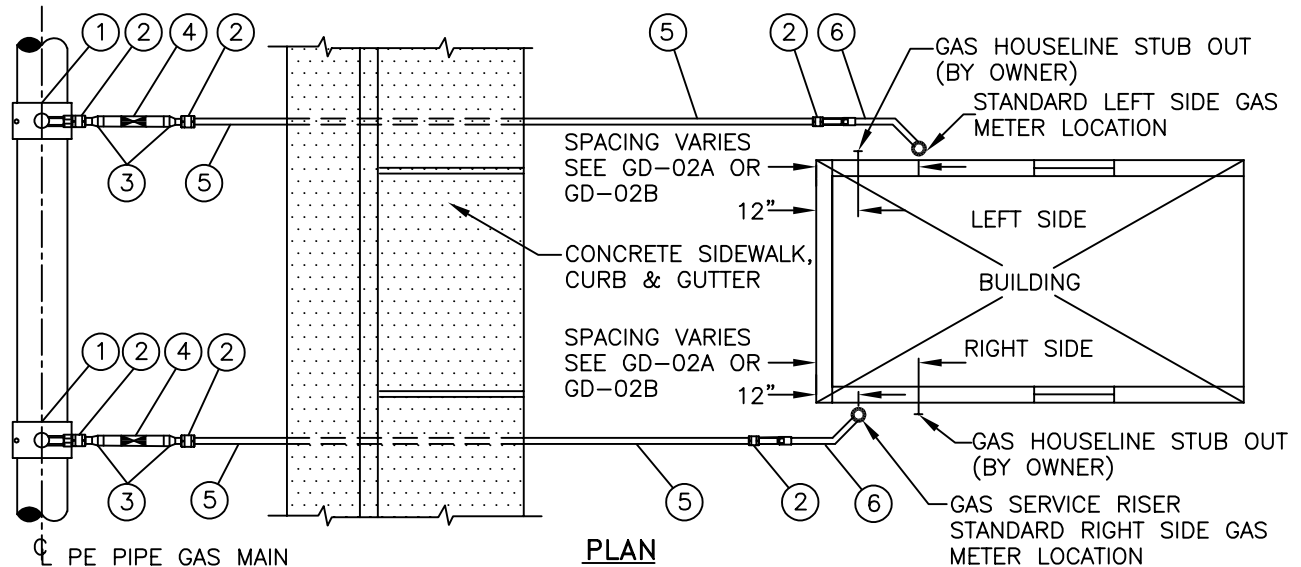


NOTES:

1. MINIMUM DEPTH OF BURY FOR SERVICE LINES IS 24".
2. ALL PIPING USED MUST BEAR THE FOLLOWING DESIGNATIONS: ASTM D2513-09a, AND PE 2708 GAS.
3. EXCESS FLOW VALVE (EFV) SHALL BE INSTALLED IN ALL NEW OR ALTERED SERVICES NOT EXCEEDING THE LARGEST APPROVED EFV SIZE BASED ON THE TOTAL SERVICE LOAD OR METER CAPACITY.
4. INSTALLATION OF EFV ON A SERVICE LINE FOR A NON SFR WITH CAPACITY EXCEEDING 1,800 SCFH REQUIRES ENGINEERING ANALYSIS FOR SIZING EFV CONSIDERING MAXIMUM EXPECTED LOAD, SERVICE LENGTH, POSSIBILITY OF SNAP ON/OFF LOAD APPLICATION, CRITICALITY OF GAS SUPPLY, CUSTOMER'S SYSTEM CONFIGURATION/APPLICATION, AND FUTURE ANTICIPATED CONFIRMED LOADS.
5. AN EFV STAINLESS STEEL TAG INDICATING THE SIZE AND FLOW CAPACITY OF THE VALVE SHALL BE ATTACHED TO THE GAS RISER WHEN ONE IS INSTALLED.

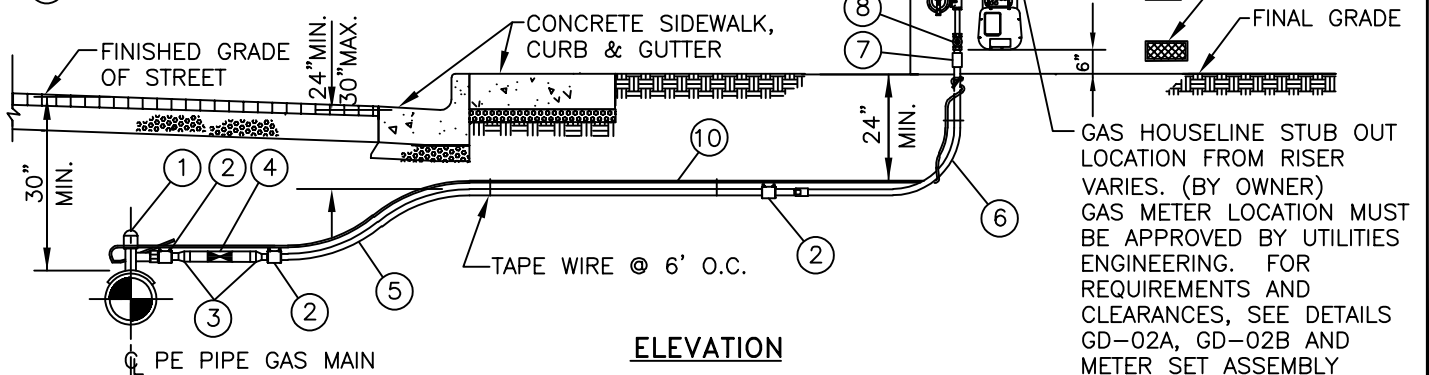
BY	DATE	1" GAS SERVICE WITH 1" EFV STANDARD DETAIL	APPROVED:	SCALE:
DRAWN J.J.	02/92		FEBRUARY 26, 2020	NONE
CHECKED J.J.	02/20		<i>Silvia Lee Santos</i> SILVIA LEE SANTOS ENGINEERING MANAGER	DWG. NO. STD. GD-01A
REVIEWED A.P.	02/20		REVISION: FEBRUARY 26, 2020	APPENDIX C

CITY OF PALO ALTO, CALIFORNIA



PLAN

- ① ELECTROFUSION TAPPING TEE, MAIN SIZE X 1" CTS
- ② 1" ELECTROFUSION COUPLING
- ③ 1-1/4" IPS X 1" CTS E-BUTT PE REDUCER, STORE NO. 49351
- ④ 1-1/4" IPS EFV, UMAC MODEL 41, SERIES 5,500
- ⑤ 1" PE SDR 11.5 PIPE GAS SERVICE
- ⑥ 1" PE CTS PREBENT ANODELESS RISER, 3/4" OR 1-1/4" MPT
- ⑦ EFV STAINLESS STEEL TAG INDICATING SIZE AND FLOW
- ⑧ METER INSULATED VALVE, MUELLER H-11179
- ⑨ REGULATOR & METER ASSEMBLY, SEE DETAIL FOR METER SIZE
- ⑩ TRACER WIRE, 10 AWG, TYPE HMW, YELLOW



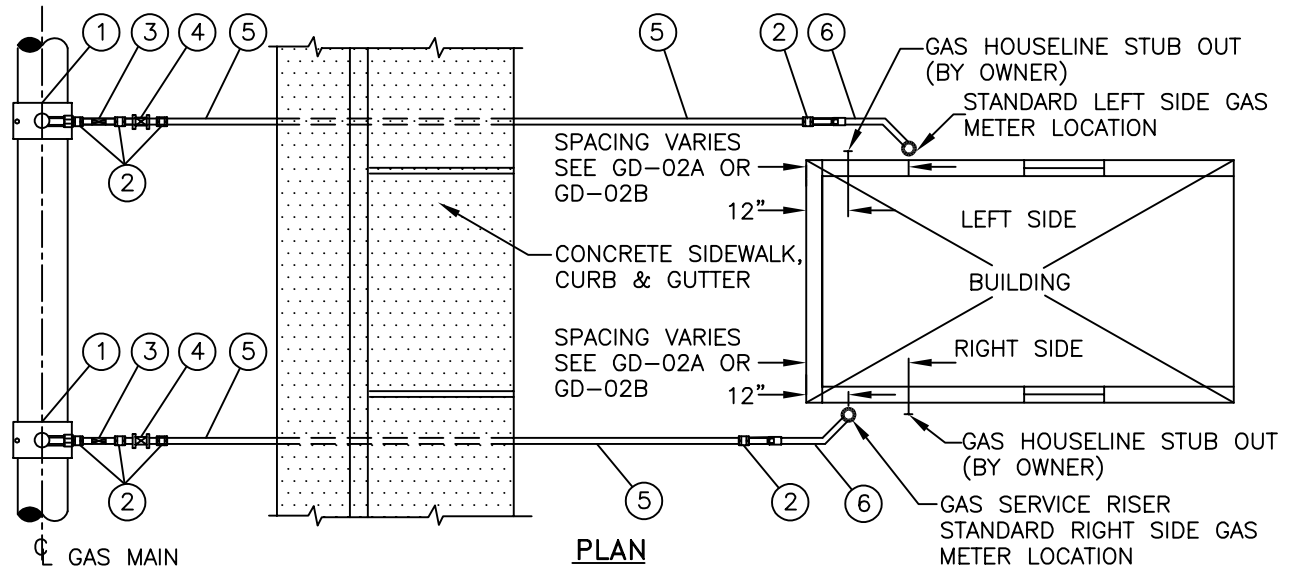
ELEVATION

NOTES:

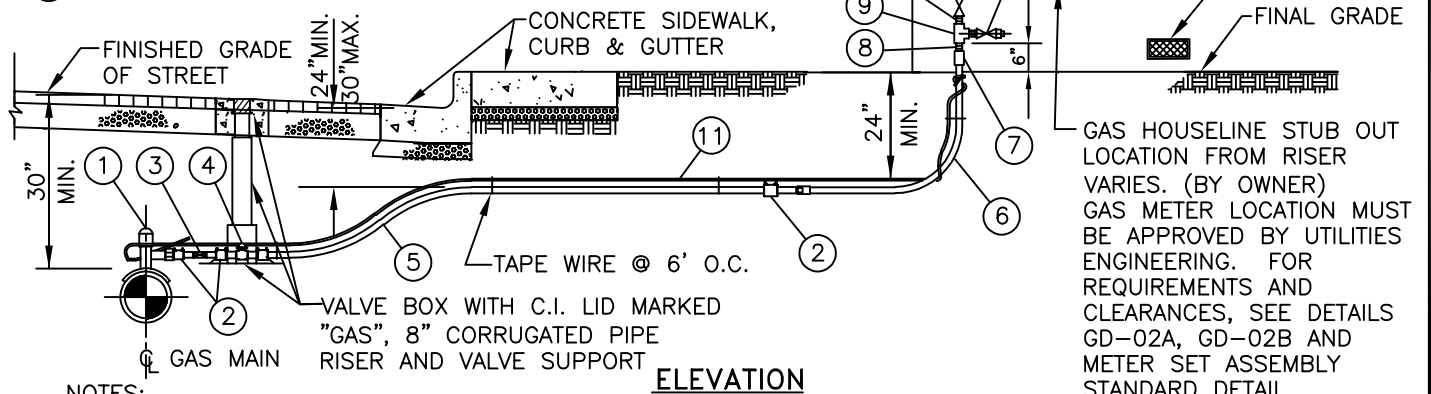
1. MINIMUM DEPTH OF BURY FOR SERVICE LINES IS 24".
2. ALL PIPING USED MUST BEAR THE FOLLOWING DESIGNATIONS: ASTM D2513-09a, AND PE 2708 GAS.
3. EXCESS FLOW VALVE (EFV) SHALL BE INSTALLED IN ALL NEW OR ALTERED SERVICES NOT EXCEEDING THE LARGEST APPROVED EFV SIZE BASED ON THE TOTAL SERVICE LOAD OR METER CAPACITY.
4. INSTALLATION OF EFV ON A SERVICE LINE FOR A NON SFR WITH CAPACITY EXCEEDING 1,800 SCFH REQUIRES ENGINEERING ANALYSIS FOR SIZING EFV CONSIDERING MAXIMUM EXPECTED LOAD, SERVICE LENGTH, POSSIBILITY OF SNAP ON/OFF LOAD APPLICATION, CRITICALITY OF GAS SUPPLY, CUSTOMER'S SYSTEM CONFIGURATION/APPLICATION, AND FUTURE ANTICIPATED CONFIRMED LOADS.
5. AN EFV STAINLESS STEEL TAG INDICATING THE SIZE AND FLOW CAPACITY OF THE VALVE SHALL BE ATTACHED TO THE GAS RISER WHEN ONE IS INSTALLED.

BY	DATE	1" GAS SERVICE WITH 1-1/4" EFV STANDARD DETAIL	APPROVED: FEBRUARY 26, 2020 <i>Silvia Lee Santos</i> SILVIA LEE SANTOS ENGINEERING MANAGER	SCALE: NONE
DRAWN	J.J. 02/20			
CHECKED	J.J. 02/20		50674 R.E. NO.	DWG. NO. STD. GD-01B
REVIEWED	A.P. 02/20		REVISION: FEBRUARY 26, 2020	APPENDIX C

CITY OF PALO ALTO, CALIFORNIA



- ① ELECTROFUSION PE TAPPING TEE, MAIN SIZE X 2" IPS
- ② 2" ELECTROFUSION COUPLING
- ③ 2" IPS EFV, UMAC, MODEL 41, SERIES 5,500 OR 10,000
- ④ 2" POLY-GAS BALL VALVE, POLYVALVE FLOWSERVE CORP.
- ⑤ 2" IPS PE SDR 11 PIPE GAS SERVICE
- ⑥ 2" IPS X 2" IPS PREBENT ANODELESS RISER
- ⑦ EFV STAINLESS STEEL TAG INDICATING SIZE AND FLOW
- ⑧ 2" TEE, BY-PASS ASSEMBLY AND END PLUG
- ⑨ METER INSULATED VALVE, MUELLER H-11179
- ⑩ TRACER WIRE, 10 AWG, TYPE HMW, YELLOW

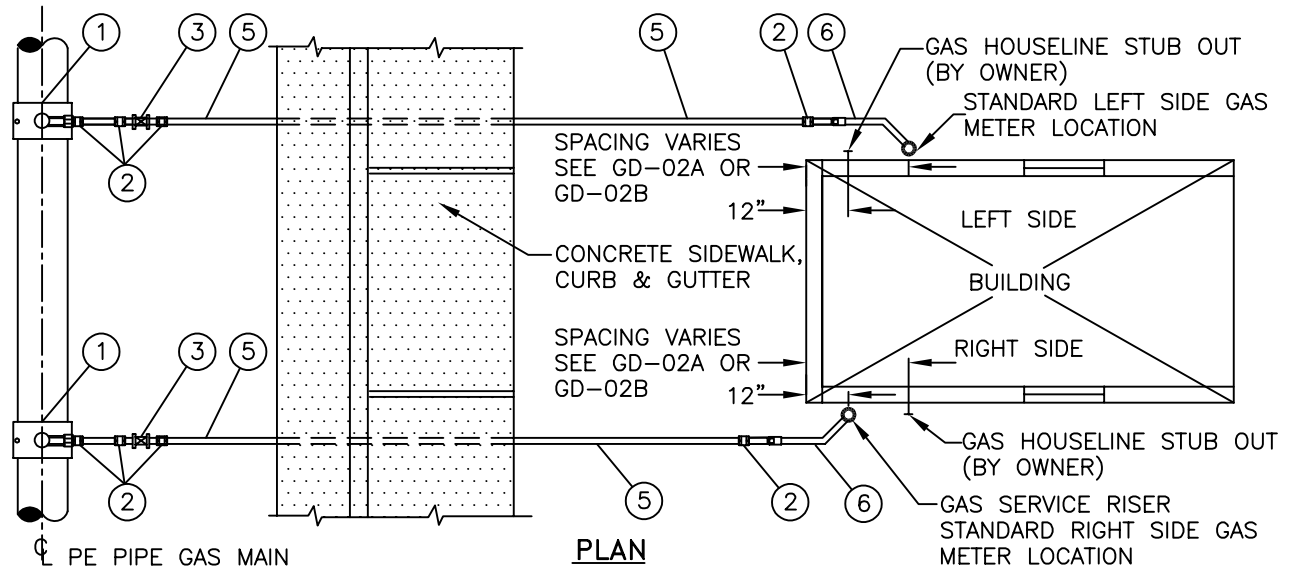


NOTES:

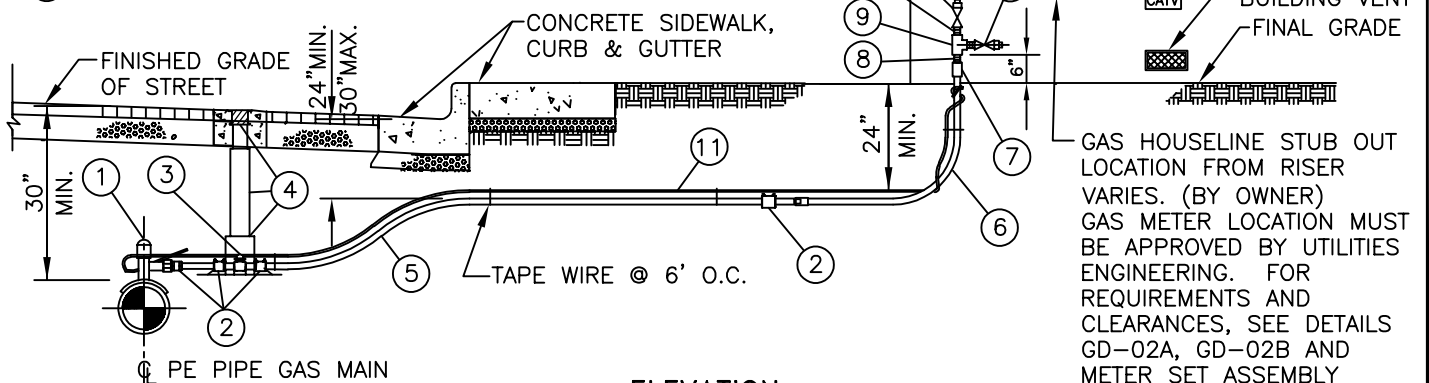
1. MINIMUM DEPTH OF BURY FOR SERVICE LINES IS 24".
2. ALL PIPING USED MUST BEAR THE FOLLOWING DESIGNATIONS: ASTM D2513-09a, AND PE 2708 GAS.
3. EXCESS FLOW VALVE (EFV) SHALL BE INSTALLED IN ALL NEW OR ALTERED SERVICES NOT EXCEEDING THE LARGEST APPROVED EFV SIZE BASED ON THE TOTAL SERVICE LOAD OR METER CAPACITY.
4. INSTALLATION OF EFV ON A SERVICE LINE TO A NON SFR PROJECT WITH CAPACITY EXCEEDING 1,800 SCFH REQUIRES ENGINEERING ANALYSIS FOR SIZING EFV CONSIDERING MAXIMUM EXPECTED LOAD, SERVICE LENGTH, POSSIBILITY OF SNAP ON/OFF LOAD APPLICATION, CRITICALITY OF GAS SUPPLY, CUSTOMER'S SYSTEM CONFIGURATION/APPLICATION, AND FUTURE ANTICIPATED CONFIRMED LOADS.
5. AN EFV STAINLESS STEEL TAG INDICATING THE SIZE AND FLOW CAPACITY OF THE VALVE SHALL BE ATTACHED TO THE GAS RISER WHEN ONE IS INSTALLED.

BY	DATE	2" GAS SERVICE WITH EFV STANDARD DETAIL	APPROVED:	SCALE:
DRAWN	J.J. 02/92		FEBRUARY 26, 2020	NONE
CHECKED	J.J. 02/20		<i>Silvia Lee Santos</i> SILVIA LEE SANTOS ENGINEERING MANAGER	DWG. NO. STD. GD-01C
REVIEWED	A.P. 02/20		REVISION: FEBRUARY 26, 2020	APPENDIX C

CITY OF PALO ALTO, CALIFORNIA



- (1) ELECTROFUSION PE TAPPING TEE, MAIN SIZE X 2" IPS
- (2) 2" ELECTROFUSION COUPLING
- (3) 2" POLY-GAS BALL VALVE, POLYVALVE FLOWSERVE CORP.
- (4) VALVE BOX WITH C.I. LID MARKED "GAS", 8" CORRUGATED PIPE VALVE BOX RISER AND VALVE SUPPORT
- (5) 2" IPS PE SDR 11 PIPE GAS SERVICE
- (6) 2" IPS X 2" IPS PREBENT ANODELESS RISER
- (7) EFV STAINLESS STEEL TAG INDICATING SIZE AND FLOW
- (8) 2" X 2-1/2" NIPPLE, BLK
- (9) 2" BLK TEE, BY-PASS ASSEMBLY AND END PLUG
- (10) METER INSULATED VALVE, MUELLER H-11179
- (11) TRACER WIRE, 10 AWG, TYPE HMW, YELLOW

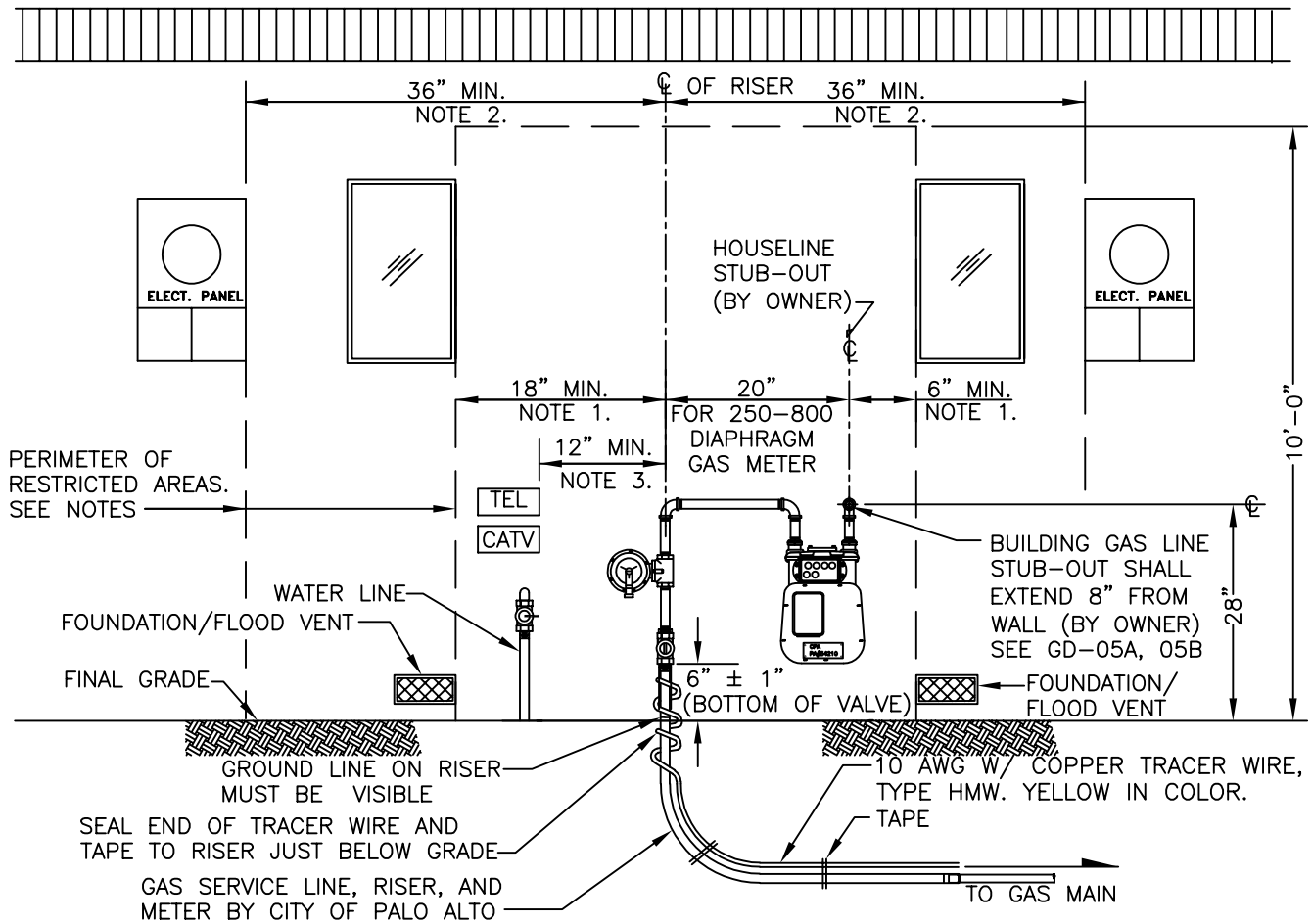


NOTES:

1. MINIMUM DEPTH OF BURY FOR SERVICE LINES IS 24".
2. ALL PIPING USED MUST BEAR THE FOLLOWING DESIGNATIONS: ASTM D2513-09a, AND PE 2708 GAS.
3. INSTALL PE SERVICE VALVE AS CLOSE AS POSSIBLE TO THE OUTLET OF TAPPING SERVICE TEE.
4. ENGINEERING ANALYSIS IS REQUIRED TO DETERMINE IF EFV IS NOT REQUIRED. EFV'S ARE NOT REQUIRED ON MULTIFAMILY RESIDENCES WITH EITHER A MASTER METER OR MULTIPLE METER MANIFOLD NOT EXCEEDING 12 UNITS OR METERS, COMMERCIAL/INDUSTRIAL PROJECTS WITH A TOTAL MAXIMUM LOAD OF 10,000 SCFH AND NOT MEETING THE CRITERIA FOR INSTALLATION.

BY	DATE	2" GAS SERVICE WITHOUT EFV STANDARD DETAIL	APPROVED:	SCALE:
DRAWN J.J.	02/20		FEBRUARY 26, 2020	NONE
CHECKED J.J.	02/20		<i>Silvia Lee Santos</i> SILVIA LEE SANTOS ENGINEERING MANAGER	DWG. NO. STD. GD-01D
REVIEWED A.P.	02/20		REVISION: FEBRUARY 26, 2020	APPENDIX C

CITY OF PALO ALTO, CALIFORNIA

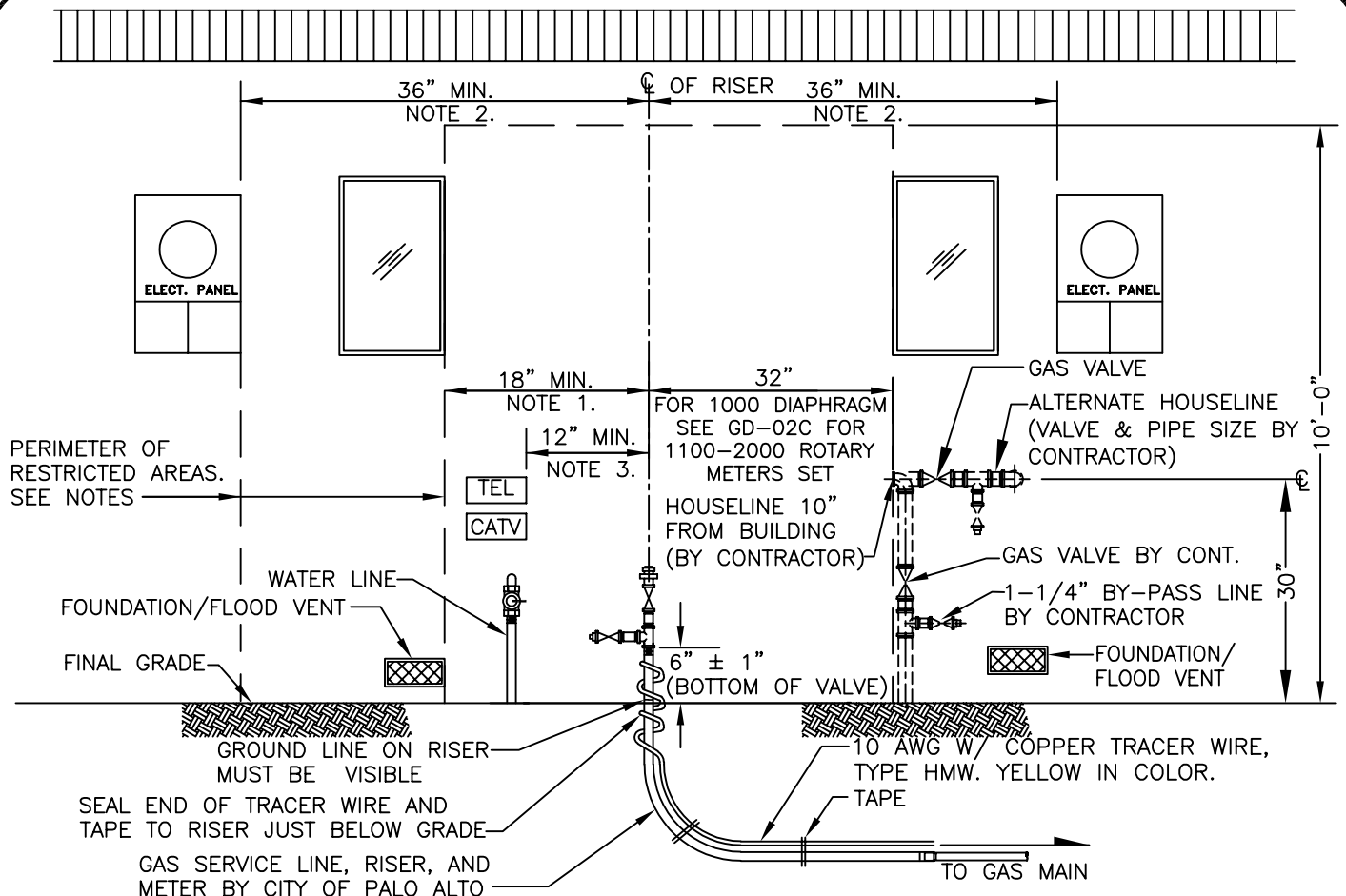


LEFT BUILDING ELEVATION

NOTES:

1. NO WINDOW, OR OTHER OPENINGS, ARE ALLOWED WITHIN 18" OF CITY GAS RISER, OR WITHIN 6" OF THE BUILDING LINE STUB-OUT, FROM FINAL GRADE TO A HEIGHT OF 10 FEET. MANUFACTURED FIXED CLOSED WINDOWS ARE ACCEPTABLE.
2. GAS METERS AND REGULATORS MUST VENT TO OUTSIDE ATMOSPHERE AND MUST BE LOCATED NOT LESS THAN 3 FEET FROM ANY SOURCE OF IGNITION OR ANY SOURCE OF HEAT WHICH MIGHT DAMAGE THE METER. ENCLOSURES ARE NOT ALLOWED. GAS METER LOCATION MUST BE APPROVED BY THE UTILITIES DEPARTMENT.
3. NO OBSTRUCTIONS SUCH AS WATER PIPES, FAUCETS, SEWER CLEANOUTS, ELECTRIC CONDUITS, ETC. ARE ALLOWED ON THE WALL BEHIND THE METER SET ASSEMBLY OR WITHIN 12" OF THE CITY GAS RISER OR WITHIN 8" OF BUILDING LINE STUB-OUT.
4. MAINTAIN 3 FEET CLEAR AND LEVEL WORKING SPACE IN FRONT OF THE GAS METER.
5. GAS METER SET ASSEMBLIES MUST BE INSTALLED BY THE CITY IN A LOCATION READILY ACCESSIBLE TO CITY PERSONNEL, PROTECTED FROM DAMAGE DUE TO VEHICULAR TRAFFIC, CORROSION (e.g., IRRIGATION SPRINKLERS, POOL CHEMICALS, ETC.) VIBRATION, OR EXTREME TEMPERATURES.
6. GAS METERS EXPOSED TO VEHICULAR TRAFFIC SHALL BE PROTECTED BY BOLLARDS WHEN WITHIN 3' OF A DRIVEWAY OR PARKING FOR BOTH RESIDENTIAL AND COMMERCIAL INSTALLATIONS. ANY METER WITHIN 3' OF A STREET SHALL BE PROTECTED BY BOLLARDS AS SET FORTH IN CITY STANDARD DETAILS WGW-05A AND WGW-05B.
7. CITY OF PALO ALTO WILL NOT SET A METER UNTIL THE ABOVE SPECIFICATIONS ARE MET AND THE BUILDING INSPECTION DIVISION APPROVES THE GAS PLUMBING AND RELEASES A SET TAG FOR THE GAS METER TO UTILITIES.

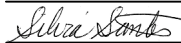
BY	DATE	RESIDENTIAL DIAPHRAGM GAS METER CLEARANCE 250-800 SCFH STANDARD DETAIL	APPROVED: FEBRUARY 26, 2020 <i>Silvia Lee Santos</i> SILVIA LEE SANTOS ENGINEERING MANAGER	SCALE: NONE
DRAWN	J.J. 02/92	CITY OF PALO ALTO, CALIFORNIA	REVISION: FEBRUARY 26, 2020	DWG. NO. STD. GD-02A
CHECKED	J.J. 02/20			APPENDIX C
REVIEWED	A.P. 02/20			

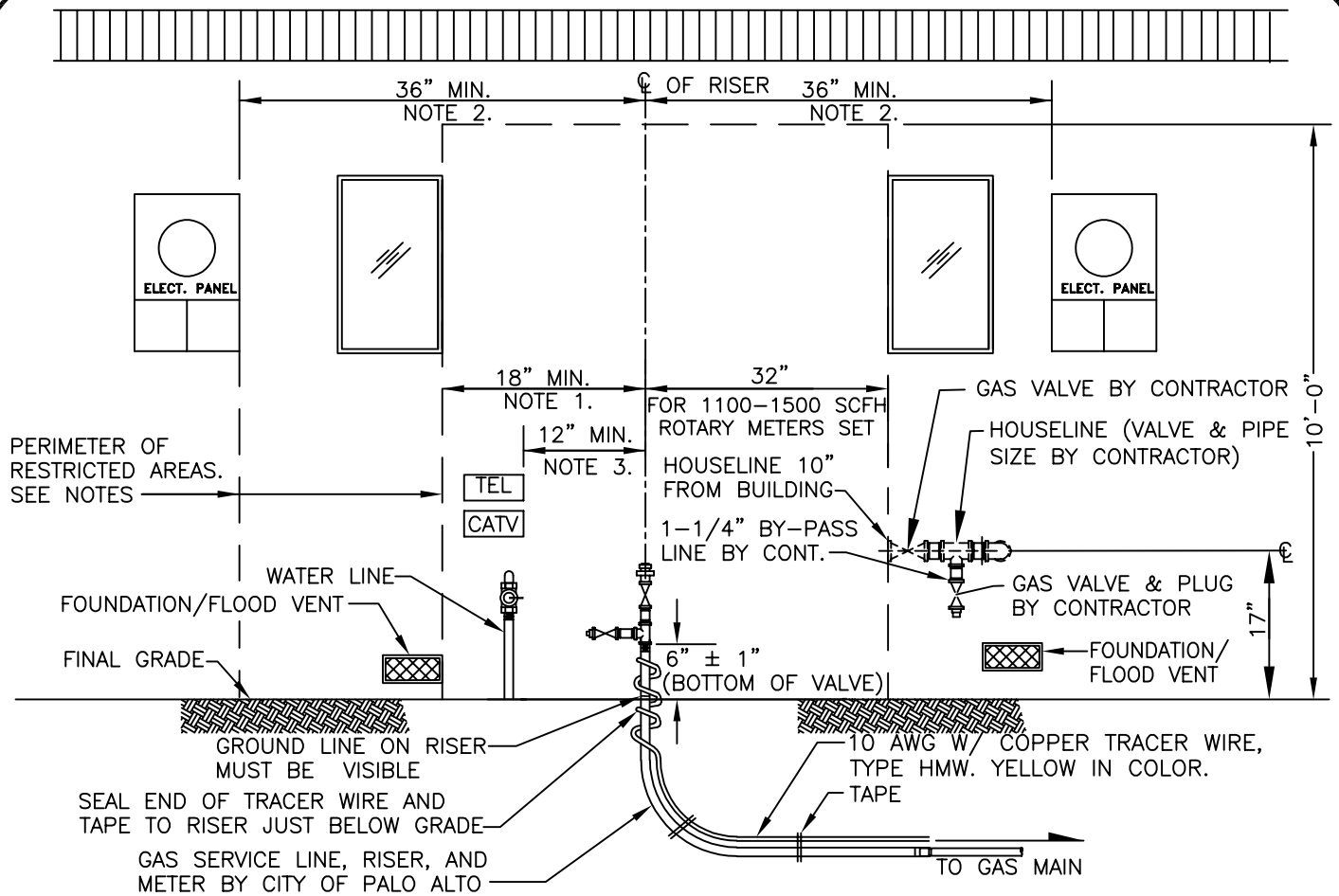


LEFT BUILDING ELEVATION

NOTES:

1. NO WINDOW, OR OTHER OPENINGS, ARE ALLOWED WITHIN 18" OF CITY GAS RISER, OR WITHIN 6" OF THE BUILDING LINE STUB-OUT, FROM FINAL GRADE TO A HEIGHT OF 10 FEET. MANUFACTURED FIXED CLOSED WINDOWS ARE ACCEPTABLE.
2. GAS METERS AND REGULATORS MUST VENT TO OUTSIDE ATMOSPHERE AND MUST BE LOCATED NOT LESS THAN 3 FEET FROM ANY SOURCE OF IGNITION OR ANY SOURCE OF HEAT WHICH MIGHT DAMAGE THE METER. ENCLOSURES ARE NOT ALLOWED. GAS METER LOCATION MUST BE APPROVED BY THE UTILITIES DEPARTMENT.
3. NO OBSTRUCTIONS SUCH AS WATER PIPES, FAUCETS, SEWER CLEANOUTS, ELECTRIC CONDUITS, ETC. ARE ALLOWED ON THE WALL BEHIND THE METER SET ASSEMBLY OR WITHIN 12" OF THE CITY GAS RISER OR WITHIN 8" OF BUILDING LINE STUB-OUT.
4. MAINTAIN 3 FEET CLEAR AND LEVEL WORKING SPACE IN FRONT OF THE GAS METER.
5. GAS METER SET ASSEMBLIES MUST BE INSTALLED BY THE CITY IN A LOCATION READILY ACCESSIBLE TO CITY PERSONNEL, PROTECTED FROM DAMAGE DUE TO VEHICULAR TRAFFIC, CORROSION (e.g., IRRIGATION SPRINKLERS, POOL CHEMICALS, ETC.) VIBRATION, OR EXTREME TEMPERATURES.
6. GAS METERS EXPOSED TO VEHICULAR TRAFFIC SHALL BE PROTECTED BY BOLLARDS WHEN WITHIN 3' OF A DRIVEWAY OR PARKING FOR BOTH RESIDENTIAL AND COMMERCIAL INSTALLATIONS. ANY METER WITHIN 3' OF A STREET SHALL BE PROTECTED BY BOLLARDS AS SET FORTH IN CITY STANDARD DETAILS WGW-05A AND WGW-05B.
7. CITY OF PALO ALTO WILL NOT SET A METER UNTIL THE ABOVE SPECIFICATIONS ARE MET AND THE BUILDING INSPECTION DIVISION APPROVES THE GAS PLUMBING AND RELEASES A SET TAG FOR THE GAS METER TO UTILITIES.

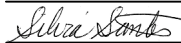
BY	DATE	RESIDENTIAL DIAPHRAGM GAS METER CLEARANCE 1000 SCFH STANDARD DETAIL	APPROVED:	SCALE:
DRAWN	J.J. 02/92		FEBRUARY 26, 2020	NONE
CHECKED	J.J. 02/20		 SILVIA LEE SANTOS ENGINEERING MANAGER	DWG. NO.
REVIEWED	A.P. 02/20		REVISION:	STD. GD-02B
		CITY OF PALO ALTO, CALIFORNIA	FEBRUARY 26, 2020	APPENDIX C

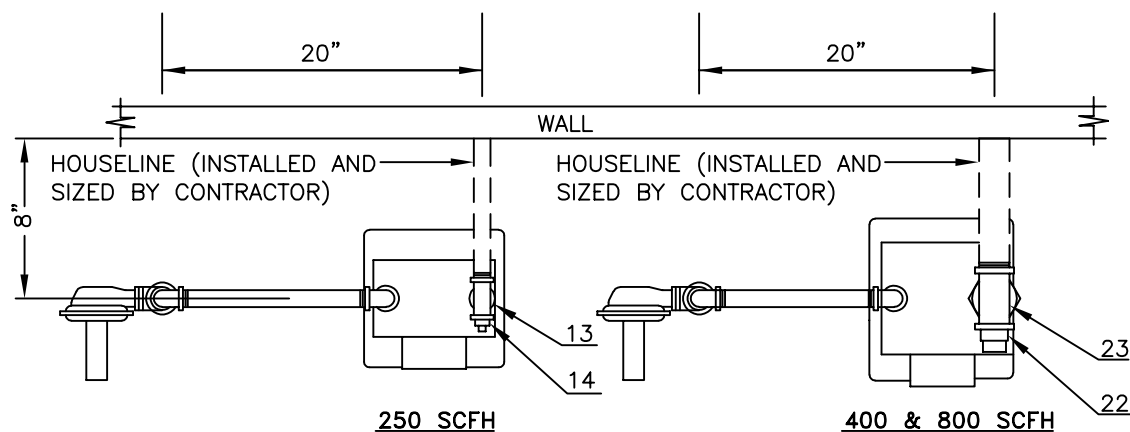


LEFT BUILDING ELEVATION

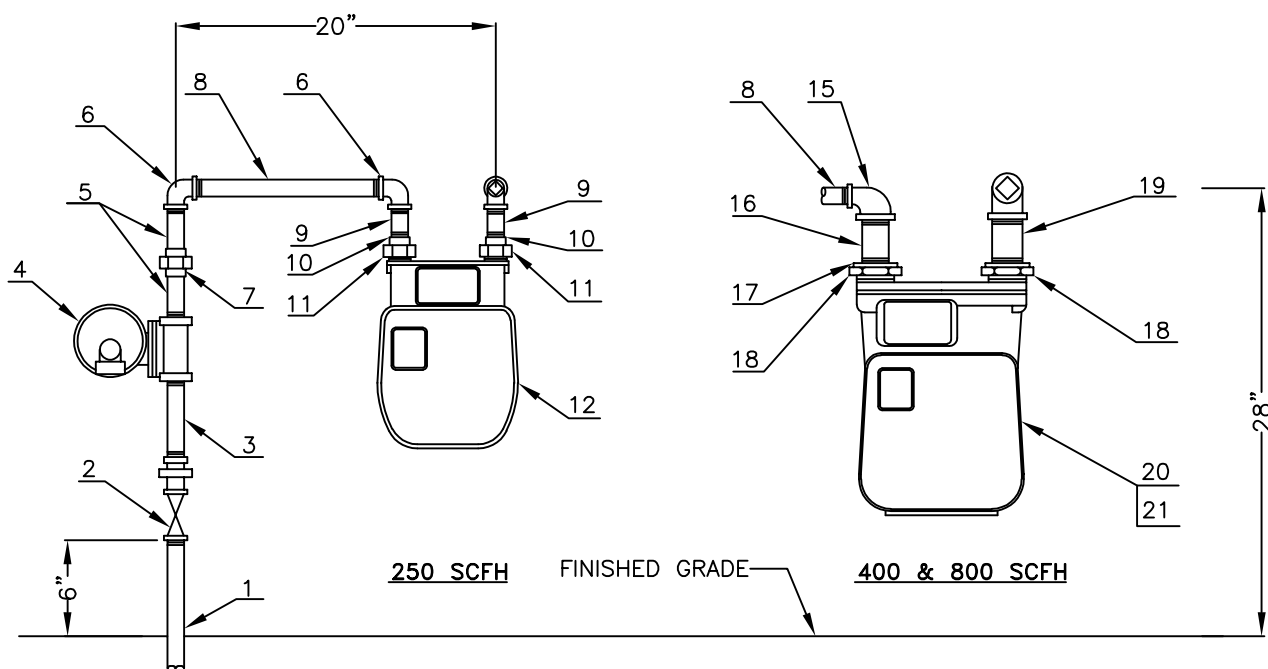
NOTES:

1. NO WINDOW, OR OTHER OPENINGS, ARE ALLOWED WITHIN 18" OF CITY GAS RISER, OR WITHIN 6" OF THE BUILDING LINE STUB-OUT, FROM FINAL GRADE TO A HEIGHT OF 10 FEET. MANUFACTURED FIXED CLOSED WINDOWS ARE ACCEPTABLE.
2. GAS METERS AND REGULATORS MUST VENT TO OUTSIDE ATMOSPHERE AND MUST BE LOCATED NOT LESS THAN 3 FEET FROM ANY SOURCE OF IGNITION OR ANY SOURCE OF HEAT WHICH MIGHT DAMAGE THE METER. ENCLOSURES ARE NOT ALLOWED. GAS METER LOCATION MUST BE APPROVED BY THE UTILITIES DEPARTMENT.
3. NO OBSTRUCTIONS SUCH AS WATER PIPES, FAUCETS, SEWER CLEANOUTS, ELECTRIC CONDUITS, ETC. ARE ALLOWED ON THE WALL BEHIND THE METER SET ASSEMBLY OR WITHIN 12" OF THE CITY GAS RISER OR WITHIN 8" OF BUILDING LINE STUB-OUT.
4. MAINTAIN 3 FEET CLEAR AND LEVEL WORKING SPACE IN FRONT OF THE GAS METER.
5. GAS METER SET ASSEMBLIES MUST BE INSTALLED BY THE CITY IN A LOCATION READILY ACCESSIBLE TO CITY PERSONNEL, PROTECTED FROM DAMAGE DUE TO VEHICULAR TRAFFIC, CORROSION (e.g., IRRIGATION SPRINKLERS, POOL CHEMICALS, ETC.) VIBRATION, OR EXTREME TEMPERATURES.
6. GAS METERS EXPOSED TO VEHICULAR TRAFFIC SHALL BE PROTECTED BY BOLLARDS WHEN WITHIN 3' OF A DRIVEWAY OR PARKING FOR BOTH RESIDENTIAL AND COMMERCIAL INSTALLATIONS. ANY METER WITHIN 3' OF A STREET SHALL BE PROTECTED BY BOLLARDS AS SET FORTH IN CITY STANDARD DETAILS WGW-05A AND WGW-05B.
7. CITY OF PALO ALTO WILL NOT SET A METER UNTIL THE ABOVE SPECIFICATIONS ARE MET AND THE BUILDING INSPECTION DIVISION APPROVES THE GAS PLUMBING AND RELEASES A SET TAG FOR THE GAS METER TO UTILITIES.

BY	DATE	RESIDENTIAL ROTARY GAS METER CLEARANCE 1100-1500 SCFH STANDARD DETAIL CITY OF PALO ALTO, CALIFORNIA	APPROVED:	SCALE:
DRAWN	J.J. 02/92		FEBRUARY 26, 2020	NONE
CHECKED	J.J. 02/20		 SILVIA LEE SANTOS ENGINEERING MANAGER	DWG. NO.
REVIEWED	A.P. 02/20		REVISION:	STD. GD-02C
			FEBRUARY 26, 2020	APPENDIX C



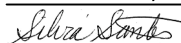
PLAN



ELEVATION

NOTES:

1. FOR PLACEMENT REQUIREMENTS REFER TO STD. GD-01A AND STD. GD-02A.
2. UPON COMPLETION OF METER ASSEMBLY, LEAK TEST ALL CONNECTIONS.
3. IT IS ASSUMED THAT THE SYSTEM INLET PRESSURE IS MIN. 8 PSIG.

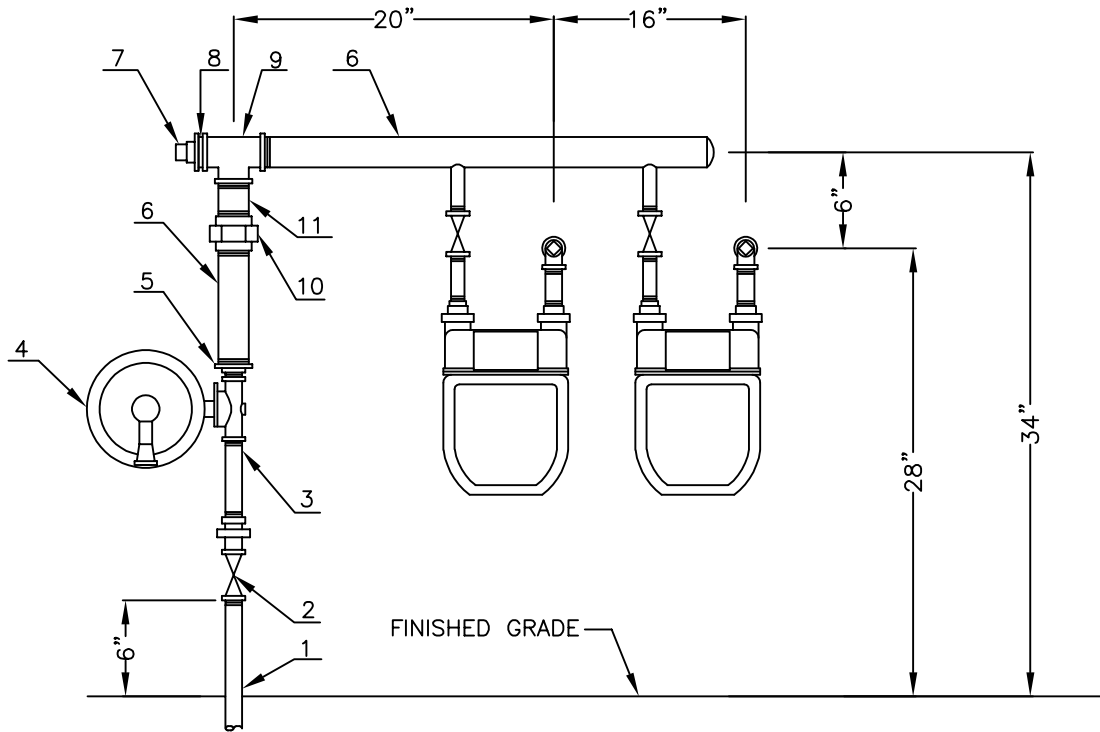
BY		DATE	RESIDENTIAL METER SET ASSEMBLY 250-800 SCFH STANDARD DETAIL	APPROVED: FEBRUARY 26, 2020		SCALE: 1"=1'-0"
DRAWN	A.P.	12/15		 SILVIA LEE SANTOS ENGINEERING MANAGER		DWG. NO.
CHECKED	A.P.	12/15		50674		STD. GD-03A
REVIEWED	A.P.	2/20		REVISION: FEBRUARY 26, 2020		APPENDIX C

LIST OF MATERIALS

NO.	DESCRIPTION	STOCK NO.	QUANTITY
1	3/4" IPS x 1" CTS RISER	43052	1
2	3/4" H-11179 MUELLER	42998	1
	METER VALVE, WITH INSULATED		
	OUTLET, BLK		
3	3/4" x 5" NIPPLE, BLK	41407	1
4	3/4" NPT ITRON B42R REGULATOR WITH	44300	1
	3/16" ORIFICE, BROWN SPRING, 1" VENT		
	1/4" ORIFICE (FOR CL 600 METER)	43065	1
5	3/4" x 3 NIPPLE, BLK	41403	2
6	3/4" ELBOW, 90 DEG, BLK	41310	2
7	3/4" UNION, GRD JOINT, BLK	41900	1
8	3/4" PIPE	41500	D.I.F
	CL 250 METER CONNECTION:		
9	3/4" x 2 NIPPLE, BLK	41401	2
10	3/4" SWIVEL, GALV, INSULATED FEMALE	44211	2
11	1A SPRAGUE NUT, GALV	44207	2
	CL 250 METER CONNECTION:		
10	3/4" SWIVEL, GALV, INSULATED MALE	44212	2
11	1A SPRAGUE NUT, GALV	44207	2
	CL 250 METER CONNECTION:		
10	3/4" SWIVEL, GALV, INSULATED MALE, OFFSET	44215	2
11	1A SPRAGUE NUT, GALV	44207	2
12	GAS METER, DIAPHRAGM, CL 250	44101	1
13	3/4" TEE, BLK	41800	1
14	3/4" PLUG, BLK	41600	1
15	1-1/4" X 3/4" ELBOW 90 DEG, RED., BLK	41349	1
	CL 400 & 600 METER CONNECTION:		
16	1-1/4" x 2-1/4" NIPPLE, BLK	41432	1
17	1-1/4" SWIVEL, FEMALE, INSULATED	44202	1
18	#3 OR #4 SPRAGUE NUT, GALV	44209	2
19	1-1/2" SWIVEL, MALE	44203	1
20	GAS METER, DIAPHRAGM, CL 400	44103	1
21	GAS METER, DIAPHRAGM, CL 600	44118	1
22	1-1/2" TEE, BLK	41803	1
23	1-1/2" PLUG, BLK	41603	1

BY		DATE	RESIDENTIAL METER SET ASSEMBLY 250-800 SCFH STANDARD DETAIL	APPROVED: FEBRUARY 26, 2020	SCALE: NONE
DRAWN	A.P.	12/15		 50674	DWG. NO.
CHECKED	A.P.	12/15		SILVIA LEE SANTOS ENGINEERING MANAGER	R.E. NO. STD. GD-03B
REVIEWED	A.P.	2/20	CITY OF PALO ALTO, CALIFORNIA	REVISION: FEBRUARY 26, 2020	APPENDIX C

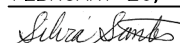
METER SET ASSEMBLY WITHOUT BYPASS



ELEVATION

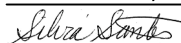
NOTES:

1. SEPARATIONS BETWEEN THE RISER AND HOUSE LINE STUB-OUTS SHOWN FOR MANIFOLD WITH MULTIPLE CLASS 250 SCFH METERS.
2. FOR PLACEMENT REQUIREMENTS REFER TO THE WATER, GAS, AND WASTEWATER UTILITY STANDARD DETAILS.
3. UPON COMPLETION OF METER ASSEMBLY, LEAK TEST ALL CONNECTIONS.
4. REGULATOR ORIENTATION IS FIELD ADJUSTABLE.
5. IT IS ASSUMED THE STANDARD DELIVERY PRESSURE OF 7" W.C.
6. COMMERCIAL MANIFOLD OF 500 SCFH THROUGH 1,250 SCFH WOULD REQUIRE 1-1/4" RISER AND BYPASS, REFER TO RESIDENTIAL/COMMERCIAL MANIFOLD 1,250 SCFH STANDARD.
7. IT IS ASSUMED THAT THE SYSTEM INLET PRESSURE IS MIN. 8 PSIG.

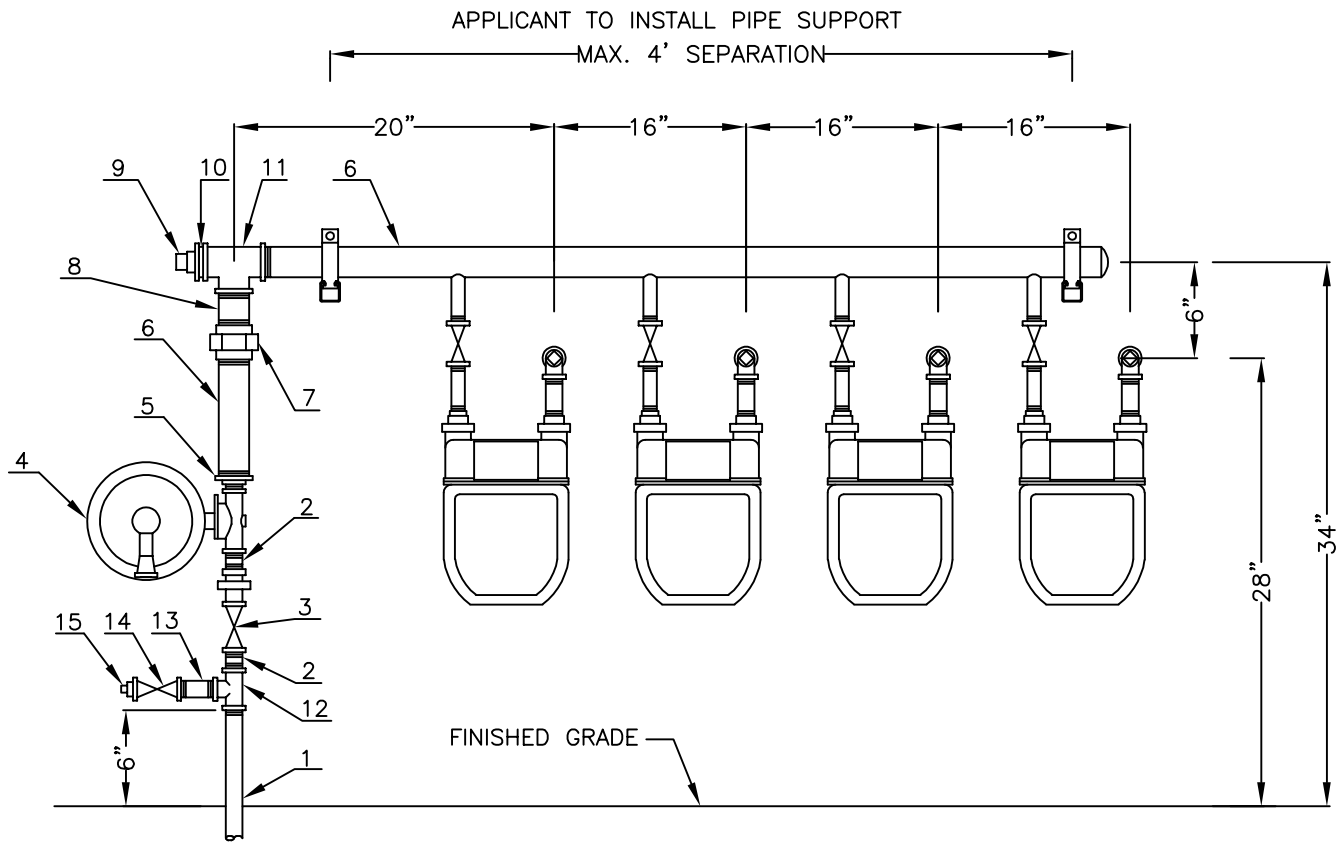
BY		DATE	RESIDENTIAL MANIFOLD METER SET ASSEMBLY W/O BYPASS 500 SCFH DELIVERY PRESSURE 7" W.C. STANDARD DETAIL	APPROVED: FEBRUARY 26, 2020		SCALE: 1"=1'-0"
DRAWN	A.P.	12/15		 50674		DWG. NO. STD. GD-04A
CHECKED	A.P.	12/15		SILVIA LEE SANTOS ENGINEERING MANAGER R.E. NO.		
REVIEWED	A.P.	2/20		CITY OF PALO ALTO, CALIFORNIA	REVISION: FEBRUARY 26, 2020	

LIST OF MATERIALS

NO.	DESCRIPTION	STOCK NO.	QUANTITY
1	3/4" IPS x 1" CTS RISER	43052	1
2	3/4" H-11179 MUELLER	42998	1
	METER VALVE, WITH INSULATED		
	OUTLET, BLK		
3	3/4" PIPE, THREADED	41500	D.I.F
4	3/4" NPT ITRON B31R	44297	1
	REGULATOR WITH 1/4" ORIFICE		
	AND GRAY SPRING; 1" VENT		
5	3/4"x1-1/2" BUSHING, BLK	41005	1
6	1-1/2" PIPE	41505	D.I.F
7	1-1/4" PLUG, BLK	41602	1
8	1-1/4"x1-1/2" BUSHING, BLK	41007	1
9	1-1/2" TEE, BLK	41803	1
10	1-1/2" UNION, GRD JOINT, BLK	41903	1
11	1-1/2" X 2-1/2" NIPPLE, BLK	41442	1

BY	DATE	RESIDENTIAL MANIFOLD METER SET ASSEMBLY W/O BYPASS 500 SCFH DELIVERY PRESSURE 7" W.C. STANDARD DETAIL	APPROVED:	SCALE:
DRAWN	A.P. 12/15		FEBRUARY 26, 2020	NONE
CHECKED	A.P. 12/15		 SILVIA LEE SANTOS ENGINEERING MANAGER	DWG. NO.
REVIEWED	A.P. 2/20		50674 R.E. NO.	STD. GD-04B
		CITY OF PALO ALTO, CALIFORNIA	REVISION:	APPENDIX C
			FEBRUARY 26, 2020	

METER SET ASSEMBLY WITH BYPASS



ELEVATION

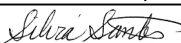
NOTES:

1. SEPARATIONS BETWEEN THE RISER AND HOUSE LINE STUB-OUTS SHOWN FOR MANIFOLD WITH MULTIPLE CLASS 250 SCFH METERS.
2. FOR PLACEMENT REQUIREMENTS REFER TO THE WATER, GAS, AND WASTEWATER UTILITY STANDARD DETAILS.
3. UPON COMPLETION OF METER ASSEMBLY, LEAK TEST ALL CONNECTIONS.
4. BYPASS AND REGULATOR ORIENTATION IS FIELD ADJUSTABLE.
5. IT IS ASSUMED THE STANDARD DELIVERY PRESSURE OF 7" W.C.
6. METER SETS WITH THREE OR FOUR 250 SCFH METERS MUST INCLUDE 3/4" BYPASS.
7. COMMERCIAL MANIFOLD OF 500 SCFH THROUGH 1,250 SCFH WOULD REQUIRE 1-1/4" RISER AND BYPASS, REFER TO RESIDENTIAL/COMMERCIAL MANIFOLD 1,250 SCFH STANDARD.
8. IT IS ASSUMED THAT THE SYSTEM INLET PRESSURE IS MIN. 8 PSIG.

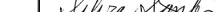
BY	DATE	RESIDENTIAL MANIFOLD METER SET ASSEMBLY W/ BYPASS 1,000 SCFH DELIVERY PRESSURE 7" W.C. STANDARD DETAIL	APPROVED: FEBRUARY 26, 2020 SILVIA LEE SANTOS ENGINEERING MANAGER	SCALE: 1"=1'-0"
DRAWN	A.P. 12/15	CITY OF PALO ALTO, CALIFORNIA	50674 R.E. NO.	DWG. NO.
CHECKED	A.P. 12/15			STD. GD-04C
REVIEWED	A.P. 2/20			APPENDIX C
			REVISION: FEBRUARY 26, 2020	

LIST OF MATERIALS

NO.	DESCRIPTION	STOCK NO.	QUANTITY
1	3/4" IPS x 1" CTS RISER	43052	1
2	3/4" x 2" NIPPLE, BLK	41401	2
3	3/4" H-11179 MUELLER METER VALVE, WITH INSULATED OUTLET, BLK	42998	1
4	3/4" NPT ITRON B31R REGULATOR WITH 1/4" ORIFICE AND GRAY SPRING; 1" VENT	44297	1
5	3/4"x1-1/2" BUSHING, BLK	41005	1
6	1-1/2" PIPE	41505	D.I.F
7	1-1/2" UNION, GRD JOINT, BLK	41903	1
8	1-1/2" X 2-1/2" NIPPLE, BLK	41442	1
9	1-1/4" PLUG, BLK	41602	1
10	1-1/4"x1-1/2" BUSHING, BLK	41007	1
11	1-1/2" TEE, BLK	41803	1
12	3/4" TEE, BLK	41800	1
13	3/4" x 3" NIPPLE, BLK	41403	1
14	3/4" H-11175 MUELLER METER VALVE, NON INSULATED	43000	1
15	3/4" PLUG, BLK	41600	1

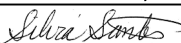
BY	DATE	RESIDENTIAL MANIFOLD METER SET ASSEMBLY W/ BYPASS 1,000 SCFH DELIVERY PRESSURE 7" W.C. STANDARD DETAIL	APPROVED: FEBRUARY 26, 2020	SCALE: NONE
DRAWN A.P.	12/15		 SILVIA LEE SANTOS ENGINEERING MANAGER	DWG. NO. STD. GD-04D
CHECKED A.P.	12/15		50674 R.E. NO.	
REVIEWED A.P.	2/20	CITY OF PALO ALTO, CALIFORNIA	REVISION: FEBRUARY 26, 2020	APPENDIX C

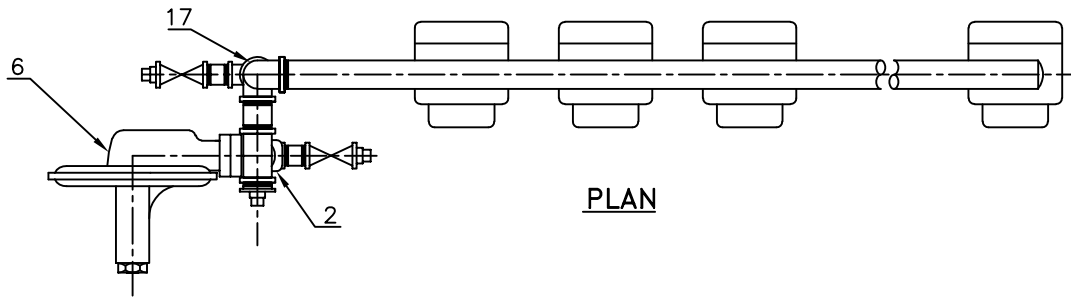


BY	DATE	RESIDENTIAL/COMMERCIAL MANIFOLD METER SET ASSEMBLY UP TO 1,250 SCFH DELIVERY PRESSURE 7" W.C. STANDARD DETAIL	APPROVED: FEBRUARY 26, 2020	SCALE: 3/4"=1'-0"
DRAWN A.P.	12/15		 50674 SILVIA LEE SANTOS ENGINEERING MANAGER	DWG. NO. STD. GD-05A
CHECKED A.P.	12/15			
REVIEWED A.P.	2/20	CITY OF PALO ALTO, CALIFORNIA	REVISION: FEBRUARY 26, 2020	APPENDIX C

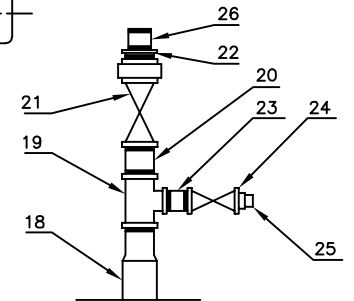
LIST OF MATERIALS

NO.	DESCRIPTION	STOCK NO.	UNIT	QUANTITY
1	1-1/4" IPS X 1" CTS SERVICE RISER, PREBENT	43050	EA.	1
2	1-1/4" TEE, BLK	41802	EA.	1
3	1-1/4" x 2-1/2" NIPPLE, BLK	41432	EA.	1
4	1-1/4" H-11179 MUELLER METER VALVE WITH INSULATED OUTLET	43001	EA.	1
5	1-1/4" X 4" NIPPLE, BLK	41435	EA.	1
6	1-1/4" NPT ITRON B31R REGULATOR WITH 1/4" ORIFICE AND GRAY SPRING FOR DELIVERY UP TO 1250 SCFH (5 METERS MANIFOLD); 1" VENT	44302	EA.	1
7	1-1/4" X 1-1/2" BUSHING, BLK	41007	EA.	2
8	1-1/2" X 2" NIPPLE, BLK	41441	EA.	2
9	1-1/2" UNION, GRD JOINT, BLK	41903	EA.	1
10	1-1/4" PLUG, BLK	41602	EA.	2
11	1-1/2" TEE, BLK	41803	EA.	1
12	1-1/2" PIPE	41505	EA.	D.I.F.
13	1-1/4" x 2" NIPPLE, BLK	41431	EA.	1
14	1-1/4" H-11175 MUELLER METER VALVE, NON INSU	43002	EA.	1

BY	DATE	RESIDENTIAL/COMMERCIAL MANIFOLD METER SET ASSEMBLY UP TO 1,250 SCFH DELIVERY PRESSURE 7" W.C. STANDARD DETAIL	APPROVED: FEBRUARY 26, 2020	SCALE: NONE
DRAWN A.P.	12/15		 SILVIA LEE SANTOS ENGINEERING MANAGER	DWG. NO. STD. GD-05B
CHECKED A.P.	12/15		50674 R.E. NO.	
REVIEWED A.P.	2/20	CITY OF PALO ALTO, CALIFORNIA	REVISION: FEBRUARY 26, 2020	APPENDIX C

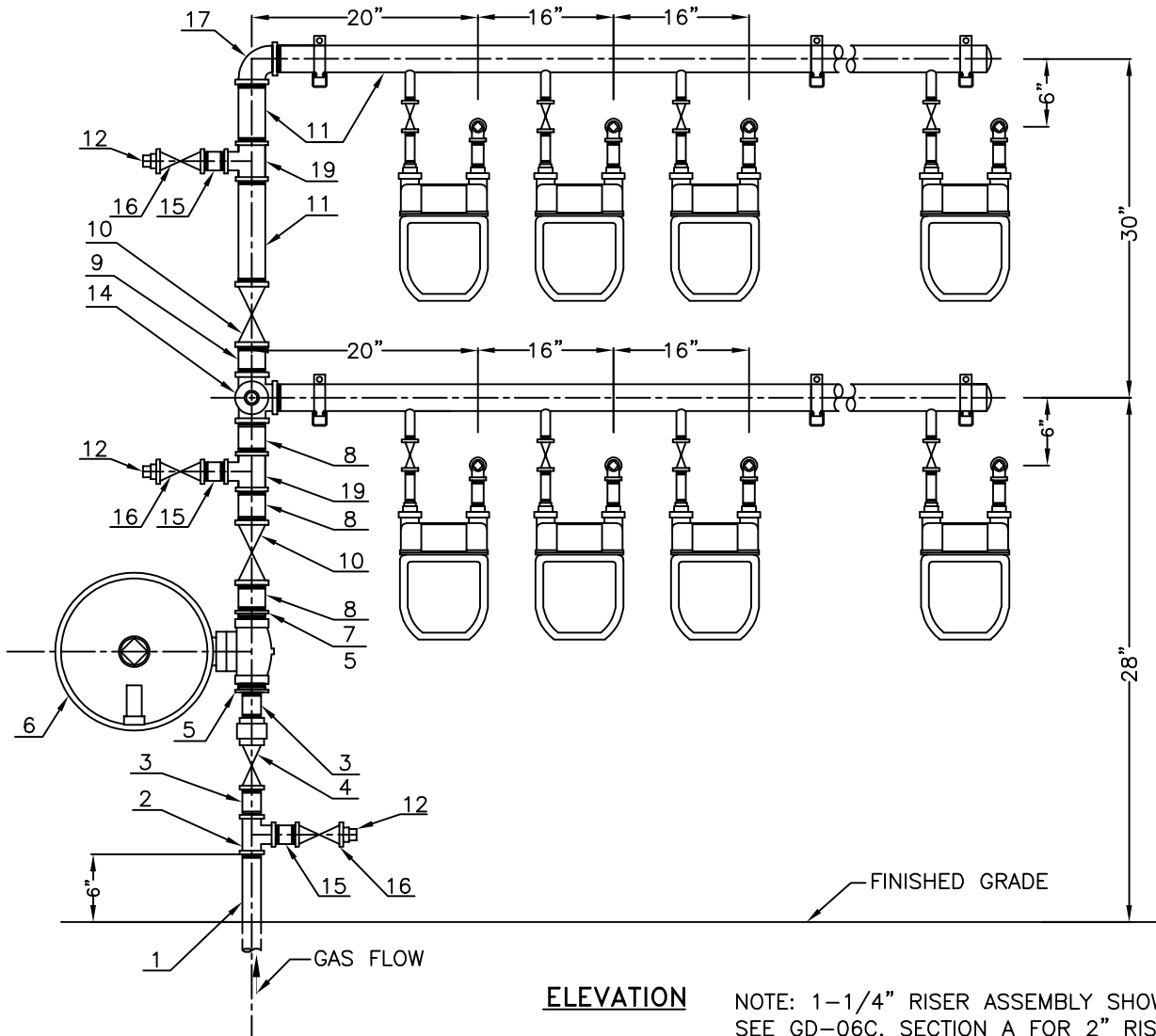


PLAN



ASSEMBLY WITH 2" RISER

MAX. 4' (APPLICANT TO INSTALL PIPE SUPPORT)



ELEVATION

NOTE: 1-1/4" RISER ASSEMBLY SHOWN.
SEE GD-06C, SECTION A FOR 2" RISER
ASSEMBLY.

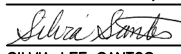
BY		DATE	RESIDENTIAL/COMMERCIAL MANIFOLD METER SET ASSEMBLY 1,500-3,000 SCFH DELIVERY PRESSURE 7" W.C. STANDARD DETAIL	APPROVED: FEBRUARY 26, 2020 SILVIA LEE SANTOS ENGINEERING MANAGER	SCALE: 3/4"=1'-0"
DRAWN	A.P.	12/15			DWG. NO.
CHECKED	A.P.	12/15		50674 R.E. NO.	STD. GD-06A
REVIEWED	A.P.	2/20		REVISION: FEBRUARY 26, 2020	APPENDIX C
			CITY OF PALO ALTO, CALIFORNIA		

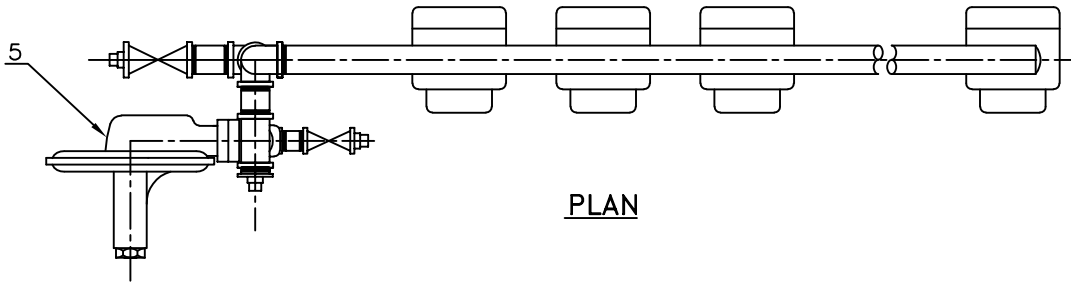
LIST OF MATERIALS

NO.	DESCRIPTION	STOCK NO.	UNIT	QUANTITY
1	1-1/4" IPS X 1" CTS SERVICE RISER, PREBENT	43050	EA.	1
2	1-1/4" TEE, BLK	41802	EA.	1
3	1-1/4" x 2-1/2" NIPPLE, BLK	41432	EA.	2
4	1-1/4" H-11179 MUELLER METER VALVE	43001	EA.	1
	WITH INSULATED OUTLET			
5	1-1/2" X 1-1/4" BUSHING, BLK	41007	EA.	2
6	1-1/2" NPT SENSUS 243-12-2 REGULATOR	44324	EA.	1
	WITH FULL CAPACITY INTERNAL RELIEF AND			
	3/8" ORIFICE WITH BLUE SPRING	44341	EA.	1
7	2" X 1-1/2" BUSHING, BLK	41011	EA.	1
8	2" x 4-1/2" NIPPLE, BLK	41455	EA.	1
9	2" x 2-1/2" NIPPLE, BLK	41451	EA.	2
10	2" VALVE METER, BLK	43004	EA.	1
11	2" PIPE, THREADED	41516	EA.	D.I.F.
12	1-1/4" PLUG, BLK	41602	EA.	3
13	2" X 1-1/4" BUSHING, BLK	41010	EA.	2
14	2" TEE, BLK	41804	EA.	3 OR 4
15	1-1/4" x 2" NIPPLE, BLK	41431	EA.	1
16	1-1/4" VALVE METER, BLK	43002	EA.	1
17	2" 90 DEG. ELBOW, BLK	41314	EA.	1
18	2" IPS X 2" IPS SERVICE RISER, PREBENT	43057	EA.	1
19	2" x 2" x 1-1/4" TEE, BLK	41810	EA.	1
20	2" x 2-1/2" NIPPLE, BLK	41451	EA.	1
21	2" H-11179 MUELLER METER VALVE WITH	43005	EA.	1
	INSULATED OUTLET			
22	2" x 1-1/2" BUSHING, BLK	41011	EA.	1
23	1-1/4" x 2" NIPPLE, BLK	44431	EA.	1
24	1-1/4" H-11175 MUELLER METER VALVE	43002	EA.	1
	NON INSULATED			
25	1-1/4" PLUG, BLK	41602	EA.	1
26	1-1/2" x CL NIPPLE, BLK	41440	EA.	1

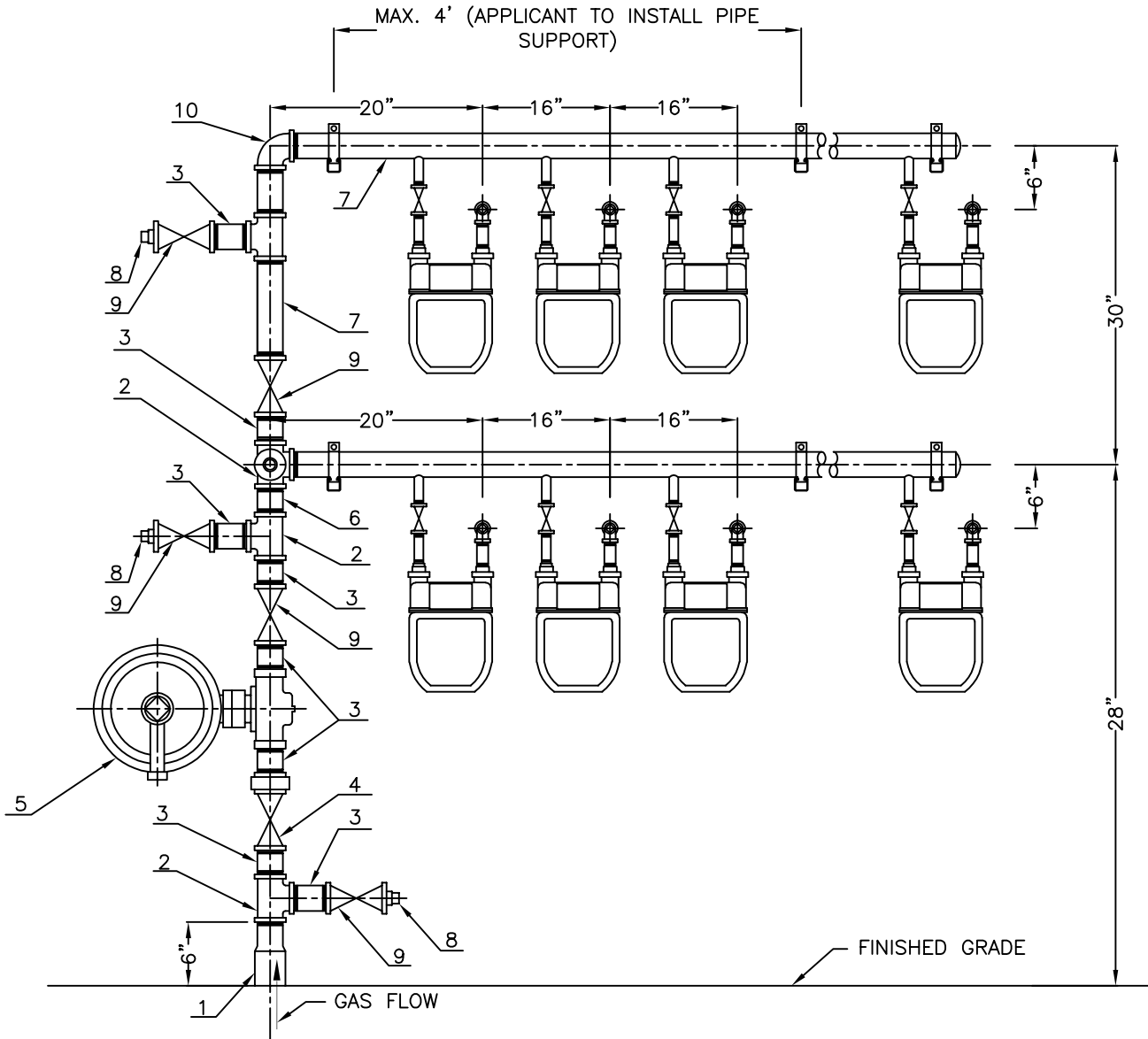
NOTES:

- SEPARATION BETWEEN THE RISER AND HOUSE LINE STUB-OUTS SHOWN FOR MANIFOLD WITH MULTIPLE CLASS 250 SCFH METERS.
- FOR PLACEMENT REQUIREMENTS REFER TO STD. GD-01B AND STD. GD-02B.
- UPON COMPLETION OF METER ASSEMBLY, LEAK TEST ALL CONNECTIONS.
- BYPASS, REGULATOR, AND METER ORIENTATIONS ARE FIELD ADJUSTABLE. FOR BYPASS REGULATOR USE SENSUS 243-8-2 (44303) OR 243-12-2 (44324) AS APPROPRIATE FOR APPLICATION ORIFICE/SPRING.
- IT IS ASSUMED THAT INLET PRESSURE UPSTREAM OF THE REGULATOR IS MIN. 10 PSIG.
- IF SET INCLUDES A COMBINATION OF DIAPHRAGM AND ROTARY METER(S), 1-1/4" PHILPOTT MODEL 125-S FILTER (STOCK 44315) SHALL BE INSTALLED UPSTREAM OF THE REGULATOR AS SHOWN ON COMMERCIAL/INDUSTRIAL 800-2,000 SCFH METER SET.
- STOCK ITEM 044324 1-1/2" 243-12-2 REGULATOR IS STOCKED WITH 3/8" ORIFICE AND ORANGE-BLACK SPRING INTENDED FOR DELIVERY OF 14" W.C.; BLUE SPRING NEEDS TO BE INSTALLED BASED ON AN APPLICATION AND AS SPECIFIED IN THIS DRAWING.
- THE SERVICE SHALL BE PROPERLY SIZED CONSIDERING HEADLOSS AND AVAILABLE INLET PRESSURE; FOR 2" SERVICE USE ASSEMBLY WITH 2" RISER. IF 2" RISER ASSEMBLY IS SELECTED, ITEM NO. 8 (NIPPLE) MAY HAVE DIFFERENT LAY LENGTH.

BY	DATE	RESIDENTIAL/COMMERCIAL MANIFOLD METER SET ASSEMBLY 1,500-3,000 SCFH DELIVERY PRESSURE 7" W.C. STANDARD DETAIL	APPROVED: FEBRUARY 26, 2020  SILVIA LEE SANTOS ENGINEERING MANAGER	SCALE: NONE
DRAWN	A.P.	12/15	50674 R.E. NO.	DWG. NO.
CHECKED	A.P.	12/15		STD. GD-06B
REVIEWED	A.P.	2/20	REVISION: FEBRUARY 26, 2020	APPENDIX C
		CITY OF PALO ALTO, CALIFORNIA		



PLAN



ELEVATION

BY DRAWN CHECKED REVIEWED	A.P. A.P. A.P.	DATE 11/15 11/15 2/20	RESIDENTIAL/COMMERCIAL MANIFOLD METER SET ASSEMBLY 3,000-5,000 SCFH DELIVERY PRESSURE 7" W.C. STANDARD DETAIL	APPROVED: FEBRUARY 26, 2020	SCALE: 3/4"=1'-0"
				<i>Silvia Lee Santos</i> SILVIA LEE SANTOS ENGINEERING MANAGER	DWG. NO. STD. GD-07A
			CITY OF PALO ALTO, CALIFORNIA	REVISION: FEBRUARY 26, 2020	APPENDIX C

LIST OF MATERIALS

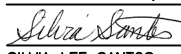
NO.	DESCRIPTION	STOCK NO.	UNIT	QUANTITY
1	2" IPS x 2" IPS ANODELESS SERVICE RISER, PREBENT	43057	EA.	1
2	2" TEE, BLK	41804	EA.	4
3	2" x 2-1/2" NIPPLE, BLK	41451	EA.	5
4	2" H-11179 MUELLER METER VALVE WITH INSULATED OUTLET	43005	EA.	1
5	2" NPT ITRON B38R REGULATOR WITH 2-1/2" FULL CAPACITY INTERNAL RELIEF WITH 5/8" (0 DEG.) ORIFICE AND GREEN SPRING FOR DELIVERY OF 3,000 TO 5,000 SCFH AT 7" W.C. B38R GREEN SPRING	44321	EA.	1
6	2" x CL NIPPLE, BLK	41450	EA.	1
7	2" PIPE, THREADED	41516	L.F.	D.I.F.
8	2" PLUG, BLK	41604	EA.	3
9	2" H-11175 MUELLER VALVE METER, NON INSULATED	43004	EA.	2
10	2" 90 DEG. ELBOW, BLK	41314	EA.	1

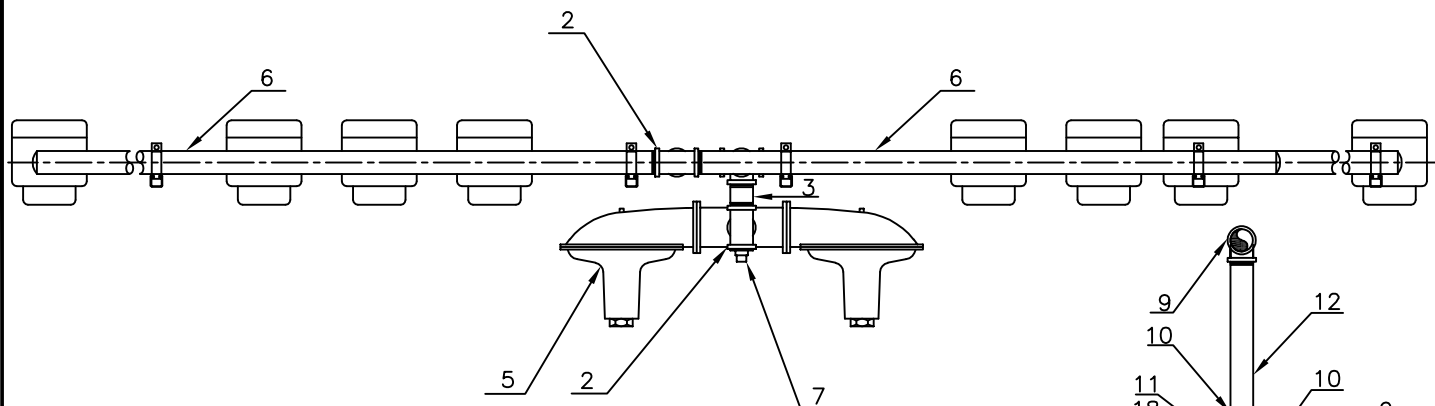
ESTIMATED PRESSURE LOSS IN INDIVIDUAL MANIFOLD RUN

SET PRESSURE INCH W.C.	FLOW SCFH	MANIFOLD SIZE	PRESSURE BEFORE FIRST LEVEL MANIFOLD INCH W.C.	PRESSURE BEFORE SECOND LEVEL MANIFOLD INCH W.C.	PRESSURE AT THE END OF MANIFOLD INCH W.C.	SET PRESSURE TO OBTAIN 7" W.C. AT THE END OF MANIFOLD
7	5000	2" SCH. 40	6.592	6.429	6.213	7.787
7	3000		6.837		6.538	7.462
7	5000	3" SCH. 40	6.907	6.646	6.637	7.363
7	3000		6.968		6.923	7.077

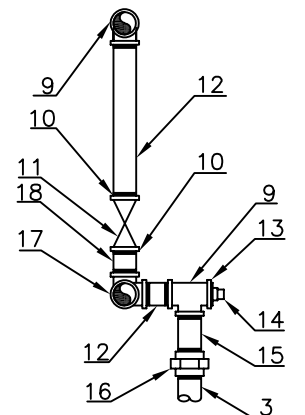
NOTES:

- SEPARATION BETWEEN THE RISER AND HOUSE LINE STUB-OUTS SHOWN FOR MANIFOLD WITH MULTIPLE CLASS 250 SCFH METERS.
- FOR PLACEMENT REQUIREMENTS REFER TO STD. GD-01B AND STD. GD-02B.
- UPON COMPLETION OF METER ASSEMBLY, LEAK TEST ALL CONNECTIONS.
- BYPASS AND REGULATOR ORIENTATIONS ARE FIELD ADJUSTABLE. FOR BYPASS REGULATOR USE SPECIFIED ON THE DRAWING REGULATOR.
- IT IS ASSUMED THE STANDARD DELIVERY PRESSURE OF 7" W.C. AND SYSTEM INLET PRESSURE IS MIN. 8 PSIG.
- IF SET INCLUDES A COMBINATION OF DIAPHRAGM AND ROTARY METER(S), 2" PHILPOTT MODEL 200-S FILTER (STOCK 44317) SHALL BE INSTALLED UPSTREAM OF THE REGULATOR AS SHOWN ON COMMERCIAL/INDUSTRIAL 2,000-3,000 SCFH OR 5,000-7,000 SCFH METER SETS.
- THE REGULATOR STOCK ITEM 44321 ITRON B38R IS STOCKED WITH 5/8" ORIFICE AND BROWN SPRING; GREEN SPRING IS SUGGESTED FOR THIS APPLICATION; IT IS THE RESPONSIBILITY OF THE ENGINEER TO SIZE ORIFICES AND SELECT APPROPRIATE SPRINGS FOR THE ACTUAL APPLICATION.
- 2" MANIFOLD IS SHOWN ON THE DRAWING, BUT IT IS RESPONSIBILITY OF THE ENGINEER TO SIZE THE MANIFOLD BASED ON ITS LENGTH AND FLOW DEMAND TO INSURE THE DELIVERY OF THE REQUIRED PRESSURE TO THE FURTHEST METER; SEE RESIDENTIAL/COMMERCIAL MANIFOLD ABOVE 5,000 TO 15,000 SCFH 3" MANIFOLD SAMPLE DRAWING THAT SHALL BE CUSTOMIZED FOR THE ACTUAL APPLICATION.
- AN ACTUAL PRESSURE LOSS IN THE MANIFOLD(S) MAY BE LESS THAN SHOWN IN THE TABLE AS DIVERSIFICATION FACTOR IS UNKNOWN.

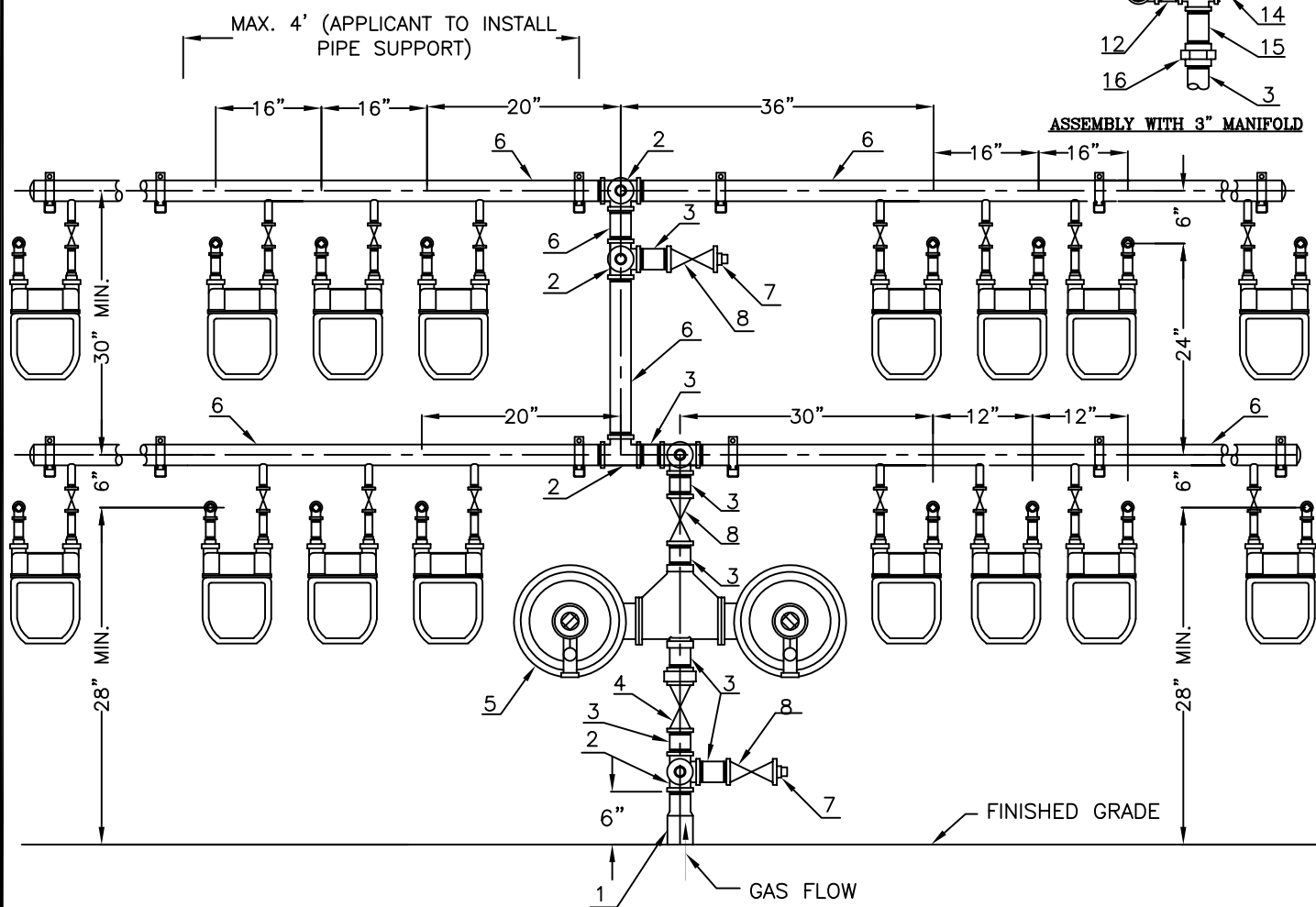
BY	DATE	RESIDENTIAL/COMMERCIAL MANIFOLD METER SET ASSEMBLY 3,000-5,000 SCFH DELIVERY PRESSURE 7" W.C. STANDARD DETAIL	APPROVED: FEBRUARY 26, 2020	SCALE: NONE
DRAWN A.P.	11/15		 SILVIA LEE SANTOS ENGINEERING MANAGER	DWG. NO. STD. GD-07B
CHECKED A.P.	11/15		50674 R.E. NO.	
REVIEWED A.P.	2/20	CITY OF PALO ALTO, CALIFORNIA	REVISION: FEBRUARY 26, 2020	APPENDIX C



PLAN



ASSEMBLY WITH 3" MANIFOLD



ELEVATION

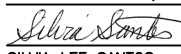
BY DRAWN CHECKED REVIEWED	A.P. A.P. A.P.	DATE 9/15 9/15 2/20	RESIDENTIAL/COMMERCIAL MANIFOLD METER SET ASSEMBLY 5,000-15,000 SCFH DELIVERY PRESSURE 7" W.C. STANDARD DETAIL	APPROVED: FEBRUARY 26, 2020 <i>Silvia Lee Santos</i> SILVIA LEE SANTOS ENGINEERING MANAGER	SCALE: 3/5"=1'-0" DWG. NO. STD. GD-08A
				REVISION: FEBRUARY 26, 2020	APPENDIX C
			CITY OF PALO ALTO, CALIFORNIA		

LIST OF MATERIALS (2" MANIFOLD)

NO.	DESCRIPTION	STOCK NO.	UNIT	QUANTITY
1	2" IPS x 2" IPS ANODELESS SERVICE RISER, PREBENT	43057	EA.	1
2	2" TEE, BLK	41804	EA.	5
3	2" x 2-1/2" NIPPLE, BLK	41451	EA.	6
4	2" H-11179 MUELLER METER VALVE WITH INSULATED OUTLET	43005	EA.	1
5	2" x 2" NPT ITRON B838R REGULATOR WITH 2-1/2" FULL CAPACITY INTERNAL RELIEF WITH 5/8" (O DEG.) ORIFICE AND GREEN SPRING FOR DELIVERY OF UP TO 7,500 SCFH AT 7" W.C.	44349	EA.	1
	5/8" ORIFICE	N/A	EA.	1
	B38R/B838R GREEN SPRING	44358	EA.	1
6	2" PIPE, THREADED	41516	L.F.	D.I.F.
7	2" PLUG, BLK	41604	EA.	2
8	2" H-11175 MUELLER METER VALVE, NON INSULATED	43004	EA.	2

LIST OF MATERIALS (3" MANIFOLD)

NO.	DESCRIPTION	STOCK NO.	UNIT	QUANTITY
5	2" x 2" NPT ITRON B838R REGULATOR WITH 2-1/2" FULL CAPACITY INTERNAL RELIEF WITH 1" (O DEG.) ORIFICE AND BROWN SPRING FOR DELIVERY OF UP TO 15,000 SCFH AT 7" W.C.	44349	EA.	1
9	3" x 3" x 2" TEE, BUTT-WELD	41812	EA.	3
10	3" 150 ANSI WELD NECK FLANGE, FLAT FACE A105	43331	EA.	2
	3" IPS 1/16" THICK, FULL FACE GASKET FOR 150 ANSI FLAT FACE FLANGE	43351	EA.	2
	STUD BOLT 5/8" X 3-1/2" WITH HEX CAP NUTS, 5/8" HEX NCT	43319	EA.	16
		43317	EA.	16
11	3" VALVE, ANSI 150, FLAT FACE FLANGE	N/A	EA.	1
12	3" PIPE, PLAIN END	41518	L.F.	D.I.F.
13	3" x 2" BUSHING, BLK	41020	EA.	1
14	2" PLUG, BLK	41605	EA.	1
15	2" x 2-1/2" PIPE, THREADED ONE END	41516	EA.	1
16	2" UNION, GRD JOINT, BLK	41904	EA.	1

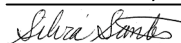
	BY	DATE	RESIDENTIAL/COMMERCIAL MANIFOLD METER SET ASSEMBLY 5,000-15,000 SCFH DELIVERY PRESSURE 7" W.C. STANDARD DETAIL	APPROVED: FEBRUARY 26, 2020  SILVIA LEE SANTOS ENGINEERING MANAGER	SCALE: NONE DWG. NO. STD. GD-08B
	DRAWN	A.P. 9/15			
	CHECKED	A.P. 9/15			
	REVIEWED	A.P. 2/20	CITY OF PALO ALTO, CALIFORNIA	REVISION: FEBRUARY 26, 2020	APPENDIX C

ESTIMATED PRESSURE LOSS IN INDIVIDUAL MANIFOLD RUN

SET PRESSURE INCH W.C.	FLOW SCFH	MANIFOLD SIZE	PRESSURE BEFORE FIRST LEVEL MANIFOLD INCH W.C.	PRESSURE BEFORE SECOND LEVEL MANIFOLD INCH W.C.	PRESSURE AT THE END OF SECOND LEVEL MANIFOLD INCH W.C.	SET PRESSURE TO OBTAIN 7" W.C. AT THE END OF SECOND LEVEL MANIFOLD
7	7500	2" SCH. 40	6.558	5.862	5.787	8.213
7	7500	3" SCH. 40	6.903	6.756	6.745	7.255
7	15000		6.661	6.149	6.110	7.890

NOTES:

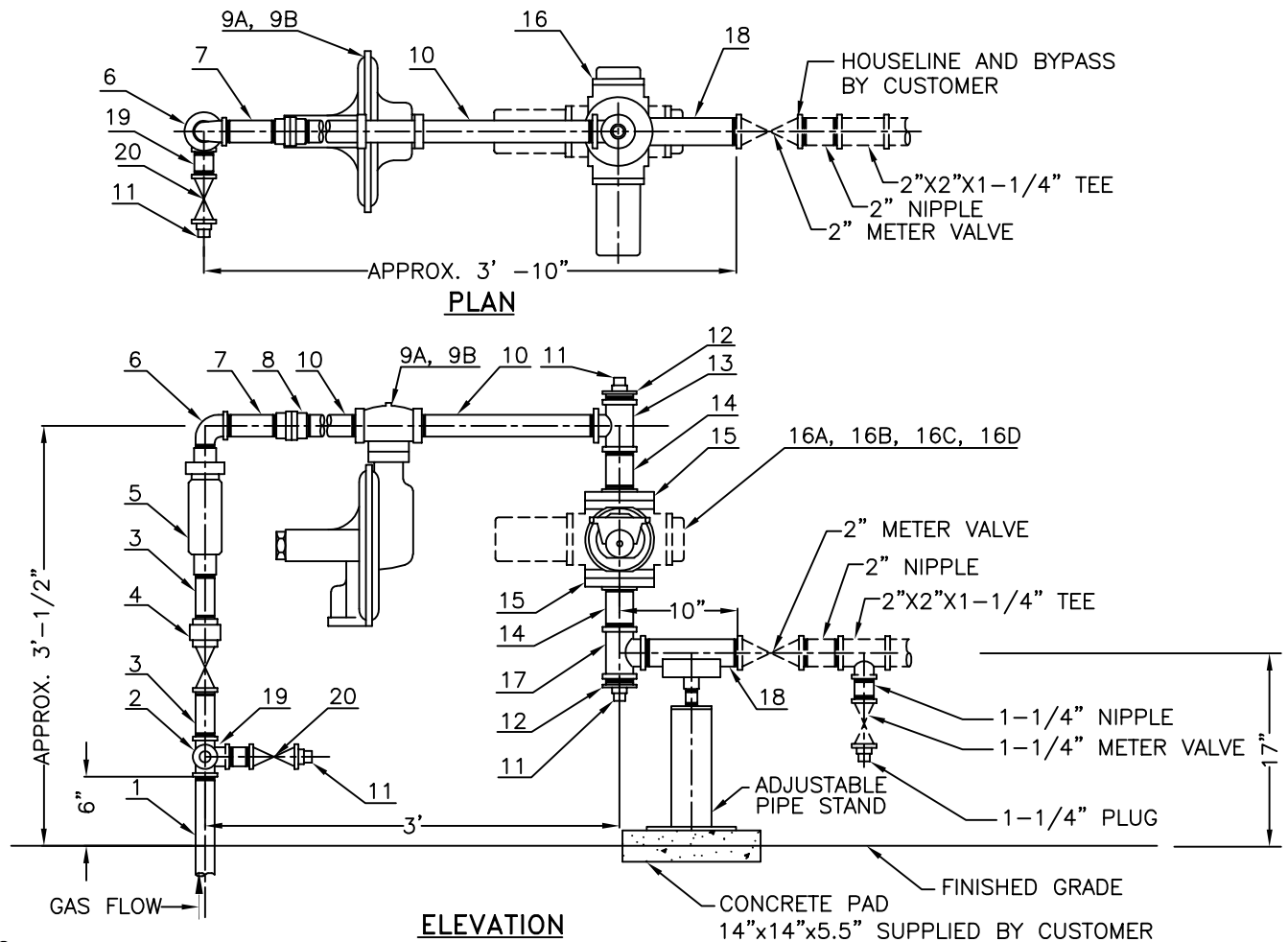
1. MANIFOLD SHOWN WITH MULTIPLE CLASS 250 METERS.
2. FOR PLACEMENT REQUIREMENTS REFER TO STD. GD-01B AND STD. GD-02B.
3. UPON COMPLETION OF METER ASSEMBLY, LEAK TEST ALL CONNECTIONS.
4. BYPASS AND REGULATOR ORIENTATIONS ARE FIELD ADJUSTABLE. FOR BYPASS REGULATOR USE B38R (44321), GREEN SPRING (44358) AND APPROPRIATELY SIZED ORIFICES: 5/8" (SUPPLIED WITH THE REG) FOR 5,000 SCFH, 3/4" (43082) FOR UP TO 7,500 SCFH, 1" (43063) UP TO 11,500 SCFH AND 1-1/4" (NOT STOCKED) ABOVE.
5. IT IS ASSUMED MIN. INLET PRESSURE OF 10 PSIG AND THE STANDARD DELIVERY PRESSURE OF 7" W.C.
6. STOCK ITEM 44349 2" B838R REGULATOR IS STOCKED WITH 1" ORIFICE AND BROWN SPRING FOR DELIVERY OF APPROXIMATELY 15,000 SCFH AT 7" W.C.
7. 2" MANIFOLD IS SHOWN ON THE DRAWING, HOWEVER DUE TO ESTIMATED HEADLOSS IN DOWNSTREAM PIPING IT IS NOT ADVISABLE FOR DELIVERY OF MORE THAN 7,500 SCFH. IF 2" MANIFOLD IS USED FOR DELIVERY OF 7,500 SCFH AT 7" W.C. A GREEN SPRING IS ADVISED. SEE ESTIMATED HEADLOSS IN THE TABLE ON THIS DRAWING. MANIFOLD SHALL BE CUSTOMIZED FOR THE APPLICATION AND IT IS RESPONSIBILITY OF THE ENGINEER TO VERIFY HEADLOSS AND SIZE THE MANIFOLD AND SELECT SPRINGS AND ORIFICES APPROPRIATE FOR THE APPLICATION. 3" MANIFOLD DESIGN IS SHOWN IN SECTION A (3" MANIFOLD).
8. 5/8" ORIFICE AND 3" VALVE ARE NOT STOCKED AND SHALL BE SPECIALLY ORDERED FOR THE APPLICATION.
9. ITRON B38R (44321) AND B838R (44349) SHARE THE SAME ORIFICES AND SPRINGS.

BY	DATE	RESIDENTIAL/COMMERCIAL MANIFOLD METER SET ASSEMBLY 5,000-15,000 SCFH DELIVERY PRESSURE 7" W.C. STANDARD DETAIL	APPROVED: FEBRUARY 26, 2020  SILVIA LEE SANTOS ENGINEERING MANAGER	SCALE: NONE
		CITY OF PALO ALTO, CALIFORNIA	REVISION: FEBRUARY 26, 2020	DWG. NO. STD. GD-08C

DRAWN	A.P.	9/15
CHECKED	A.P.	9/15
REVIEWED	A.P.	2/20

50674
R.E. NO.

APPENDIX C



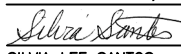
NOTES:

1. FOR PLACEMENT REQUIREMENTS REFER TO STD. GD-01A AND STD. GD-02A.
2. UPON COMPLETION OF METER ASSEMBLY, LEAK TEST ALL CONNECTIONS.
3. IT IS ASSUMED THAT INLET PRESSURE DOWNSTREAM OF THE FILTER IS MIN. 10 PSIG.
4. DIMENSIONS OF ITEMS 3 AND 10 ARE FLEXIBLE AND FIELD ADJUSTABLE.
5. BYPASS, REGULATOR, AND METER ORIENTATIONS ARE FIELD ADJUSTABLE. USE REGULATOR AS SPECIFIED ON THIS DRAWING WITH APPROPRIATE ORIFICE AND SPRING FOR OUTLET PRESSURE. FOR BYPASS REGULATOR USE AS SPECIFIED ON THIS DRAWING.
6. REGULATOR POSITION (VERTICAL AS SHOWN OR HORIZONTAL) IS DETERMINED BASED ON SPACE AVAILABILITY.
7. 243-8-2 REGULATOR SHALL NOT BE USED FOR DELIVERY PRESSURE HIGHER THAN 1 PSIG.
8. STOCK ITEM 044324 1-1/2" 243-12-2 REGULATOR IS STOCKED WITH 3/8" ORIFICE AND 10"-18" ORANGE-BLACK SPRING.
9. STOCK ITEM 044303 1-1/2" 243-8-2 REGULATOR IS STOCKED WITH 3/8" ORIFICE AND 1-2 PSIG ORANGE SPRING.
10. THE ESTIMATED PRESSURE LOSS, SHOWN IN THE TABLES, INCLUDES DIFFERENTIAL LOSS ACROSS THE METER AT 100% FLOW.
11. THE ESTIMATED PRESSURE LOSS THROUGH RISER, METER VALVE, FITTINGS, AND FILTER IS APPROXIMATELY 0.5 PSIG.
12. THE SERVICE SHALL BE PROPERLY SIZED CONSIDERING HEADLOSS AND AVAILABLE INLET PRESSURE; DELIVERY ABOVE 1,500 SCFH MAY REQUIRE A 2" SERVICE. IN THIS CASE REFER TO COMMERCIAL/INDUSTRIAL 2,000-3,000 SCFH METER SET ASSEMBLY DRAWING.

BY	DATE	RESIDENTIAL/COMMERCIAL/INDUSTRIAL ROTARY METER SET ASSEMBLY 800-2,000 SCFH DELIVERY PRESSURE 7" W.C., 14" W.C., 1 PSIG, 2 PSIG STANDARD DETAIL	APPROVED:	SCALE:
DRAWN	A.P. 9/15		FEBRUARY 26, 2020	3/4"=1'-0"
CHECKED	A.P. 9/15		<i>Silvia Lee Santos</i> 50674 SILVIA LEE SANTOS R.E. NO. ENGINEERING MANAGER	DWG. NO. STD. GD-09A
REVIEWED	A.P. 2/20		REVISION: FEBRUARY 26, 2020	APPENDIX C
		CITY OF PALO ALTO, CALIFORNIA		

LIST OF MATERIALS

NO.	DESCRIPTION	STOCK NO.	UNIT	QUANTITY
1	1-1/4" IPS x 1" CTS SERVICE RISER, PREBENT	43050	EA.	1
2	1-1/4" TEE, BLK	41802	EA.	1
3	1-1/4" x 4" NIPPLE, BLK	41435	EA.	2
4	1-1/4" H-11179 MUELLER METER VALVE, WITH INSULATED OUTLET	43001	EA.	1
5	1-1/4" FILTER, PHILPOTT MODEL 125-S, 10 MICRON NPT THREADED CONNECTIONS	44315	EA.	1
6	1-1/4" MALE X 1-1/2" FEMALE RED. ELBOW, BLK	41361	EA.	1
7	1-1/2" x 4-1/2" NIPPLE, BLK	41446	EA.	1
8	1-1/2" UNION, GRD JOINT, BLK	41903	EA.	1
9				
A	1-1/2" NPT SENSUS 243-12-2 REGULATOR WITH FULL CAPACITY INTERNAL RELIEF 1/4" ORIFICE (UP TO 1100 SCFH) AND 3/8" ORIFICE (1500 AND 2000 SCFH) WITH BLUE, ORANGE/BLACK, OR BLACK SPRING FOR 7" W.C., 14" W.C., AND 1 PSIG OUTLET PRESSURE SETTING RESPECTIVELY AND 1/4" ORIFICE (800 SCFH) AND 3/8" ORIFICE (1100-2000 SCFH) WITH CADMIUM SPRING FOR 2 PSIG OUTLET PRESSURE SETTING 1/4" ORIFICE	44324	EA.	1
	BLUE SPRING FOR 7" W.C.	44350	EA.	1
	BLACK SPRING FOR 1 PSIG	44341	EA.	1
	CADMIUM SPRING FOR 2 PSIG	44336	EA.	1
		44340	EA.	1
B	1-1/2" NPT SENSUS 243-8-2 REGULATOR WITH FULL CAPACITY INTERNAL RELIEF 1/4" ORIFICE (UP TO 1100 SCFH) AND 3/8" ORIFICE (1500 AND 2000 SCFH) WITH BLUE-BLACK, GREEN, AND ORANGE SPRING FOR 7" W.C., 14" W.C., AND 1 PSIG OUTLET PRESSURE SETTING RESPECTIVELY 1/4" ORIFICE	44303	EA.	1
	BLUE-BLACK SPRING FOR 7" W.C.	44350	EA.	1
	GREEN SPRING FOR 14" W.C.	44359	EA.	1
	ORANGE SPRING FOR 1 PSIG	44346	EA.	1
		44339	EA.	1
10	1-1/2" PIPE, THREADED	41505	L.F.	D.I.F.
11	1-1/4" PLUG, BLK	41602	EA.	3
12	2" X 1-1/4" BUSHING, BLK	41010	EA.	2
13	2" X 2 X 1-1/2" TEE, BLK		EA.	1
14	2" x 3-1/2" NIPPLE, BLK	41453	EA.	2

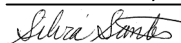
BY	DATE	RESIDENTIAL/COMMERCIAL/INDUSTRIAL ROTARY METER SET ASSEMBLY 800-2,000 SCFH DELIVERY PRESSURE 7" W.C., 14" W.C., 1 PSIG, 2 PSIG STANDARD DETAIL	APPROVED: FEBRUARY 26, 2020	SCALE: NONE
DRAWN A.P.	9/15		 SILVIA LEE SANTOS ENGINEERING MANAGER	DWG. NO.
CHECKED A.P.	9/15		50674 R.E. NO.	STD. GD-09B
REVIEWED A.P.	2/20	CITY OF PALO ALTO, CALIFORNIA	REVISION: FEBRUARY 26, 2020	APPENDIX C

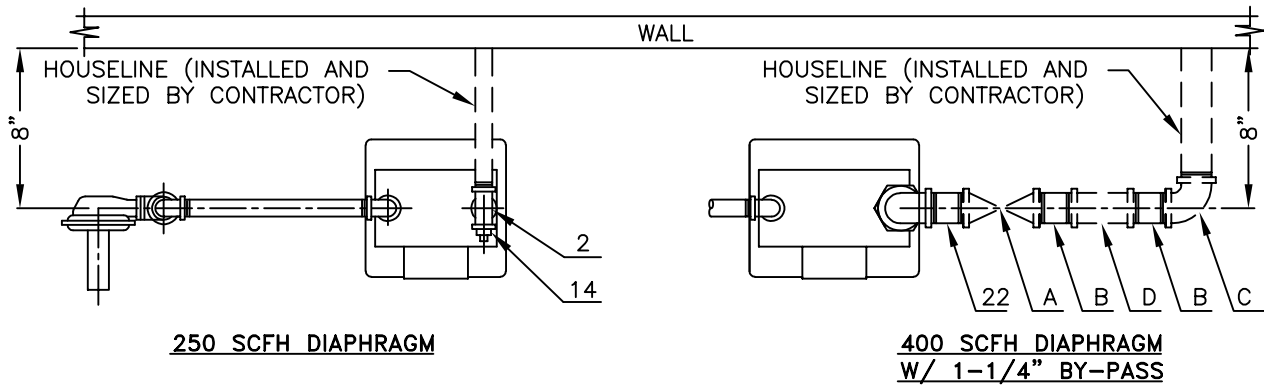
LIST OF MATERIALS

NO.	DESCRIPTION	STOCK NO.	UNIT	QUANTITY
15	2" 150 ANSI THREADED FLANGE, FLAT FACE	43321	EA.	2
	ASTM A105			2
	2" IPS 1/16" THICK, FULL FACE GASKET FOR	43350	EA.	2
	150 ANSI FLAT FACE FLANGE			
	STUD BOLT 5/8" x 1-1/2" WITH HEX CAP AND	43312	EA.	8
	NUTS			
16				
A	2" 175 MAOP 2000 SCFH ROTARY GAS METER	44126	EA.	1
	WITH A DIGITAL NON-COMPENSATED INDEX			
B	2" 175 MAOP 1500 SCFH ROTARY GAS METER	44125	EA.	1
	WITH A DIGITAL NON-COMPENSATED INDEX			
C	2" 175 MAOP 1100/1000 SCFH ROTARY GAS METER	44123	EA.	1
	WITH A DIGITAL NON-COMPENSATED INDEX			
D	2" 175 MAOP 800 SCFH ROTARY GAS METER	44121	EA.	1
	WITH A DIGITAL NON-COMPENSATED INDEX			
17	2" TEE, BLK	41804	EA.	1
18	2" PIPE, THREADED	41516	L.F.	D.I.F.
19	1-1/4" x 2" NIPPLE, BLK	41431	EA.	1
20	1-1/4" H-11175 MUELLER METER VALVE, NON INSU	43002	EA.	1

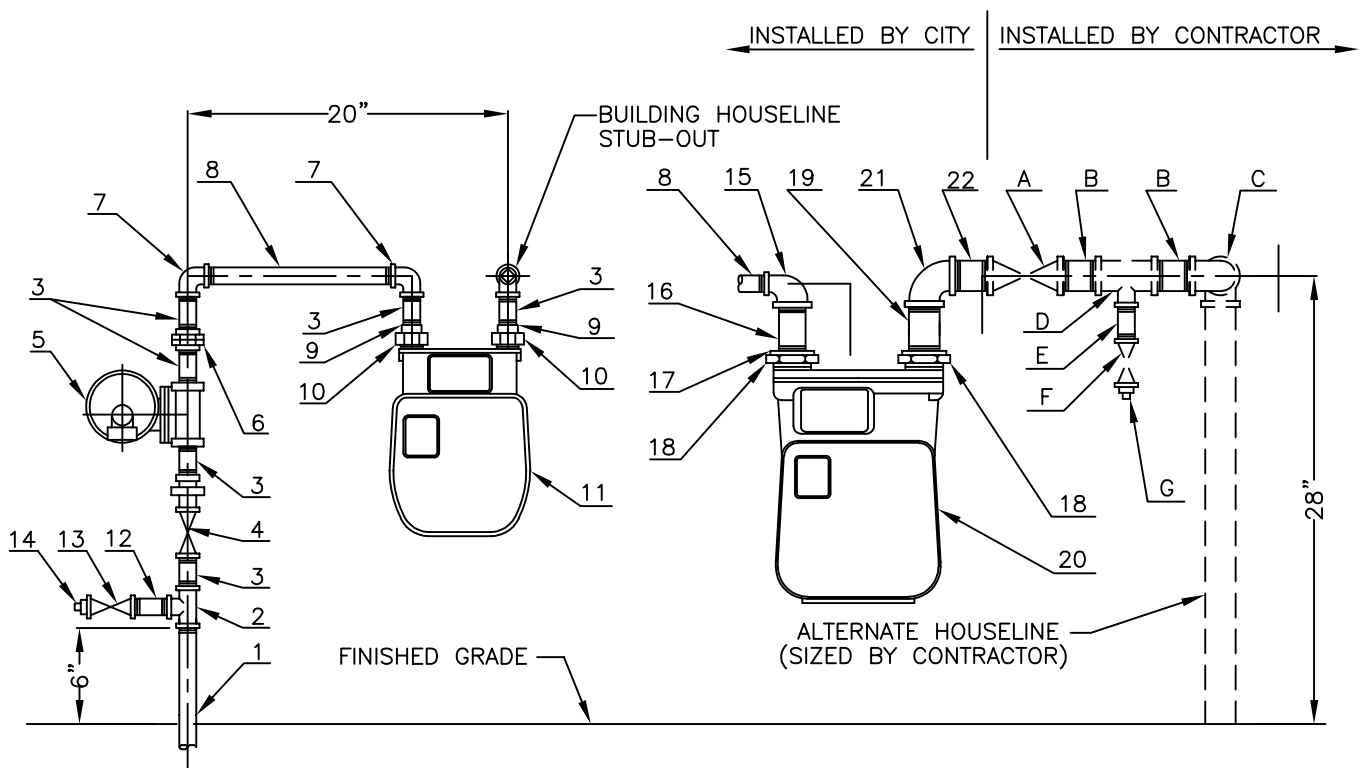
ESTIMATED PRESSURE LOSS IN DOWNSTREAM OF REGULATOR CITY PIPING

FLOW SCFH	SET PRESSURE	PRESSURE AT THE CUSTOMER PIPING	SET PRESSURE TO COMPENSATE FOR CITY PIPING HEADLOSS
1100	7" W.C.	6.352" W.C.	7.648" W.C.
	14" W.C.	13.353" W.C.	14.647" W.C.
	1 PSIG	0.976 PSIG	1.024 PSIG
	2 PSIG	1.976 PSIG	2.024 PSIG
1500	7" W.C.	6.236" W.C.	7.764" W.C.
	14" W.C.	13.237" W.C.	14.763" W.C.
	1 PSIG	0.972 PSIG	1.028 PSIG
	2 PSIG	1.972 PSIG	2.028 PSIG
2000	7" W.C.	6.098" W.C.	7.901" W.C.
	14" W.C.	13.101" W.C.	14.899" W.C.
	1 PSIG	0.968 PSIG	1.077 PSIG
	2 PSIG	1.968 PSIG	2.077 PSIG

BY	DATE	RESIDENTIAL/COMMERCIAL/INDUSTRIAL ROTARY METER SET ASSEMBLY 800-2,000 SCFH DELIVERY PRESSURE 7" W.C., 14" W.C., 1 PSIG, 2 PSIG STANDARD DETAIL	APPROVED:	SCALE:
DRAWN	A.P.		FEBRUARY 26, 2020	NONE
CHECKED	A.P.		 SILVIA LEE SANTOS ENGINEERING MANAGER	DWG. NO. STD. GD-09C
REVIEWED	A.P.	CITY OF PALO ALTO, CALIFORNIA	REVISION: FEBRUARY 26, 2020	APPENDIX C



PLAN



ELEVATION

NOTES:

1. FOR PLACEMENT REQUIREMENTS REFER TO STD. GD-01A AND STD. GD-02A.
2. UPON COMPLETION OF METER ASSEMBLY, LEAK TEST ALL CONNECTIONS.
3. LISTED REGULATOR, ORIFICE AND SPRING ARE SPECIFIED FOR STANDARD 7" W.C. DELIVERY; FOR DELIVERY OF 14" W.C. SILVER SPRING IS REQUIRED - NOT STOCKED.
4. IT IS ASSUMED THAT THE SYSTEM INLET PRESSURE IS MIN. 8 PSIG.

BY		DATE	COMMERCIAL METER SET ASSEMBLY 250-425 SCFH DELIVERY PRESSURE 7" W.C. STANDARD DETAIL	APPROVED: FEBRUARY 26, 2020 <i>Silvia Lee Santos</i> SILVIA LEE SANTOS ENGINEERING MANAGER	SCALE: 1"=1'-0"
DRAWN	A.P.	1/16			
CHECKED	A.P.	1/16		50674 R.E. NO.	DWG. NO. STD. GD-10A
REVIEWED	A.P.	2/20		REVISION: FEBRUARY 26, 2020	APPENDIX C

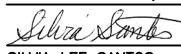
CITY OF PALO ALTO, CALIFORNIA

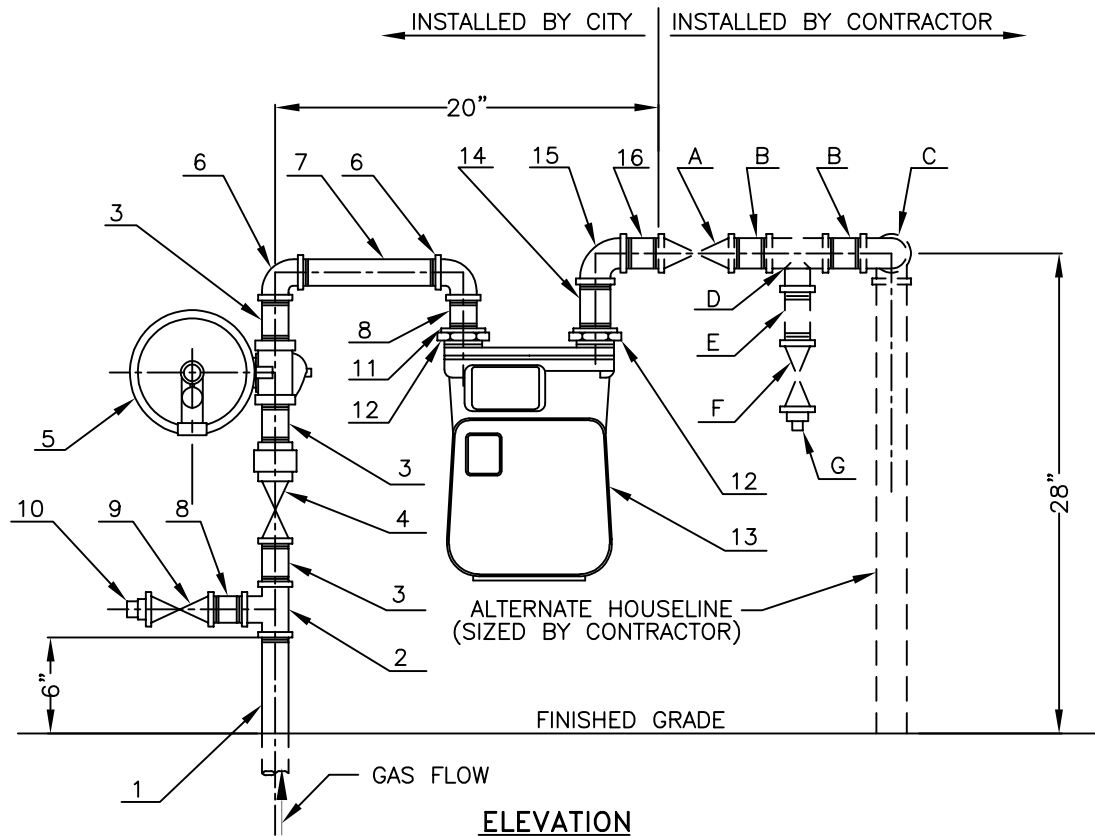
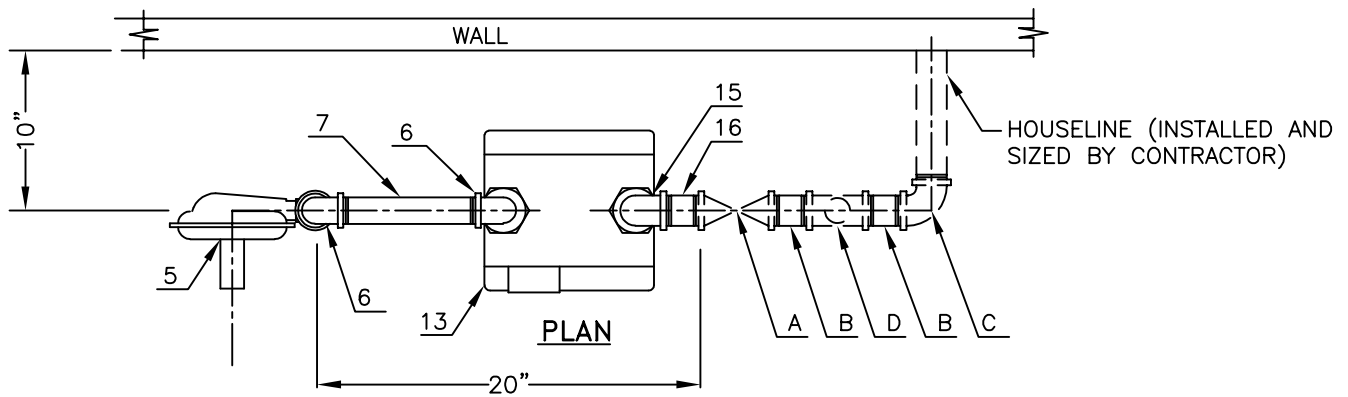
LIST OF MATERIALS

NO.	DESCRIPTION	STOCK NO.	QUANTITY
1	3/4" IPS x 1" CTS RISER	43052	1
2	3/4" TEE, BLK	41800	1
3	3/4" x 2" NIPPLE, BLK	41401	4
4	3/4" H-11179 MUELLER METER VALVE, WITH INSULATED OUTLET OUTLET, BLK	42998	1
5	3/4" NPT ITRON B42R REGULATOR WITH 3/16" ORIFICE, BROWN SPRING, 1" VENT	44300	1
6	3/4" UNION, GRD JOINT, BLK	41900	1
7	3/4" ELBOW, 90 DEG, BLK	41310	2
8	3/4" PIPE	41500	D.I.F
A	CL 250 METER CONNECTION:		1
3	3/4" x 2 NIPPLE, BLK	41401	2
9	3/4" SWIVEL, GALV, INSULATED FEMALE	44211	2
10	1A SPRAGUE NUT, GALV	44207	2
B	CL 250 METER CONNECTION:		1
9	3/4" SWIVEL, GALV, INSULATED MALE	44212	2
10	1A SPRAGUE NUT, GALV	44207	2
C	CL 250 METER CONNECTION:		1
9	3/4" SWIVEL, GALV, INSULATED MALE, OFFSET	44215	2
10	1A SPRAGUE NUT, GALV	44207	2
11	GAS METER, DIAPHRAGM, CL 250	44101	1
12	3/4" x 3 NIPPLE, BLK	41403	1
13	3/4" H-11175 MUELLER METER VALVE, NON INSULATED	43000	1
14	3/4" PLUG, BLK	41600	2
15	1-1/4" x 3/4" ELBOW 90 DEG, RED., BLK	41349	1
D	CL 400 METER CONNECTION:		1
16	1-1/4" x 2-1/2" NIPPLE, BLK	41432	1
17	1-1/4" SWIVEL, FEMALE, INSULATED	44202	1
18	#3 OR #4 SPRAGUE NUT, GALV	44209	2
19	1-1/2" SWIVEL, MALE	44203	1
20	GAS METER, DIAPHRAGM, CL 400	44103	1
21	1-1/2" 90 DEG, ELBOW, BLK	41313	1
22	1-1/2" x 2" NIPPLE, BLK	41441	1

MATERIALS SUPPLIED AND INSTALLED BY CONTRACTOR

NO.	DESCRIPTION	QUANTITY
A	1-1/2" METER VALVE (NATURAL GAS APPROVED)	1
B	1-1/2" NIPPLE (LENGTH AS REQUIRED)	2
C	1-1/2" 90° ELBOW	1
D	1-1/2" x 1-1/2" x 3/4" TEE	1
E	3/4" NIPPLE (LENGTH AS REQUIRED)	1
F	3/4" METER VALVE (NATURAL GAS APPROVED)	1
G	3/4" PLUG	1

BY	DATE	COMMERCIAL METER SET ASSEMBLY 250-425 SCFH DELIVERY PRESSURE 7" W.C. STANDARD DETAIL	APPROVED: FEBRUARY 26, 2020  SILVIA LEE SANTOS ENGINEERING MANAGER	SCALE: NONE
DRAWN A.P.	1/16		50674 R.E. NO.	DWG. NO.
CHECKED A.P.	1/16			STD. GD-10B
REVIEWED A.P.	2/20	CITY OF PALO ALTO, CALIFORNIA	REVISION: FEBRUARY 26, 2020	APPENDIX C



NOTES:

1. FOR PLACEMENT REQUIREMENTS REFER TO STD. GD-01A AND STD. GD-02A.
2. UPON COMPLETION OF METER ASSEMBLY, LEAK TEST ALL CONNECTIONS.
3. LISTED REGULATOR, ITRON B31R, STOCK NO. 44302 IS SUPPLIED WITH 1/4" ORIFICE AND GRAY SPRING; FOR THE APPLICATION 3/16" ORIFICE IS REQUIRED.
4. LISTED REGULATOR ORIFICE AND SPRING ARE SPECIFIED FOR STANDARD 7" W.C. DELIVERY; FOR DELIVERY OF 14" W.C. SILVER SPRING IS REQUIRED - NOT STOCKED.
5. IT IS ASSUMED THAT THE SYSTEM INLET PRESSURE IS MIN. 8 PSIG.

BY		DATE	COMMERCIAL METER SET ASSEMBLY 630-800 SCFH DELIVERY PRESSURE 7" W.C. STANDARD DETAIL	APPROVED: FEBRUARY 26, 2020 SILVIA LEE SANTOS ENGINEERING MANAGER	SCALE: 1"=1'-0"
DRAWN	A.P.	1/16			DWG. NO.
CHECKED	A.P.	1/16		50674 R.E. NO.	STD. GD-11A
REVIEWED	A.P.	2/20		REVISION: FEBRUARY 26, 2020	APPENDIX C

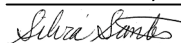
CITY OF PALO ALTO, CALIFORNIA

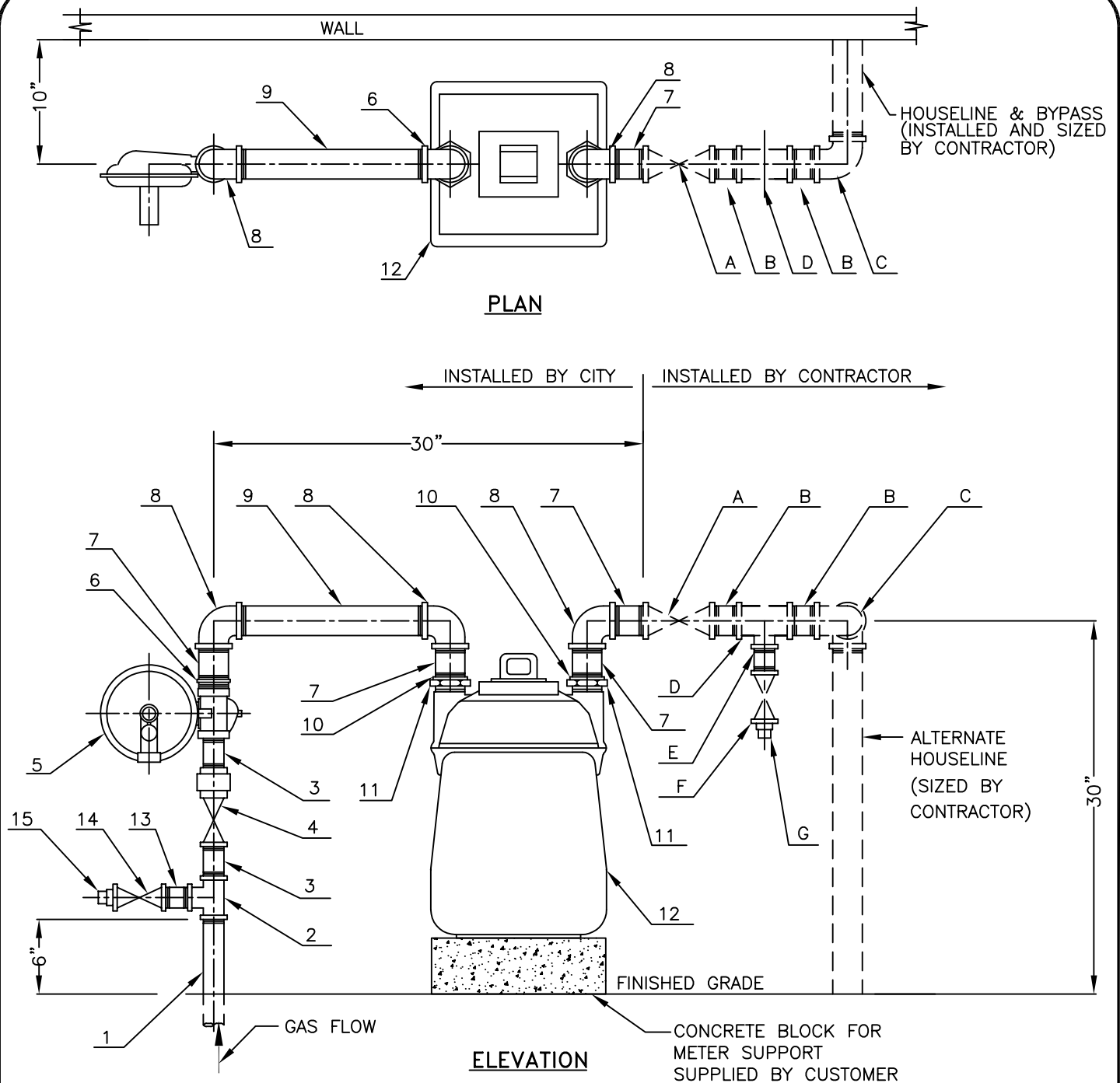
LIST OF MATERIALS

NO.	DESCRIPTION	STOCK NO.	QUANTITY
1	1-1/4" IPS x 1" CTS RISER, PREBENT	43050	1
2	1-1/4" TEE, BLK	41802	1
3	1-1/4" x 2-1/2" NIPPLE, BLK	41432	3
4	1-1/4" H-11179 MUELLER METER VALVE WITH INSULATED OUTLET, BLK	43001	1
5	1-1/4" NPT ITRON B31R REGULATOR WITH 3/16" ORIFICE, GRAY SPRING, 1" VENT 3/16" ORIFICE FOR ITRON B31R	44302	1
6	1-1/4" ELBOW, 90 DEG, BLK	41312	2
7	1-1/4" PIPE	41505	D.I.F
8	1-1/4" x 2" NIPPLE, BLK	41431	2
9	1-1/4" H-11175 MUELLER METER VALVE, NON INSULATED	43002	1
10	1-1/4" PLUG, BLK	41602	1
11	1-1/4" SWIVEL, FEMALE, INSULATED	44202	1
12	#4 SPRAGUE NUT, GALV	44209	2
13	GAS METER, DIAPHRAGM, CL 600 OR CL 800	44118	1
14	1-1/2" SWIVEL, MALE	44203	1
15	1-1/2" 90 DEG, ELBOW, BLK	41313	1
16	1-1/2" x 2" NIPPLE, BLK	41441	1

MATERIALS SUPPLIED AND INSTALLED BY CONTRACTOR

NO.	DESCRIPTION	QUANTITY
A	1-1/2" METER VALVE (NATURAL GAS APPROVED)	1
B	1-1/2" NIPPLE (LENGTH AS REQUIRED)	2
C	1-1/2" 90° ELBOW	1
D	1-1/2" x 1-1/2" x 1-1/4" TEE	1
E	1-1/4" NIPPLE (LENGTH AS REQUIRED)	1
F	1-1/4" METER VALVE (NATURAL GAS APPROVED)	1
G	1-1/4" PLUG	1

BY	DATE	COMMERCIAL METER SET ASSEMBLY 630-800 SCFH DELIVERY PRESSURE 7" W.C. STANDARD DETAIL	APPROVED: FEBRUARY 26, 2020	SCALE: NONE
DRAWN A.P.	1/16		 SILVIA LEE SANTOS ENGINEERING MANAGER	DWG. NO.
CHECKED A.P.	1/16		50674 R.E. NO.	STD. GD-11B
REVIEWED A.P.	2/20	CITY OF PALO ALTO, CALIFORNIA	REVISION: FEBRUARY 26, 2020	APPENDIX C



NOTES:

1. FOR PLACEMENT REQUIREMENTS REFER TO STD. GD-01A AND STD. GD-02A.
2. UPON COMPLETION OF METER ASSEMBLY, LEAK TEST ALL CONNECTIONS.
3. LISTED REGULATOR IS STOCKED WITH ORIFICE AND SPRING SPECIFIED FOR STANDARD 7" W.C. DELIVERY; FOR DELIVERY OF 14" W.C. SILVER SPRING IS REQUIRED - NOT STOCKED.
4. IT IS ASSUMED THAT THE SYSTEM INLET PRESSURE IS MIN. 8 PSIG.

BY		COMMERCIAL METER SET ASSEMBLY 1,000 SCFH DELIVERY PRESSURE 7" W.C. STANDARD DETAIL	APPROVED: FEBRUARY 26, 2020 SILVIA LEE SANTOS ENGINEERING MANAGER	SCALE: 1"=1'-0"
DRAWN	A.P.			
CHECKED	A.P.		50674 R.E. NO.	DWG. NO. STD. GD-12A
REVIEWED	A.P.		REVISION: FEBRUARY 26, 2020	APPENDIX C

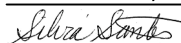
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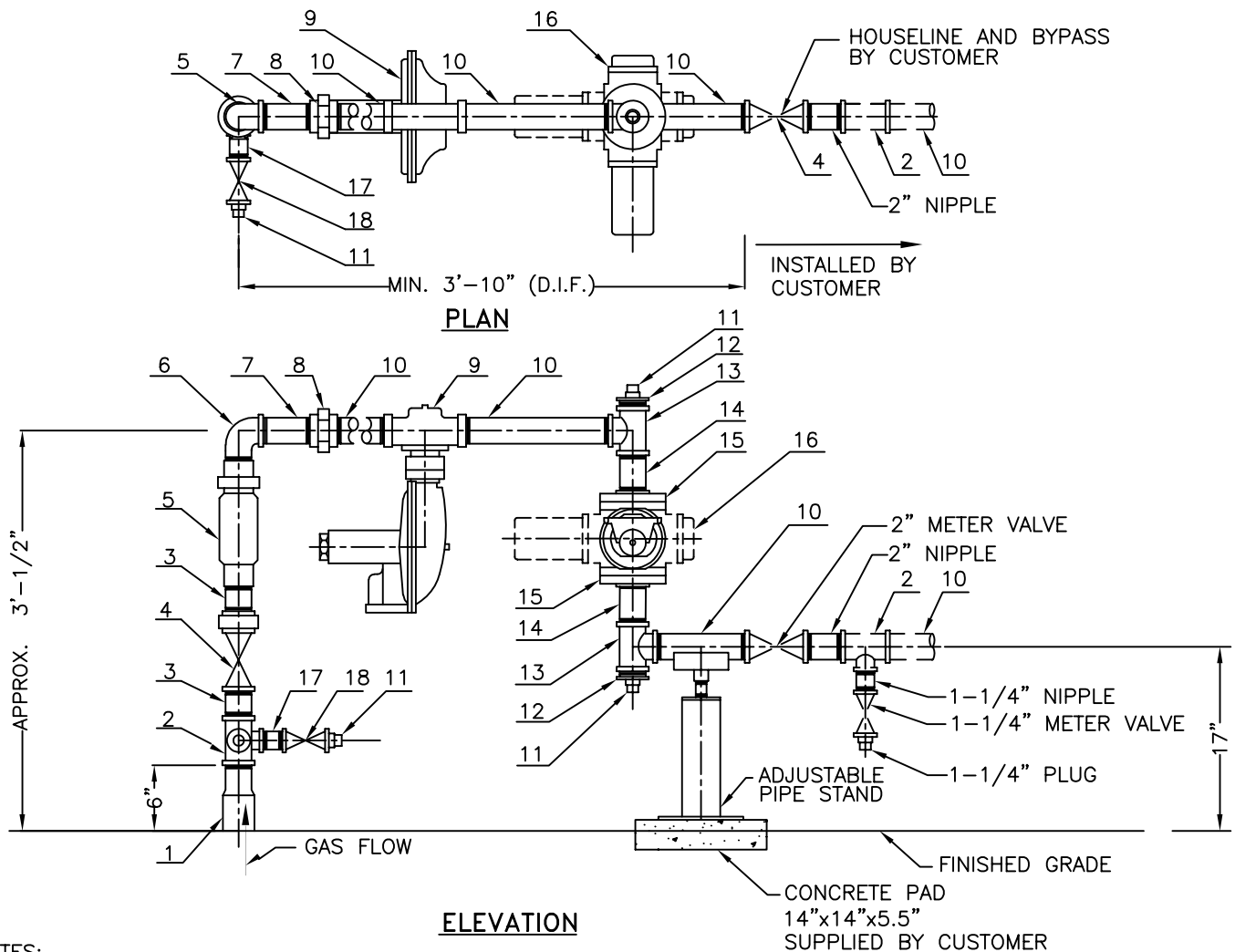
LIST OF MATERIALS

NO.	DESCRIPTION	STOCK NO.	QUANTITY
1	1-1/4" IPS x 1" CTS RISER, PREBENT	43050	1
2	1-1/4" TEE, BLK	41802	1
3	1-1/4" x 2-1/2" NIPPLE, BLK	41432	2
4	1-1/4" H-11179 MUELLER METER VALVE WITH INSULATED OUTLET, BLK	43001	1
5	1-1/4" NPT ITRON B31R REGULATOR WITH 1/4" ORIFICE, GRAY SPRING, 1" VENT	44302	1
6	2" x 1-1/4" BUSHING, BLK	41010	1
7	2" x 2-1/2" NIPPLE, BLK	41451	4
8	2" ELBOW, 90 DEG, BLK	41314	3
9	2" PIPE	41516	D.I.F
10	2" SWIVEL, FEMALE, INSULATED	44204	2
11	#5 SPRAGUE NUT, GALV	44210	2
12	GAS METER, DIAPHRAGM, CL 1000	44105	1
13	1-1/4" x 2" NIPPLE, BLK	41431	1
14	1-1/4" H-11175 MUELLER METER VALVE, NON INSULATED	43002	1
15	1-1/4" PLUG, BLK	41602	1

MATERIALS SUPPLIED AND INSTALLED BY CONTRACTOR

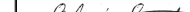
NO.	DESCRIPTION	QUANTITY
A	2" METER VALVE (NATURAL GAS APPROVED)	1
B	2" NIPPLE (LENGTH AS REQUIRED)	2
C	2" 90° ELBOW	1
D	2" x 1-1/4" TEE	1
E	1-1/4" NIPPLE (LENGTH AS REQUIRED)	1
F	1-1/4" METER VALVE (NATURAL GAS APPROVED)	1
G	1-1/4" PLUG	1

BY	DATE	COMMERCIAL METER SET ASSEMBLY 1,000 SCFH DELIVERY PRESSURE 7" W.C. STANDARD DETAIL	APPROVED: FEBRUARY 26, 2020	SCALE: NONE
DRAWN A.P.	1/16		 SILVIA LEE SANTOS ENGINEERING MANAGER	DWG. NO. STD. GD-12B
CHECKED A.P.	1/16		50674 R.E. NO.	
REVIEWED A.P.	2/20	CITY OF PALO ALTO, CALIFORNIA	REVISION: FEBRUARY 26, 2020	APPENDIX C



NOTES:

1. FOR PLACEMENT REQUIREMENTS REFER TO STD. GD-01A AND STD. GD-02A.
2. UPON COMPLETION OF METER ASSEMBLY, LEAK TEST ALL CONNECTIONS.
3. IT IS ASSUMED THAT INLET PRESSURE DOWNSTREAM OF THE FILTER IS MIN. 10 PSIG.
4. DIMENSIONS OF THE ITEM 10 ARE FLEXIBLE AND FIELD ADJUSTABLE UPSTREAM OF THE REGULATOR; DOWNSTREAM OF THE REGULATOR THE PIPES' LENGTH SHALL BE SHOWN ON THE DRAWING IF POSSIBLE TO MINIMIZE HEAD LOSS AT LOWER DELIVERY PRESSURE, SPECIFICALLY WHEN DELIVER 7" W.C.
5. BYPASS, REGULATOR, AND METER ORIENTATIONS ARE FIELD ADJUSTABLE. FOR BYPASS REGULATOR USE SENSUS 243-8-2 (44303) UP TO 1 PSIG OR 243-12-2 (44324) WITH APPROPRIATE FOR AN APPLICATION SPRING.
6. REGULATOR POSITION (VERTICAL, AS SHOWN, OR HORIZONTAL) IS DETERMINED BASED ON SPACE AVAILABILITY.
7. REGULATOR IS SHIPPED WITH 5/8" ORIFICE & BROWN SPRING AS IT IS THE SAME REGULATOR USED ON 5,000-7,000 SCFH (SINGLE REGULATOR) METER SET ASSEMBLY. APPROPRIATE SPRING/ORIFICE SHALL BE INSTALLED BASED ON AN APPLICATION AND AS SPECIFIED IN DESCRIPTION.
8. THE ESTIMATED PRESSURE LOSS, SHOWN IN THE TABLE, INCLUDES DIFFERENTIAL LOSS ACROSS THE METER AT 100% FLOW. FOR DELIVERY OF 7" W.C. BLACK SPRING MAY BE USED INSTEAD OF SPECIFIED GREEN SPRING TO DELIVER LARGER SPRING RANGE IF NECESSARY.
9. THE ESTIMATED PRESSURE LOSS THROUGH RISER, METER VALVE, FITTINGS, AND FILTER IS APPROXIMATELY 0.5 PSIG

BY		DATE	COMMERCIAL/INDUSTRIAL ROTARY METER SET ASSEMBLY 2,000-3,000 SCFH DELIVERY PRESSURE 7" W.C., 14" W.C., 1 PSIG, 2 PSIG STANDARD DETAIL	APPROVED: FEBRUARY 26, 2020	SCALE: 3/4"=1'-0"
DRAWN	A.P.	9/15		 50674 SILVIA LEE SANTOS ENGINEERING MANAGER R.E. NO.	DWG. NO.
CHECKED	A.P.	9/15			STD. GD-13A
REVIEWED	A.P.	2/20			
			CITY OF PALO ALTO, CALIFORNIA	REVISION: FEBRUARY 26, 2020	APPENDIX C

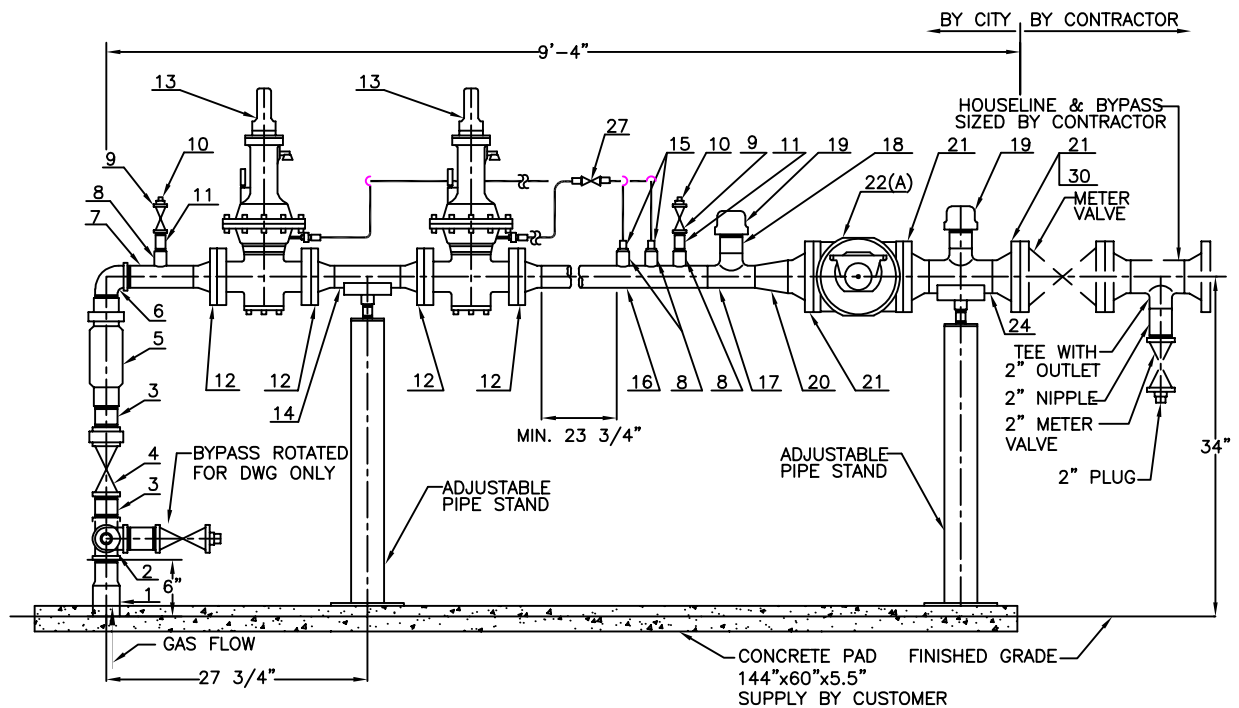
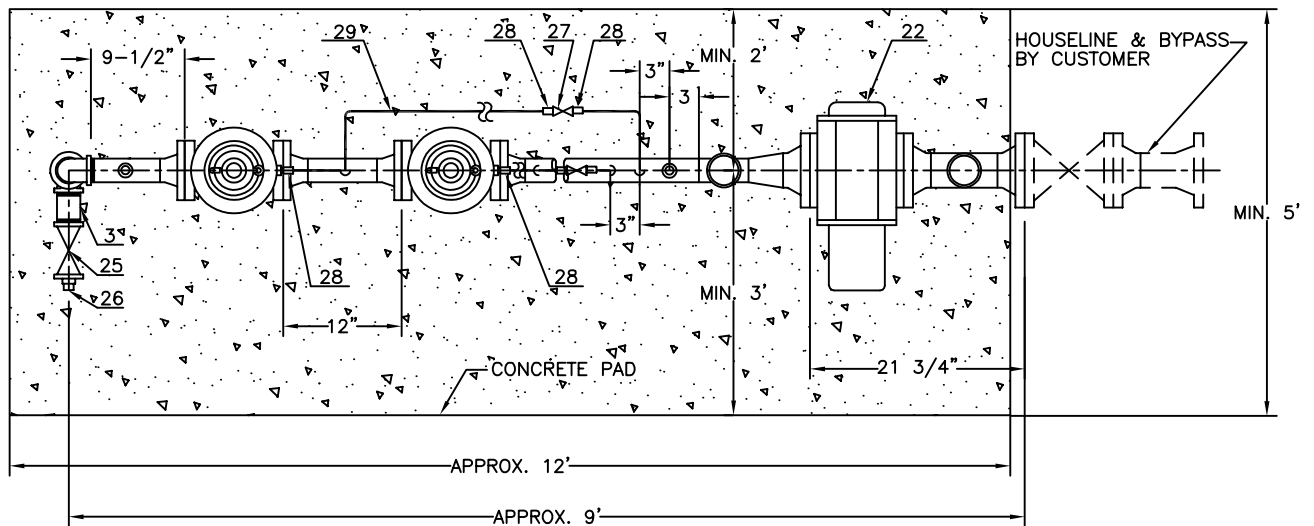
LIST OF MATERIALS

NO.	DESCRIPTION	STOCK NO.	UNIT	QUANTITY
1	2" IPS x 2" IPS ANODELESS SERVICE RISER, PREBENT	43057	EA.	1
2	2" x 2" x 1-1/4" TEE, BLK	41810	EA.	1
3	2" x 2-1/2" NIPPLE, BLK	41451	EA.	2
4	2" H-11179 MUELLER METER VALVE WITH INSULATED OUTLET	43005	EA.	1
5	2" FILTER, PHILPOTT MODEL 200-S, 10 MICRON NPT THREADED CONNECTIONS	44317	EA.	1
6	2" MALE X 2" FEMALE ELBOW, BLK	41365	EA.	1
7	2" x 4-1/2" NIPPLE, BLK	41455	EA.	1
8	2" UNION, GRD JOINT, BLK	41904	EA.	1
9	2" NPT ITRON B38R REGULATOR WITH FULL CAPACITY INTERNAL RELIEF AND 3/8" ORIFICE WITH GREEN, PURPLE, BLUE/WHITE, AND SILVER SPRINGS FOR DELIVERY OF 2,000 SCFH AT SET PRESSURE OF 7" W.C., 14" W.C., 1 PSIG, AND 2 PSIG RESPECTIVELY; AND 1/2" ORIFICE WITH GREEN PURPLE, BLUE/WHITE, AND SILVER SPRINGS FOR DELIVERY OF 3,000 SCFH AT SET PRESSURE OF 7" W.C., 14" W.C., 1 PSIG, AND 2 PSIG.	44321	EA.	1
	B38R 3/8" ORIFICE	43061	EA.	1
	B38R 1/2" ORIFICE	43060	EA.	1
	B38R GREEN SPRING	44358	EA.	1
	B38R BLACK SPRING	44356	EA.	1
	B38R PURPLE SPRING	44348	EA.	1
	B38R BLUE/WHITE SPRING	44347	EA.	1
	B38R SILVER SPRING	44357	EA.	1
10	2" PIPE, THREADED	41516	L.F.	D.I.F.
11	1-1/4" PLUG, BLK	41602	EA.	3
12	2" X 1-1/4" BUSHING, BLK	41010	EA.	2
13	2" TEE, BLK	41804	EA.	2
14	2" x 3-1/2" NIPPLE, BLK	41453	EA.	2
15	2" 150 ANSI THREADED FLANGE, FLAT FACE ASTM A105	43321	EA.	2
	2" IPS 1/16" THICK, FULL FACE GASKET FOR 150 ANSI FLAT FACE FLANGE	43350	EA.	2
	STUD BOLT 5/8" x 1-1/2" WITH HEX CAP AND NUTS	43312	EA.	8
16A	2" 175 MAOP 3000 SCFH ROTARY GAS METER WITH A DIGITAL NON-COMPENSATED INDEX	44127	EA.	1
16B	2" 175 MAOP 2000 SCFH ROTARY GAS METER WITH A DIGITAL NON-COMPENSATED INDEX	44126	EA.	1
17	1-1/4" x 2" NIPPLE, BLK	41431	EA.	1
18	1-1/4" H-11175 MUELLER METER VALVE, NON-INSUL	43002	EA.	1

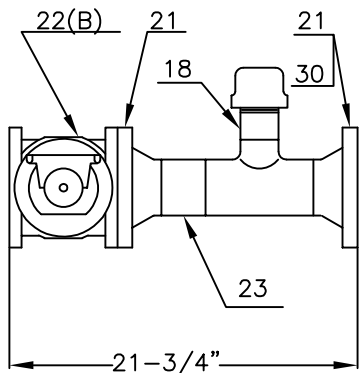
ESTIMATED PRESSURE LOSS IN DOWNSTREAM OF REGULATOR CITY PIPING

FLOW SCFH	SET PRESSURE	PRESSURE AT THE CUSTOMER PIPING	SET PRESSURE TO COMPENSATE FOR CITY PIPING HEADLOSS
2000	7" W.C.	6.120" W.C.	7.880" W.C.
	14" W.C.	13.882" W.C.	14.878" W.C.
	1 PSIG	0.969 PSIG	1.031 PSIG
	2 PSIG	1.969 PSIG	2.031 PSIG
3000	7" W.C.	5.891" W.C.	8.109" W.C.
	14" W.C.	12.895" W.C.	15.105" W.C.
	1 PSIG	0.960 PSIG	1.040 PSIG
	2 PSIG	1.961 PSIG	2.039 PSIG

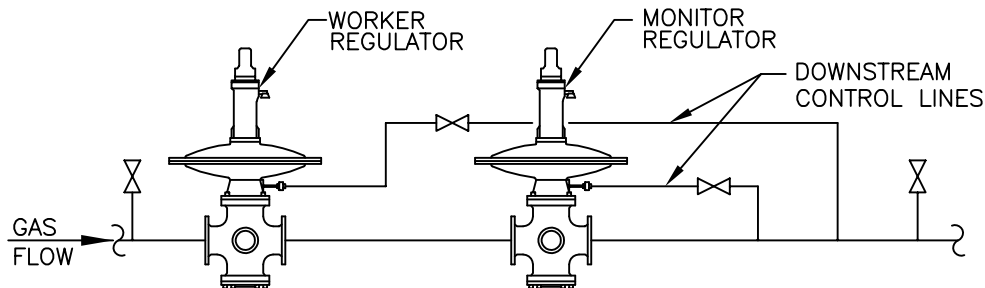
BY	DATE	COMMERCIAL/INDUSTRIAL ROTARY METER SET ASSEMBLY 2,000-3,000 SCFH DELIVERY PRESSURE 7" W.C., 14" W.C., 1 PSIG, 2 PSIG STANDARD DETAIL	APPROVED: FEBRUARY 26, 2020	SCALE: NONE
DRAWN A.P.	9/15		<i>Silvia Santos</i> SILVIA LEE SANTOS ENGINEERING MANAGER	DWG. NO. STD. GD-13B
CHECKED A.P.	9/15		50674 R.E. NO.	
REVIEWED A.P.	2/20	CITY OF PALO ALTO, CALIFORNIA	REVISION: FEBRUARY 26, 2020	APPENDIX C



BY	DATE	COMMERCIAL/INDUSTRIAL ROTARY METER SET ASSEMBLY 5,000 & 7,000 SCFH DELIVERY PRESSURE 3 PSIG & 5 PSIG STANDARD DETAIL	APPROVED:	SCALE:
DRAWN	A.P.		FEBRUARY 26, 2020	$3/4" = 1'-0"$
CHECKED	A.P.		<i>Silvia Santos</i> 50674 SILVIA LEE SANTOS R.E. NO. ENGINEERING MANAGER	DWG. NO. STD. GD-14A
REVIEWED	A.P.		REVISION: FEBRUARY 26, 2020	APPENDIX C
		CITY OF PALO ALTO, CALIFORNIA		



**5000 SCFH METER
INSTALLATION**



**SCHEMATIC
NOT TO SCALE**

NOTES:

1. FOR PLACEMENT REQUIREMENTS REFER TO STD. GD-01B AND STD. GD-02B.
2. UPON COMPLETION OF METER ASSEMBLY, LEAK TEST ALL CONNECTIONS.
3. IT IS ASSUMED THAT INLET PRESSURE DOWNSTREAM OF THE FILTER IS MIN. 10 PSIG FOR DELIVERY PRESSURE OF 5 PSIG.
4. 7000 SCFH METER IS SHOWN ON PLAN AND ELEVATION.
5. MIN. 10 OUTSIDE PIPE DIAMETERS BETWEEN THE REGULATOR'S FRAME AND SENSING LINE COUPLING.
6. PER MANUFACTURER RECOMMENDATION THE SET POINT OF THE MONITOR REGULATOR SHALL BE 2 PSIG HIGHER THAN THE DELIVERY PRESSURE.
7. FOR BYPASS USE THE REGULATOR SPECIFIED FOR THE METER SET ASSEMBLY.
8. BYPASS SHALL BE USED ONLY IN PRESENCE OF THE CITY QUALIFIED PERSONNEL WHILE PERFORMING METER SET SERVICE.
9. THE ESTIMATED PRESSURE LOSS, SHOWN IN THE TABLE, INCLUDES DIFFERENTIAL LOSS ACROSS THE METER AT 100% FLOW.
10. THE ESTIMATED PRESSURE LOSS THROUGH RISER, METER VALVE, FITTINGS, AND FILTER IS APPROXIMATELY 0.5 PSIG.

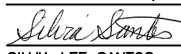
**ESTIMATED PRESSURE LOSS IN
DOWNSTREAM OF REGULATOR CITY PIPING**

FLOW SCFH	SET PRESSURE	PRESSURE AT CUSTOMER PIPING	SET PRESSURE TO COMPENSATE FOR CITY PIPING HEADLOSS
5000	3 PSIG	2.949 PSIG	3.051 PSIG
	5 PSIG	4.951 PSIG	5.049 PSIG
7000	3 PSIG	2.934 PSIG	3.066 PSIG
	5 PSIG	4.937 PSIG	5.063 PSIG

BY	DATE	COMMERCIAL/INDUSTRIAL ROTARY METER SET ASSEMBLY 5,000 & 7,000 SCFH DELIVERY PRESSURE 3 PSIG & 5 PSIG STANDARD DETAIL	APPROVED: FEBRUARY 26, 2020	SCALE: NONE
DRAWN A.P.	6/15		<i>Silvia Lee Santos</i> 50674	DWG. NO.
CHECKED A.P.	6/15		SILVIA LEE SANTOS R.E. NO.	STD. GD-14B
REVIEWED A.P.	2/20		REVISION: FEBRUARY 26, 2020	APPENDIX C

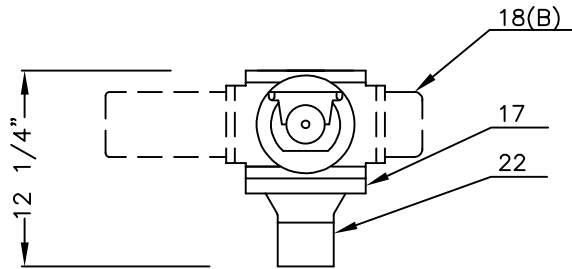
LIST OF MATERIALS

NO.	DESCRIPTION	STOCK NO.	UNIT	QUANTITY
1	2" IPS x 2" IPS ANODELESS SERVICE RISER, PREBENT	43057	EA.	1
2	2" TEE, BLK	41804	EA.	1
3	2" x 2-1/2" NIPPLE, BLK	41451	EA.	3
4	2" H-11179 MUELLER METER VALVE WITH INSULATED OUTLET	43005	EA.	1
5	2" FILTER, PHILPOTT MODEL 200-S, 10 MICRON NPT THREADED CONNECTIONS	44317	EA.	1
6	2" MALE X 2" FEMALE ELBOW, BLK	41365	EA.	1
7	2" X 7" PIPE, THREADED ON ONE END	41516	EA.	1
8	3/4" 3000 PSI FEMALE NPT STEEL COUPLING, BUTT-WELD ENDS	41210	EA.	4
9	3/4" VALVE METER, BLK	43000	EA.	2
10	3/4" PLUG, BLK	41600	EA.	2
11	3/4" x 3" NIPPLE, BLK	41403	EA.	2
12	2" 150 ANSI WELD NECK FLANGE, FLAT FACE; A105 2" IPS 1/16" THICK, FULL FACE GASKET FOR 150 ANSI FLAT FACE FLANGE	43330 43350	EA. EA.	4 4
	STUD BOLT 5/8" x 3-1/2 WITH HEX CAP AND NUTS	43319	EA.	24
	NUT, 5/8" HEX NCT	43317	EA.	24
13	2" SENSUS 461-57S, "ROLL-OUT" DIAPHRAGM SINGLE SEAT REGULATOR, WITH 1" V PORT, YELLOW SPRING FOR 3 AND 5 PSIG OUTLET PRESSURE SETTING, 125 ANSI FLAT FACE CONNECTIONS	44344	EA.	2
	57S GRAY SPRING FOR MONITOR 7 PSIG SET POINT	44360	EA.	1
14	2" x 7" PIPE, A53 GRADE A, TYPE E, SCH. 40	41516	EA.	1
15	3/4" MALE NPT FOR 3/8" TUBE CONNECTOR SS-600-1-12	41533	EA.	2
16	2" PIPE, A53 GRADE A, TYPE E, SCH. 40	41516	L.F.	D.I.F.
17	2" x 2" x 2" TEE, BUTT-WELD ENDS	41811	EA.	1
18	2" x 3" NIPPLE, THREADED ON ONE END	41490	EA.	2
19	2" CAP	41104	EA.	2
20	3" x 2" REDUCER SCH. 40, BUTT-WELD ENDS	41375	EA.	1
21	3" 150 ANSI WELD NECK FLANGE, FLAT FACE; A105 3" IPS 1/16" THICK, FULL FACE GASKET FOR 150 ANSI FLAT FACE FLANGE	43331 43351	EA. EA.	3 2
	STUD BOLT 5/8"-11 x 1-3/4" WITH HEX CAP SAE GRADE 5 STEEL ZINC PLATED WITH WASHERS	43313	EA.	8
22A	3" 175 MAOP 7000 SCFH ROTARY GAS METER	44129	EA.	1
22B	WITH A DIGITAL NON-COMPENSATED INDEX 3" 175 MAOP 5000 SCFH ROTARY GAS METER	44128	EA.	1
	WITH A DIGITAL NON-COMPENSATED INDEX			
23	3" x 2-3/4" PIPE, A53 GRADE A, TYPE E, SCH. 40	41518	EA.	1
24	3" x 3" x 2" TEE SCH. 40, BUTT-WELD ENDS	41812	EA.	1
25	2" VALVE METER, BLK	43004	EA.	1
26	2" PLUG, BLK	41604	EA.	1
27	1/4" FEMALE NPT-18 PLUG VALVE SS-4P4T4	41535	EA.	2
28	1/4" MALE NPT-18 FOR 3/8" TUBE CONNECTOR SS-600-1-4	41537	EA.	6
29	3/8" x 0.035" TUBE 316 STAINLESS STEEL; A-269	41530	L.F.	D.I.F.
30	3" ANSI 150 FLANGE ISOLATION KIT	43360	EA.	1

BY	DATE	COMMERCIAL/INDUSTRIAL ROTARY METER SET ASSEMBLY 5,000 & 7,000 SCFH DELIVERY PRESSURE 3 PSIG & 5 PSIG STANDARD DETAIL	APPROVED: FEBRUARY 26, 2020  SILVIA LEE SANTOS ENGINEERING MANAGER	SCALE: NONE
DRAWN	A.P.	6/15	50674 R.E. NO.	DWG. NO. STD. GD-14C
CHECKED	A.P.	6/15		
REVIEWED	A.P.	2/20		
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BY	DATE	COMMERCIAL/INDUSTRIAL ROTARY METER SET ASSEMBLY 5,000-7,000 SCFH DELIVERY PRESSURE 7" W.C., 14" W.C., 1 PSIG, 2 PSIG STANDARD DETAIL	APPROVED: FEBRUARY 26, 2020	SCALE: 3/4"=1'-0"
DRAWN A.P.	9/15		 50674 SILVIA LEE SANTOS R.E. NO.	DWG. NO. STD. GD-15A
CHECKED A.P.	9/15		ENGINEERING MANAGER	
REVIEWED A.P.	2/20	CITY OF PALO ALTO, CALIFORNIA	REVISION: FEBRUARY 26, 2020	APPENDIX C



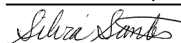
5000 SCFH METER INSTALLATION

ESTIMATED PRESSURE LOSS IN DOWNSTREAM OF REGULATOR CITY PIPING

FLOW SCFH	SET PRESSURE	PRESSURE AT CUSTOMER PIPING	SET PRESSURE TO COMPENSATE FOR CITY PIPING HEADLOSS
5000	7" W.C.	5.68" W.C.	8.32" W.C.
	14" W.C.	12.69" W.C.	15.32" W.C.
	1 PSIG	0.953 PSIG	1.047 PSIG
	2 PSIG	1.953 PSIG	2.047 PSIG
7000	7" W.C.	5.31" W.C.	8.63" W.C.
	14" W.C.	12.32" W.C.	15.68" W.C.
	1 PSIG	0.94 PSIG	1.06 PSIG
	2 PSIG	1.942 PSIG	2.058 PSIG

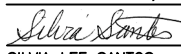
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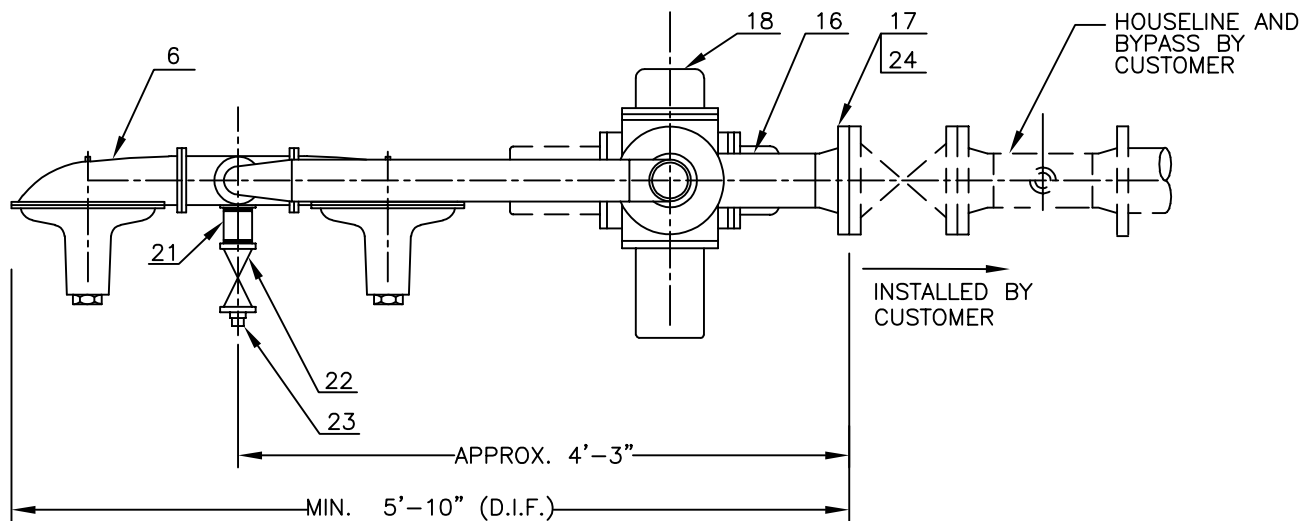
1. FOR PLACEMENT REQUIREMENTS REFER TO STD. GD-01B AND STD. GD-02B.
2. UPON COMPLETION OF METER ASSEMBLY, LEAK TEST ALL CONNECTIONS.
3. IT IS ASSUMED THAT INLET PRESSURE DOWNSTREAM OF THE FILTER IS MIN. 10 PSIG.
4. ITRON B38R (44321) AND B838R (44349) SHARE SAME ORIFICES AND SPRINGS.
5. REGULATOR ITRON B38R (44321) IS SHIPPED WITH 5/8" ORIFICE AND BROWN SPRING. APPROPRIATE SPRING/ORIFICE SHALL BE INSTALLED BASED ON AN APPLICATION AND AS SPECIFIED ON THE DRAWING. BLUE SPRING (44355) MAY BE USED FOR DELIVERY OF 14" W.C. BASED ON CONFIGURATION OF DOWNSTREAM PIPING.
6. THE ESTIMATED PRESSURE LOSS, SHOWN IN THE TABLE, INCLUDES DIFFERENTIAL LOSS ACROSS THE METER AT 100% FLOW.
7. THE ESTIMATED PRESSURE LOSS THROUGH RISER, METER VALVE, FITTINGS AND FILTER IS APPROXIMATELY 0.5 PSIG.
8. BYPASS, REGULATOR, AND METER ORIENTATIONS ARE FIELD ADJUSTABLE. FOR BYPASS REGULATOR USE SPECIFIED ON THIS DRAWING REGULATOR WITH APPROPRIATE FOR AN APPLICATION SPRING AND ORIFICE.

BY	DATE	COMMERCIAL/INDUSTRIAL ROTARY METER SET ASSEMBLY 5,000-7,000 SCFH DELIVERY PRESSURE 7" W.C., 14" W.C., 1 PSIG, 2 PSIG STANDARD DETAIL	APPROVED: FEBRUARY 26, 2020  SILVIA LEE SANTOS ENGINEERING MANAGER	SCALE: NONE
DRAWN	A.P.	9/15	50674 R.E. NO.	DWG. NO. STD. GD-15B
CHECKED	A.P.	9/15		
REVIEWED	A.P.	2/20		
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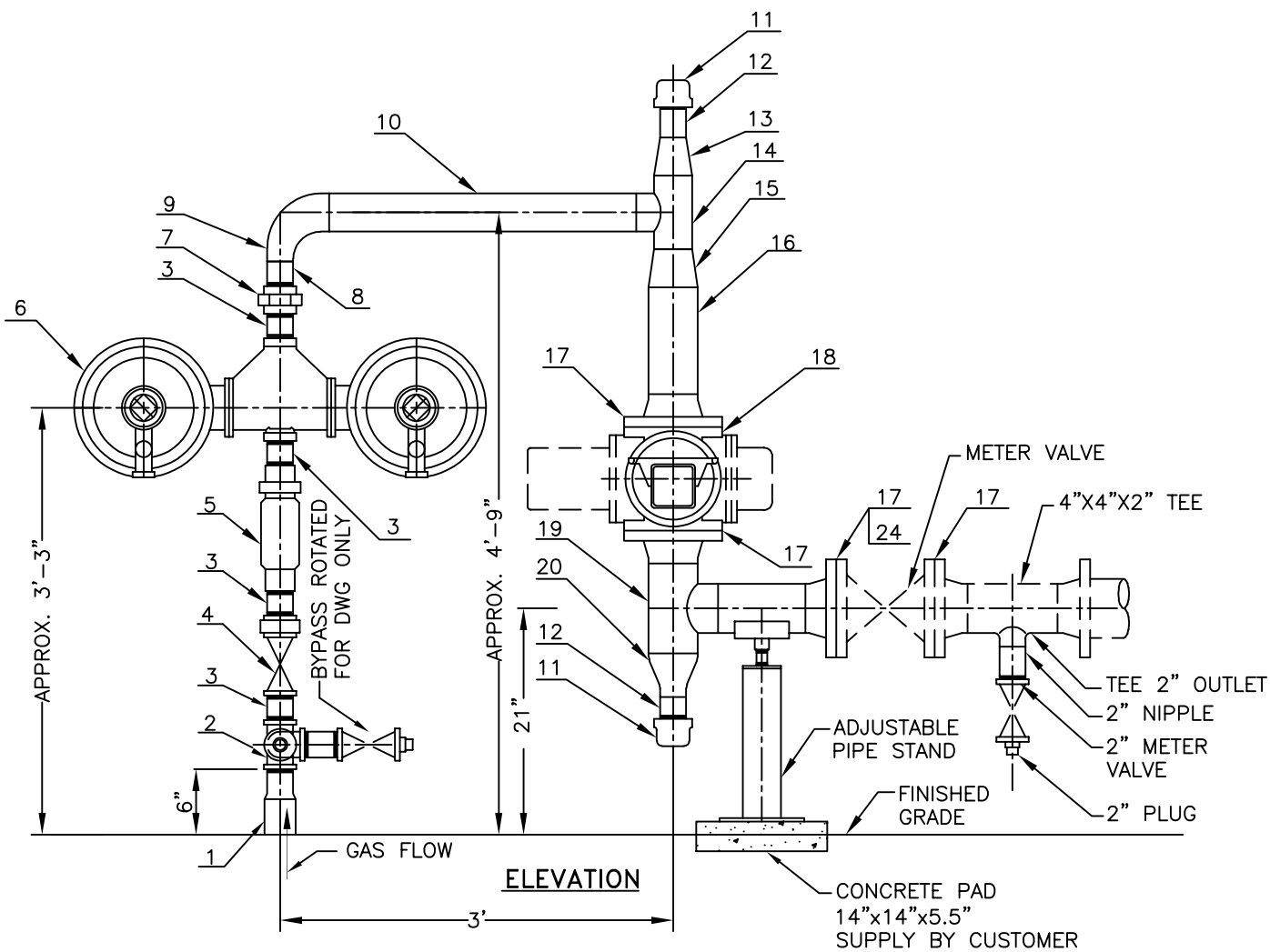
LIST OF MATERIALS

NO.	DESCRIPTION	STOCK NO.	UNIT	QUANTITY
1	2" IPS x 2" IPS ANODELESS SERVICE RISER, PREBENT	43057	EA.	1
2	2" TEE, BLK	41804	EA.	1
3	2" x 2-1/2" NIPPLE, BLK	41451	EA.	5
4	2" H-11179 MUELLER METER VALVE WITH INSULATED OUTLET	43005	EA.	1
5	2" FILTER, PHILPOTT MODEL 200-S, 10 MICRON, NPT THREADED CONNECTIONS	44317	EA.	1
6	2" PIPE, THREADED ENDS	41516	EA.	D.I.F.
7	2" UNION, GRD JOINT, BLK	41904	EA.	2
8	2" 90 DEG. ELBOW, BLK	41314	EA.	1
9	2" NPT ITRON B38R REGULATOR WITH 2-1/2" FULL CAPACITY INTERNAL RELIEF VALVE WITH 5/8" ORIFICE AND GREEN, PURPLE, AND BLUE/WHITE SPRINGS FOR DELIVERY OF 5,000 SCFH AT SET PRESSURE OF 7" W.C., 14" W.C., AND 1 PSIG RESPECTIVELY AND 3/4" ORIFICE WITH SILVER SPRING FOR DELIVERY OF 5,000 SCFH AT SET PRESSURE OF 2 PSIG; AND 3/4" ORIFICE WITH GREEN, PURPLE, AND BLUE/WHITE SPRINGS FOR DELIVERY OF 7000 SCFH AT SET PRESSURES OF 7" W.C., 14" W.C., AND 1 PSIG RESPECTIVELY AND 1" ORIFICE WITH SILVER SPRING FOR DELIVERY OF 7000 SCFH AT 2 PSIG	44321	EA.	1
	B38R 3/4" ORIFICE	43062	EA.	1
	B38R 1" ORIFICE	43063	EA.	1
	B38R GREEN SPRING	44358	EA.	1
	B38R BLUE/WHITE SPRING	44347	EA.	1
	B38R SILVER SPRING	44357	EA.	1
	B38R PURPLE SPRING	44348	EA.	1
10	2" x 2" NIPPLE, THREADED ON ONE END	41516	EA.	1
11	3" x 2" REDUCER SCH. 40, BUTT-WELD ENDS	41375	EA.	3
12	3" x 9-1/2" PIPE, PLAIN END	41518	EA.	1
13	2" CAP	41104	EA.	2
14	2" x 3" NIPPLE, THREADED ON ONE END	41490	EA.	2
15	3" TEE STD, WELD ENDS	43109	EA.	2
16	3" x 3" PIPE, PLAIN END	41518	EA.	1
17	3" 150 ANSI WELD NECK FLANGE, FLAT FACE; A105	43331	EA.	3
	3" IPS 1/16" THICK, FULL FACE GASKET FOR 150 ANSI FLAT FACE FLANGE	43351	EA.	2
	STUD BOLT 5/8" x 1-3/4" WITH HEX CAP AND NUTS	43313	EA.	8
18A	3" 175 MAOP 7000 SCFH ROTARY GAS METER WITH A DIGITAL NON-COMPENSATED INDEX	44129	EA.	1
18B	3" 175 MAOP 5000 SCFH ROTARY GAS METER WITH A DIGITAL NON-COMPENSATED INDEX	44128	EA.	1
19	3" PIPE, PLAIN END	41518	L.F.	D.I.F.
20	2" VALVE METER, BLK	43004	EA.	1
21	2" PLUG, BLK	41604	EA.	1
22	3" x 2-3/4" PIPE, PLAIN END	41518	EA.	1
23	3" ANSI 150 FLANGE ISOLATION KIT	43360	EA.	1

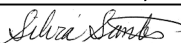
BY	DATE	COMMERCIAL/INDUSTRIAL ROTARY METER SET ASSEMBLY 5,000-7,000 SCFH DELIVERY PRESSURE 7" W.C., 14" W.C., 1 PSIG, 2 PSIG STANDARD DETAIL	APPROVED: FEBRUARY 26, 2020  SILVIA LEE SANTOS ENGINEERING MANAGER	SCALE: NONE
DRAWN	A.P.	9/15	50674 R.E. NO.	DWG. NO.
CHECKED	A.P.	9/15		STD. GD-15C
REVIEWED	A.P.	2/20		APPENDIX C
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PLAN



ELEVATION

BY	DATE	COMMERCIAL/INDUSTRIAL ROTARY METER SET ASSEMBLY 11,000 SCFH DELIVERY PRESSURE 7" W.C., 14" W.C., 1 PSIG STANDARD DETAIL	APPROVED: FEBRUARY 26, 2020  SILVIA LEE SANTOS ENGINEERING MANAGER	SCALE: 3/4"=1'-0"
DRAWN A.P.	9/15			DWG. NO. STD. GD-16A
CHECKED A.P.	9/15			APPENDIX C
REVIEWED A.P.	2/20	CITY OF PALO ALTO, CALIFORNIA	REVISION: FEBRUARY 26, 2020	

LIST OF MATERIALS

NO.	DESCRIPTION	STOCK NO.	UNIT	QUANTITY
1	2" IPS x 2" IPS ANODELESS SERVICE RISER PREBENT	43057	EA.	1
2	2" TEE, BLK	41804	EA.	1
3	2" x 2-1/2" NIPPLE, BLK	41451	EA.	4
4	2" H-11179 MUELLER METER VALVE WITH INSULATED OUTLET	43005	EA.	1
5	2" FILTER, PHILPOTT MODEL 200-S, 10 MICRON NPT THREADED CONNECTIONS	44317	EA.	1
6	2" x 2" NPT ITRON B838R REGULATOR WITH 2-1/2" FULL CAPACITY INTERNAL RELIEF WITH 1" (0 DEG.) ORIFICE WITH BROWN SPRING FOR 7" W.C, BLACK SPRING FOR 14" W.C., AND BLUE SPRING FOR 1 PSIG DELIVERY PRESSURE	44349	EA.	1
	ITRON B838R BLACK SPRING/BLUE SPRING	44356/44355	EA.	1/1
7	2" UNION, GRD JOINT, BLK	41904	EA.	2
8	2" x 2-1/2" NIPPLE, THREADED ON ONE END	41516	EA.	1
9	3" x 2" 90 DEG. REDUCING ELBOW SCH. 40	41369	EA.	1
10	3" PIPE, PLAIN END	41518	EA.	1
11	2" CAP	41104	EA.	2
12	2" x 3" NIPPLE, THREADED ON ONE END	41490	EA.	2
13	3" x 2" REDUCER SCH. 40, BUTT-WELD ENDS	41375	EA.	1
14	3" TEE, STD, WELD ENDS	43109	EA.	1
15	4" x 3" REDUCER SCH. 40, BUTT-WELD ENDS	41377	EA.	1
16	4" PIPE, A53/A106 GRADE B, TYPE S, SCH. 40	N/A	L.F.	D.I.F.
17	4" 150 ANSI WELD NECK FLANGE, FLAT FACE; A105	43332	EA.	3
	4" IPS 1/16" THICK, FULL FACE GASKET FOR 150 ANSI FLAT FACE FLANGE	43352	EA.	2
	STUD BOLT 5/8" x 1-3/4" WITH HEX CAP AND NUTS	43313	EA.	16
18	4" 175 MAOP 11000 SCFH ROTARY GAS METER WITH A DIGITAL NON-COMPENSATED INDEX	44130	EA.	1
19	4" TEE SCH. 40, BUTT-WELD ENDS (SPECIAL ORDER)	44390	EA.	1
20	4" x 2" REDUCER SCH. 40, BUTT-WELD ENDS	41376	EA.	1
21	1-1/4" x 3-1/2" NIPPLE, BLK	41434	EA.	1
22	1-1/4" H-11175 MUELLER METER VALVE, NON-INSU	43002	EA.	1
23	1-1/4" PLUG, BLK	41602	EA.	1
24	4" ANSI 150 FLANGE ISOLATION KIT	44381	EA.	1

ESTIMATED PRESSURE LOSS IN DOWNSTREAM OF REGULATOR CITY PIPING

FLOW SCFH	SET PRESSURE	PRESSURE AT CUSTOMER PIPING	SET PRESSURE TO COMPENSATE FOR CITY PIPING HEADLOSS
11000	7" W.C.	5.17" W.C.	8.83" W.C.
	14" W.C.	12.18" W.C.	15.82" W.C.
	1 PSIG	0.936 PSIG	1.060 PSIG

NOTES:

- FOR PLACEMENT REQUIREMENTS REFER TO STD. GD-01B AND STD. GD-02B.
- UPON COMPLETION OF METER ASSEMBLY, LEAK TEST ALL CONNECTIONS.
- BYPASS, REGULATOR, AND METER ORIENTATIONS ARE FIELD ADJUSTABLE. FOR BYPASS REGULATOR USE B38R (44321) WITH 1" ORIFICE (43063) AND APPROPRIATE SPRING.
- IT IS ASSUMED THAT INLET PRESSURE DOWNSTREAM OF THE FILTER IS MIN. 10 PSIG.
- THE ESTIMATED PRESSURE LOSS, SHOWN IN THE TABLE, INCLUDES DIFFERENTIAL LOSS ACROSS THE METER AT 100% FLOW. THE ESTIMATED PRESSURE LOSS THROUGH RISER, METER VALVE, FITTING, AND FILTER IS APPROXIMATELY 0.5 PSIG.
- NO DELIVERY OF 2 PSIG OR ABOVE IS AVAILABLE BY STOCKED B838R (44349) FOR THE SPECIFIED FLOW.

BY	DATE	COMMERCIAL/INDUSTRIAL ROTARY METER SET ASSEMBLY 11,000 SCFH DELIVERY PRESSURE 7" W.C., 14" W.C., 1 PSIG STANDARD DETAIL	APPROVED: FEBRUARY 26, 2020	SCALE: NONE
DRAWN A.P.	9/15		<i>Silvia Santos</i> SILVIA LEE SANTOS ENGINEERING MANAGER	DWG. NO. STD. GD-16B
CHECKED A.P.	9/15		50674 R.E. NO.	
REVIEWED A.P.	2/20	CITY OF PALO ALTO, CALIFORNIA	REVISION: FEBRUARY 26, 2020	APPENDIX C

LIST OF MATERIALS

NO.	DESCRIPTION	STOCK NO.	UNIT	QUANTITY
1	2" IPS x 2" IPS ANODELESS SERVICE RISER, PREBENT	43057	EA.	1
2	2" TEE, BLK	41804	EA.	1
3	2" x 3-1/2" NIPPLE, BLK	41453	EA.	2
4	2" H-11179 MUELLER METER VALVE WITH INSULATED OUTLET	43005	EA.	1
5	2" x 9-1/4" PIPE, THREADED ON ONE END	41516	EA.	1
6	2" 90° ELBOW SCH. 40, BUTT-WELD END	41366	EA.	1
7	2" 150 ANSI WELD NECK FLANGE, FLAT FACE; A105	43330	EA.	6
	2" IPS 1/16" THICK, FULL FACE GASKET FOR 150 ANSI FLAT FACE FLANGE	43350	EA.	6
	STUD BOLT 5/8" x 3-1/2" WITH HEX CAP AND NUTS	43319	EA.	24
	NUT, 5/8" HEX NCT	43317	EA.	24
8	2" GFT-02-150 SAFECO NATURAL GAS FILTER, 5 MICRON, WITH FLAT FACE FLANGE CONNECTIONS	44450	EA.	1
9	2" x 7" PIPE, PLAIN END	41516	EA.	2
10	3/4" 3000 PSI FEMALE NPT STEEL COUPLING, BUTT-WELD ENDS	41210	EA.	5
11	3/4" VALVE METER, BLK	43000	EA.	2
12	3/4" PLUG, BLK	41600	EA.	2
13	3/4" x 3" NIPPLE, BLK	41403	EA.	2
	2" 125 ANSI WELD NECK FLANGE, FLAT FACE			
14A	2" SENSUS 461-12S, DOUBLE SEAT REGULATOR WITH 1" V PORT, 12" DIAPHRAGM, AND GREEN, ORANGE, BLACK, AND CADMIUM SPRINGS RESPECTIVELY FOR 7" W.C., 14" W.C., 1" PSIG, AND 2 PSIG DELIVERY PRESSURE SETTINGS; ALUMINUM DIAPHRAGM CASING, AND 125 ANSI FLAT FACE FLANGE CONNECTIONS	44342	EA.	2
	461-12S GREEN SPRING	44351	EA.	2
	461-12S ORANGE SPRING	44339	EA.	2
	461-12S BLACK SPRING	44336	EA.	2
	461-12S CADMIUM SPRING	44340	EA.	2

NOTES:

- FOR PLACEMENT REQUIREMENTS REFER TO STD. GD-01B AND STD. GD-02B.
- UPON COMPLETION OF METER ASSEMBLY, LEAK TEST ALL CONNECTIONS.
- DRAWING DEPICTS 461-12S REGULATOR; 461-57S WILL HAVE THE SAME CONNECTION DIMENSIONS, BUT SMALLER DIAPHRAGM AND WILL BE SLIGHTLY TALLER. REGULATOR 461-12S IS STOCKED WITH THE BLUE SPRING.
- MIN. 10 OUTSIDE PIPE DIAMETERS BETWEEN THE REGULATOR'S FLANGE AND FIRST SENSING LINE COUPLING.
- IT IS ASSUMED THAT SYSTEM INLET PRESSURE IS MIN. 12 PSIG FOR DELIVERY 11,000 SCFH AND 15 PSIG FOR DELIVERY OF 16,000 SCFH AT ELEVATED PRESSURE.
- PER MANUFACTURER RECOMMENDATION THE SET POINT OF THE MONITOR REGULATOR 461-12S SHALL BE 12"-16" OR 1 PSIG HIGHER THAN THE DELIVERY PRESSURE OF 7"-14", OR 1-2 PSIG RESPECTIVELY; FOR 461-57S 2 PSIG HIGHER THAN THE DELIVERY PRESSURE.
- THE ESTIMATED PRESSURE LOSS, SHOWN IN THE TABLE, INCLUDES DIFFERENTIAL LOSS ACROSS THE METER AT 100% FLOW.
- FOR BYPASS USE THE REGULATORS SPECIFIED FOR THIS METER SET ASSEMBLY.
- BYPASS SHALL BE USED ONLY IN PRESENCE OF THE CITY QUALIFIED PERSONNEL WHILE PERFORMING METER SET SERVICE.
- THE ESTIMATED PRESSURE LOSS THROUGH RISER, METER VALVE, FITTINGS, AND FILTER IS APPROXIMATELY 0.5 PSIG.

BY	DATE	COMMERCIAL/INDUSTRIAL ROTARY METER SET ASSEMBLY 11,000/16,000 SCFH DELIVERY PRESSURE 7" W.C., 14" W.C., 1, 2, 3 & 5 PSIG STANDARD DETAIL	APPROVED: FEBRUARY 26, 2020	SCALE: NONE
DRAWN A.P.	5/15		<i>Silvia Santos</i> SILVIA LEE SANTOS ENGINEERING MANAGER	DWG. NO. STD. GD-17B
CHECKED A.P.	5/15		50674 R.E. NO.	
REVIEWED A.P.	2/20	CITY OF PALO ALTO, CALIFORNIA	REVISION: FEBRUARY 26, 2020	APPENDIX C

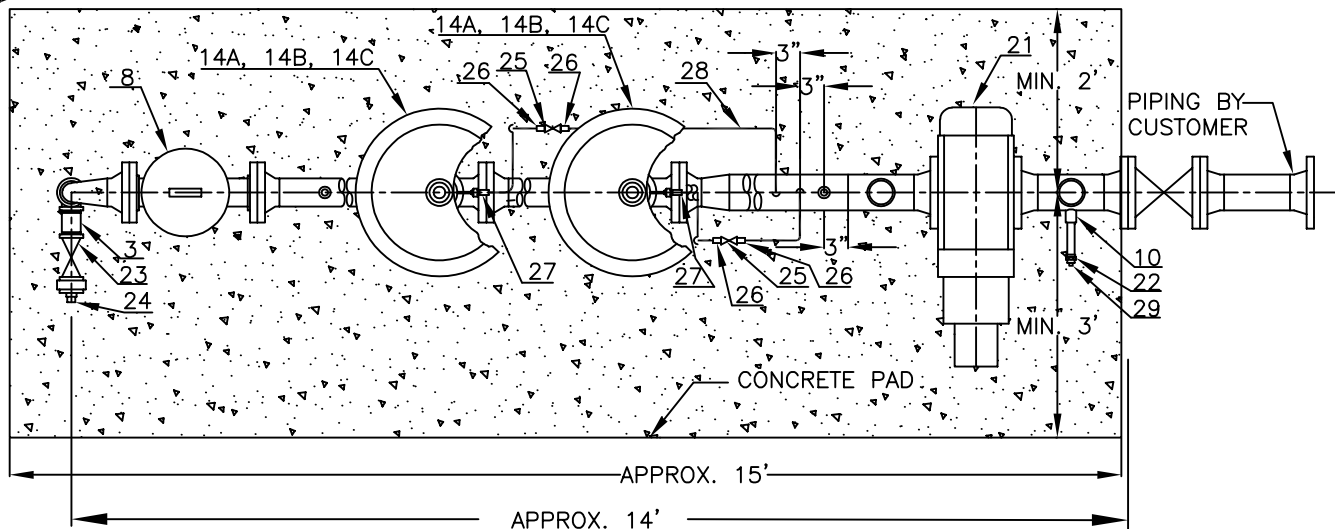
LIST OF MATERIALS

NO.	DESCRIPTION	STOCK NO.	UNIT	QUANTITY
14B	2" SENSUS 461-57S, "ROLL-OUT" DIAPHRAGM	44343	EA.	2
	DOUBLE SEAT REGULATOR, WITH 1" VALVE, YELLOW			
	SPRING FOR 3 AND 5 PSIG DELIVERY PRESSURE			
	SETTINGS, 125 ANSI FLAT FACE CONNECTIONS			
	57S GRAY SPRING FOR MONITOR 7 PSIG SET POINT	44360	EA.	1
15	3/4" MALE NPT FOR 3/8" TUBE CONNECTOR	41533	EA.	2
	SS-600-1-12			
16	4" PIPE, A53/A106 GRAD B, TYPE S, SCH. 40	N/A	L.F.	D.I.F.
17	4" x 4" x 2" TEE SCH. 40, BUTT-WELD ENDS	41814	EA.	2
18	2" x 3" NIPPLE, THREADED ON ONE END	41490	EA.	2
19	2" CAP	41104	EA.	2
20	4" x 2" REDUCER SCH. 40, BUTT-WELD ENDS	41376	EA.	1
21	4" 150 ANSI WELD NECK FLANGE, FLAT FACE; A105	43332	EA.	3
	4" IPS 1/16" THICK, FULL FACE GASKET FOR	43352	EA.	2
	150 ANSI FLAT FACE FLANGE			
	STUD BOLT 5/8"-11 x 1-3/4" WITH HEX CAP	43313	EA.	16
	SAE GRADE 5 STEEL ZINC PLATED WITH WASHERS			
22A	4" 175 MAOP 11000 SCFH ROTARY GAS METER	44130	EA.	1
	WITH A DIGITAL NON-COMPENSATED INDEX			
22B	4" 175 MAOP 16000 SCFH ROTARY GAS METER	44131	EA.	1
	WITH A DIGITAL NON-COMPENSATED INDEX			
23	3/4" MALE x 1/2" FEMALE THERMOWELL 4" LONG,	41550	EA.	1
	THREADED TYPE, 304 STAINLESS STEEL			
24	2" H-11175 MUELLER METER VALVE, NON-INSULATED	43004	EA.	1
25	2" PLUG, BLK	41604	EA.	1
26	1/4" FEMALE NPT-18 PLUG VALVE SS-4P4T4	41535	EA.	2
27	1/4" MALE NPT-18 FOR 3/8" TUBE CONNECTOR	41537	EA.	6
	SS-600-1-4			
28	3/8" x 0.035" TUBE 316 STAINLESS STEEL; A-269	41530	L.F.	D.I.F.
29	1/2" PLUG, BLK	41603	EA.	1
30	4" ANSI 150 FLANGE ISOLATION KIT	44381	EA.	1

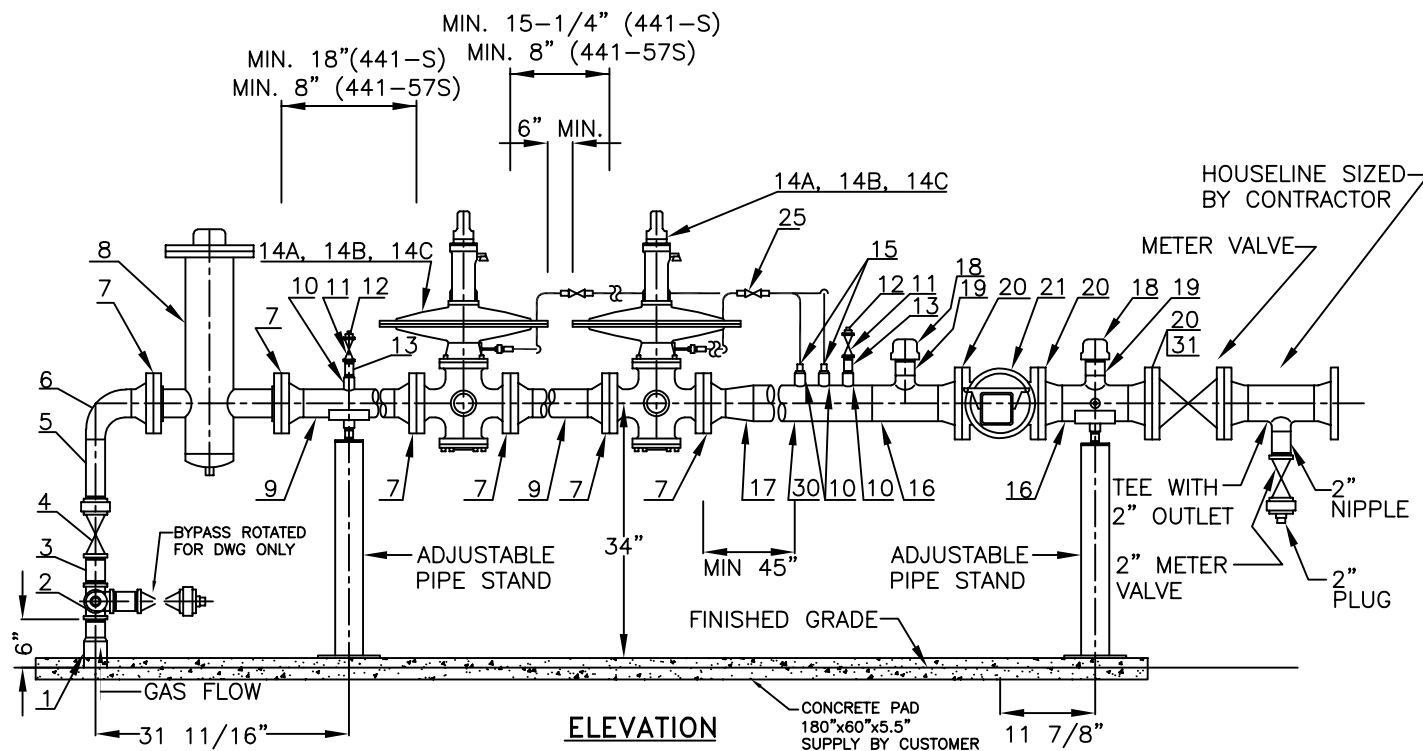
ESTIMATED PRESSURE LOSS IN DOWNSTREAM OF REGULATOR CITY PIPING

FLOW SCFH	SET PRESSURE	PRESSURE AT CUSTOMER PIPING	SET PRESSURE TO COMPENSATE FOR CITY PIPING HEADLOSS
11000	7" W.C.	5.007" W.C.	8.991" W.C.
	14" W.C.	12.022" W.C.	15.976" W.C.
	1 PSIG	0.93 PSIG	1.07 PSIG
	2 PSIG	1.932 PSIG	2.068 PSIG
	3 PSIG	2.934 PSIG	2.066 PSIG
	5 PSIG	4.936 PSIG	5.064 PSIG
16000	7" W.C.	3.567" W.C.	10.425" W.C.
	14" W.C.	12.198" W.C.	17.395" W.C.
	1 PSIG	0.937 PSIG	1.121 PSIG
	2 PSIG	1.883 PSIG	2.117 PSIG
	3 PSIG	2.916 PSIG	3.114 PSIG
	5 PSIG	4.892 PSIG	5.108 PSIG

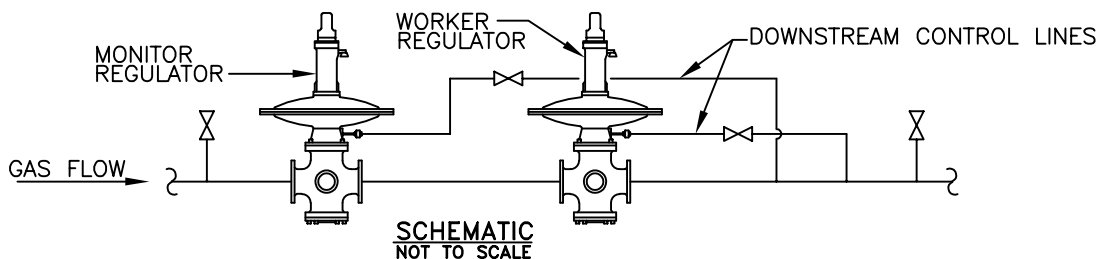
BY	DATE	COMMERCIAL/INDUSTRIAL ROTARY METER SET ASSEMBLY 11,000/16,000 SCFH DELIVERY PRESSURE 7" W.C., 14" W.C., 1, 2, 3 & 5 PSIG STANDARD DETAIL	APPROVED: FEBRUARY 26, 2020	SCALE: NONE
DRAWN A.P.	5/15		<i>Silvia Santos</i> SILVIA LEE SANTOS ENGINEERING MANAGER	DWG. NO. STD. GD-17C
CHECKED A.P.	5/15		50674 R.E. NO.	
REVIEWED A.P.	2/20	CITY OF PALO ALTO, CALIFORNIA	REVISION: FEBRUARY 26, 2020	APPENDIX C

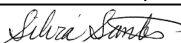


PLAN



ELEVATION



BY	DATE	INDUSTRIAL ROTARY METER SET ASSEMBLY 23,000 SCFH DELIVERY PRESSURE 14" W.C., 1, 2, 3, & 5 PSIG STANDARD DETAIL	APPROVED: FEBRUARY 26, 2020  SILVIA LEE SANTOS ENGINEERING MANAGER	SCALE: 1/2"=1'-0"
DRAWN A.P.	5/15			DWG. NO. STD. GD-18A
CHECKED A.P.	5/15			APPENDIX C
REVIEWED A.P.	2/20	CITY OF PALO ALTO, CALIFORNIA	REVISION: FEBRUARY 26, 2020	

LIST OF MATERIALS

NO.	DESCRIPTION	STOCK NO.	UNIT	QUANTITY
1	2" IPS x 2" IPS ANODELESS SERVICE RISER, PREBENT	43057	EA.	1
2	2" TEE, BLK	41804	EA.	1
3	2" x 3-1/2" NIPPLE, BLK	41453	EA.	2
4	2" H-11179 MUELLER METER VALVE WITH INSULATED OUTLET	43005	EA.	1
5	2" x 7-1/2" PIPE, THREADED ON ONE END	41516	EA.	1
6	3" x 2" 90° REDUCING ELBOW SCH. 40, BUTT-WELD ENDS	41369	EA.	1
7	3" 150 ANSI WELD NECK FLANGE, FLAT FACE; A105 3" IPS 1/16" THICK, FULL FACE GASKET FOR 150 ANSI FLAT FACE FLANGE	43331 43351	EA. EA.	6 6
	STUD BOLT 5/8" x 3-1/2" WITH HEX CAP	43319	EA.	24
	NUTS, 5/8" HEX NCT	43317	EA.	24
8	3" 180 MAOP, JUNIOR SAFECO NATURAL GAS FILTER, 10 MICRON, WITH FLAT FACE FLANGE ANSI 150 CONNECTIONS, GFT-JR-03-180-F	44318	EA.	1
9	3" PIPE, PLAIN END	41518	L.F.	D.I.F.
10	3/4" 3000 PSI FEMALE NPT STEEL COUPLING, BUTT-WELD ENDS	41210	EA.	5
11	3/4" VALVE METER, BLK	43000	EA.	2
12	3/4" PLUG, BLK	41600	EA.	2
13	3/4" x 3" NIPPLE, BLK	41403	EA.	2
14A	3" SENSUS 441-S LOW PRESSURE REGULATOR, WITH 1-3/4" V PORT, 16" DIAPHRAGM, GRAY SPRING FOR 14" W.C., AND BLUE FOR 1 PSIG DELIVERY PRESSURE SETTING, 125 ANSI FLAT FACE FLANGE CONNECTIONS	44332	EA.	2
	3" 441-S BLUE SPRING	44338	EA.	2
14B	3" SENSUS 441-S LOW PRESSURE REGULATOR, WITH 1-3/4" V PORT, 14" DIAPHRAGM, RED SPRING FOR 2 PSIG DELIVERY PRESSURE SETTING; 125 ANSI FLAT FACE FLANGE CONNECTIONS	44334	EA.	2
14C	3" SENSUS 441-57S REGULATOR, WITH 1-1/2" V PORT, YELLOW SPRING FOR 3 AND 5 PSIG DELIVERY PRESSURE SETTING, 125 ANSI FLAT FACE FLANGE CONNECTIONS	44335	EA.	2
	57S GRAY SPRING FOR MONITOR 7 PSIG SET POINT	44360	EA.	1
15	3/4" MALE NPT FOR 3/8" TUBE CONNECTOR SS-600-1-12	41533	EA.	2
16	4" x 4" x 2" TEE SCH. 40, BUTT-WELD ENDS	41814	EA.	2
17	4" x 3" REDUCER SCH. 40, BUTT-WELD ENDS	41377	EA.	1
18	2" CAP	41104	EA.	2
19	2" x 3" NIPPLE, THREADED ON ONE END	41490	EA.	2
20	4" 150 ANSI WELD NECK FLANGE, FLAT FACE; A105 4" IPS 1/16" THICK, FULL FACE GASKET FOR 150 ANSI FLAT FACE FLANGE	43332 43352	EA. EA.	3 2
	STUD BOLT 5/8"-11 x 2-1/2" WITH HEX CAP	43315	EA.	16
	SAE GRADE 5 STEEL ZINC PLATED WITH WASHERS			

BY DRAWN CHECKED REVIEWED	DATE A.P. A.P. A.P.	INDUSTRIAL ROTARY METER SET ASSEMBLY 23,000 SCFH DELIVERY PRESSURE 14" W.C., 1, 2, 3, & 5 PSIG STANDARD DETAIL	APPROVED: FEBRUARY 26, 2020 <i>Silvia Santos</i> SILVIA LEE SANTOS ENGINEERING MANAGER	SCALE: NONE
			50674 R.E. NO.	DWG. NO. STD. GD-18B
		CITY OF PALO ALTO, CALIFORNIA	REVISION: FEBRUARY 26, 2020	APPENDIX C

LIST OF MATERIALS

NO.	DESCRIPTION	STOCK NO.	UNIT	QUANTITY
21	4" FF FLANGE 175 MAOP 23000 SCFH ROTARY GAS WITH A DIGITAL NON-COMPENSATED INDEX AND INTERNAL PULSER	44152	EA.	1
22	3/4" MALE x 1/2" FEMALE THERMOWELL 4" LONG, THREADED TYPE, 304 STAINLESS STEEL	41550	EA.	1
23	2" H-11175 MUELLER METER VALVE, NON-INSULATED	43004	EA.	1
24	2" PLUG, BLK	41604	EA.	1
25	1/4" FEMALE NPT-18 PLUG VALVE SS-4P4T4	41535	EA.	2
26	1/4" MALE NPT-18 FOR 3/8" TUBE CONNECTOR	41537	EA.	4
27	SS-600-1-4 1/2" MALE NPT-14 FOR 3/8" TUBE CONNECTOR	41539	EA.	2
	SS-600-1-8			
28	3/8" x 0.035" TUBE 316 STAINLESS STEEL; A-269	41530	L.F.	D.I.F.
29	1/2" PLUG, BLK	41603	EA.	1
30	4" PIPE, A53/A106 GRAD B, TYPE S, SCH. 40	N/A	L.F.	D.I.F.
31	4" ANSI 150 FLANGE ISOLATION KIT	44381	EA.	1

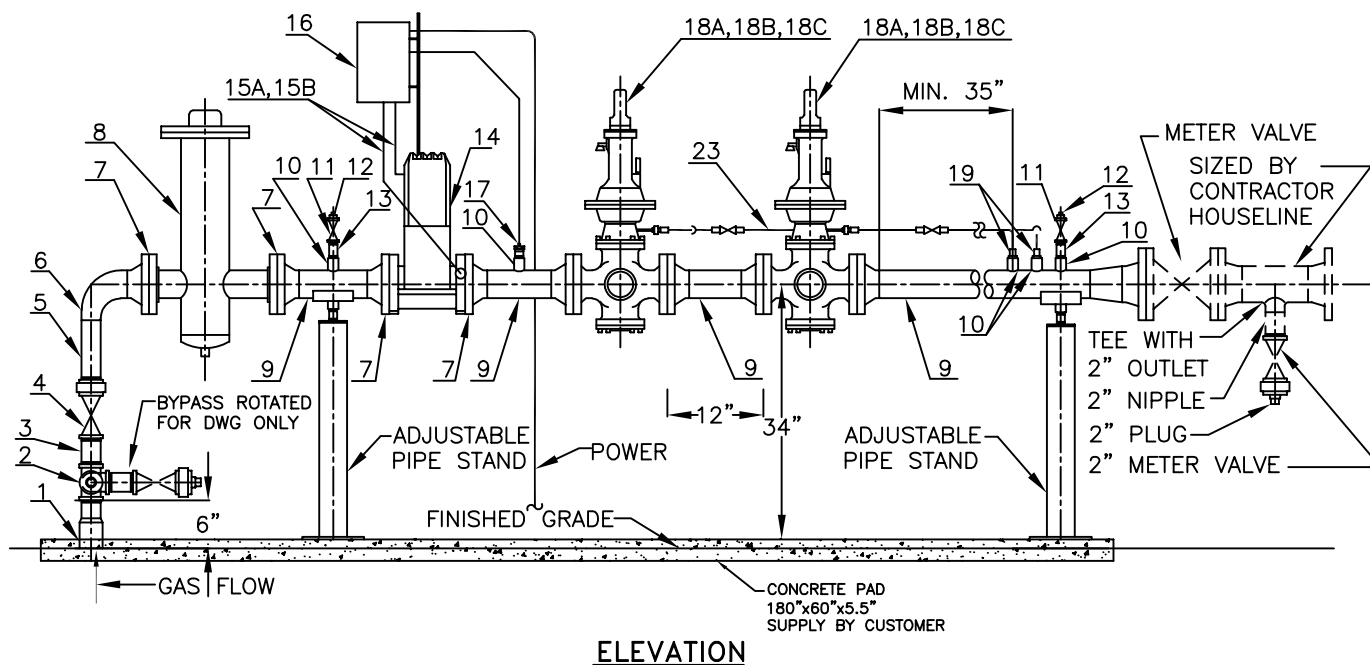
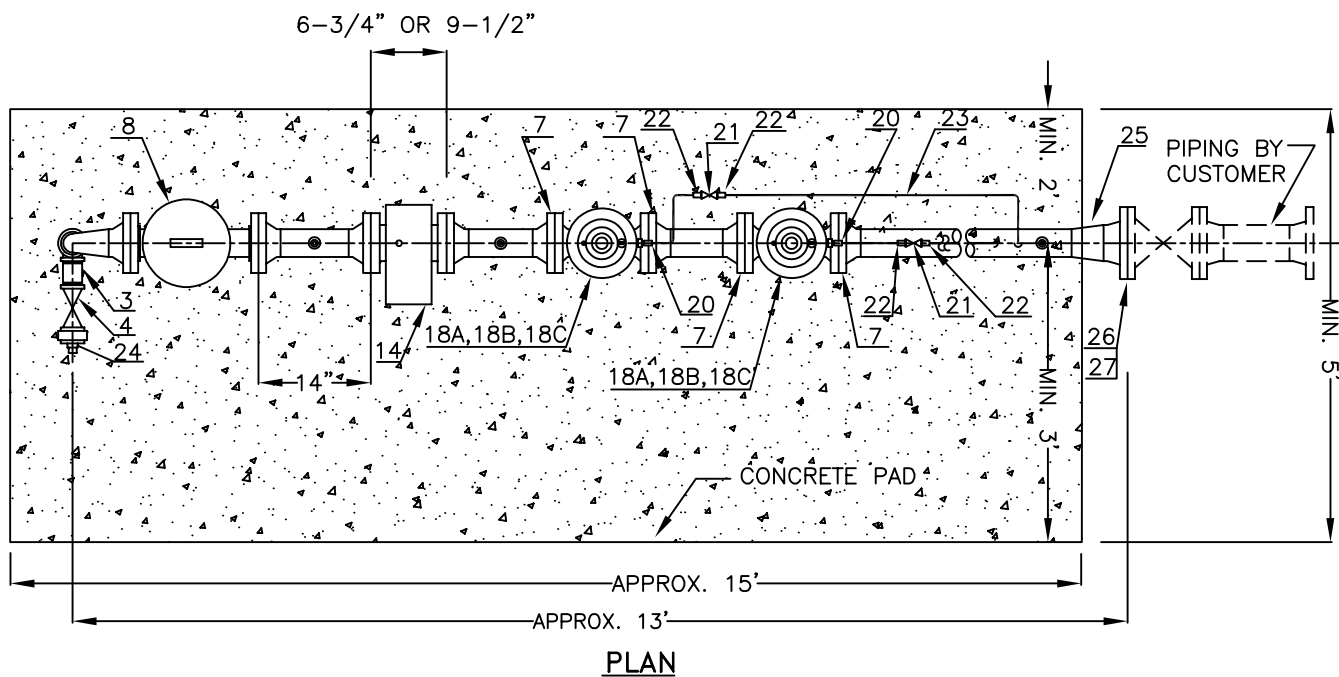
ESTIMATED PRESSURE LOSS IN DOWNSTREAM OF REGULATOR CITY PIPING

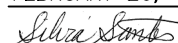
FLOW SCFH	SET PRESSURE	PRESSURE AT CUSTOMER PIPING	SET PRESSURE TO COMPENSATE FOR CITY PIPING HEADLOSS
23000	14" W.C.	10.754" W.C.	17.244" W.C.
	1 PSIG	0.883 PSIG	1.117 PSIG
	2 PSIG	1.885 PSIG	2.115 PSIG
	3 PSIG	2.887 PSIG	3.113 PSIG
	5 PSIG	4.889 PSIG	5.111 PSIG

NOTES:

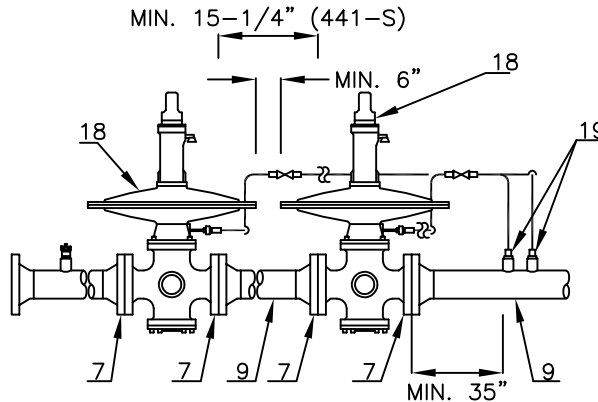
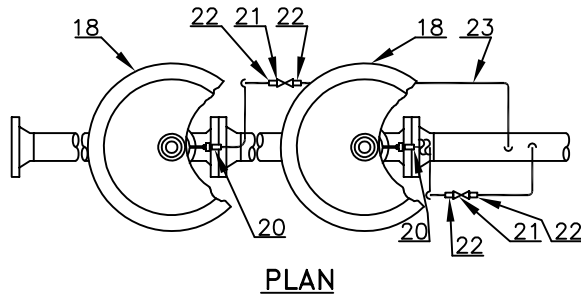
- FOR PLACEMENT REQUIREMENTS REFER TO STD. GD-01B AND STD. GD-02B.
- UPON COMPLETION OF METER ASSEMBLY, LEAK TEST ALL CONNECTIONS.
- DRAWING DEPICTS 441-S REGULATOR; 441-57S WILL HAVE THE SAME CONNECTION DIMENSIONS, BUT SMALLER DIAPHRAGM.
- MIN. 10 OUTSIDE PIPE DIAMETERS BETWEEN THE REGULATOR'S FLANGE AND SENSING LINE COUPLING.
- IT IS ASSUMED THAT SYSTEM INLET PRESSURE IS MIN. 12 PSIG FOR DELIVERY PRESSURE OF 14" W.C. TO 5 PSIG.
- PER MANUFACTURER RECOMMENDATION THE SET POINT OF THE MONITOR REGULATOR 441-S SHALL BE 1 PSIG HIGHER THAN THE DELIVERY PRESSURE (OF 1 OR 2 PSIG). IF THE DELIVERY PRESSURE IS 1 PSIG, THE MONITOR SHALL BE A REGULATOR WITH 14" DIAPHRAGM (44334) AND RED SPRING; FOR 441-57S SET MONITOR 2 PSIG HIGHER THAN THE DELIVERY PRESSURE.
- FOR BYPASS USE THE FOLLOWING REGULATORS: 2" SENSUS 461-12S STOCK 44342 (DELIVERY PRESSURE 14" W.C. TO 2 PSIG W/ APPROPRIATE SPRING) AND 2" SENSUS 461-57S STOCK 44343 (DELIVERY PRESSURE 3 AND 5 PSIG W/ APPROPRIATE SPRING).
- BYPASS SHALL BE USED ONLY IN PRESENCE OF THE CITY QUALIFIED PERSONNEL WHILE PERFORMING METER SET SERVICE.
- 23M ROTARY METER (44152) STOCKED WITH INTERNAL PULSER AND CAN BE USED WITH VOLUME CORRECTOR (44440); VOLUME CORRECTOR INSTALLATION DESIGN AND PARTS, SHOWN ON 23,000-45,000 METER SET ASSEMBLY, SHALL BE USED.
- THE ESTIMATED PRESSURE LOSS, SHOWN IN THE TABLE, INCLUDES DIFFERENTIAL LOSS ACROSS THE METER AT 100% FLOW.
- THE ESTIMATED PRESSURE LOSS THROUGH RISER, METER VALVE, FITTINGS, AND FILTER IS APPROXIMATELY 0.5 PSIG.

BY	DATE	INDUSTRIAL ROTARY METER SET ASSEMBLY 23,000 SCFH DELIVERY PRESSURE 14" W.C., 1, 2, 3, & 5 PSIG STANDARD DETAIL	APPROVED: FEBRUARY 26, 2020	SCALE: NONE
DRAWN A.P.	5/15		<i>Silvia Santos</i> 50674	DWG. NO.
CHECKED A.P.	5/15		SILVIA LEE SANTOS ENGINEERING MANAGER R.E. NO.	STD. GD-18C
REVIEWED A.P.	2/20	CITY OF PALO ALTO, CALIFORNIA	REVISION: FEBRUARY 26, 2020	APPENDIX C



BY		DATE	INDUSTRIAL ULTRASONIC METER SET ASSEMBLY 16,000–25,000 SCFH DELIVERY PRESSURE 14" W.C., 1, 3, 5, 7 & 10 PSIG STANDARD DETAIL	APPROVED: FEBRUARY 26, 2020		SCALE: 1/2"=1'-0"
DRAWN	A.P.	7/16		 50674		DWG. NO.
CHECKED	A.P.	7/16		SILVIA LEE SANTOS ENGINEERING MANAGER		STD. GD-19A
REVIEWED	A.P.	2/20		CITY OF PALO ALTO, CALIFORNIA	REVISION: FEBRUARY 26, 2020	APPENDIX C

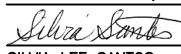
LOW PRESSURE REGULATORS



ELEVATION

NOTES

1. FOR PLACEMENT REQUIREMENTS REFER TO STD. GD-01B AND STD. GD-02B.
2. UPON COMPLETION OF METER ASSEMBLY, LEAK TEST ALL CONNECTIONS.
3. MIN. 10 OUTSIDE PIPE DIAMETERS BETWEEN THE REGULATOR'S FLANGE AND SENSING LINE COUPLING.
4. IT IS ASSUMED THAT THE SYSTEM INLET PRESSURE IS MIN. 15 PSIG FOR DELIVERY FROM 14" W.C TO 5 PSIG AND MIN. 15 PSIG AT THE REGULATOR INLET FOR DELIVERY OF 7 AND 10 PSIG.
5. ITEM 14 STORE #44434 ULTRASONIC METER IS NOT STOCKED AND REQUIRES A SPECIAL ORDER. THE METER MAY BE SUPPLIED WITH 6.75" OR 9.5" FLANGE TO FLANGE DIMENSIONS (9.5" MODEL IS SHOWN ON THE DRAWING).
6. MAX METERING CAPACITY OF A 3" ULTRASONIC METER IS 27,940 SCFH AT 15 PSIG.
7. PER MANUFACTURER RECOMMENDATION THE SET POINT OF THE MONITOR REGULATOR 441-S SHALL BE 1 PSIG HIGHER THAN THE DELIVERY PRESSURE (OF 1 OR 2 PSIG). IF THE DELIVERY PRESSURE IS 1 PSIG, THE MONITOR SHALL BE A REGULATOR WITH 14" DIAPHRAGM (44334) AND RED SPRING; FOR 441-57S SET MONITOR 2 PSIG HIGHER THAN THE DELIVERY PRESSURE.
8. FOR BYPASS USE THE FOLLOWING REGULATORS: 2" SENSUS 461-12S STOCK 44342 (DELIVERY PRESSURE 14" W.C. - 2 PSIG WITH APPROPRIATE SPRING) AND 2" SENSUS 461-57S STOCK 44343 (DELIVERY PRESSURE 3 AND 5 PSIG WITH APPROPRIATE SPRING), AND 2" SENSUS 441-57S STOCK 44345 (DELIVERY PRESSURE OF 7 AND 10 PSIG WITH APPROPRIATE SPRING).
9. IF PERMANENT BY-PASS IS NEEDED, THE DESIGN IS SHOWN ON 23,000-45,000 SCFH METER SET.
10. BYPASS SHALL BE USED ONLY IN PRESENCE OF THE CITY QUALIFIED PERSONNEL WHILE PERFORMING METER SET SERVICE.
11. IN ORDER TO ACCOMMODATE THE VOLUME CORRECTOR THE CUSTOMER SHALL PROVIDE POWER (7-30 VDC) AND REGULAR TELEPHONE LINE.
12. THE ESTIMATED PRESSURE LOSS THROUGH RISER, METER VALVE, FITTINGS, FILTER, AND METER IS APPROXIMATELY 0.85 PSIG.

BY		DATE	INDUSTRIAL ULTRASONIC METER SET ASSEMBLY 16,000-25,000 SCFH DELIVERY PRESSURE 14" W.C., 1, 3, 5, 7 & 10 PSIG STANDARD DETAIL	APPROVED: FEBRUARY 26, 2020  SILVIA LEE SANTOS ENGINEERING MANAGER	SCALE: 1/2"=1'-0"
DRAWN	A.P.	7/16			
CHECKED	A.P.	7/16		50674 R.E. NO.	DWG. NO. STD. GD-19B
REVIEWED	A.P.	2/20		REVISION: FEBRUARY 26, 2020	APPENDIX C

CITY OF PALO ALTO, CALIFORNIA

LIST OF MATERIALS

NO.	DESCRIPTION	STOCK NO.	UNIT	QUANTITY
1	2" IPS x 2" IPS ANODELESS SERVICE RISER, PREBENT	43057	EA.	1
2	2" TEE, BLK	41804	EA.	1
3	2" x 3-1/2" NIPPLE, BLK	41453	EA.	2
4	2" H-11179 MUELLER METER VALVE WITH INSULATED OUTLET	43005	EA.	2
5	2" x 7-1/2" PIPE, THREADED ON ONE END	41516	EA.	1
6	3" x 2" 90° REDUCING ELBOW SCH. 40, BUTT-WELD ENDS	41369	EA.	1
7	3" 150 ANSI WELD NECK FLANGE, FLAT FACE; A105	43331	EA.	8
	3" IPS 1/16" THICK, FULL FACE GASKET FOR 150 ANSI FLAT FACE FLANGE	43351	EA.	7
	STUD BOLT 5/8" x 3-1/2" WITH HEX CAP	43319	EA.	20
	NUTS, 5/8" HEX NCT	43317	EA.	20
	STUD BOLT 5/8"-11 x 3-1/2" FLOUROKOTE #1 COATED (ULTRASONIC METER)	44437	EA.	8
8	3" 180 MAOP, JUNIOR SAFECO NATURAL GAS FILTER, 10 MICRON, WITH FLAT FACE FLANGE ANSI 150 CONNECTIONS, GFT-JR-03-180-F	44318	EA.	1
9	3" PIPE, PLAIN END	41518	L.F.	D.I.F.
10	3/4" 3000 PSI FEMALE NPT STEEL COUPLING, BUTT-WELD ENDS	41210	EA.	5
11	3/4" VALVE METER, BLK	43000	EA.	2
12	3/4" PLUG, BLK	41600	EA.	2
13	3/4" x 3" NIPPLE, BLK	41403	EA.	2
14	3" 14M285 FLOWSIC500 ULTRASONIC GAS METER; OUTPUTS 1 A-CODED RS-485, 1 B-CODED PULSE & 1 INPUT POWER WITH 6.75" OR 9.5" FLANGE TO FLANGE DIMENSION; FLAT FACE FLANGE CONNECTIONS	44434	EA.	1
15A	FLOWSIC A-CODED CABLE GME-FS500-PC-16FT-A	44436	EA.	1
15B	FLOWSIC B-CODED CABLE GME-FS500-PC-16FT-B	44437	EA.	1
16	GME-ER-XARTU/1-VC-CPA STANDARD VOLUME CORRECTOR WITH POLE MOUNT KIT	44440	EA.	1
	PIPING KIT GME-PIPING KIT-IMAC	44438	EA.	1
17	3/4" X 2-1/2" 306 THERMOWELL GME-ER-TW-9020084-3/4-2.5	44441	EA.	1
18A	3" SENSUS 441-57S REGULATOR, WITH 1-1/2" V PORT, YELLOW SPRING FOR 3 AND 5 PSIG, GRAY SPRING FOR 7 PSIG, AND BLUE SPRING FOR 10 PSIG OUTLET PRESSURE SETTING; 125 ANSI FLAT FACE FLANGE CONNECTIONS	44335	EA.	2
	57S BLUE SPRING	44337	EA.	2
	57S GRAY SPRING	44360	EA.	2
18B	3" SENSUS 441-S LOW PRESSURE REGULATOR, WITH 1-3/4" V PORT, 16" DIAPHRAGM, GRAY SPRING FOR 14" W.C., AND BLUE FOR 1 PSIG DELIVERY PRESSURE SETTING, 125 ANSI FLAT FACE FLANGE CONNECTIONS	44332	EA.	2
	3" 441-S BLUE SPRING	44338	EA.	2

BY	DATE	INDUSTRIAL ULTRASONIC METER SET ASSEMBLY 16,000-25,000 SCFH DELIVERY PRESSURE 14" W.C., 1, 3, 5, 7 & 10 PSIG STANDARD DETAIL	APPROVED: FEBRUARY 26, 2020	SCALE: NONE
DRAWN A.P.	7/16		<i>Silvia Santos</i> 50674	DWG. NO.
CHECKED A.P.	7/16		SILVIA LEE SANTOS ENGINEERING MANAGER R.E. NO.	STD. GD-19C
REVIEWED A.P.	12/18		REVISION: FEBRUARY 26, 2020	APPENDIX C

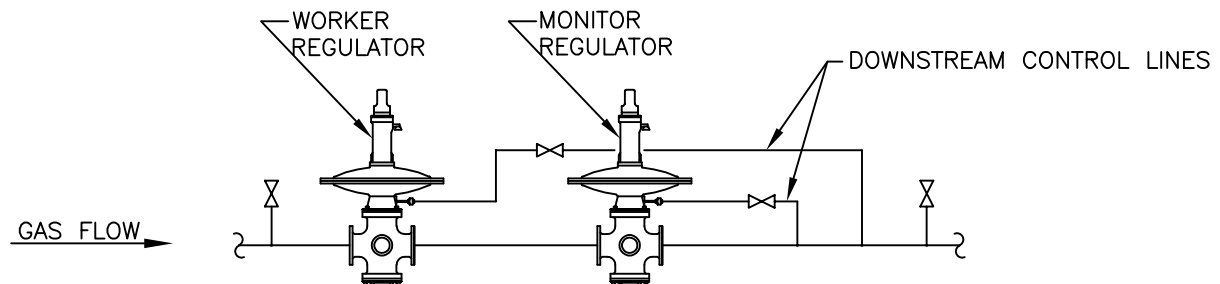
CITY OF PALO ALTO, CALIFORNIA

LIST OF MATERIALS

NO.	DESCRIPTION	STOCK NO.	UNIT	QUANTITY
18C	3" SENSUS 441-S LOW PRESSURE REGULATOR, WITH 1-3/4" V PORT, 14" DIAPHRAGM, RED SPRING FOR 2 PSIG DELIVERY PRESSURE SETTING; 125 ANSI FLAT FACE FLANGE CONNECTIONS	44334	EA.	2
19	3/4" MALE NPT FOR 3/8" TUBE CONNECTOR SS-600-1-12	41533	EA.	2
20	1/2" MALE NPT-14 FOR 3/8" TUBE CONNECTOR SS-600-1-8	41539	EA.	2
21	1/4" FEMALE NPT-18 PLUG VALVE SS-4P4T4	41535	EA.	2
22	1/4" MALE NPT-18 FOR 3/8" TUBE CONNECTOR SS-600-1-4	41537	EA.	4
23	3/8" x 0.035" TUBE 316 STAINLESS STEEL ASTM A-269	41530	L.F.	D.I.F.
24	2" PLUG, BLK	41604	EA.	1
25	4" x 3" REDUCER SCH. 40, BUTT-WELD ENDS	41377	EA.	1
26	4" 150 ANSI WELD NECK FLANGE, FLAT FACE A105	43332	EA.	1
27	4" ANSI 150 FLANGE ISOLATION KIT	44381	EA.	1

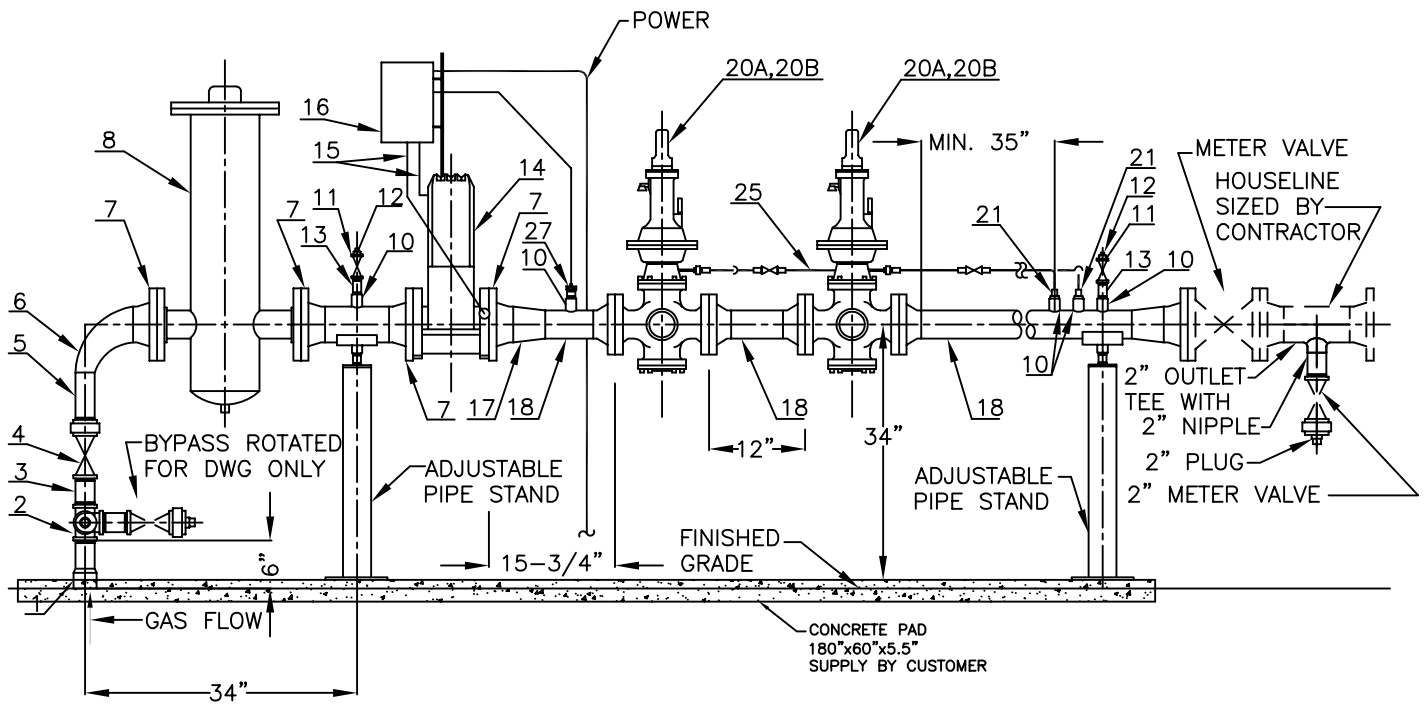
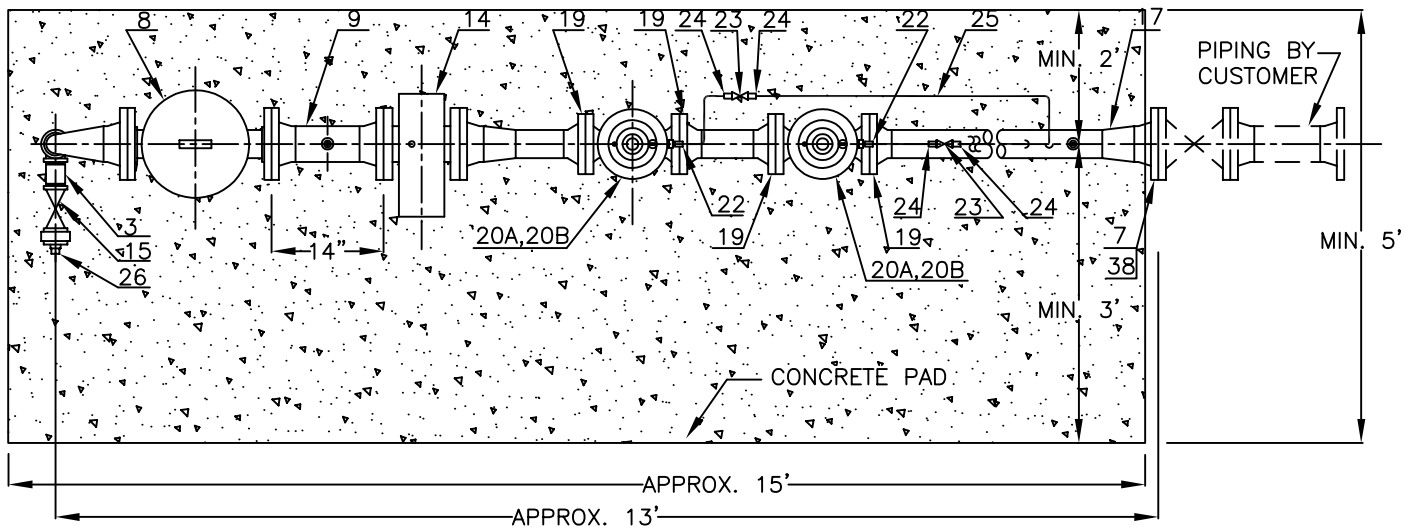
ESTIMATED PRESSURE LOSS IN DOWNSTREAM OF REGULATOR CITY PIPING

FLOW SCFH	SET PRESSURE	PRESSURE AT CUSTOMER PIPING	SET PRESSURE TO COMPENSATE FOR CITY PIPING HEADLOSS
16000	14" W.C.	13.388 W.C.	14.611 W.C.
	1 PSIG	0.979 PSIG	1.021 PSIG
	2 PSIG	1.980 PSIG	2.020 PSIG
	3 PSIG	2.978 PSIG	3.022 PSIG
	5 PSIG	4.980 PSIG	5.020 PSIG
	7 PSIG	6.982 PSIG	7.018 PSIG
	10 PSIG	9.984 PSIG	10.016 PSIG
25000	14" W.C.	12.598 W.C.	15.397 W.C.
	1 PSIG	0.951 PSIG	1.049 PSIG
	2 PSIG	1.954 PSIG	2.046 PSIG
	3 PSIG	2.950 PSIG	3.050 PSIG
	5 PSIG	4.955 PSIG	5.045 PSIG
	7 PSIG	6.959 PSIG	7.040 PSIG
	10 PSIG	9.964 PSIG	10.036 PSIG

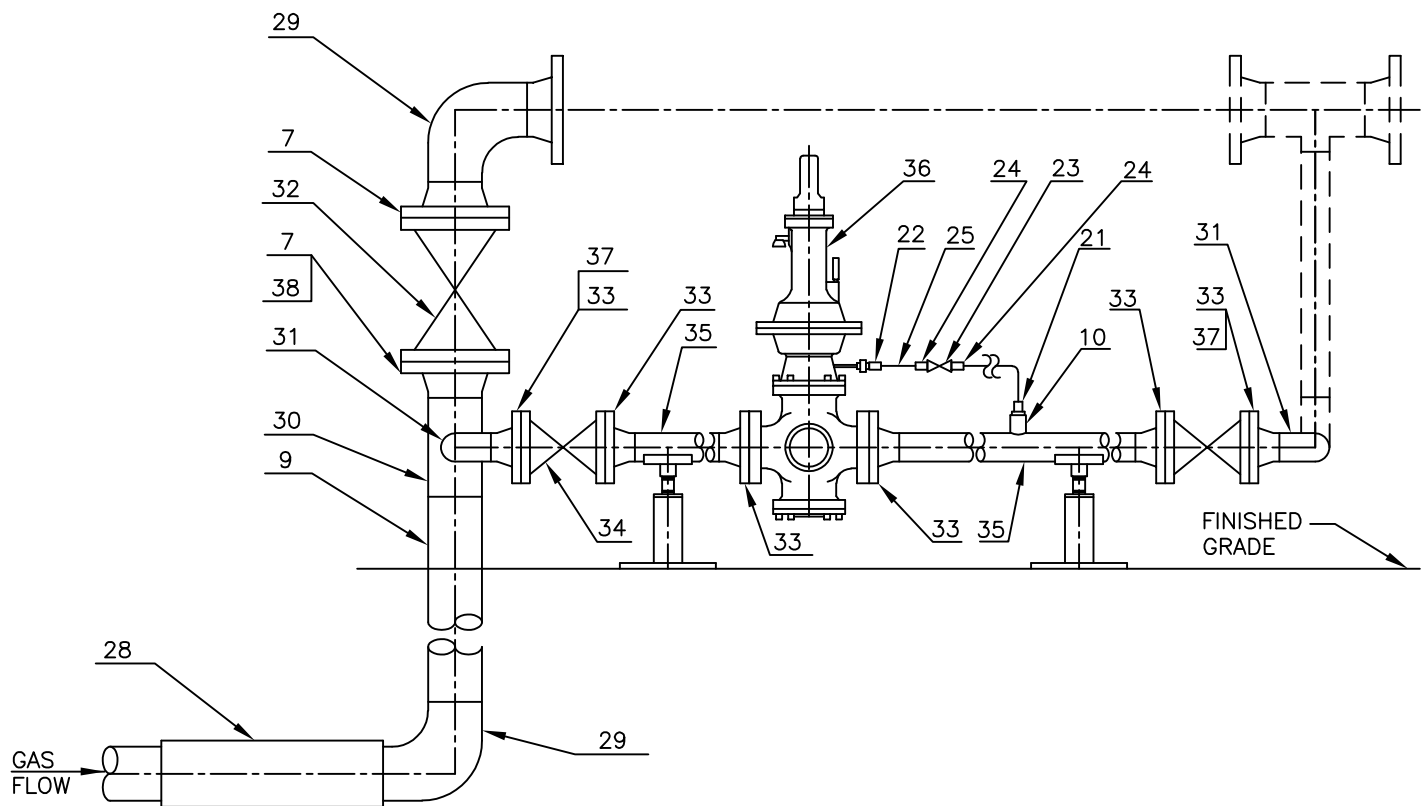


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NOT TO SCALE

BY	DATE	INDUSTRIAL ULTRASONIC METER SET ASSEMBLY 16,000-25,000 SCFH DELIVERY PRESSURE 14" W.C., 1, 3, 5, 7 & 10 PSIG STANDARD DETAIL	APPROVED: FEBRUARY 26, 2020	SCALE: NONE
DRAWN A.P.	7/16		<i>Silvia Santos</i> 50674	DWG. NO.
CHECKED A.P.	7/16		SILVIA LEE SANTOS ENGINEERING MANAGER	STD. GD-19D
REVIEWED A.P.	2/20		REVISION: FEBRUARY 26, 2020	APPENDIX C



BY	DATE	INDUSTRIAL ULTRASONIC METER SET ASSEMBLY 23,000-45,000 SCFH DELIVERY PRESSURE 3, 5, 7 & 10 PSIG STANDARD DETAIL	APPROVED: FEBRUARY 26, 2020 <i>Silvia Lee Santos</i> SILVIA LEE SANTOS ENGINEERING MANAGER	SCALE: 1/2"=1'-0"
DRAWN A.P.	1/16			DWG. NO. STD. GD-20A
CHECKED A.P.	1/16		REVISION: FEBRUARY 26, 2020	APPENDIX C
REVIEWED A.P.	2/20	CITY OF PALO ALTO, CALIFORNIA		



PERMANENT BY-PASS DESIGN 4" RISER PIPE

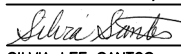
NOTES:

1. FOR PLACEMENT REQUIREMENTS REFER TO STD. GD-01B AND STD. GD-02B.
2. UPON COMPLETION OF METER ASSEMBLY, LEAK TEST ALL CONNECTIONS.
3. MIN. 10 OUTSIDE PIPE DIAMETERS BETWEEN THE REGULATOR'S FLANGE AND SENSING LINE COUPLING.
4. IT IS ASSUMED THAT THE SYSTEM INLET PRESSURE IS MIN. 15 PSIG FOR DELIVERY OF 3 AND 5 PSIG AND MIN. 15 PSIG AT THE REGULATOR INLET FOR DELIVERY OF 7 AND 10 PSIG.
5. ITEM 20 REGULATOR – SELECTION OF A REGULATOR/VALVE SIZE/SPRING SHALL BE BASED ON ACTUAL APPLICATION PRESSURE SETTING. SELECTION OF ITEM 20 (A) WOULD REQUIRE A SPECIAL ORDER.
6. PER MANUFACTURER RECOMMENDATION THE SET POINT OF THE MONITOR REGULATOR SHALL BE 2 PSIG HIGHER THAN THE DELIVERY PRESSURE; APPROPRIATE SPRING SHALL BE SELECTED FOR THE MONITOR.
7. FOR CONNECTION TO THE EXISTING 6" SERVICE USE 4" RISER PIPE; FOR 2" OR 4" SERVICE USE 2" RISER.
8. IF PERMANENT BY-PASS IS NEEDED FOR 2" RISER, DESIGN IS SIMILAR TO SHOWN FOR 4" RISER PIPE, BUT METER VALVES WITH INSULATED THREADED CONNECTIONS CAN BE USED.
9. BYPASS REGULATOR IS THE SAME SIZE (2") FOR ALL RISER PIPES, BUT APPROPRIATE SPRING SHALL BE USED. BYPASS REGULATOR IS SHIPPED WITH YELLOW SPRING; GRAY & BLUE SPRINGS FOR 7 & 10 PSIG DELIVERY ARE STOCK ITEMS.
10. BYPASS SHALL BE USED ONLY IN PRESENCE OF THE CITY QUALIFIED PERSONNEL WHILE PERFORMING METER SET SERVICE.
11. PIPE DOWNSTREAM OF REGULATOR MAY BE SIZED 4" TO MATCH THE HOUSELINE; IN THIS CASE THE MIN. STRAIGHT LENGTH SHALL BE 45".
12. IN ORDER TO ACCOMMODATE THE VOLUME CORRECTOR THE CUSTOMER SHALL PROVIDE POWER (7-30 VDC) AND REGULAR TELEPHONE LINE.
13. MAX. METERING CAPACITY OF A 4" ULTRASONIC METER IS 45,910 SCFH AT 15 PSIG.
14. THE ESTIMATED PRESSURE LOSS THROUGH RISER (2"), METER VALVE, FITTINGS, FILTER, AND METER IS APPROXIMATELY 1 PSIG.

BY		DATE	INDUSTRIAL ULTRASONIC METER SET ASSEMBLY 23,000-45,000 SCFH DELIVERY PRESSURE 3, 5, 7 & 10 PSIG STANDARD DETAIL	APPROVED: FEBRUARY 26, 2020	SCALE: 3/4"=1'-0"
DRAWN	A.P.	1/16		 50674	DWG. NO.
CHECKED	A.P.	1/16		SILVIA LEE SANTOS ENGINEERING MANAGER	R.E. NO.
REVIEWED	A.P.	2/20		CITY OF PALO ALTO, CALIFORNIA	REVISION: FEBRUARY 26, 2020

LIST OF MATERIAL (2" RISER)

NO.	DESCRIPTION	STOCK NO.	UNIT	QUANTITY
1	2" IPS x 2" IPS ANODELESS SERVICE RISER, PREBENT	43057	EA.	1
2	2" x 2" x 2" TEE, BLK	41804	EA.	1
3	2" x 3-1/2" NIPPLE, BLK	41453	EA.	2
4	2" H-11179 MUELLER METER VALVE WITH INSULATED OUTLET	43005	EA.	2
5	2" x 7" PIPE, THREADED ON ONE END	41516	EA.	1
6	4" x 2" 90° REDUCING ELBOW SCH. 40, BUTT-WELD ENDS		EA.	1
7	4" 150 ANSI WELD NECK FLANGE, FLAT FACE A105	43332	EA.	5
	4" IPS 1/16" THICK, FULL FACE GASKET FOR 150 ANSI FLAT FACE FLANGE	43352	EA.	4
	STUD BOLT 5/8" x 3-1/2" WITH HEX CAP	43319	EA.	16
	NUTS, 5/8" HEX NCT	43317	EA.	16
	STUD BOLT 5/8"-11 x 3-1/2" FLOUROKOTE #1 COATED (ULTRASONIC METER)	44437	EA.	16
8	4" GFT-04-150-FF SAFECO NATURAL GAS FILTER 5 MICRON, WITH FLAT FACE FLANGE ANSI 150 CONNECTIONS	44451	EA.	1
9	4" PIPE, A106, GRADE B, TYPE S, SCH. 40	41519	L.F.	D.I.F.
10	3/4" 3000 PSI FEMALE NPT STEEL COUPLING, BUTT-WELD ENDS	41210	EA.	5
11	3/4" VALVE METER, BLK	43000	EA.	2
12	3/4" PLUG, BLK	41600	EA.	2
13	3/4" x 3" NIPPLE, BLK	41403	EA.	2
14	4" 23M285 FLOWSIC500 ULTRASONIC GAS METER; OUTPUTS 1 A-CODED RS-485, 1 B-CODED PULSE AND 1 INPUT POWER WITH 9.5" FLANGE TO FLANGE DIMENSION; FLAT FACE FLANGE CONNECTIONS	44435	EA.	1
15	2" H-11175 MUELLER METER VALVE, NON-INSULATED	43004	EA.	1
A	FLOWSIC A-CODED CABLE GME-FS500-PC-16FT-A	44436	EA.	1
B	FLOWSIC B-CODED CABLE GME-FS500-PC-16FT-B	44437	EA.	1
16	GME-ER-XARTU/1-VC-CPA STANDARD VOLUME CORRECTOR WITH POLE MOUNT KIT PIPING KIT GME-PIPING KIT-IMAC	44440	EA.	1
		44438	EA.	1
17	4" x 3" REDUCER SCH. 40, BUTT-WELD ENDS	41377	EA.	1
18	3" PIPE, PLAIN END	41518	L.F.	D.I.F.
19	3" 150 ANSI WELD NECK FLANGE, FLAT FACE A105	43331	EA.	4
	3" IPS 1/16" THICK, FULL FACE GASKET FOR 150 ANSI FLAT FACE FLANGE	43351	EA.	4
	STUD BOLT 5/8" x 3-1/2" WITH HEX CAP	43319	EA.	32
	NUTS, 5/8" HEX NCT	43317	EA.	32
20A	3" SENSUS 441-57S REGULATOR, WITH 1-3/4" V PORT, YELLOW SPRING FOR 3 AND 5 PSIG, GRAY SPRING FOR 7 PSIG, AND BLUE SPRING FOR 10 PSIG OUTLET PRESSURE SETTING; 125 ANSI FLAT FACE FLANGE CONNECTIONS FOR DELIVERY UP TO 45,000 SCFH	N/A	EA.	2

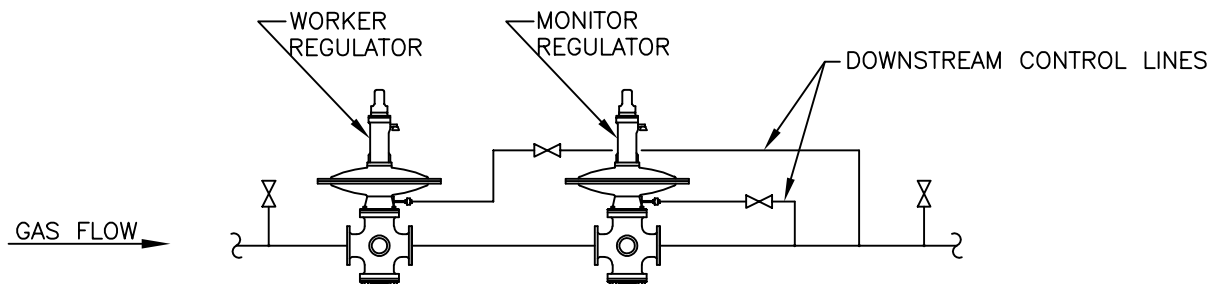
BY DRAWN A.P. CHECKED A.P. REVIEWED A.P.	DATE	INDUSTRIAL ULTRASONIC METER SET ASSEMBLY 23,000-45,000 SCFH DELIVERY PRESSURE 3, 5, 7 & 10 PSIG STANDARD DETAIL CITY OF PALO ALTO, CALIFORNIA	APPROVED: FEBRUARY 26, 2020  SILVIA LEE SANTOS ENGINEERING MANAGER	SCALE: NONE
	1/16		50674 R.E. NO.	DWG. NO. STD. GD-20C
	2/20		REVISION: FEBRUARY 26, 2020	APPENDIX C

LIST OF MATERIAL (2" RISER)

NO.	DESCRIPTION	STOCK NO.	UNIT	QUANTITY
20				
B	3" SENSUS 441-57S REGULATOR, WITH 1-1/2" V PORT, YELLOW SPRING FOR 3 AND 5 PSIG, GRAY SPRING FOR 7 PSIG, AND BLUE SPRING FOR 10 PSIG OUTLET PRESSURE SETTING; 125 ANSI FLAT FACE FLANGE CONNECTIONS FOR DELIVERY UP TO 30,000 SCFH	44335	EA.	2
	57S BLUE SPRING	44337	EA.	2
	57S GRAY SPRING	44360	EA.	2
21	3/4" MALE NPT FOR 3/8" TUBE CONNECTOR SS-600-1-12	41533	EA.	2
22	1/2" MALE NPT-14 FOR 3/8" TUBE CONNECTOR SS-600-1-8	41539	EA.	2
23	1/4" FEMALE NPT-18 PLUG VALVE SS-4P4T4	41535	EA.	2
24	1/4" MALE NPT-18 FOR 3/8" TUBE CONNECTOR SS-600-1-4	41537	EA.	4
25	3/8" x 0.035" TUBE 316 STAINLESS STEEL ASTM A-269	41530	L.F.	D.I.F.
26	2" PLUG, BLK	41604	EA.	1
27	3/4" X 2-1/2" 306 THERMOWELL GME-ER-TW-9020084-3/4-2.5	44441	EA.	1

ESTIMATED PRESSURE LOSS IN DOWNSTREAM OF REGULATOR CITY PIPING

FLOW SCFH	SET PRESSURE	PRESSURE AT CUSTOMER PIPING	SET PRESSURE TO COMPENSATE FOR CITY PIPING HEADLOSS
25000	3 PSIG	2.947 PSIG	3.053 PSIG
	5 PSIG	4.952 PSIG	5.047 PSIG
	10 PSIG	9.962 PSIG	10.038 PSIG
35000	3 PSIG	2.903 PSIG	3.096 PSIG
	5 PSIG	4.913 PSIG	5.087 PSIG
	10 PSIG	9.931 PSIG	10.069 PSIG
45000	3 PSIG	2.847 PSIG	3.151 PSIG
	5 PSIG	4.863 PSIG	5.136 PSIG
	10 PSIG	9.891 PSIG	10.109 PSIG

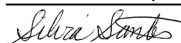


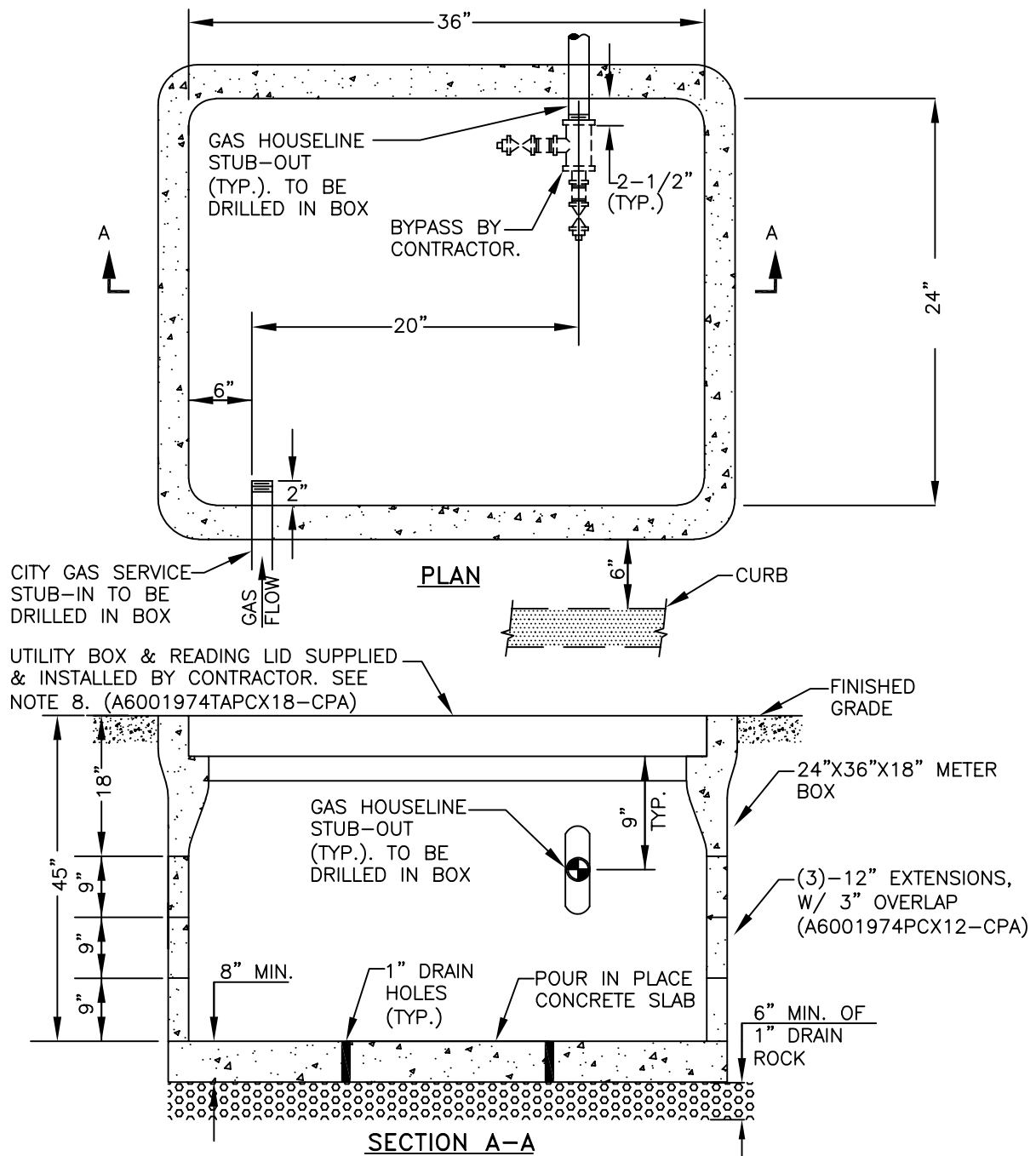
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BY	DATE	INDUSTRIAL ULTRASONIC METER SET ASSEMBLY 23,000-45,000 SCFH DELIVERY PRESSURE 3, 5, 7 & 10 PSIG STANDARD DETAIL	APPROVED: FEBRUARY 26, 2020 <i>Silvia Santos</i> SILVIA LEE SANTOS ENGINEERING MANAGER	SCALE: NONE
DRAWN	A.P.	1/16	50674 R.E. NO.	DWG. NO.
CHECKED	A.P.	1/16		STD. GD-20D
REVIEWED	A.P.	2/20	REVISION: FEBRUARY 26, 2020	APPENDIX C
		CITY OF PALO ALTO, CALIFORNIA		

LIST OF MATERIAL
4" RISER PIPE WITH PERMANENT BY-PASS ADDITIONAL FITTINGS

NO.	DESCRIPTION	STOCK NO.	UNIT	QUANTITY
7	4" 150 ANSI WELD NECK FLANGE, FLAT FACE A105	43332	EA.	2
	4" IPS 1/16" THICK, FULL FACE GASKET FOR 150 ANSI FLAT FACE FLANGE	43352	EA.	1
	STUD BOLT 5/8" x 3-1/2" WITH HEX CAP	43319	EA.	16
	NUTS, 5/8" HEX NCT	43317	EA.	16
9	4" PIPE, A106, GRADE B, TYPE S, SCH. 40	41519	L.F.	D.I.F.
10	3/4" 3000 PSI FEMALE NPT STEEL COUPLING, BUTT-WELD ENDS	41210	EA.	1
21	3/4" MALE NPT FOR 3/8" TUBE CONNECTOR SS-600-1-12	41533	EA.	2
22	1/2" MALE NPT-14 FOR 3/8" TUBE CONNECTOR SS-600-1-8	41539	EA.	1
23	1/4" FEMALE NPT-18 PLUG VALVE SS-4P4T4	41535	EA.	1
24	1/4" MALE NPT-18 FOR 3/8" TUBE CONNECTOR SS-600-1-4	41537	EA.	2
25	3/8" x 0.035" TUBE 316 STAINLESS STEEL ASTM A-269	41530	L.F.	D.I.F.
28	4" TRANSITION FITTING, IPS, WE	45584	L.F.	1
29	4" 90 DEG, ELBOW, WE, BLK	41368	L.F.	2
30	4" x 4" x 2" TEE, WE, BLK	41814	L.F.	1
31	2" 90 DEG, ELBOW, WE, BLK	41366	L.F.	2
32	4" ANSI 150, FULL PORT, BALL VALVE, FLAT FACE	43371	L.F.	1
33	2" 150 ANSI WELD NECK FLANGE, FLAT FACE A105	43330	EA.	6
	2" IPS 1/16" THICK, FULL FACE GASKET FOR 150 ANSI FLAT FACE FLANGE	43350	EA.	5
	STUD BOLT 5/8" x 3-1/2" WITH HEX CAP	43319	EA.	24
	NUTS, 5/8" HEX NCT			
34	2" ANSI 150, FULL PORT, BALL VALVE, FLAT FACE	43370	L.F.	2
35	2" PIPE, PLAIN END	41516	L.F.	D.I.F.
36	2" SENSUS 441-57S REGULATOR, WITH 1-1/2" VALVE, YELLOW SPRING FOR 3 AND 5 PSIG AND BLUE SPRING FOR 10 PSIG OUTLET PRESSURE SETTING, 125 ANSI FLAT FACE FLANGE CONNECTIONS 441-57S BLUE SPRING FOR 10 PSIG	44345	EA.	1
		44337	EA.	1
37	2" ANSI 150 FLANGE ISOLATION KIT	44380	EA.	2
38	4" ANSI 150 FLANGE ISOLATION KIT	44381	EA.	2

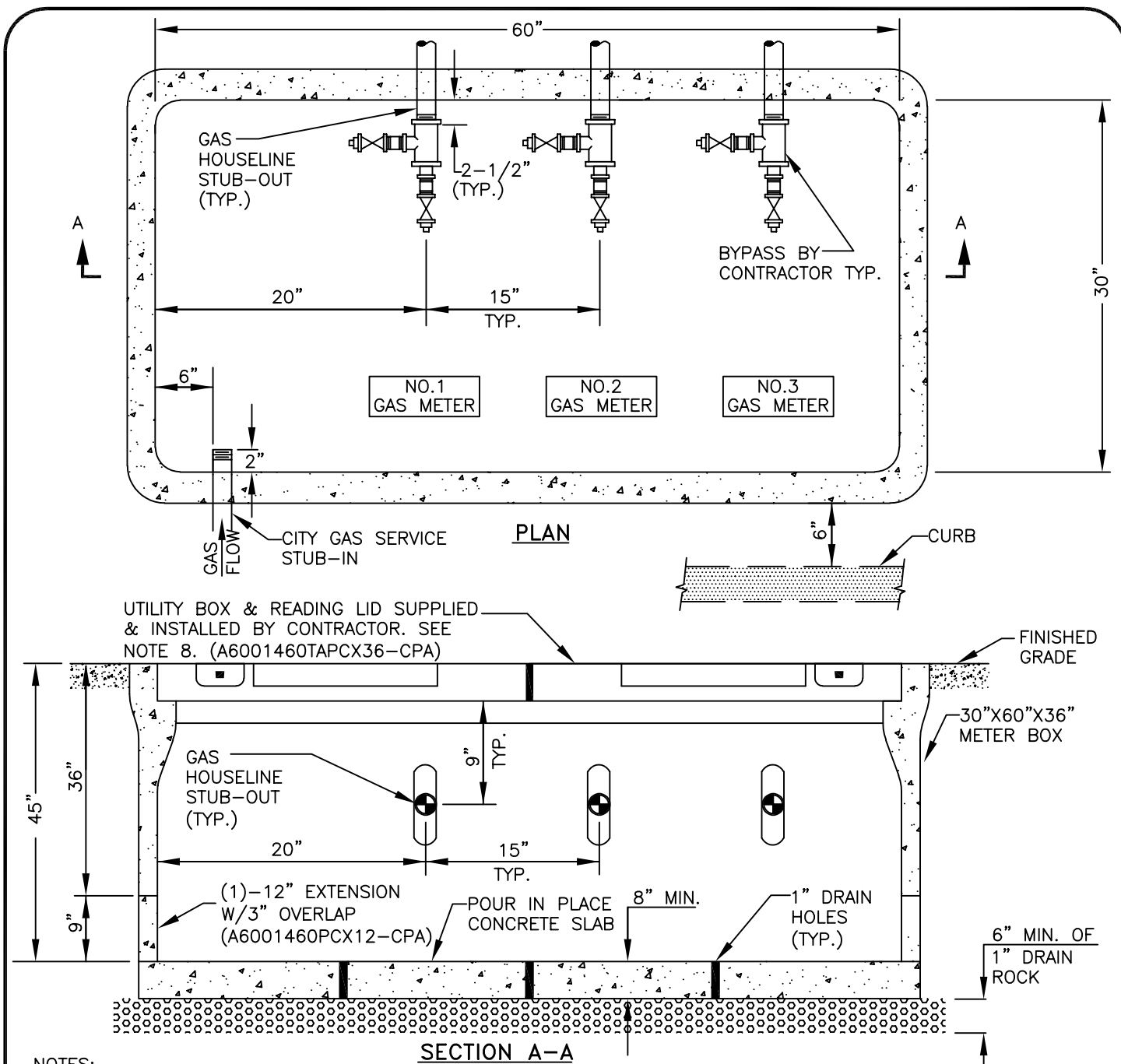
BY	DATE	INDUSTRIAL ULTRASONIC METER SET ASSEMBLY 23,000-45,000 SCFH DELIVERY PRESSURE 3, 5, 7 & 10 PSIG STANDARD DETAIL	APPROVED: FEBRUARY 26, 2020	SCALE: NONE
DRAWN A.P.	1/16		 SILVIA LEE SANTOS ENGINEERING MANAGER	DWG. NO. STD. GD-20E
CHECKED A.P.	1/16		50674 R.E. NO.	
REVIEWED A.P.	2/20	CITY OF PALO ALTO, CALIFORNIA	REVISION: FEBRUARY 26, 2020	APPENDIX C



NOTES:

1. CURB METER BOX, INSTALLATION AND LOCATION SHALL BE APPROVED BY THE UTILITIES DEPARTMENT.
2. CONTRACTOR SHALL FURNISH AND INSTALL METER BOX, LID, HOUSELINE & BY-PASS.
3. CURB METER BOXES MUST NOT BE LOCATED IN CONTINUOUS VEHICULAR TRAFFIC AREAS.
4. CURB METER BOXES SHALL NOT BE INSTALLED IN AREAS PRONE TO FLOODING (RAINFALL, SURFACE WATER FLOW, IRRIGATION, ETC.)
5. GAS SERVICE LINE, CONNECTION TO MAIN, AND METER INSTALLATION BY CITY OF PALO ALTO (C.P.A.).
6. C.P.A. WILL NOT SET METERS UNTIL ALL SPECIFICATIONS HAVE BEEN MET.
7. METER BOX AND LIDS SHALL HAVE MIN. H-20 RATING FOR SW & PLANTING STRIP APPLICATIONS.
8. METER BOX SHALL BE ARMORCAST POLYMERE CONCRETE UTILITY BOX (24"x36"x18") ASSEMBLY W/ SINGLE COVER AND DROP IN READING LID MARKED "GAS" (A6001974TAPCX18-CPA) AND 3-24"x36"x12" CONCRETE BOX EXTENSIONS WITH 3" OVERLAP (A6001974PCX12-CPA).

BY	DATE	CURB GAS METER 250-630 SCFH STANDARD DETAIL	APPROVED: FEBRUARY 26, 2020	SCALE: NONE
DRAWN A.P.	8/96		<i>Silvia Santos</i> SILVIA LEE SANTOS ENGINEERING MANAGER	DWG. NO. STD. GD-21
CHECKED A.P.	2/20		50674 R.E. NO.	
REVIEWED A.P.	2/20	CITY OF PALO ALTO, CALIFORNIA	REVISION: FEBRUARY 26, 2020	APPENDIX C

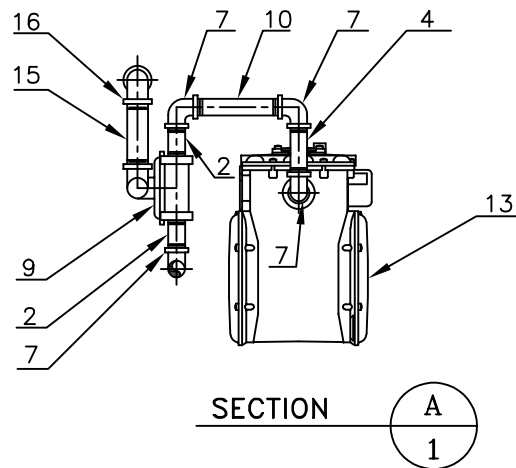
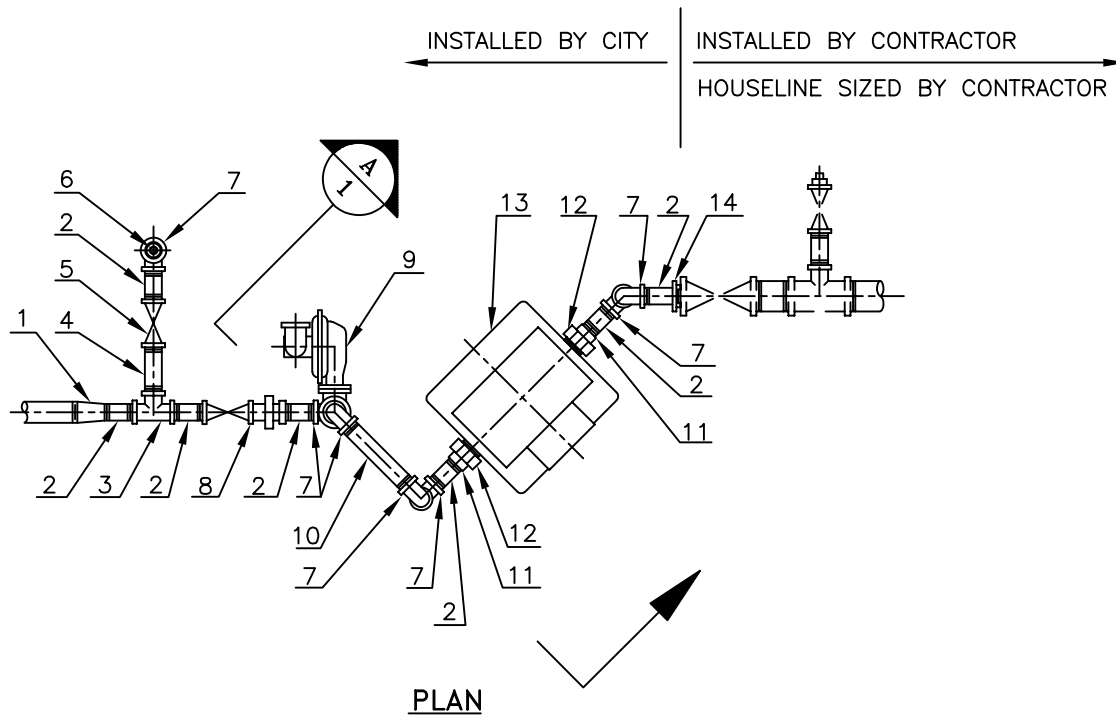


NOTES:

- CURB METER BOX, INSTALLATION AND LOCATION SHALL BE APPROVED BY THE UTILITIES DEPARTMENT. CONTRACTOR SHALL FURNISH AND INSTALL METER BOX, LID, HOUSELINE & BY-PASS.
- CURB METER BOXES MUST NOT BE LOCATED IN CONTINUOUS VEHICULAR TRAFFIC AREAS.
- CURB METER BOXES SHALL NOT BE INSTALLED IN AREAS PRONE TO FLOODING (RAINFALL, SURFACE WATER FLOW, IRRIGATION, ETC.)
- GAS SERVICE LINE, CONNECTION TO MAIN, AND METER INSTALLATION BY CITY OF PALO ALTO (C.P.A.). C.P.A. WILL NOT SET METERS UNTIL ALL SPECIFICATIONS HAVE BEEN MET.
- METER BOX AND LIDS SHALL BE H-20 RATING FOR SW & PLANTING STRIP APPLICATIONS.
- METER BOX SHALL BE ARMORCAST POLYMERE CONCRETE UTILITY BOX (30"x60"x36") ASSEMBLY W/ TWO PIECE COVER AND TWO DROP IN METER READING LIDS MARKED "GAS" (A6001460TAPCX36-CPA) AND 1-30"x60"x12" POLYMER CONCRETE BOX EXTENSION WITH 3" OVERLAP (A6001460PCX12-CPA).

BY	DATE	MULTIPLE CURB GAS METERS 250-630 SCFH STANDARD DETAIL	APPROVED: FEBRUARY 26, 2020	SCALE: NONE
DRAWN A.P.	8/96		 50674	DWG. NO.
CHECKED A.P.	2/20		SILVIA LEE SANTOS ENGINEERING MANAGER	R.E. NO. STD. GD-22
REVIEWED A.P.	2/20		CITY OF PALO ALTO, CALIFORNIA	REVISION: FEBRUARY 26, 2020

250 SCFH METER ASSEMBLY (UTILITY BOX)



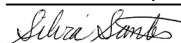
NOTES:

1. FOR BOX REQUIREMENTS REFER TO UTILITY STANDARD DETAILS.
2. UPON COMPLETION OF METER ASSEMBLY, LEAK TEST ALL CONNECTIONS.
3. AN ACTUAL SET CONFIGURATION WILL BE FIELD ADJUSTABLE; DIFFERENT NIPPLES' SIZES THAN ARE SHOWN IN THE SPECIFICATIONS MAY BE REQUIRED.
4. HOUSELINE IS SHOWN AS 1-1/2", BUT IS SIZED BY THE CONTRACTOR AND CAN BE DIFFERENT SIZE THAN SHOWN.
5. ITRON B42R REGULATOR (CAST IRON CASE) FOR CURB INSTALLATION IS SUPPLIED WITH 3/16" ORIFICE.
6. INSTALLATION OF MULTIPLE CURB METERS REQUIRES SELECTION OF APPROPRIATE REGULATOR AND INDIVIDUAL DESIGN.
7. IT IS ASSUMED THAT THE SYSTEM INLET PRESSURE UPSTREAM OF THE REGULATOR IS MIN. 8 PSIG.

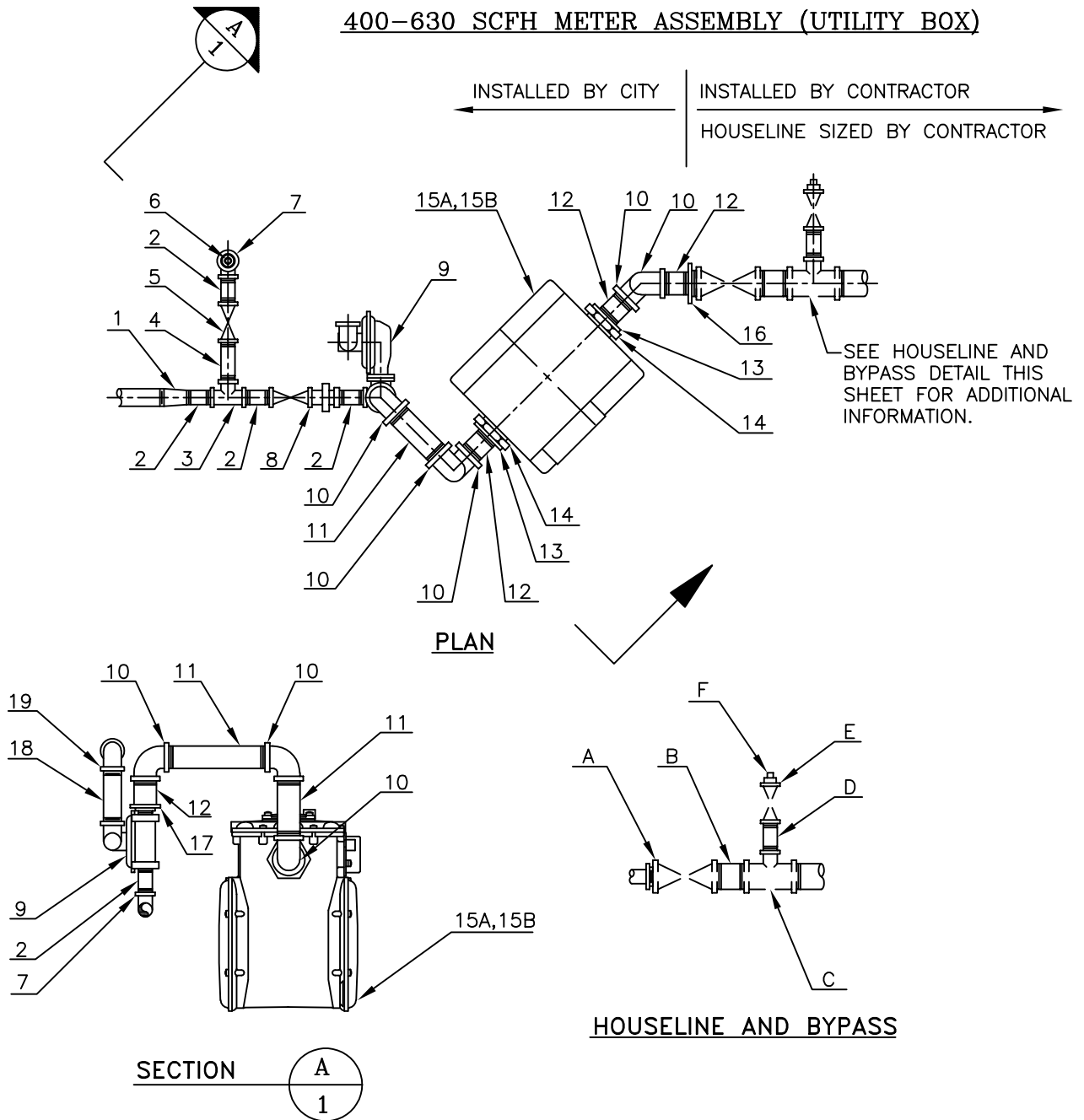
BY		UTILITY BOX (CURB LOCATION) METER SET ASSEMBLY 250 SCFH STANDARD DETAIL	APPROVED: FEBRUARY 26, 2020 SILVIA LEE SANTOS ENGINEERING MANAGER	SCALE: 1"=1'-0"
DRAWN	A.P.			
CHECKED	A.P.		50674 R.E. NO.	DWG. NO. STD. GD-23A
REVIEWED	A.P.		REVISION: FEBRUARY 26, 2020	APPENDIX C

LIST OF MATERIALS
250 SCFH METER ASSEMBLY (UTILITY BOX)

NO.	DESCRIPTION	STOCK NO.	QUANTITY
1	3/4" x 1" REDUCER, BLK	41700	1
2	3/4" x 2 NIPPLE, BLK	41401	8
3	3/4" TEE, BLK	41800	1
4	3/4" x 3 NIPPLE, BLK	41403	3
5	3/4" H-11175 MUELLER METER VALVE, NON-INSULATED	43000	1
6	3/4" PLUG, BLK	41600	1
7	3/4" ELBOW, 90 DEG, BLK	41310	8
8	3/4" H-11179 MUELLER METER VALVE, WITH INSULATED OUTLET, BLK	42998	1
9	3/4" NPT ITRON B42R REGULATOR WITH 3/16" ORIFICE, BROWN SPRING, 1" VENT CAST IRON CASE	43066	1
10	3/4" PIPE	41500	D.I.F
11	3/4" SWIVEL, GALV, INSULATED FEMALE	44211	2
12	1A SPRAGUE NUT, GALV	44207	2
13	GAS METER, DIAPHRAGM, CL 250, CURB	44110	1
14	3/4" x 1-1/2" BUSHING, BLK	41005	1
15	1" x 4" NIPPLE, BLK	41425	1
16	1" ELBOW, 90 DEG, BLK	41311	1

BY	DATE	UTILITY BOX (CURB LOCATION) METER SET ASSEMBLY 250 SCFH STANDARD DETAIL	APPROVED: FEBRUARY 26, 2020  SILVIA LEE SANTOS ENGINEERING MANAGER	SCALE: NONE
				DWG. NO. STD. GD-23B
			REVISION: FEBRUARY 26, 2020	APPENDIX C
DRAWN	A.P. 2/16	CITY OF PALO ALTO, CALIFORNIA		
CHECKED	A.P. 2/16			
REVIEWED	A.P. 2/20			

400-630 SCFH METER ASSEMBLY (UTILITY BOX)



NOTES:

- FOR BOX REQUIREMENTS REFER TO UTILITY STANDARD DETAILS.
- UPON COMPLETION OF METER ASSEMBLY, LEAK TEST ALL CONNECTIONS.
- AN ACTUAL SET CONFIGURATION WILL BE FIELD ADJUSTABLE; DIFFERENT NIPPLES' SIZES THAN ARE SHOWN IN THE SPECIFICATIONS MAY BE REQUIRED.
- HOUSELINE IS SHOWN AS 1-1/2", BUT IS SIZED BY THE CONTRACTOR AND CAN BE DIFFERENT SIZE THAN SHOWN.
- ITRON B42R REGULATOR (CAST IRON CASE) FOR CURB INSTALLATION IS SUPPLIED WITH 3/16" ORIFICE; FOR METER SETS WITH CLASS 630 METERS, 1/4" ORIFICE SHALL BE USED; AVAILABLE IN STORES.
- INSTALLATION OF MULTIPLE CURB METERS REQUIRES SELECTION OF APPROPRIATE REGULATOR AND INDIVIDUAL DESIGN.
- IT IS ASSUMED THAT THE SYSTEM INLET PRESSURE UPSTREAM OF THE REGULATOR IS MIN. 8 PSIG.

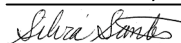
BY		DATE	UTILITY BOX (CURB LOCATION) METER SET ASSEMBLY 400-630 SCFH STANDARD DETAIL CITY OF PALO ALTO, CALIFORNIA	APPROVED: FEBRUARY 26, 2020 <i>Silvia Lee Santos</i> SILVIA LEE SANTOS ENGINEERING MANAGER	SCALE: 1"=1'-0"
DRAWN	A.P.	2/16		50674 R.E. NO.	DWG. NO.
CHECKED	A.P.	2/16			STD. GD-23C
REVIEWED	A.P.	2/20		REVISION: FEBRUARY 26, 2020	APPENDIX C

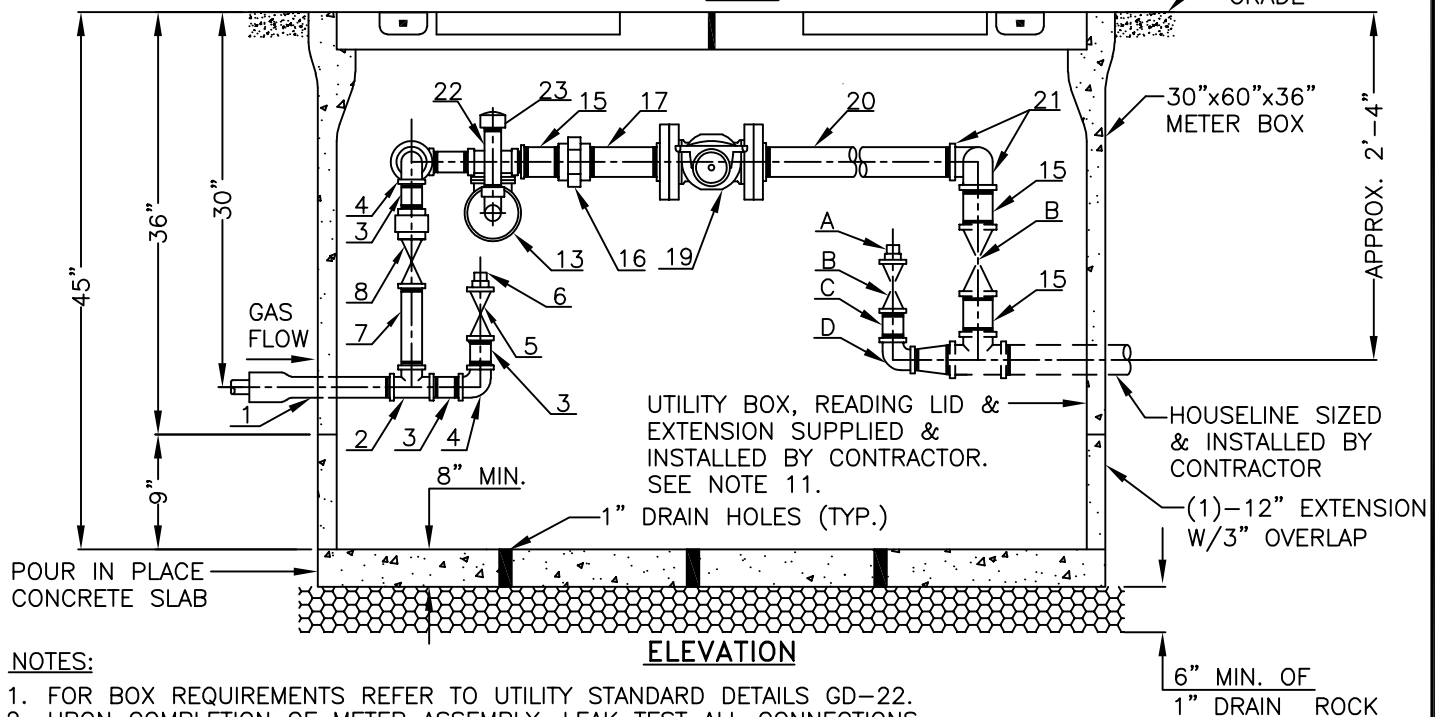
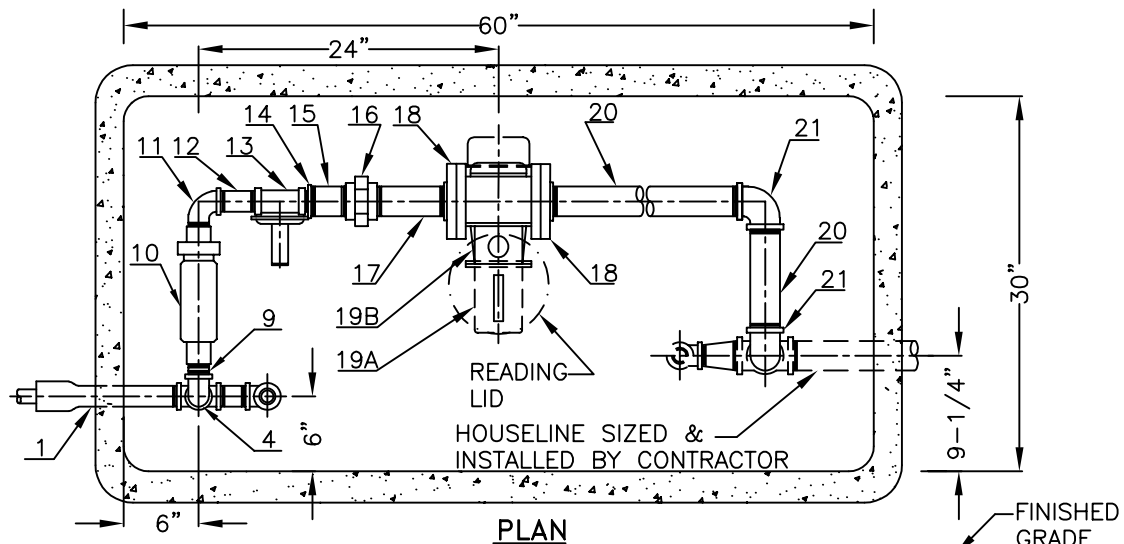
LIST OF MATERIALS
400-630 SCFH METER ASSEMBLY (UTILITY BOX)

NO.	DESCRIPTION	STOCK NO.	QUANTITY
1	3/4" x 1" REDUCER, BLK	41700	1
2	3/4" x 2 NIPPLE, BLK	41401	5
3	3/4" TEE, BLK	41800	1
4	3/4" x 3 NIPPLE, BLK	41403	1
5	3/4" H-11175 MUELLER METER VALVE, NON-INSULATED	43000	1
6	3/4" PLUG, BLK	41600	1
7	3/4" ELBOW, 90 DEG, BLK	41310	2
8	3/4" H-11179 MUELLER METER VALVE, WITH INSULATED OUTLET, BLK	42998	1
9	3/4" NPT ITRON B42R REGULATOR WITH 3/16" ORIFICE, BROWN SPRING, 1" VENT CAST IRON CASE	43066	1
	1/4" ORIFICE (FOR CL 600 METER)	43065	1
10	1-1/4" ELBOW 90 DEG, BLK	41312	5
11	1-1/4" PIPE	41430	D.I.F
12	1-1/4" x 2 NIPPLE, BLK	41431	4
13	1-1/4" SWIVEL, FEMALE, INSULATED	44202	2
14	#4 SPRAGUE NUT, GALV	44209	2
15			
A	GAS METER, DIAPHRAGM, CL 400, CURB	44100	1
B	GAS METER, DIAPHRAGM, CL 600, CURB	44119	1
16	1-1/4" x 1-1/2" BUSHING, BLK	41007	1
17	1-1/4" x 3/4" BUSHING, BLK	41003	1
18	1" x 4" NIPPLE, BLK	41425	1
19	1" ELBOW, 90 DEG, BLK	41311	1

MATERIALS SUPPLIED AND INSTALLED BY CONTRACTOR

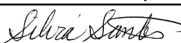
NO.	DESCRIPTION	QUANTITY
A	METER VALVE (SIZE BY CONT.) (NATURAL GAS APPROVED)	1
B	NIPPLE, BLK (SIZE AND LENGTH (AS REQUIRED BY CONTRACTOR)	1
C	X x 3/4" TEE	1
D	3/4" NIPPLE (LENGTH AS REQUIRED)	1
E	3/4" METER VALVE (NATURAL GAS APPROVED)	1
F	3/4" PLUG	1

BY	DATE	UTILITY BOX (CURB LOCATION) METER SET ASSEMBLY 400-630 SCFH STANDARD DETAIL	APPROVED: FEBRUARY 26, 2020  SILVIA LEE SANTOS ENGINEERING MANAGER	SCALE: NONE
			50674 R.E. NO.	DWG. NO. STD. GD-23D
DRAWN	A.P.	2/16	REVISION: FEBRUARY 26, 2020	APPENDIX C
CHECKED	A.P.	2/16		
REVIEWED	A.P.	2/20		
		CITY OF PALO ALTO, CALIFORNIA		



NOTES:

- FOR BOX REQUIREMENTS REFER TO UTILITY STANDARD DETAILS GD-22.
- UPON COMPLETION OF METER ASSEMBLY, LEAK TEST ALL CONNECTIONS.
- AN ACTUAL SET CONFIGURATION MAY REQUIRE FIELD ADJUSTMENT. BOX DIMENSIONS ARE SHOWN.
- 1-1/4" ITRON B42R REGULATOR (CAST IRON CASE) IS STOCKED WITH 5/16" ORIFICE BROWN SPRING INTENDED FOR DELIVERY UP TO 1100 SCFH AT 7" W.C.; FOR DELIVERY OF 800 SCFH AT 7" W.C. 1/4" SHALL BE USED.
- THE ESTIMATED PRESSURE LOSS, SHOWN IN THE TABLE, INCLUDES DIFFERENTIAL LOSS ACROSS THE METER AT 100% FLOW.
- THE ESTIMATED PRESSURE LOSS THROUGH RISER, METER VALVE, FITTINGS, AND FILTER IS APPROXIMATELY 0.5 PSIG.
- IT IS ASSUMED THAT THE SYSTEM INLET PRESSURE IS MIN. 10 PSIG OR LARGER ORIFICE SHALL BE USED (NOT STOCKED).
- BOX AND LIDS SHALL HAVE MIN. H-20 RATING FOR SW AND PLANTING STRIP APPLICATIONS.
- THE GAS REGULATOR, METER AND OTHER COMPONENTS INSTALLED IN THE UTL. BOX MUST BE REGULARLY INSPECTED FOR SIGNS OF CORROSION.
- THE STANDARD IS INTENDED FOR RECONSTRUCTION OF THE EXISTING METER SETS; AT ALL NEW CONSTRUCTIONS METER SETS LOCATIONS SHALL BE ABOVE THE GROUND.
- METER BOX SHALL BE ARMORCAST POLYMERE CONCRETE UTILITY BOX (30"x60"x36") ASSEMBLY W/ TWO PIECE COVER AND TWO DROP IN METER READING LIDS MARKED "GAS" AND (1)-12" EXTENSION.

BY	DATE	COMMERCIAL ROTARY METER SET ASSEMBLY 800-1,100 SCFH UTILITY BOX (CURB LOCATION) STANDARD DETAIL	APPROVED: FEBRUARY 26, 2020	SCALE: 1"=1'-0"
DRAWN	A.P. 8/96		 SILVIA LEE SANTOS ENGINEERING MANAGER	DWG. NO. STD. GD-24A
CHECKED	A.P. 8/96		REVISION: FEBRUARY 26, 2020	APPENDIX C
REVIEWED	A.P. 2/20	CITY OF PALO ALTO, CALIFORNIA		

LIST OF MATERIALS

NO.	DESCRIPTION	STOCK NO.	UNIT	QUANTITY
1	1-1/4" TRANSITION FITTING, THREADED END	45598	EA.	1
2	1-1/4" TEE, BLK	41802	EA.	1
3	1-1/4" x 2-1/2" NIPPLE, BLK	41432	EA.	3
4	1-1/4" 90° ELBOW, BLK	41312	EA.	2
5	1-1/4" H-11175 MUELLER METER VALVE, NON-INSUL.	43002	EA.	1
6	1-1/4" PLUG, BLK	41602	EA.	1
7	1-1/4" x 7-1/2" NIPPLE, BLK	41472	EA.	1
8	1-1/4" H-11179 MUELLER METER VALVE WITH INSULATED OUTLET, BLK	43001	EA.	1
9	1-1/4" x CL NIPPLE, BLK	41430	EA.	1
10	1-1/4" FILTER, PHILPOTT MODEL 125-S, 10 MICRON NPT THREADED CONNECTIONS	44315	EA.	1
11	1-1/4" MALE x 1-1/4" FEMALE 90° ELBOW	41360	EA.	1
12	1-1/4" x 3" NIPPLE, BLK	41433	EA.	1
13	1-1/4" X 1-1/4" NPT B42R CAST IRON CASE REGULATOR WITH 1" INTERNAL RELIEF VALVE AND 5/16" ORIFICE FOR DELIVERY OF 1000/1100 SCFH AND 1/4" ORIFICE FOR DELIVERY OF 800 SCFH WITH BROWN SPRING FOR 7" W.C. OUTLET PRESSURE SETTING; POSITION 18 1/4" ORIFICE	44298	EA.	1
14	2" x 1-1/4" BUSHING, BLK	43065	EA.	1
15	2" x 3" NIPPLE, BLK	41010	EA.	1
16	2" UNION GRD JOINT, BLK	41452	EA.	2
17	2" X 6" NIPPLE, BLK	41904	EA.	1
18	2" TREADED FLANGE, FLAT FACE, ASTM 105 2" IPS 1/16" THICK, FULL FACE GASKET FOR 150 ANSI FLAT FACE FLANGE	41458	EA.	1
19	STUD BOLT 5/8" x 1-1/2" WITH HEX CAP AND NUTS	43321	EA.	2
A	2" 175 MAOP 1100/1000 SCFH ROTARY GAS METER WITH A DIGITAL NON-COMPENSATED INDEX	43350	EA.	2
B	2" 175 MAOP 800 SCFH ROTARY GAS METER WITH A DIGITAL NON-COMPENSATED INDEX	44123	EA.	1
20	2" PIPE, THREADED BOTH ENDS	44121	EA.	1
21	2" x 90° ELBOW, BLK	41516	L.F.	D.I.F.
22	1" x 9" NIPPLE, BLK	41314	EA.	2
23	1" FEMALE TYPE 975 VERTICAL VENT	41470	EA.	1
		44311	EA.	1

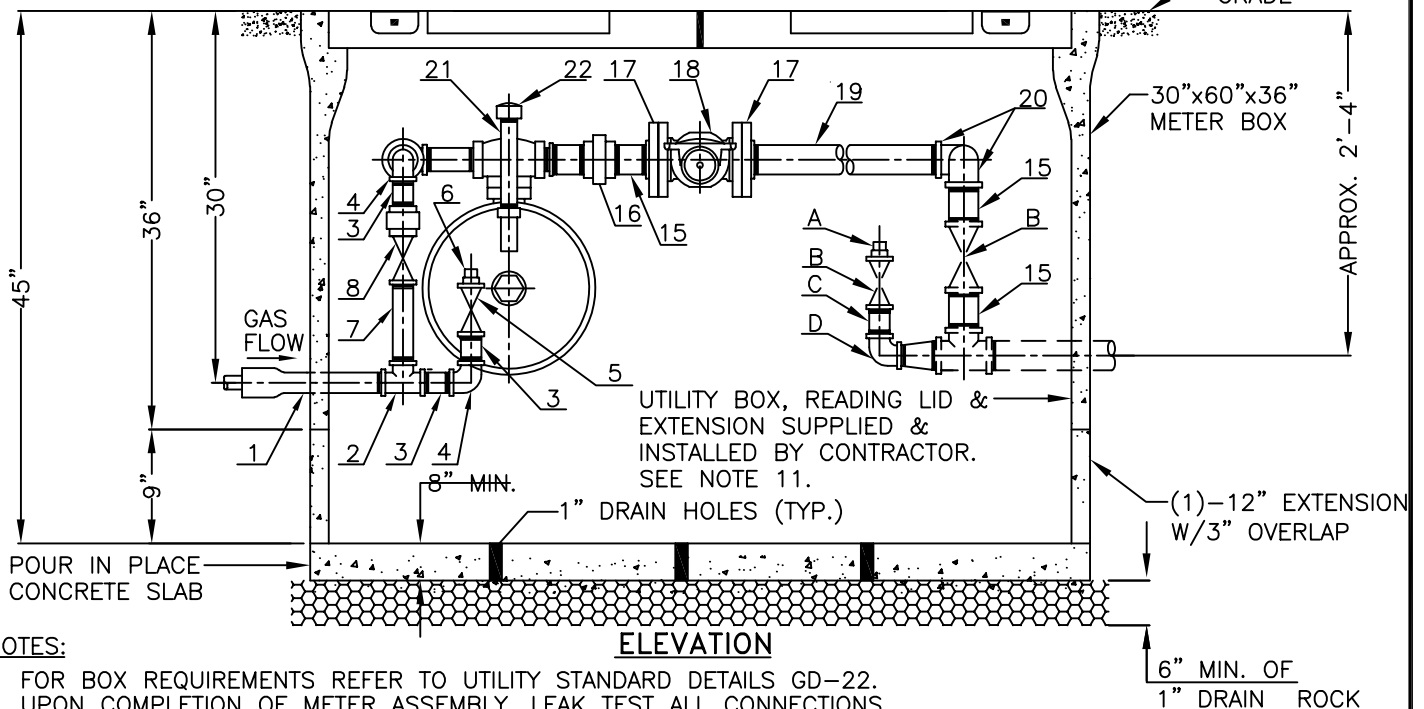
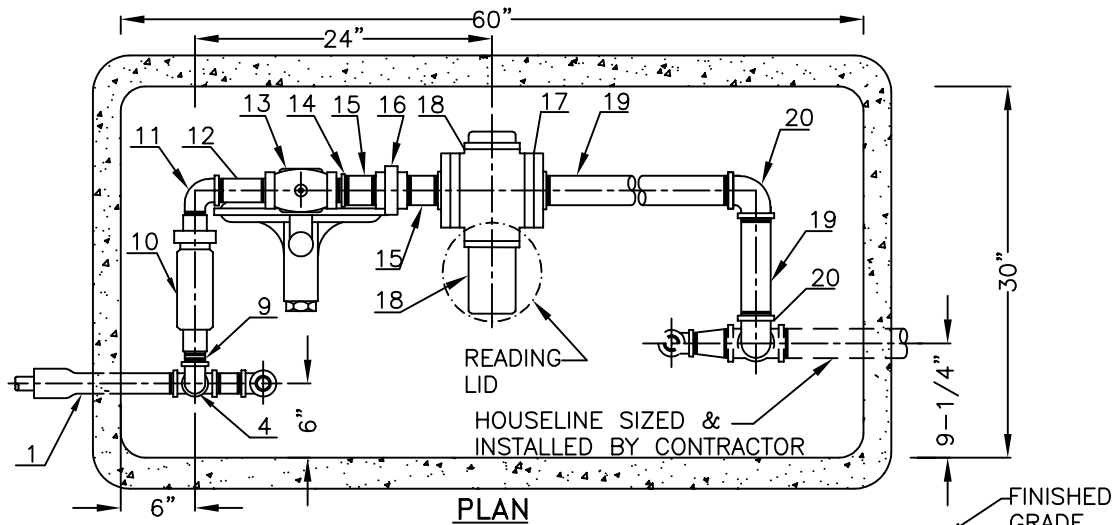
ESTIMATED PRESSURE LOSS IN DOWNSTREAM OF REGULATOR CITY PIPING

FLOW SCFH	SET PRESSURE	PRESSURE AT CUSTOMER PIPING	SET PRESSURE TO COMPENSATE FOR CITY PIPING HEADLOSS
800	7" W.C.	6.378" W.C.	7.622" W.C.
1100	7" W.C.	6.360" W.C.	7.640" W.C.

MATERIALS SUPPLIED AND INSTALLED BY CONTRACTOR

NO.	DESCRIPTION	QUANTITY
A	2" PLUG	1
B	2" METER VALVE (NATURAL GAS APP.)	1
C	2" NIPPLE (LENGTH AS REQUIRED)	1
D	2" 90° ELBOW	1

BY	DATE	COMMERCIAL ROTARY METER SET ASSEMBLY 800-1,100 SCFH UTILITY BOX (CURB LOCATION) STANDARD DETAIL	APPROVED: FEBRUARY 26, 2020	SCALE: NONE
DRAWN A.P.	8/96		<i>Silvia Santos</i> 50674	DWG. NO.
CHECKED A.P.	8/96		SILVIA LEE SANTOS ENGINEERING MANAGER	STD. GD-24B
REVIEWED A.P.	2/20		REVISION: FEBRUARY 26, 2020	APPENDIX C



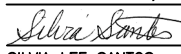
NOTES:

1. FOR BOX REQUIREMENTS REFER TO UTILITY STANDARD DETAILS GD-22.
2. UPON COMPLETION OF METER ASSEMBLY, LEAK TEST ALL CONNECTIONS.
3. AN ACTUAL SET CONFIGURATION MAY REQUIRE FIELD ADJUSTMENT. BOX DIMENSIONS ARE SHOWN.
4. STOCK ITEM 044324 1-1/2" 243-12-2 REGULATOR IS STOCKED WITH 3/8" ORIFICE AND 10"-18" ORANGE-BLACK SPRING. STOCK ITEM 044303 1-1/2" 243-8-2 REGULATOR IS STOCKED WITH 3/8" ORIFICE AND 1-2 PSIG ORANGE SPRING. 243-8-2 REGULATOR SHALL NOT BE USED FOR DELIVERY PRESSURE HIGHER THAN 1 PSIG.
5. THE ESTIMATED PRESSURE LOSS, SHOWN IN THE TABLE, INCLUDES DIFFERENTIAL LOSS ACROSS THE METER AT 100% FLOW.
6. THE ESTIMATED PRESSURE LOSS THROUGH RISER, METER VALVE, FITTINGS, AND FILTER IS APPROXIMATELY 0.5 PSIG.
7. IT IS ASSUMED THAT INLET PRESSURE DOWNSTREAM OF THE FILTER IS MIN. 10 PSIG..
8. BOX AND LIDS SHALL HAVE MIN. H-20 RATING FOR SW AND PLANTING STRIP APPLICATIONS.
9. THE GAS REGULATOR, METER AND OTHER COMPONENTS INSTALLED IN THE UTL. BOX MUST BE REGULARLY INSPECTED FOR SIGNS OF CORROSION.
10. THE STANDARD IS INTENDED FOR RECONSTRUCTION OF THE EXISTING METER SETS; AT ALL NEW CONSTRUCTIONS METER SETS LOCATIONS SHALL BE ABOVE THE GROUND.
11. METER BOX SHALL BE ARMORCAST POLYMERE CONCRETE UTILITY BOX (30"x60"x36") ASSEMBLY W/ TWO PIECE COVER AND TWO DROP IN METER READING LIDS MARKED "GAS" AND (1)-12" EXTENSION.

BY	DATE	COMMERCIAL ROTARY METER SET ASSEMBLY 1,500-2,000 SCFH UTILITY BOX (CURB LOCATION) STANDARD DETAIL	APPROVED: FEBRUARY 26, 2020	SCALE: 1"=1'-0"
DRAWN	A.P. 8/96		 SILVIA LEE SANTOS ENGINEERING MANAGER	DWG. NO. STD. GD-25A
CHECKED	A.P. 8/96		REVISION: FEBRUARY 26, 2020	APPENDIX C
REVIEWED	A.P. 2/20	CITY OF PALO ALTO, CALIFORNIA		

LIST OF MATERIALS

NO.	DESCRIPTION	STOCK NO.	UNIT	QUANTITY
1	1-1/4" TRANSITION FITTING, THREADED END	45598	EA.	1
2	1-1/4" TEE, BLK	41802	EA.	1
3	1-1/4" x 2-1/2" NIPPLE, BLK	41432	EA.	3
4	1-1/4" 90° ELBOW, BLK	41312	EA.	2
5	1-1/4" H-11175 MUELLER METER VALVE, NON-INSUL.	43002	EA.	1
6	1-1/4" PLUG, BLK	41602	EA.	1
7	1-1/4" x 7-1/2" NIPPLE, BLK	41472	EA.	1
8	1-1/4" H-11179 MUELLER METER VALVE WITH INSULATED OUTLET, BLK	43001	EA.	1
9	1-1/4" x CL NIPPLE, BLK	41430	EA.	1
10	1-1/4" FILTER, PHILPOTT MODEL 125-S, 10 MICRON NPT THREADED CONNECTIONS	44315	EA.	1
11	1-1/4" MALE x 1-1/2" FEMALE 90° RED. ELBOW	41361	EA.	1
12	1-1/2" x 4" NIPPLE, BLK	41445	EA.	1
13				
A	1-1/2" NPT SENSUS 243-12-2 REGULATOR WITH FULL CAPACITY INTERNAL RELIEF VALVE AND 3/8" ORIFICE WITH BLUE, ORANGE/BLACK, BLACK, OR CADMIUM SPRING FOR 7" W.C., 14" W.C., 1 PSIG, AND 2 PSIG OUTLET PRESSURE SETTING RESPECTIVELY	44324	EA.	1
	BLUE SPRING FOR 7" W.C.	44341	EA.	1
	BLACK SPRING FOR 1 PSIG	44336	EA.	1
	CADMIUM SPRING FOR 2 PSIG	44340	EA.	1
B	1-1/2" NPT SENSUS 243-8-2 REGULATOR WITH FULL CAPACITY INTERNAL RELIEF VALVE AND 3/8" ORIFICE WITH BLUE-BLACK, GREEN, OR ORANGE SPRING FOR 7" W.C., 14" W.C., AND 1 PSIG OUTLET PRESSURE SETTING RESPECTIVELY	44303	EA.	1
	BLUE-BLACK SPRING FOR 7" W.C.	44359	EA.	1
	GREEN SPRING FOR 14" W.C.	44346	EA.	1
	ORANGE SPRING FOR 1 PSIG	44339	EA.	1
14	2" x 1-1/2" BUSHING, BLK	41011	EA.	1
15	2" x 3" NIPPLE, BLK	41452	EA.	3
16	2" UNION GRD JOINT, BLK	41904	EA.	1
17	2" TREADED FLANGE, FLAT FACE, ASTM 105	43321	EA.	2
	2" IPS 1/16" THICK, FULL FACE GASKET FOR 150 ANSI FLAT FACE FLANGE	43350	EA.	2
	STUD BOLT 5/8" x 1-1/2" WITH HEX CAP AND NUTS	43312		8
18				
A	2" 175 MAOP 1500 SCFH ROTARY GAS METER WITH A DIGITAL NON-COMPENSATED INDEX	44125	EA.	1
B	2" 175 MAOP 2000 SCFH ROTARY GAS METER WITH A DIGITAL NON-COMPENSATED INDEX	44126	EA.	1
19	2" PIPE, THREADED BOTH ENDS	41516	L.F.	D.I.F.
20	2" x 90° ELBOW, BLK	41314	EA.	2
21	1" x 9" NIPPLE, BLK	41470	EA.	1
22	1" FEMALE TYPE 975 VERTICAL VENT	44311	EA.	1

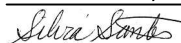
BY	DATE	COMMERCIAL ROTARY METER SET ASSEMBLY 1,500-2,000 SCFH UTILITY BOX (CURB LOCATION) STANDARD DETAIL	APPROVED: FEBRUARY 26, 2020  SILVIA LEE SANTOS ENGINEERING MANAGER	SCALE: NONE
DRAWN	A.P.	8/96	50674 R.E. NO.	DWG. NO. STD. GD-25B
CHECKED	A.P.	8/96		
REVIEWED	A.P.	2/20		
CITY OF PALO ALTO, CALIFORNIA			REVISION: FEBRUARY 26, 2020	APPENDIX C

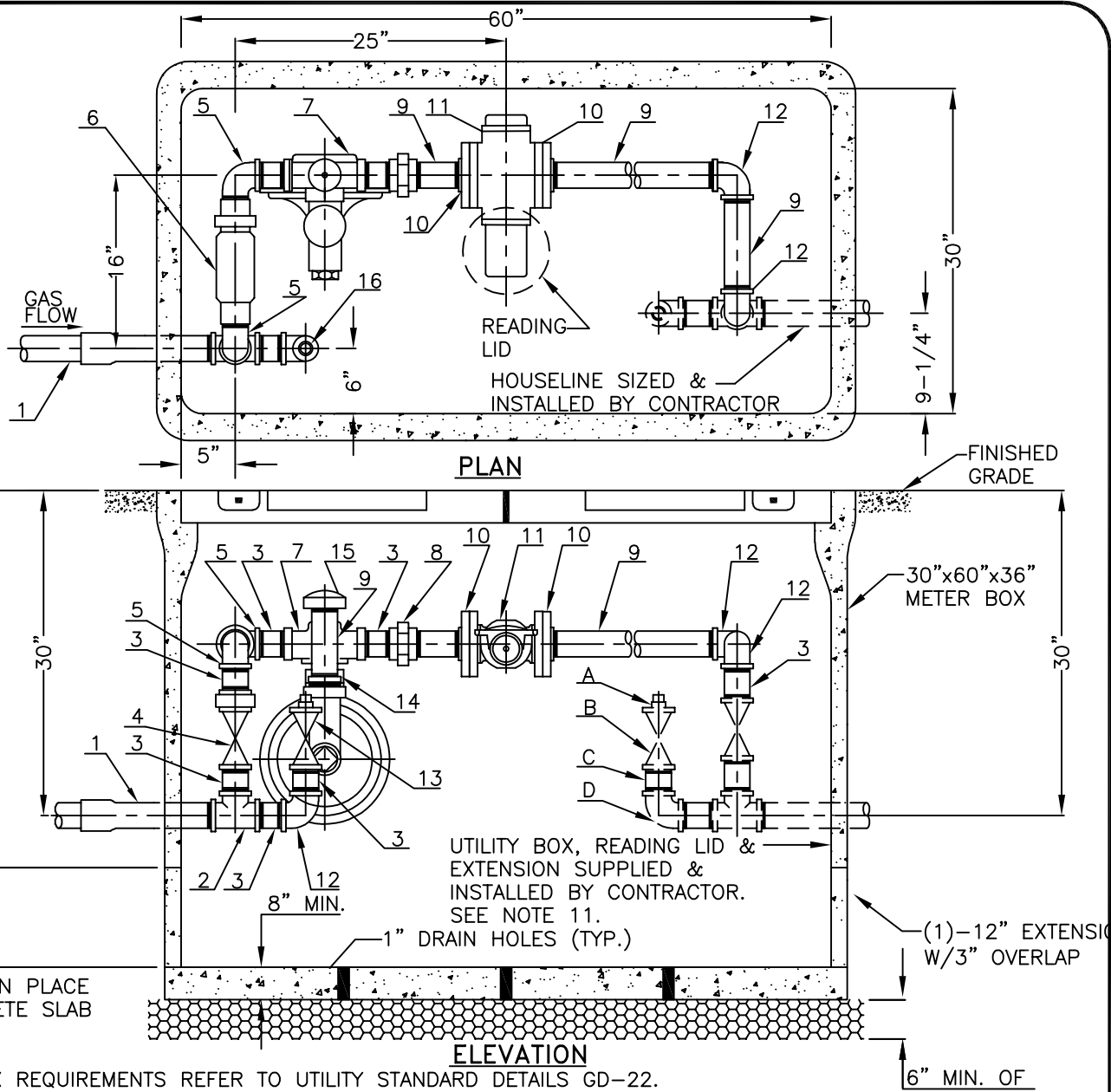
MATERIALS SUPPLIED AND INSTALLED BY CONTRACTOR

NO.	DESCRIPTION	QUANTITY
A	1-1/4" PLUG	1
B	1-1/4" METER VALVE (NATURAL GAS APPROVED)	1
C	1-1/4" NIPPLE	1
D	1-1/4" 90° ELBOW	1

ESTIMATED PRESSURE LOSS IN DOWNSTREAM OF REGULATOR CITY PIPING

FLOW SCFH	SET PRESSURE	PRESSURE AT THE CUSTOMER PIPING	SET PRESSURE TO COMPENSATE FOR CITY PIPING HEADLOSS
1500	7" W.C.	6.132" W.C.	7.868" W.C.
	14" W.C.	13.133" W.C.	14.867" W.C.
	1 PSIG	0.969 PSIG	1.031 PSIG
	2 PSIG	1.969 PSIG	2.031 PSIG
2000	7" W.C.	6.086" W.C.	7.914" W.C.
	14" W.C.	13.087" W.C.	14.913" W.C.
	1 PSIG	0.967 PSIG	1.033 PSIG
	2 PSIG	1.968 PSIG	2.032 PSIG

BY	DATE	COMMERCIAL ROTARY METER SET ASSEMBLY 1,500-2,000 SCFH UTILITY BOX (CURB LOCATION) STANDARD DETAIL	APPROVED: FEBRUARY 26, 2020	SCALE: NONE
DRAWN A.P.	8/96		 50674	DWG. NO.
CHECKED A.P.	8/96		SILVIA LEE SANTOS ENGINEERING MANAGER	STD. GD-25C
REVIEWED A.P.	2/20	CITY OF PALO ALTO, CALIFORNIA	REVISION: FEBRUARY 26, 2020	APPENDIX C



NOTES:

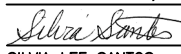
- FOR BOX REQUIREMENTS REFER TO UTILITY STANDARD DETAILS GD-22.
- UPON COMPLETION OF METER ASSEMBLY, LEAK TEST ALL CONNECTIONS.
- AN ACTUAL SET CONFIGURATION MAY REQUIRE FIELD ADJUSTMENT. BOX DIMENSIONS ARE SHOWN.
- IT IS ASSUMED THAT INLET PRESSURE DOWNSTREAM OF THE FILTER IS MIN. 10 PSIG.
- REGULATOR ITRON B38R (44321) IS SHIPPED WITH 5/8" ORIFICE AND BROWN SPRING. APPROPRIATE SPRING/ORIFICE SHALL BE INSTALLED BASED ON AN APPLICATION AND AS SPECIFIED ON THE DRAWING. GREEN SPRING (44358) MAY BE USED FOR DELIVERY OF 7" W.C. BASED ON CONFIGURATION OF DOWNSTREAM PIPING.
- THE ESTIMATED PRESSURE LOSS, SHOWN IN THE TABLE, INCLUDES DIFFERENTIAL LOSS ACROSS THE METER AT 100% FLOW.
- THE ESTIMATED PRESSURE LOSS THROUGH RISER, METER VALVE, FITTINGS, AND FILTER IS APPROXIMATELY 0.5 PSIG.
- BOX AND LIDS SHALL HAVE MIN. H-20 RATING FOR SW AND PLANTING STRIP APPLICATIONS.
- THE GAS REGULATOR, METER AND OTHER COMPONENTS INSTALLED IN THE UTL. BOX MUST BE REGULARLY INSPECTED FOR SIGNS OF CORROSION.
- THIS STANDARD IS INTENDED FOR RECONSTRUCTION OF THE EXISTING METER SETS; AT ALL NEW CONSTRUCTIONS METER SETS LOCATIONS SHALL BE ABOVE GROUND.
- METER BOX SHALL BE ARMORCAST POLYMERE CONCRETE UTILITY BOX (30"x60"x36") ASSEMBLY W/ TWO PIECE COVER AND TWO DROP IN METER READING LIDS MARKED "GAS" AND (1) 12" EXTENSION.

BY	DATE	COMMERCIAL/INDUSTRIAL ROTARY METER SET ASSEMBLY 2,000-3,000 SCFH UTILITY BOX (CURB LOCATION) STANDARD DETAIL	APPROVED: FEBRUARY 26, 2020	SCALE: 1"=1'-0"
DRAWN A.P.	8/96		<i>Silvia Santos</i> 50674	DWG. NO.
CHECKED A.P.	8/96		SILVIA LEE SANTOS ENGINEERING MANAGER	STD. GD-26A
REVIEWED A.P.	2/20		REVISION: FEBRUARY 26, 2020	APPENDIX C

CITY OF PALO ALTO, CALIFORNIA

LIST OF MATERIALS

NO.	DESCRIPTION	STOCK NO.	UNIT	QUANTITY
1	2" IPS TRANSITION FITTING, THREADED END	45599	EA.	1
2	2" TEE, BLK	41804	EA.	1
3	2" x 3" NIPPLE, BLK	41452	EA.	7
4	2" H-11179 MUELLER METER VALVE WITH INSULATED OUTLET	43005	EA.	1
5	2" MALE x 2" FEMALE STREET ELBOW, BLK	41365	EA.	2
6	2" FILTER, PHILPOTT MODEL 200-S, 10 MICRON NPT THREADED CONNECTIONS	44317	EA.	1
7	2" NPT ITRON B38R REGULATOR WITH 2-1/2" FULL CAPACITY INTERNAL RELIEF VALVE WITH 3/8" ORIFICE AND BLACK, PURPLE, AND BLUE/WHITE AND SILVER SPRINGS FOR DELIVERY OF 2,000 SCFH AT SET PRESSURE OF 7" W.C., 14" W.C., 1 PSIG, AND 2 PSIG RESPECTIVELY; AND 1/2" ORIFICE WITH BLACK, PURPLE, BLUE/WHITE, AND SILVER SPRINGS FOR DELIVERY OF 3,000 SCFH AT SET PRESSURE OF 7" W.C., 14" W.C., 1 PSIG, AND 2 PSIG RESPECTIVELY	44321	EA.	1
	B38R 3/8" ORIFICE	43061	EA.	1
	B38R 1/2" ORIFICE	43060	EA.	1
	B38R GREEN SPRING	44358	EA.	1
	B38R BLACK SPRING	44356	EA.	1
	B38R BLUE/WHITE SPRING	44347	EA.	1
	B38R SILVER SPRING	44357	EA.	1
	B38R PURPLE SPRING	44348	EA.	1
8	2" UNION, GRD JOINT, BLK	41904	EA.	1
9	2" PIPE, THREADED BOTH ENDS	41516	L.F.	D.I.F.
10	2" 150 ANSI THREADED FLANGE, FLAT FACE ASTM 105	43321	EA.	2
	2" IPS 1/16" THICK, FULL FACE GASKET FOR 150 ANSI FLAT FACE FLANGE	43350	EA.	2
	STUD BOLT 5/8" x 1-1/2" WITH HEX CAP AND NUTS	43312	EA.	8
11				
A	2" 175 MAOP 3000 SCFH ROTARY GAS METER WITH A DIGITAL NON-COMPENSATED INDEX	44127	EA.	1
B	2" 175 MAOP 2000 SCFH ROTARY GAS METER WITH A DIGITAL NON-COMPENSATED INDEX	44126	EA.	1
12	2" 90 DEG. ELBOW, BLK	41314	EA.	3
13	2" H-11175 MUELLER METER VALVE, NON-INSULATED	43004	EA.	1
14	2-1/2" x 2" BUSHING, BLK	41015	EA.	1
15	2" FEMALE VENT CAP	N/A	EA.	1
16	2" PLUG, BLK	41604	EA.	1

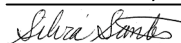
BY	DATE	COMMERCIAL/INDUSTRIAL ROTARY METER SET ASSEMBLY 2,000-3,000 SCFH UTILITY BOX (CURB LOCATION) STANDARD DETAIL	APPROVED: FEBRUARY 26, 2020  SILVIA LEE SANTOS ENGINEERING MANAGER	SCALE: NONE
DRAWN A.P.	8/96		50674 R.E. NO.	DWG. NO.
CHECKED A.P.	8/96			STD. GD-26B
REVIEWED A.P.	2/20	CITY OF PALO ALTO, CALIFORNIA	REVISION: FEBRUARY 26, 2020	APPENDIX C

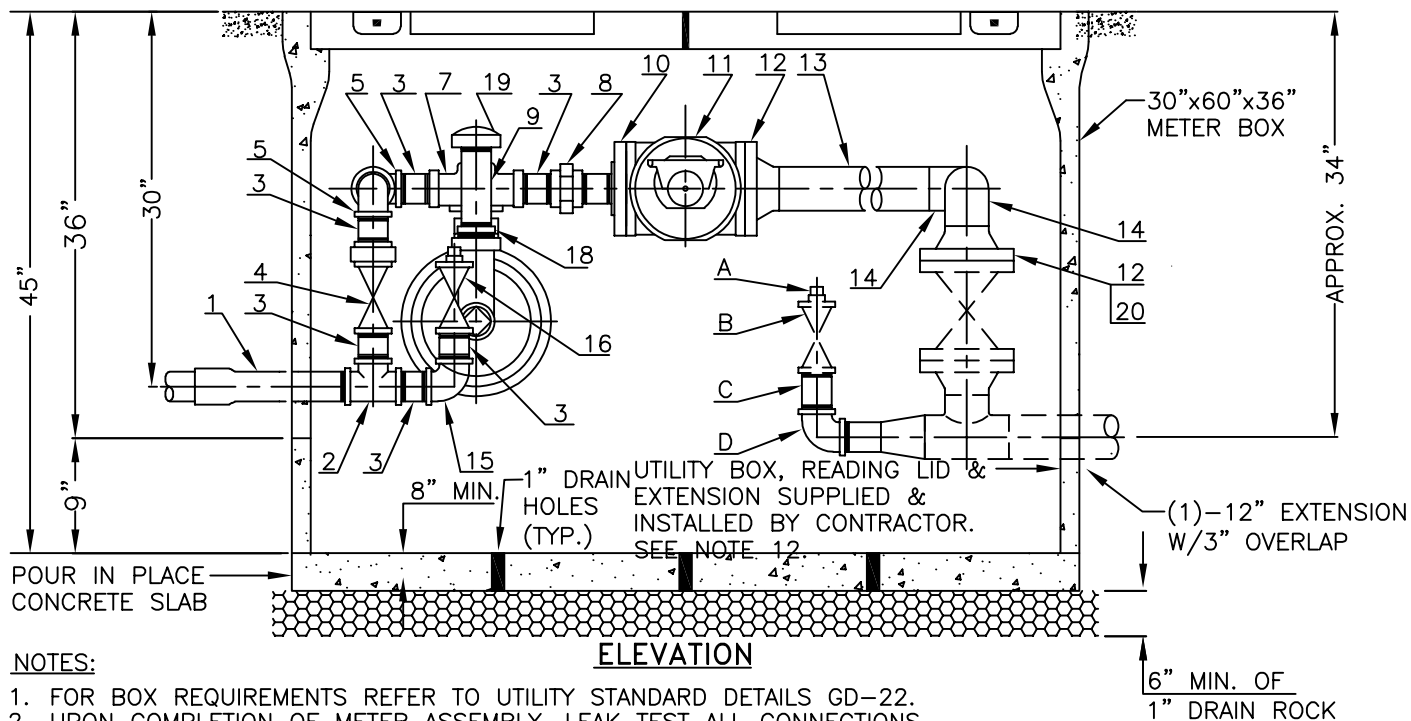
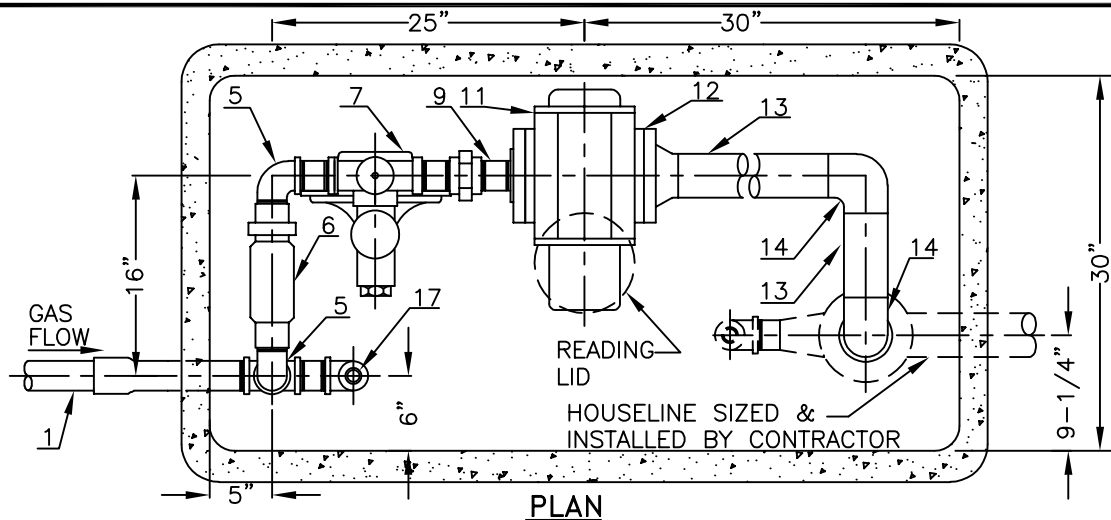
MATERIALS SUPPLIED AND INSTALLED BY CONTRACTOR

NO.	DESCRIPTION	QUANTITY
A	2" PLUG	1
B	2" METER VALVE (NATURAL GAS APPROVED)	1
C	2" NIPPLE (LENGTH AS REQUIRED)	1
D	2" 90° ELBOW	1

ESTIMATED PRESSURE LOSS IN DOWNSTREAM OF REGULATOR CITY PIPING

FLOW SCFH	SET PRESSURE	PRESSURE AT THE CUSTOMER PIPING	SET PRESSURE TO COMPENSATE FOR CITY PIPING HEADLOSS
2000	7" W.C.	5.988" W.C.	8.012" W.C.
	14" W.C.	12.890" W.C.	15.110" W.C.
	1 PSIG	0.961 PSIG	1.039 PSIG
	2 PSIG	1.961 PSIG	2.039 PSIG
3000	7" W.C.	5.768" W.C.	8.232" W.C.
	14" W.C.	12.773" W.C.	15.227" W.C.
	1 PSIG	0.956 PSIG	1.044 PSIG
	2 PSIG	1.956 PSIG	2.044 PSIG

BY	DATE	COMMERCIAL/INDUSTRIAL ROTARY METER SET ASSEMBLY 2,000-3,000 SCFH UTILITY BOX (CURB LOCATION) STANDARD DETAIL	APPROVED: FEBRUARY 26, 2020	SCALE: NONE
DRAWN A.P.	8/96		 SILVIA LEE SANTOS ENGINEERING MANAGER	DWG. NO.
CHECKED A.P.	8/96		50674 R.E. NO.	STD. GD-26C
REVIEWED A.P.	2/20	CITY OF PALO ALTO, CALIFORNIA	REVISION: FEBRUARY 26, 2020	APPENDIX C



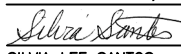
NOTES:

1. FOR BOX REQUIREMENTS REFER TO UTILITY STANDARD DETAILS GD-22.
2. UPON COMPLETION OF METER ASSEMBLY, LEAK TEST ALL CONNECTIONS.
3. AN ACTUAL SET CONFIGURATION MAY REQUIRE FIELD ADJUSTMENT. BOX DIMENSIONS ARE SHOWN.
4. IT IS ASSUMED THAT INLET PRESSURE DOWNSTREAM OF THE FILTER IS MIN. 10 PSIG.
5. REGULATOR ITRON B38R (44321) IS SHIPPED WITH 5/8" ORIFICE AND BROWN SPRING. APPROPRIATE SPRING/ORIFICE SHALL BE INSTALLED BASED ON APPLICATION AND AS SPECIFIED ON THE DRAWING. BLUE SPRING (44355) MAY BE USED FOR DELIVERY OF 14" W.C. BASED ON CONFIGURATION OF DOWNSTREAM PIPING.
6. THE ESTIMATED PRESSURE LOSS, SHOWN IN THE TABLE, INCLUDES DIFFERENTIAL LOSS ACROSS THE METER AT 100% FLOW.
7. THE ESTIMATED PRESSURE LOSS THROUGH RISER, METER VALVE, FITTINGS, AND FILTER IS APPROX 0.5 PSIG.
8. BOX AND LIDS SHALL HAVE MIN. H-20 RATING FOR SW AND PLANTING STRIP APPLICATIONS.
9. FLANGE TO FLANGE DIMENSIONS OF 7,000 SCFH AND 5,000 SCFH METERS ARE DIFFERENT REQUIRING CHANGE IN ITEMS 9 AND 13 LENGTHS.
10. THE GAS REGULATOR, METER AND OTHER COMPONENTS INSTALLED IN THE UTL. BOX MUST BE REGULARLY INSPECTED FOR SIGNS OF CORROSION.
11. THIS STANDARD IS INTENDED FOR RECONSTRUCTION OF THE EXISTING METER SETS; AT ALL NEW CONSTRUCTION METER SETS LOCATIONS SHALL BE ABOVE GROUND.
12. METER BOX SHALL BE ARMORCAST POLYMERE CONCRETE UTILITY BOX (30"x60"x36") ASSEMBLY W/ TWO PIECE COVER AND TWO DROP IN METER READING LIDS MARKED "GAS" AND (1)-12" EXTENSION.

BY	DATE	COMMERCIAL/INDUSTRIAL ROTARY METER SET ASSEMBLY 5,000-7,000 SCFH UTILITY BOX (CURB LOCATION) STANDARD DETAIL	APPROVED: FEBRUARY 26, 2020	SCALE: 1"=1'-0"
DRAWN	A.P. 8/96		<i>Silvia Santos</i> 50674	DWG. NO.
CHECKED	A.P. 8/96		SILVIA LEE SANTOS ENGINEERING MANAGER	STD. GD-27A
REVIEWED	A.P. 2/20		REVISION: FEBRUARY 26, 2020	APPENDIX C
		CITY OF PALO ALTO, CALIFORNIA		

LIST OF MATERIALS

NO.	DESCRIPTION	STOCK NO.	UNIT	QUANTITY
1	2" IPS TRANSITION FITTING, THREADED END	45599	EA.	1
2	2" TEE, BLK	41804	EA.	1
3	2" x 3" NIPPLE, BLK	41452	EA.	5
4	2" H-11179 MUELLER METER VALVE WITH INSULATED OUTLET	43005	EA.	1
5	2" MALE x 2" FEMALE STREET ELBOW, BLK	41365	EA.	2
6	2" FILTER, PHILPOTT MODEL 200-S, 10 MICRON, NPT THREADED CONNECTIONS	44317	EA.	1
7	2" NPT ITRON B38R REGULATOR WITH 2-1/2" FULL CAPACITY INTERNAL RELIEF VALVE WITH 5/8" ORIFICE AND GREEN, PURPLE, AND BLUE/WHITE SPRINGS FOR DELIVERY OF 5,000 SCFH AT SET PRESSURE OF 7" W.C., 14" W.C., AND 1 PSIG RESPECTIVELY AND 3/4" ORIFICE WITH SILVER SPRING FOR DELIVERY OF 5,000 SCFH AT SET PRESSURE OF 2 PSIG; AND 3/4" ORIFICE WITH GREEN, PURPLE, AND BLUE/WHITE SPRINGS FOR DELIVERY OF 7000 SCFH AT SET PRESSURES OF 7" W.C., 14" W.C., AND 1 PSIG RESPECTIVELY AND 1" ORIFICE WITH SILVER SPRING FOR DELIVERY OF 7000 SCFH AT AT 2 PSIG	44321	EA.	1
	B38R 3/4" ORIFICE	43062	EA.	1
	B38R 1" ORIFICE	43063	EA.	1
	B38R GREEN SPRING	44358	EA.	1
	B38R BLUE/WHITE SPRING	44347	EA.	1
	B38R SILVER SPRING	44357	EA.	1
	B38R PURPLE SPRING	44348	EA.	1
8	2" UNION, GRD JOINT, BLK	41904	EA.	1
9	2" NIPPLE, THREADED ON ONE END	41516	L.F.	D.I.F.
10	3" x 2" 150 ANSI REDUCING FLANGE, FLAT FACE, SLIP-ON, A 105	43322	EA.	1
	3" IPS 1/16" THICK, FULL FACE GASKET FOR 150 ANSI FLAT FACE FLANGE	43351	EA.	1
	STUD BOLT 5/8" x 1-3/4" WITH HEX CAP AND NUTS	43313	EA.	4
11				
A	3" 175 MAOP 7000 SCFH ROTARY GAS METER WITH A DIGITAL NON-COMPENSATED INDEX	44129	EA.	1
B	3" 175 MAOP 5000 SCFH ROTARY GAS METER WITH A DIGITAL NON-COMPENSATED INDEX	44128	EA.	1
12	3" 150 ANSI WELD NECK FLANGE, FLAT FACE ASTM A105	43331	EA.	2
	3" IPS 1/16" THICK, FULL FACE GASKET FOR 150 ANSI FLAT FACE FLANGE	43351	EA.	1
	STUD BOLT 5/8" x 1-3/4" WITH HEX CAP AND NUTS	43313	EA.	4

BY	DATE	COMMERCIAL/INDUSTRIAL ROTARY METER SET ASSEMBLY 5,000-7,000 SCFH UTILITY BOX (CURB LOCATION) STANDARD DETAIL	APPROVED: FEBRUARY 26, 2020	SCALE: NONE
DRAWN A.P.	8/96		 SILVIA LEE SANTOS ENGINEERING MANAGER	DWG. NO. STD. GD-27B
CHECKED A.P.	8/96		50674 R.E. NO.	
REVIEWED A.P.	2/20	CITY OF PALO ALTO, CALIFORNIA	REVISION: FEBRUARY 26, 2020	APPENDIX C

LIST OF MATERIALS

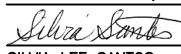
NO.	DESCRIPTION	STOCK NO.	UNIT	QUANTITY
13	3" PIPE, PLAIN END	41518	L.F.	D.I.F.
14	3" 90° ELBOW SCH. 40, BUTT-WELD ENDS, SHORT RADIUS	41368	EA.	2
15	2" 90 DEG. ELBOW, BLK	41314	EA.	1
16	2" H-11175 MUELLER METER VALVE, NON-INSULATED	43004	EA.	1
17	2" PLUG, BLK	41604	EA.	1
18	2-1/2" x 2" BUSHING, BLK	41105	EA.	1
19	2" FEMALE VENT CAP	N/A	EA.	1
20	3" ANSI 150 FLANGE ISOLATION KIT	43360	EA.	1

MATERIALS SUPPLIED AND INSTALLED BY CONTRACTOR

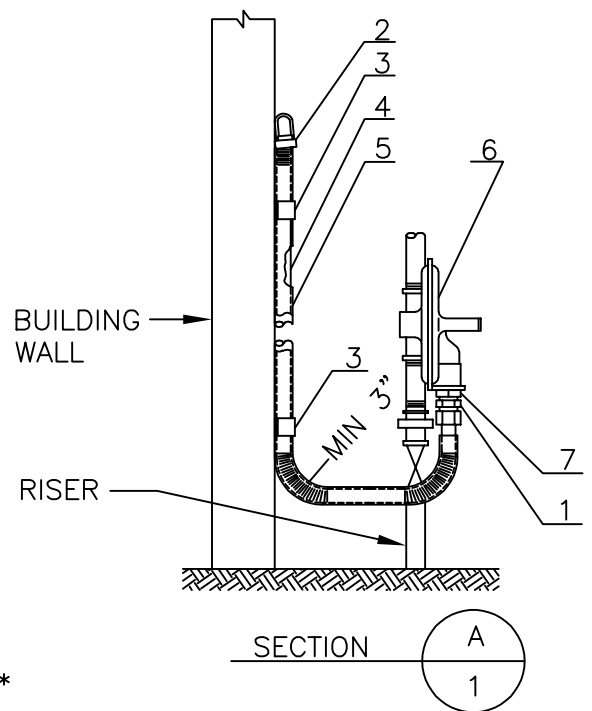
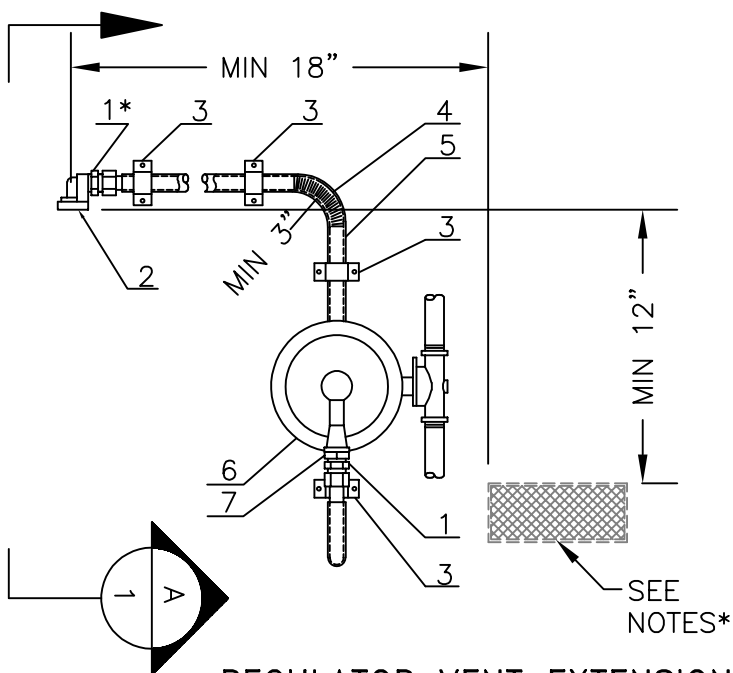
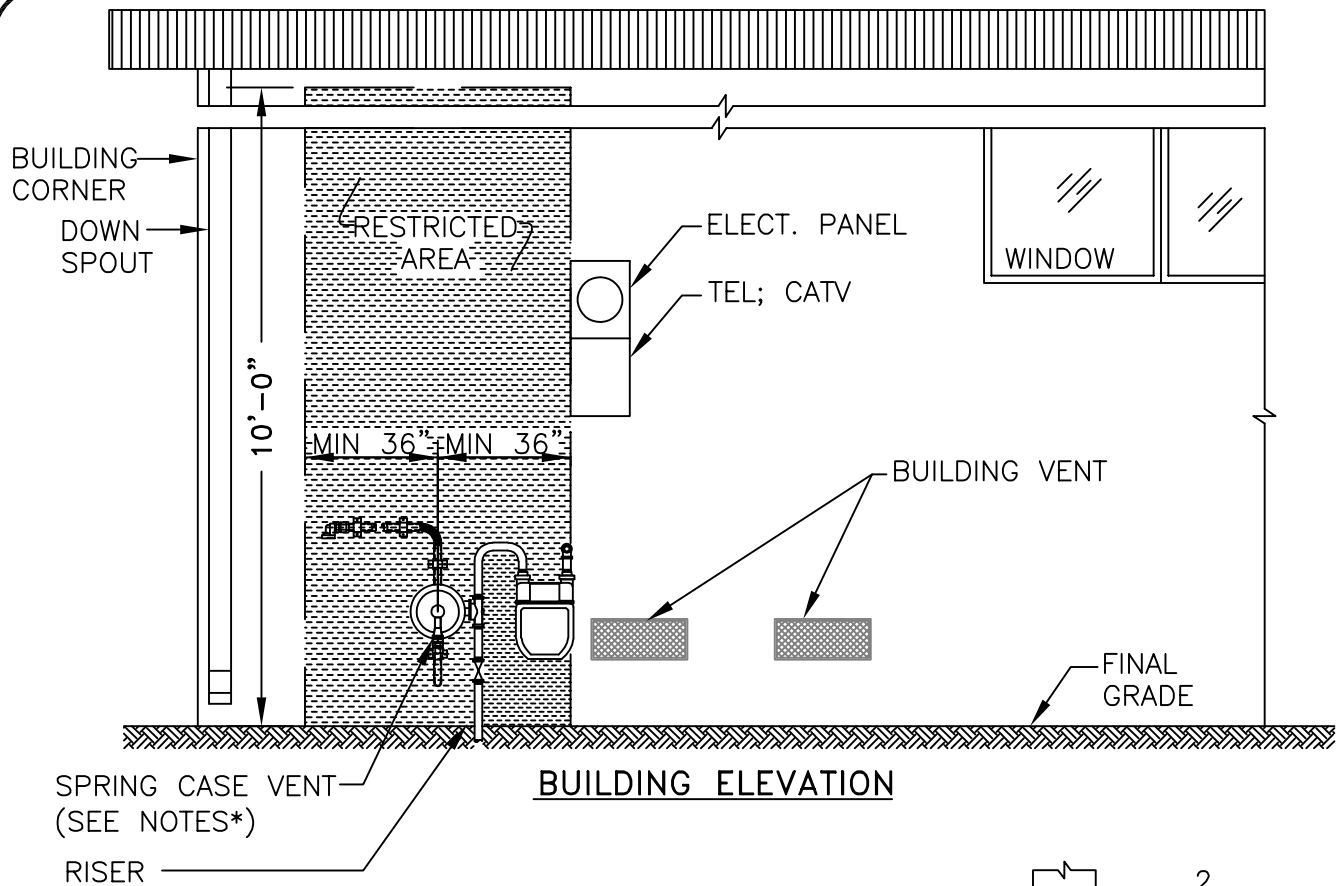
NO.	DESCRIPTION	QUANTITY
A	2" PLUG	1
B	2" METER VALVE (NATURAL GAS APPROVED)	1
C	2" NIPPLE (LENGTH AS REQUIRED)	1
D	2" 90° ELBOW	1

ESTIMATED PRESSURE LOSS IN DOWNSTREAM OF REGULATOR CITY PIPING

FLOW SCFH	SET PRESSURE	PRESSURE AT THE CUSTOMER PIPING	SET PRESSURE TO COMPENSATE FOR CITY PIPING HEADLOSS
5000	7" W.C.	5.881" W.C.	8.062" W.C.
	14" W.C.	12.883" W.C.	15.061" W.C.
	1 PSIG	0.96 PSIG	1.038 PSIG
	2 PSIG	1.96 PSIG	2.038 PSIG
7000	7" W.C.	5.782" W.C.	8.114" W.C.
	14" W.C.	12.786" W.C.	15.112" W.C.
	1 PSIG	0.956 PSIG	1.04 PSIG
	2 PSIG	1.957 PSIG	2.04 PSIG

BY DRAWN CHECKED REVIEWED	A.P. A.P. A.P.	DATE 8/96 8/96 2/20	COMMERCIAL/INDUSTRIAL ROTARY METER SET ASSEMBLY 5,000-7,000 SCFH UTILITY BOX (CURB LOCATION) STANDARD DETAIL	APPROVED: FEBRUARY 26, 2020  SILVIA LEE SANTOS ENGINEERING MANAGER	SCALE: NONE
				50674 R.E. NO.	DWG. NO. STD. GD-27C
				REVISION: FEBRUARY 26, 2020	APPENDIX C

CITY OF PALO ALTO, CALIFORNIA



BY	DATE	GAS SERVICE REGULATOR VENT EXTENSION ASSEMBLY STANDARD DETAIL	APPROVED: FEBRUARY 26, 2020	SCALE: NONE
DRAWN A.P.	4/97		<i>Silvia Lee Santos</i> 50674	DWG. NO.
CHECKED A.P.	4/97		SILVIA LEE SANTOS ENGINEERING MANAGER R.E. NO.	STD. GD-28A
REVIEWED A.P.	2/20	CITY OF PALO ALTO, CALIFORNIA	REVISION: FEBRUARY 26, 2020	APPENDIX C

LIST OF MATERIALS

NO.	DESCRIPTION	STOCK NO.	QUANTITY
1	3/4" MECHANICAL ADAPTER (3/4" TUBING BY 3/4" MIPT)	N/A	2
2	3/4" ELBOW VENT WITH BUG SCREEN	N/A	1
3	SUPPORT CLAMP	N/A	D.I.F.
4	3/4" PVC OR CSST TUBING	N/A	LENGTH D.I.F.
5	1-1/4" PROTECTIVE STEEL CONDUIT	N/A	LENGTH D.I.F.
6	3/4" REGULATOR		1
7	1" MALE x 3/4" FEMALE NPT BRASS BUSHING (IF REQUIRED)	22020	1

NOTES:

1. IF WINDOWS, BUILDING VENTS, CATV OR TELEPHONE LINES, ELECTRIC PANELS, OR OTHER SOURCES OF IGNITION ARE WITHIN 36" HORIZONTALLY, OR 10' VERTICALLY, OF THE GAS REGULATOR CASE VENT, OR IF THE REGULATOR IS INSTALLED IN AN ENCLOSURE, A REGULATOR VENT EXTENSION IS REQUIRED.
2. FOR GAS METER INSTALLATION REQUIREMENTS, REFER TO THE STD. GD-01A, GD-01B, 02A, AND 02B STANDARD DETAILS.
3. RECOMMENDED SPACING OF SUPPORT CLAMPS IS 12".

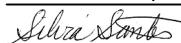
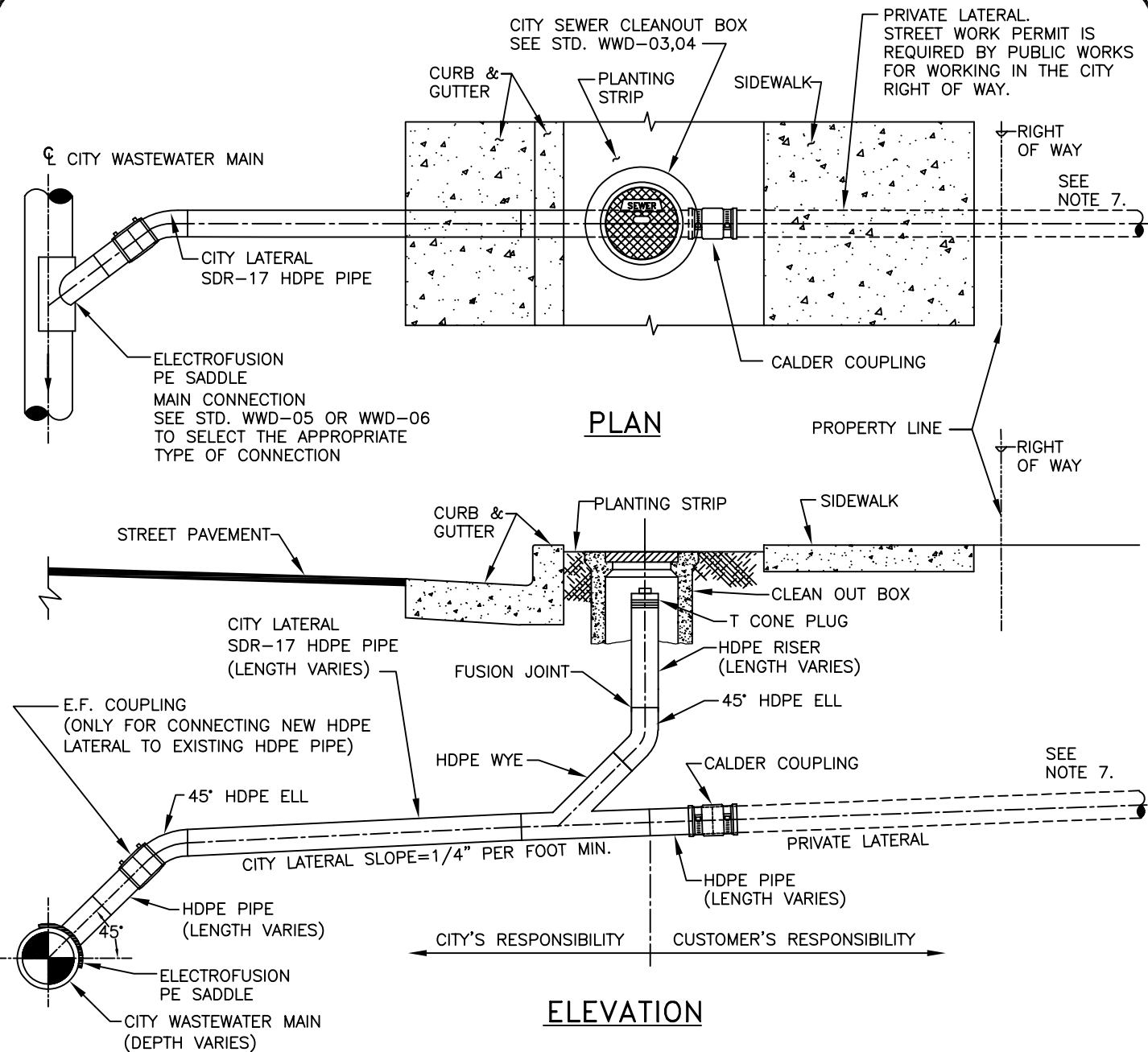
BY	DATE	GAS SERVICE REGULATOR VENT EXTENSION ASSEMBLY STANDARD DETAIL	APPROVED: FEBRUARY 26, 2020	SCALE: NONE
DRAWN A.P.	4/97		 SILVIA LEE SANTOS ENGINEERING MANAGER	DWG. NO.
CHECKED A.P.	4/97		50674 R.E. NO.	STD. GD-28B
REVIEWED A.P.	2/20	CITY OF PALO ALTO, CALIFORNIA	REVISION: FEBRUARY 26, 2020	APPENDIX C

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Wastewater Standard Details

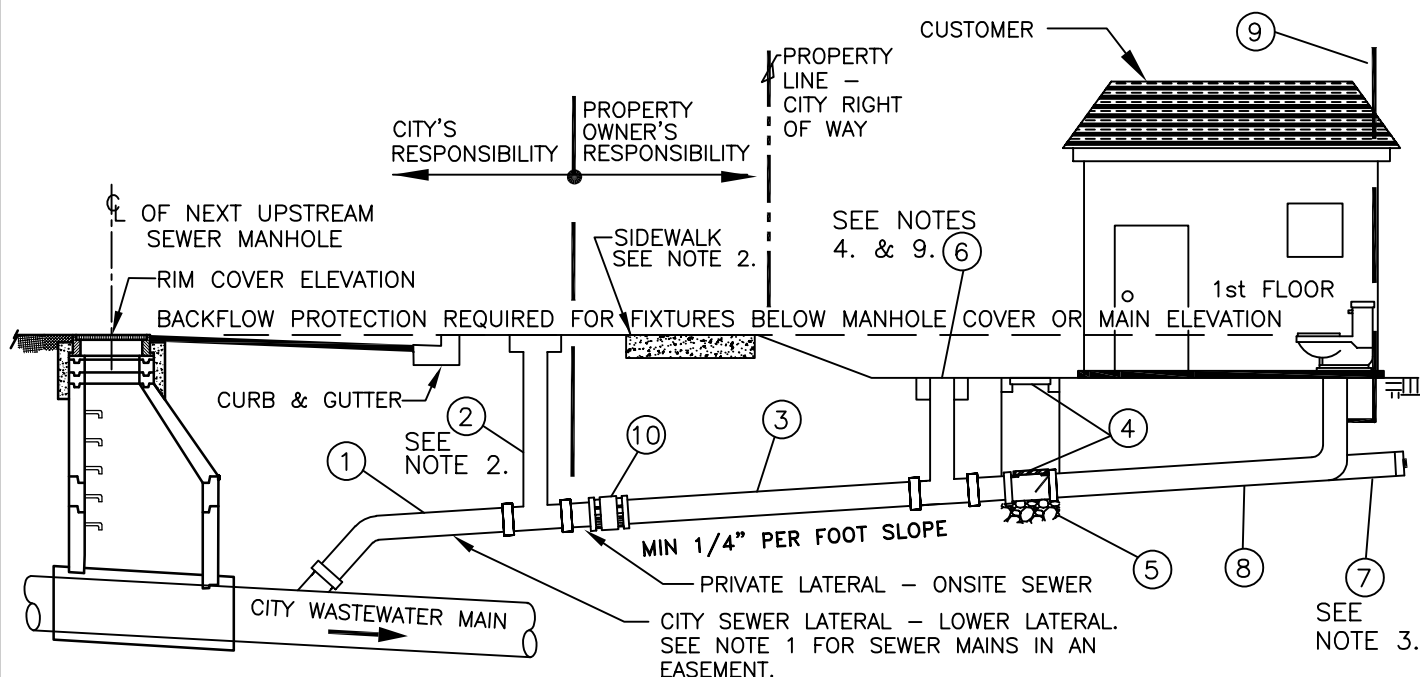
<u>Detail No.</u>	<u>Title</u>
WWD-01A	Sanitary Sewer Lateral
WWD-01B	Sanitary Sewer Lateral with Backwater Valve Protection Type 1
WWD-01C	Sanitary Sewer Lateral with Backwater Valve Protection Type 2
WWD-02A	Sanitary Sewer Cleanout Type 1
WWD-02B	Sanitary Sewer Cleanout Type 2
WWD-03	Sanitary Sewer Cleanout Box Type 1
WWD-04	Sanitary Sewer Cleanout Box Type 2 (Traffic Area)
WWD-05	Sanitary Sewer Lateral to Main Connections
WWD-06	Sanitary Sewer Lateral Connection with Tap-Tite
WWD-07A	Sanitary Sewer Manhole (For New Pipes 36" and Less)
WWD-07B	Sanitary Sewer Manhole (For Existing Pipes 36" and less)
WWD-08A	Sanitary Sewer Manhole (For New Pipes Larger Than 36")
WWD-08B	Sanitary Sewer Manhole (For Existing Pipes Larger Than 36")
WWD-09	Sanitary Sewer Manhole Outside Drop
WWD-10	Sanitary Sewer Manhole Frame and Cover



NOTES:

1. THE LOCATION OF THE CITY CLEANOUT AND LIMIT OF RESPONSABILITY WHERE SIDEWALK & CURB ARE INTEGRAL IS AT THE BACK OF SIDEWALK INSTEAD CURB IN THE PLANTING STRIP AS SHOWN.
2. LATERALS INSTALLED IN AN EASEMENT WILL BE PRIVATE FROM THE BUILDING TO THE MAIN CONNECTION AND NOT MAINTAINED BY THE CITY.
3. ALL HDPE CONNECTIONS SHALL BE BY THERMAL BUTT-FUSION OR ELECTROFUSION COUPLING.
4. VCP/PVC WYE, STRAPPED FLEX. SADDLE, TAP-TITE/INSERTA-TTEE, OR ELECTROFUSION SADDLE. SEE STD. WWD-05 & 06.
5. IF THE CITY WASTEWATER MAIN IS LOCATED IN AN EASEMENT, THE ENTIRE SEWER LATERAL FROM THE BUILDING TO THE SEWER MAIN SHALL BE THE RESPONSIBILITY OF THE CUSTOMER.
6. AN ELASTOMERIC SEALANT SHALL BE APPLIED TO THE FLEXIBLE, SHIELDED, NON-SHEAR COUPLING.
7. AN APPROVED BACKWATER VALVE MUST BE INSTALLED FOR PLUMBING DRAINAGE FIXTURES INSTALLED BELOW THE NEXT UPSTREAM MANHOLE COVER OR BELOW THE MAIN SEWER LEVEL. (CPC 710.1). SEE STD. DETAILS WW-01B, 01C.

BY	DATE	SANITARY SEWER LATERAL STANDARD DETAIL	APPROVED: FEBRUARY 26, 2020	SCALE: NONE
DRAWN AL	2/20		<i>Silvia Santos</i> 50674	DWG. NO.
CHECKED J.J.	2/20		SILVIA LEE SANTOS ENGINEERING MANAGER R.E. NO.	STD. WWD-01A
REVIEWED RA	2/20	CITY OF PALO ALTO, CALIFORNIA	REVISION: FEBRUARY 26, 2020	APPENDIX D



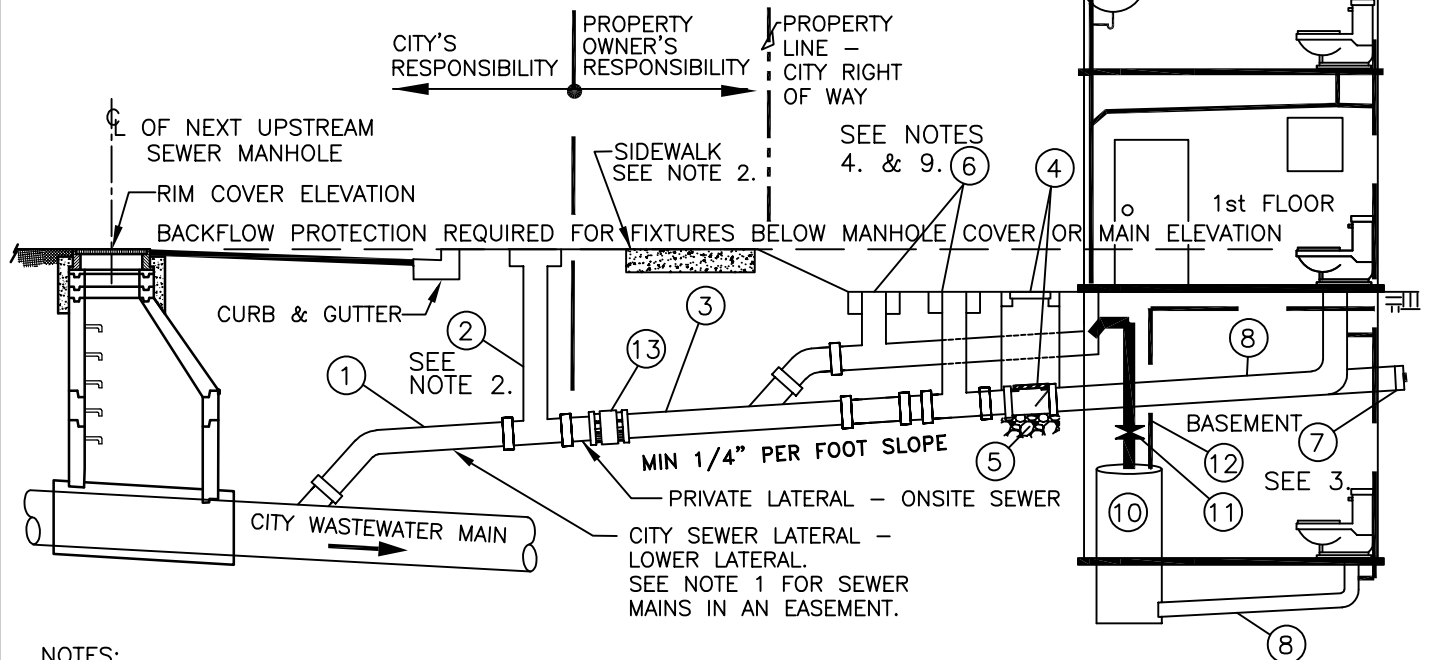
① CITY SEWER LATERAL - LOWER LATERAL	⑥ BUILDING SEWER CLEANOUT - SEE GENERAL NOTE 3.
② CITY SEWER CLEANOUT. SEE NOTE 2.	⑦ BUILDING SEWER END OF LINE CLEANOUT
③ UPPER SEWER LATERAL - BUILDING SEWER LINE	⑧ BUILDING SEWER DRAIN PIPE
④ BACKWATER VALVE & CHRISTY BOX, SEE NOTES BELOW	⑨ BUILDING SEWER VENT PIPE
⑤ DRAIN ROCK	⑩ CALDER COUPLING

NOTES:

- LATERALS IN AN EASEMENT WILL BE PRIVATE FROM THE BUILDING TO THE MAIN CONNECTION AND NOT MAINTAINED BY THE CITY.
- THE LOCATION OF THE CITY CLEANOUT AND LIMIT OF RESPONSABILITY WHERE SIDEWALK & CURB ARE INTEGRAL IS AT THE BACK OF SIDEWALK INSTEAD OF THE CURB IN THE PLANTING STRIP AS SHOWN.
- TWO WAY CLEANOUT IS REQUIRED WHEN NO END OF LINE CLEANOUT EXIST. HEAD TO HEAD DOUBLE COMBO ARE APPROVED FITTINGS. KELLY FITTINGS ARE NOT ALLOWED.
- A BACKWATER VALVE MUST BE INSTALLED FOR PLUMBING DRAINAGE FIXTURES INSTALLED BELOW THE NEXT UPSTREAM MANHOLE COVER OR BELOW THE MAIN SEWER LEVEL. (CPC 710.1)
- SEWER FIXTURES ON SUCH FLOOR LEVEL THAT ARE NOT BELOW THE NEXT UPSTREAM MANHOLE COVER ARE NOT REQUIRED TO BE PROTECTED AND SHALL NOT DISCHARGE THROUGH THE BACKWATER VALVE. (CPC 710.1)
- THE BACKWATER VALVE SHALL BE A RECTORSEAL CLEAN CHECK BACKWATER VALVE OR APPROVED EQUAL.
- THE BACKWATER VALVE MUST BE AN APPROVED DEVICE AND MUST BE INSPECTED BY BUILDING INSPECTOR.
- THE DEVICE MUST BE EASILY ACCESSIBLE WITH AN EASY TO REMOVE AND MAINTAIN ASSEMBLY.
- CLEANOUTS FOR DRAINS THAT PASS THROUGH A BACKWATER VALVE SHALL BE CLEARLY IDENTIFIED WITH A PERMANENT LABEL STATING "BACKWATER VALVE DOWNSTREAM".

BY	DATE	SANITARY SEWER LATERAL WITH BACKWATER VALVE PROTECTION STANDARD DETAIL	APPROVED: FEBRUARY 26, 2020	SCALE: NONE
DRAWN J.J.	7/16		<i>Silvia Lee Santos</i> 50674	DWG. NO.
CHECKED J.J.	02/20		SILVIA LEE SANTOS ENGINEERING MANAGER R.E. NO.	STD. WWD-01B
REVIEWED J.J.	02/20	CITY OF PALO ALTO, CALIFORNIA	REVISION: FEBRUARY 26, 2020	APPENDIX D

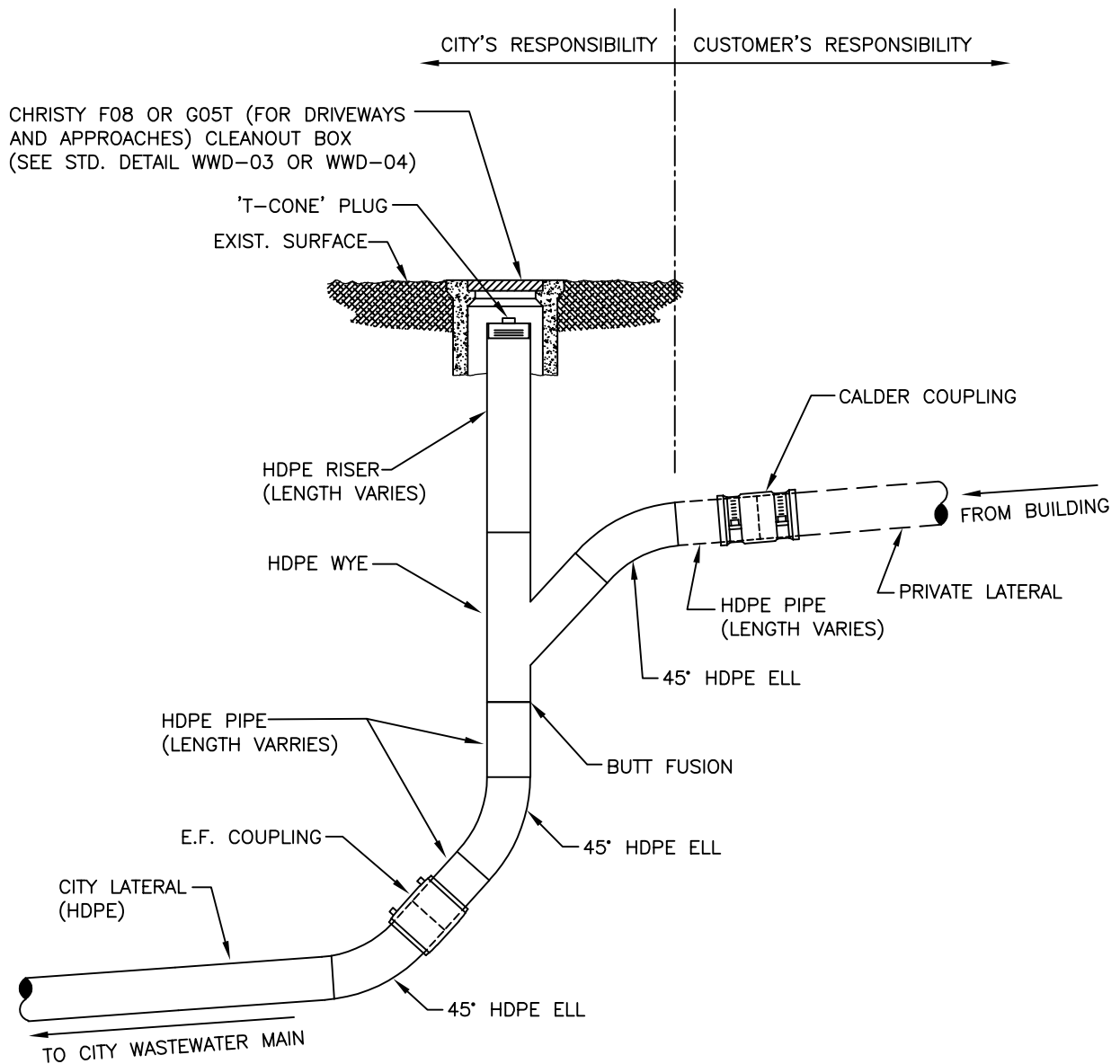
- ① CITY SEWER LATERAL – LOWER LATERAL
- ② CITY SEWER CLEANOUT
- ③ UPPER SEWER LATERAL – BUILDING SEWER LINE
- ④ BACKWATER VALVE & CHRISTY BOX, SEE NOTES BELOW
- ⑤ DRAIN ROCK
- ⑥ BUILDING SEWER CLEANOUT – SEE 6.
- ⑦ SEWER END OF LINE CLEANOUT
- ⑧ BUILDING SEWER DRAIN PIPE
- ⑨ BUILDING SEWER VENT PIPE
- ⑩ SEWER EJECTOR PUMPS (30 G.P.M MAX. DISCHARGE)
- ⑪ EJECTOR DISCHARGE LINE, GATE & CHECK OR BACKWATER VALVES
- ⑫ EJECTOR PUMP VENT PIPE
- ⑬ CALDER COUPLING



NOTES:

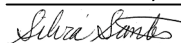
1. LATERALS IN AN EASEMENT WILL BE PRIVATE FROM THE BUILDING TO THE MAIN CONNECTION AND NOT MAINTAINED BY THE CITY.
2. THE LOCATION OF THE CITY CLEANOUT AND LIMIT OF RESPONSABILITY WHERE SIDEWALK & CURB ARE INTEGRAL IS AT THE BACK OF SIDEWALK INSTEAD OF THE CURB IN THE PLANTING STRIP AS SHOWN.
3. TWO WAY CLEANOUT IS REQUIRED WHEN NO END OF LINE CLEANOUT EXIST. HEAD TO HEAD DOUBLE COMBO ARE APPROVED FITTINGS. KELLY FITTINGS ARE NOT ALLOWED.
4. A BACKWATER VALVE MUST BE INSTALLED FOR PLUMBING DRAINAGE FIXTURES INSTALLED BELOW THE NEXT UPSTREAM MANHOLE COVER OR BELOW THE MAIN SEWER LEVEL. (CPC 710.1)
5. SEWER FIXTURES ON SUCH FLOOR LEVEL THAT ARE NOT BELOW THE NEXT UPSTREAM MANHOLE COVER ARE NOT REQUIRED TO BE PROTECTED AND SHALL NOT DISCHARGE THROUGH THE BACKWATER VALVE. (CPC 710.1)
6. THE BACKWATER VALVE SHALL BE A RECTORSEAL CLEAN CHECK BACKWATER VALVE OR APPROVED EQUAL.
7. THE BACKWATER VALVE MUST BE AN APPROVED DEVICE AND MUST BE INSPECTED BY BUILDING INSPECTOR.
8. THE DEVICE MUST BE EASILY ACCESSIBLE WITH AN EASY TO REMOVE AND MAINTAIN ASSEMBLY.
9. CLEANOUTS FOR DRAINS THAT PASS THROUGH A BACKWATER VALVE SHALL BE CLEARLY IDENTIFIED WITH A PERMANENT LABEL STATING "BACKWATER VALVE DOWNSTREAM".

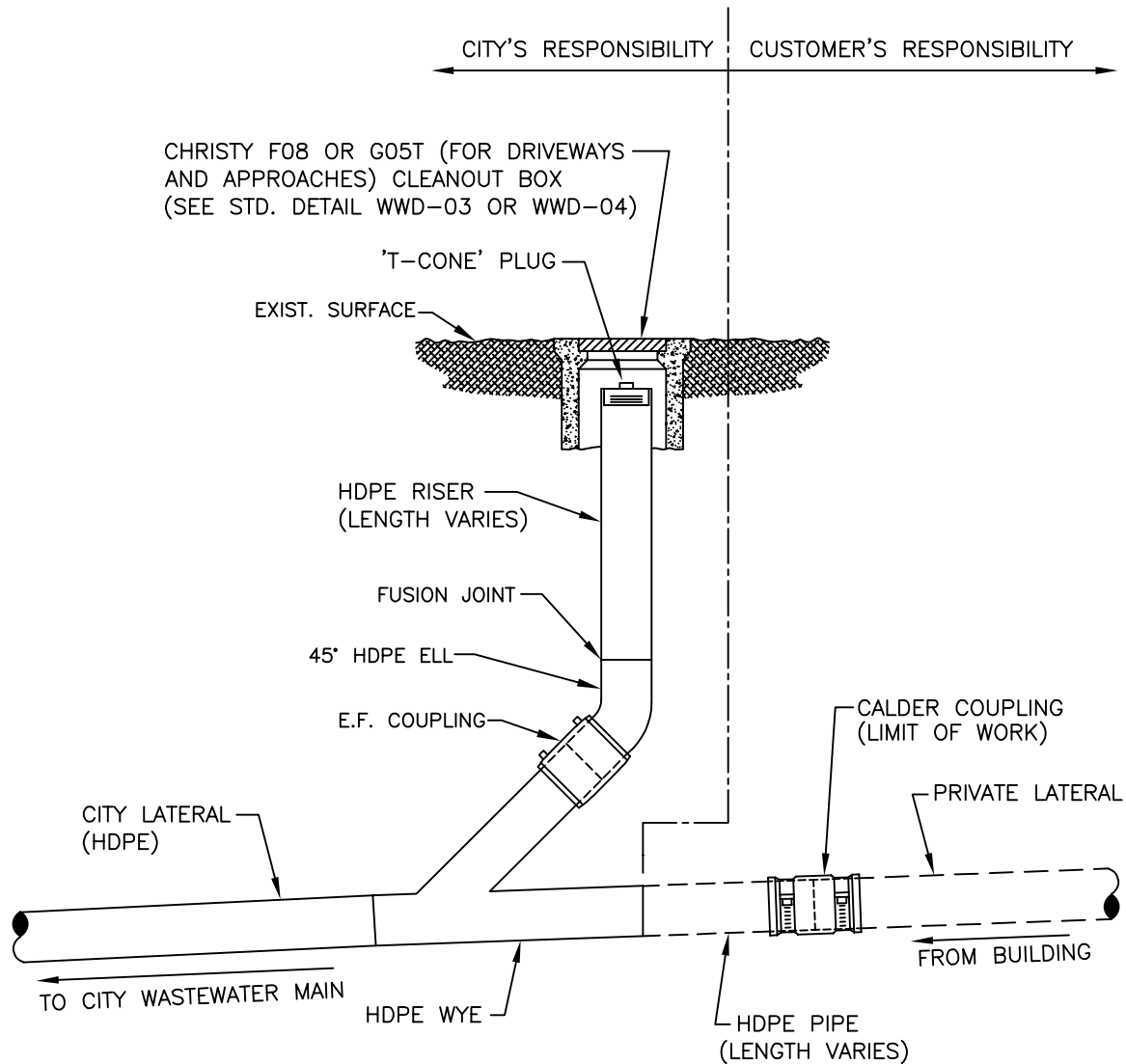
BY	DATE	SANITARY SEWER LATERAL WITH BACKWATER VALVE PROTECTION STANDARD DETAIL	APPROVED: FEBRUARY 26, 2020	SCALE: NONE
DRAWN J.J.	7/16		<i>Silvia Lee Santos</i> 50674	DWG. NO.
CHECKED J.J.	02/20		SILVIA LEE SANTOS ENGINEERING MANAGER	STD. WWD-01C
REVIEWED J.J.	02/20		REVISION: FEBRUARY 26, 2020	APPENDIX D



NOTES:

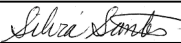
1. SEE WWD-01A FOR STANDARD SEWER CLEANOUT LOCATION.
2. ALL HDPE TO HDPE CONNECTIONS SHALL BE BY THERMAL BUTT-FUSION OR ELECTROFUSION COUPLING.
3. CLEANOUT BOX SHALL BE SET FLUSH TO FINISHED GRADE.
4. AN ELASTOMERIC SEALANT SHALL BE APPLIED TO THE FLEXIBLE, SHIELDED, NON-SHEAR COUPLING.

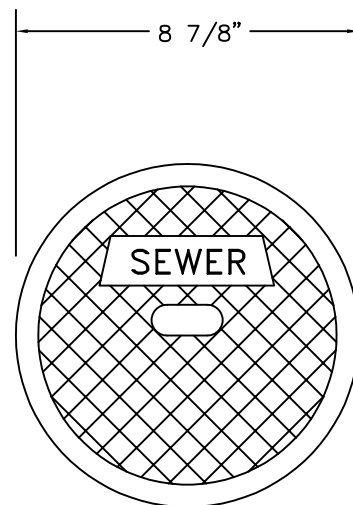
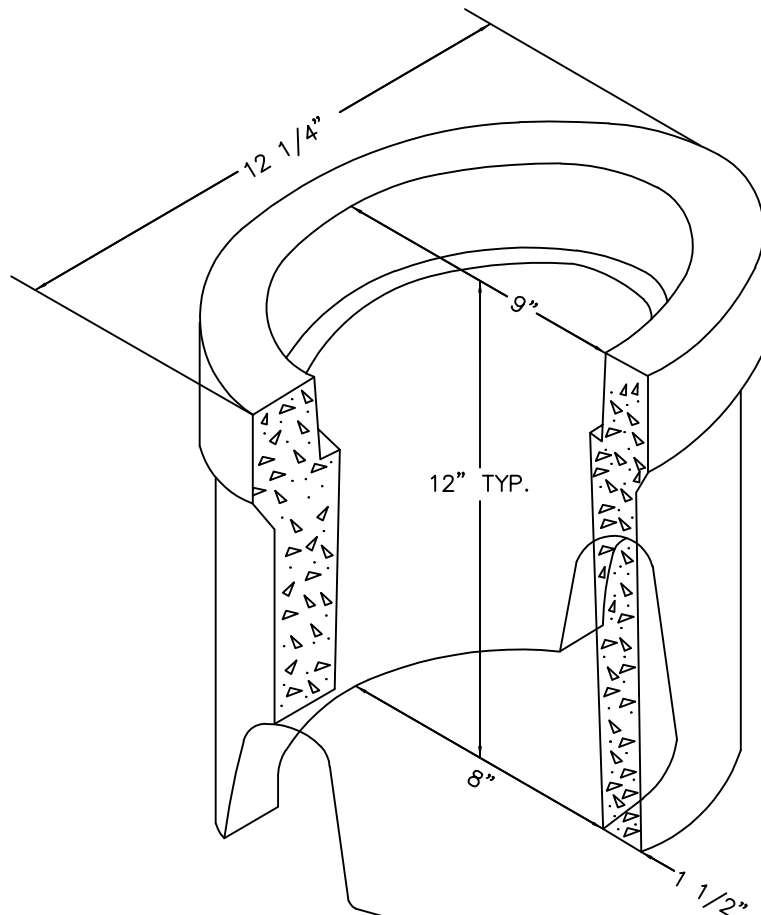
BY		DATE	SANITARY SEWER CLEANOUT TYPE I STANDARD DETAIL	APPROVED: FEBRUARY 26, 2020		SCALE: NO SCALE
DRAWN	EMM	2/20		 SILVIA LEE SANTOS ENGINEERING MANAGER		DWG. NO.
CHECKED	AL	2/20		50674 R.E. NO.		STD. WWD-02A
REVIEWED	RA	2/20		REVISION: FEBRUARY 26, 2020		APPENDIX D



NOTES:

1. SEE WWD-01A FOR STANDARD SEWER CLEANOUT LOCATION.
2. ALL HDPE TO HDPE CONNECTIONS SHALL BE BY THERMAL BUTT-FUSION OR ELECTROFUSION COUPLING.
3. CLEANOUT BOX SHALL BE SET FLUSH TO FINISHED GRADE.
4. AN ELASTOMERIC SEALANT SHALL BE APPLIED TO THE FLEXIBLE, SHIELDED, NON-SHEAR COUPLING.

BY		DATE	SANITARY SEWER CLEANOUT TYPE 2 STANDARD DETAIL CITY OF PALO ALTO, CALIFORNIA	APPROVED: FEBRUARY 26, 2020	SCALE: NONE
DRAWN	EMM	2/20		 50674 SILVIA LEE SANTOS ENGINEERING MANAGER R.E. NO.	DWG. NO. STD. WWD-02B
CHECKED	AL	2/20		REVISION: FEBRUARY 26, 2020	APPENDIX D
REVIEWED	RA	2/20			



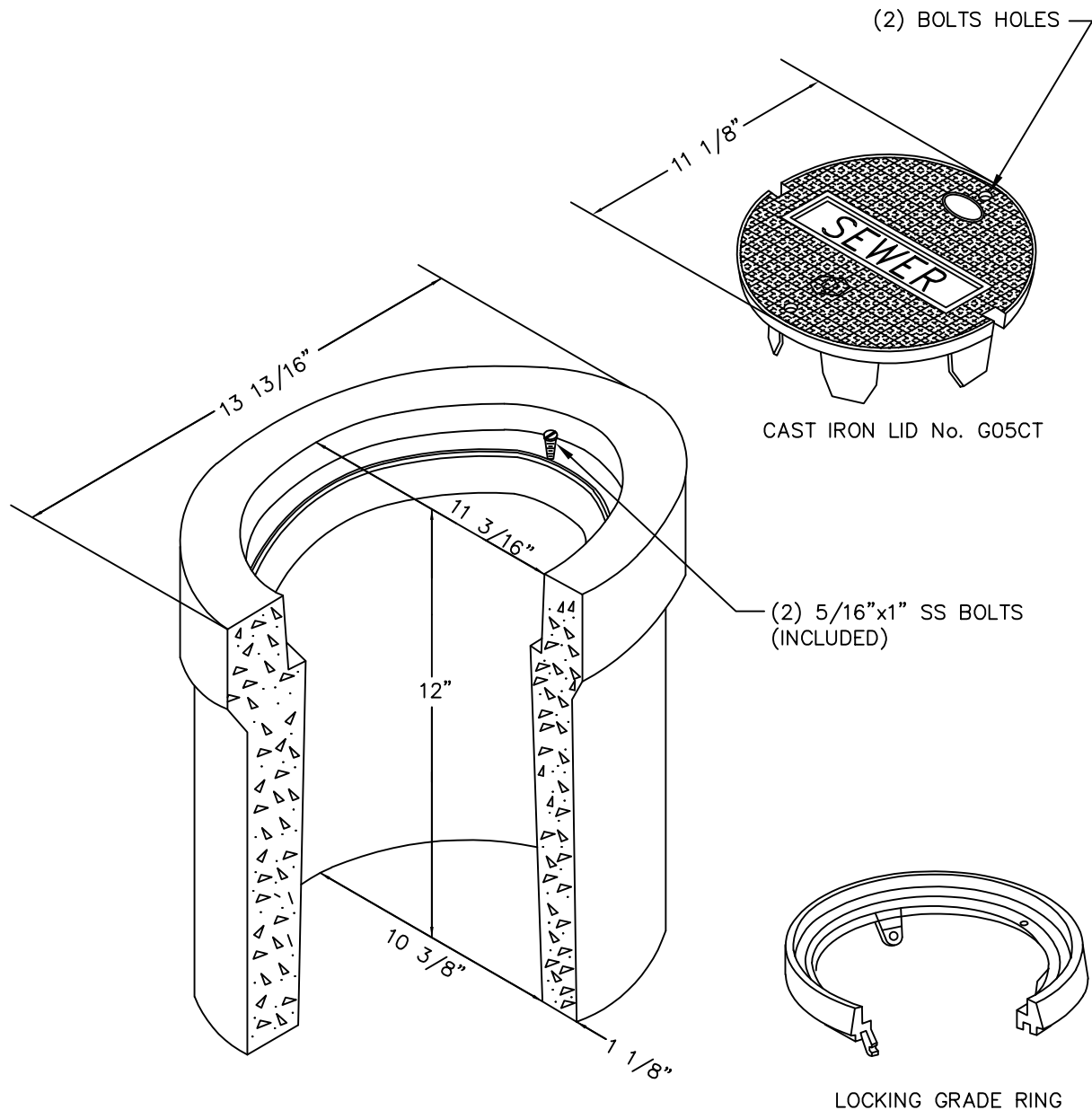
CAST IRON LID No. F08C

OLDCASTLE PRECAST CHRISTY CURB VALVE
BOX No. F08 BOX WITH CAST IRON LID No.
F08C FOR NON-TRAFFIC AREAS

NOTE:

CLEANOUT BOX SHALL BE MARKED ON THE LID
WITH THE LETTERS "SEWER"

BY		DATE	SANITARY SEWER CLEANOUT BOX TYPE 1 STANDARD DETAIL	APPROVED: FEBRUARY 26, 2020		SCALE: NONE
DRAWN	J.J.	2/19		 50674		DWG. NO.
CHECKED	A.L.	2/20		SILVIA LEE SANTOS ENGINEERING MANAGER		STD. WWD-03
REVIEWED	R.A.	2/20		CITY OF PALO ALTO, CALIFORNIA		REVISION: FEBRUARY 26, 2020
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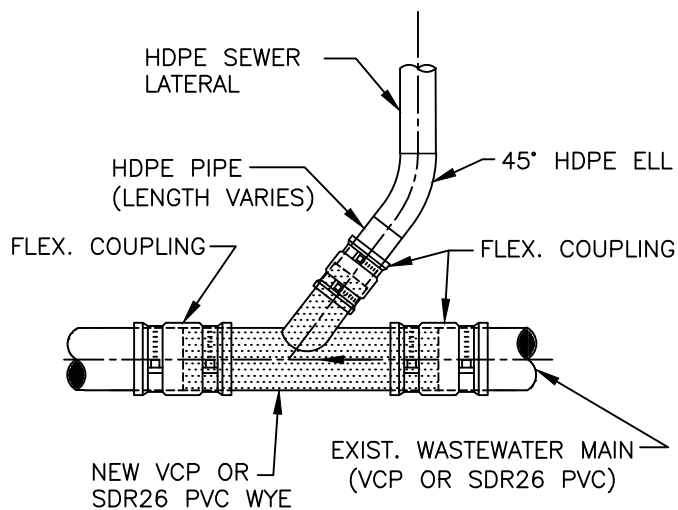
OLDCASTLE PRECAST CHRISTY TRAFFIC VALVE
BOX H/20 RATED No. G05T WITH CAST IRON
LID No. G05CT FOR DRIVEWAYS AND
APPROACHES

NOTE:

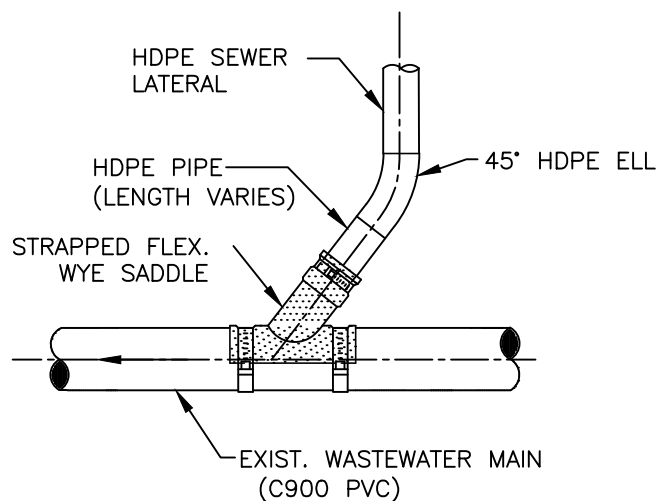
CLEANOUT BOX SHALL BE MARKED ON THE LID
WITH THE LETTERS "SEWER"

BY		DATE	SANITARY SEWER CLEANOUT BOX TYPE 2 (TRAFFIC AREAS) STANDARD DETAIL	APPROVED: FEBRUARY 26, 2020	SCALE: NONE
DRAWN	J.J.	2/19		 50674	DWG. NO.
CHECKED	A.L.	2/20		SILVIA LEE SANTOS ENGINEERING MANAGER	R.E. NO. STD. WWD-04
REVIEWED	R.A.	2/20		CITY OF PALO ALTO, CALIFORNIA	REVISION: FEBRUARY 26, 2020

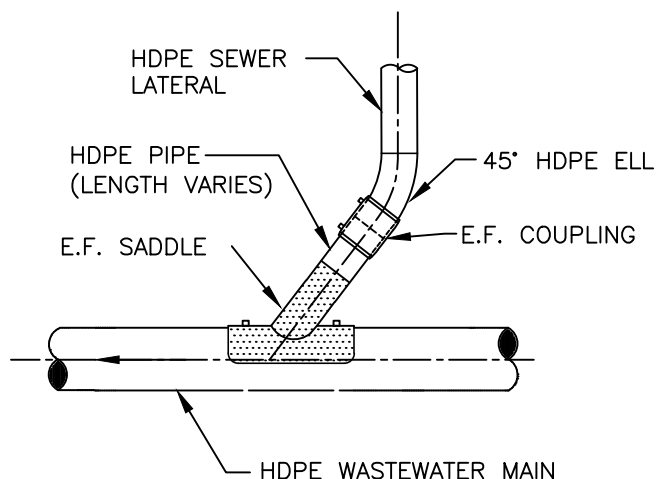
A HDPE LATERAL to VCP or SDR26 PVC MAIN



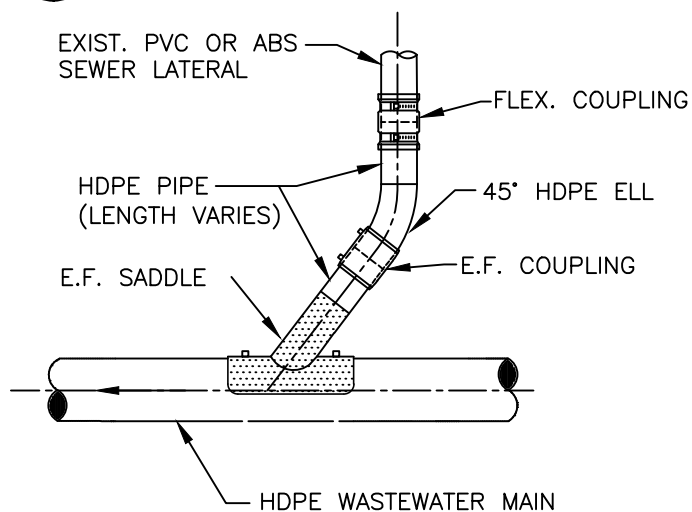
B HDPE LATERAL to PVC C900 MAIN



C HDPE LATERAL to HDPE MAIN



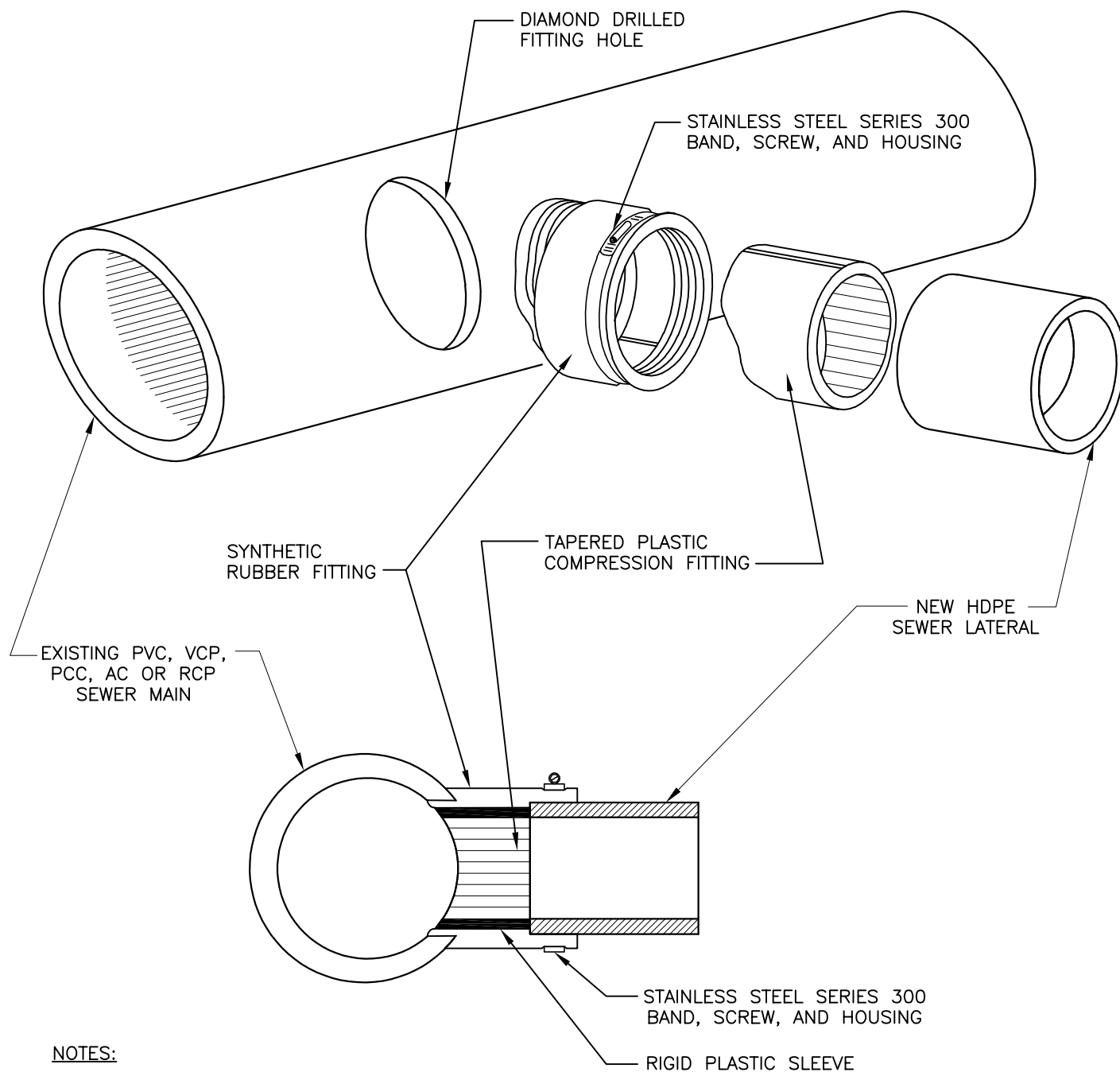
D PVC/ABS LATERAL to HDPE MAIN



NOTES:

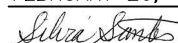
1. UPON ENGINEER'S APPROVAL, TAP-TITE OR INSERTA-TEE CAN BE INSTALLED ON C900 PVC, SDR26 PVC, AND VCP MAINS 10" AND LARGER. SEE DETAIL WWD-06.
2. ELASTOMERIC SEALANT SHALL BE APPLIED TO ALL FLEXIBLE COUPLINGS AND SADDLES.
3. ALL HDPE TO HDPE CONNECTIONS SHALL BE BY THERMAL BUTT-FUSION OR ELECTROFUSION COUPLING.
4. ALL NEW LATERALS SHALL BE HIGH-DENSITY-POLYETHYLENE (HDPE).
5. NEW LATERAL CONNECTION AT MAIN SHALL BE AT LEAST 24" FROM THE NEAREST LATERAL CONNECTION.

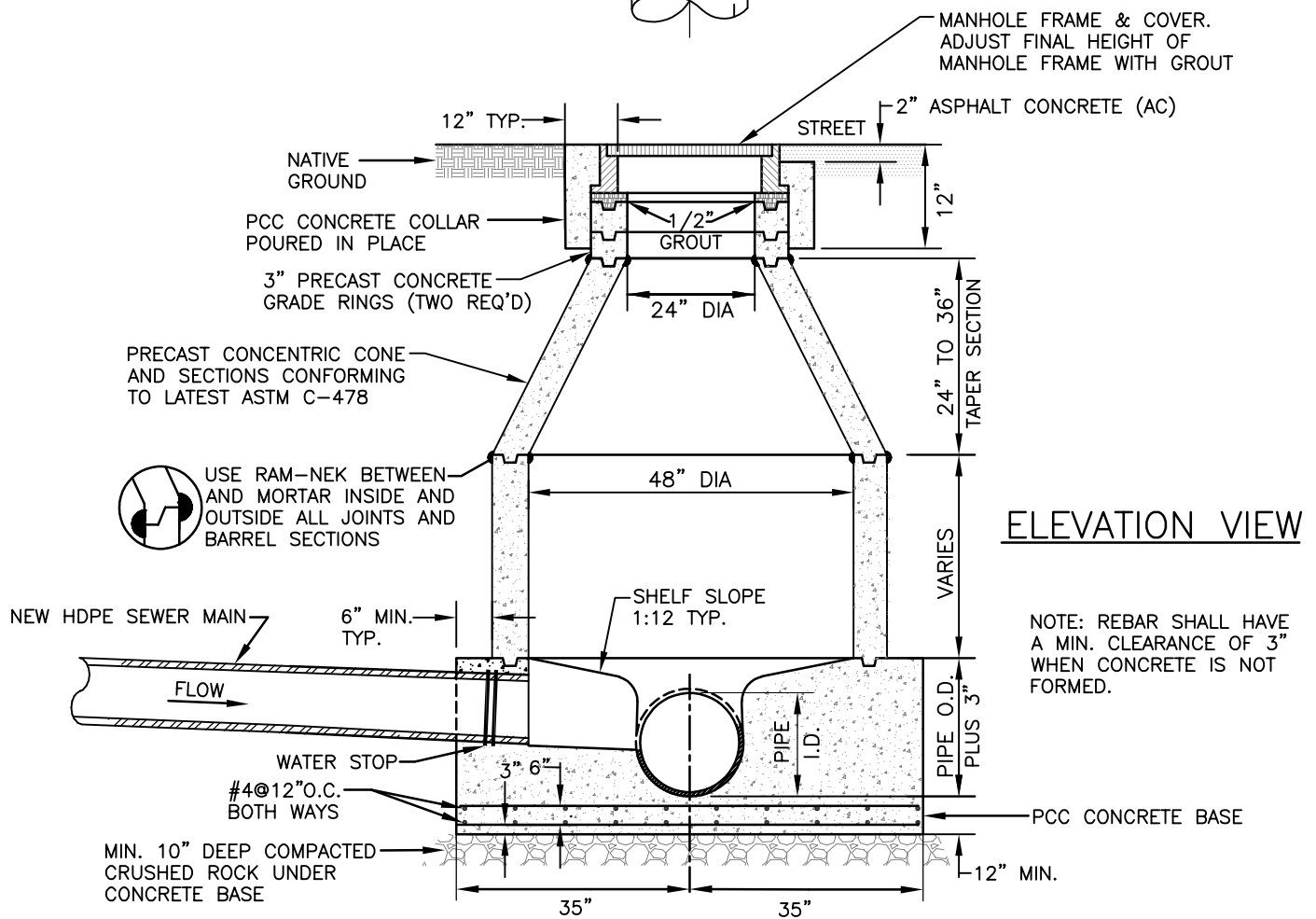
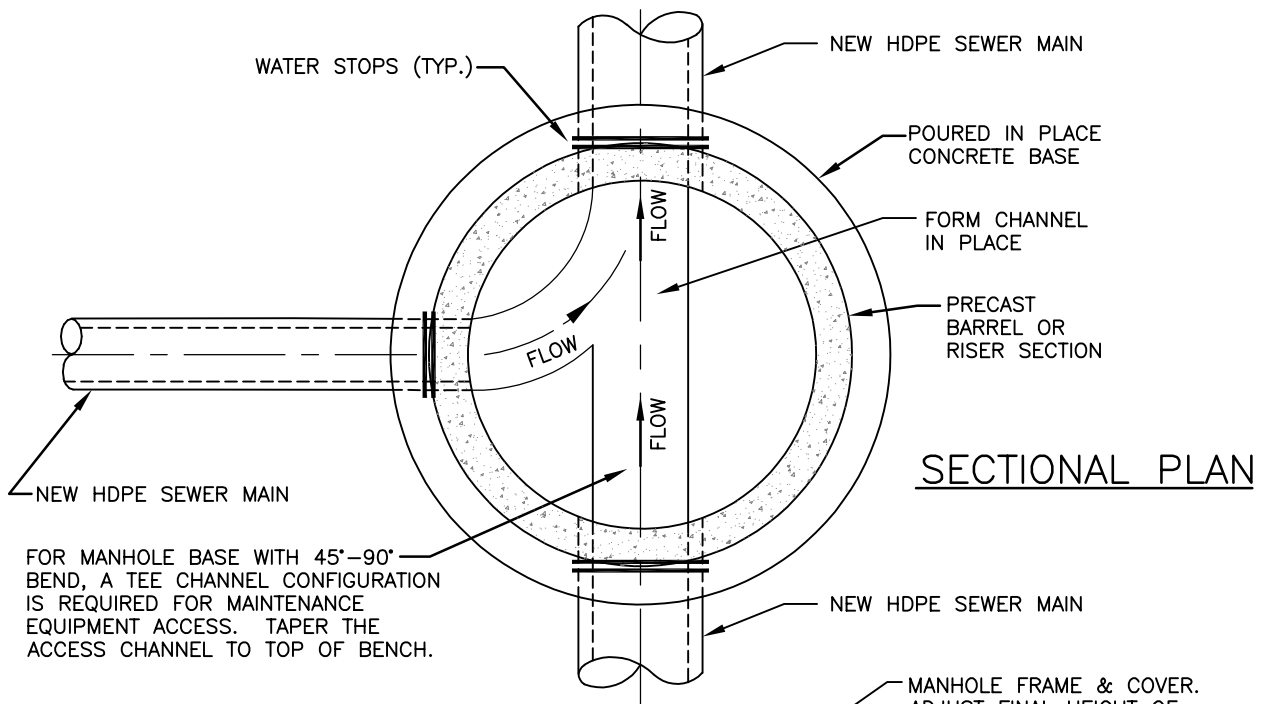
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DRAWN AL	11/18		<i>Silvia Lee Santos</i> 50674	DWG. NO.
CHECKED AL	2/20		SILVIA LEE SANTOS ENGINEERING MANAGER	STD. WWD-05
REVIEWED RA	2/20		REVISION: FEBRUARY 26, 2020	APPENDIX D



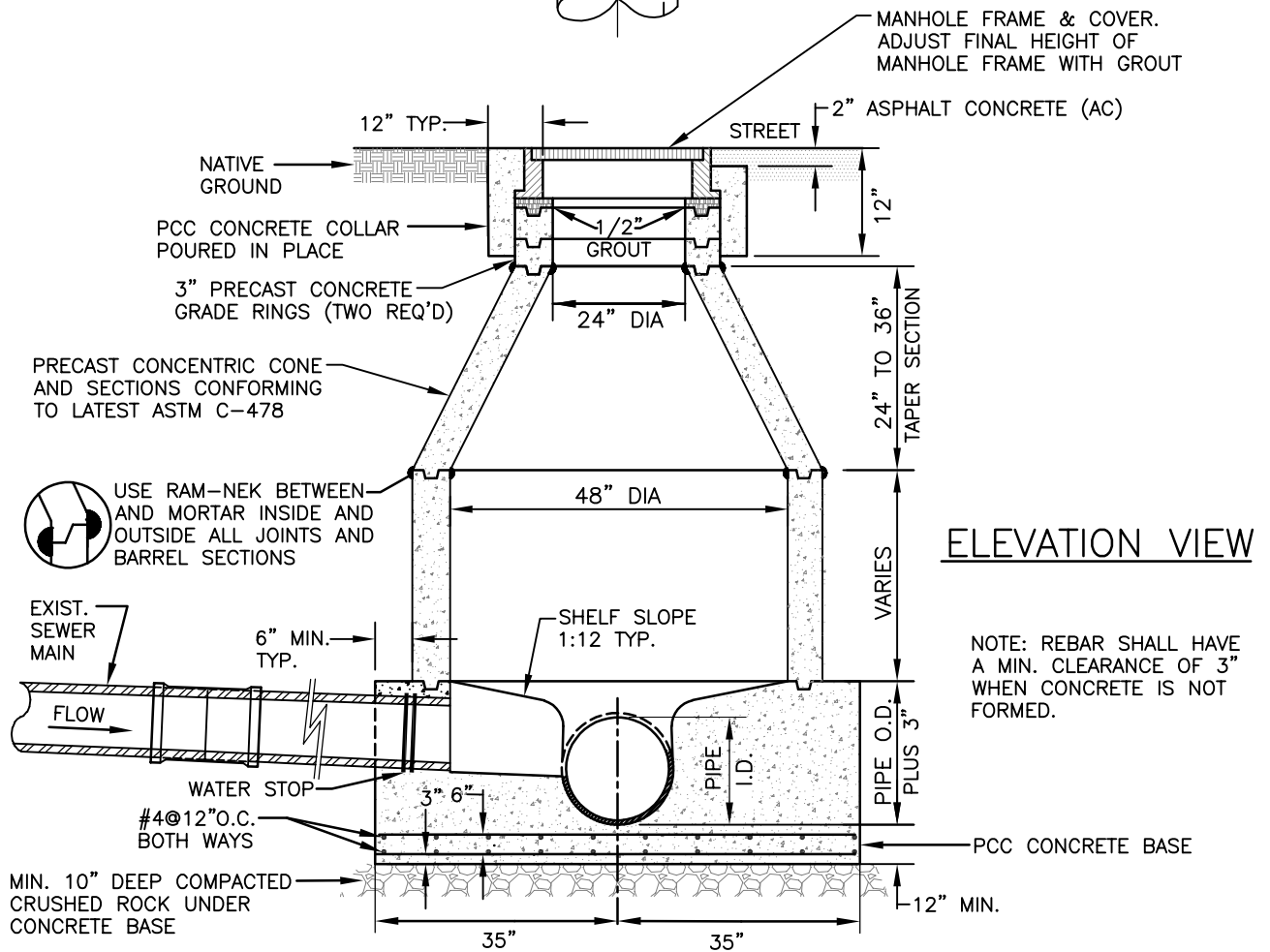
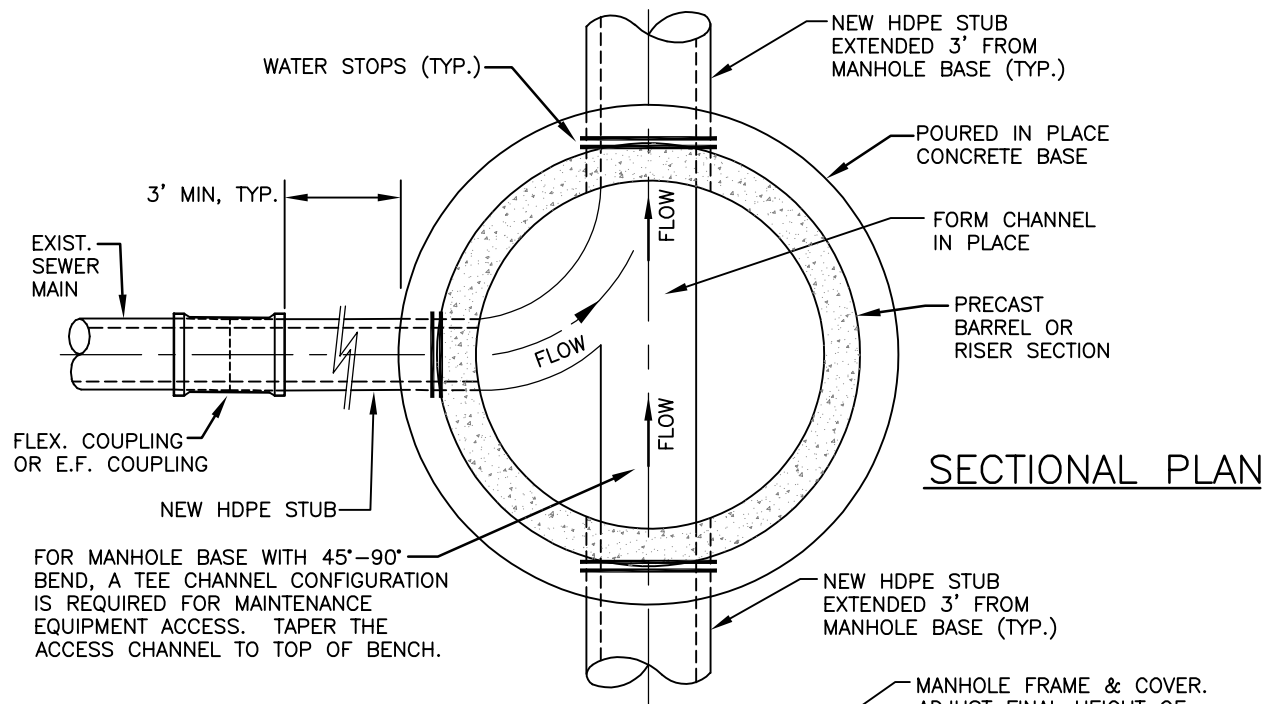
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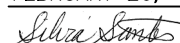
1. "TAP-TITE" (OR APPROVED EQUAL) CAN ONLY BE USED WITH THE PRIOR APPROVAL OF THE ENGINEER.
2. AN ELASTOMERIC SEALANT SHALL BE APPLIED BETWEEN THE SEWER MAIN AND THE FLEXIBLE SADDLE TO ENSURE AN AIR TIGHT CONNECTION.
3. COUPON SHALL BE REMOVED AND GIVEN TO THE CITY INSPECTOR.

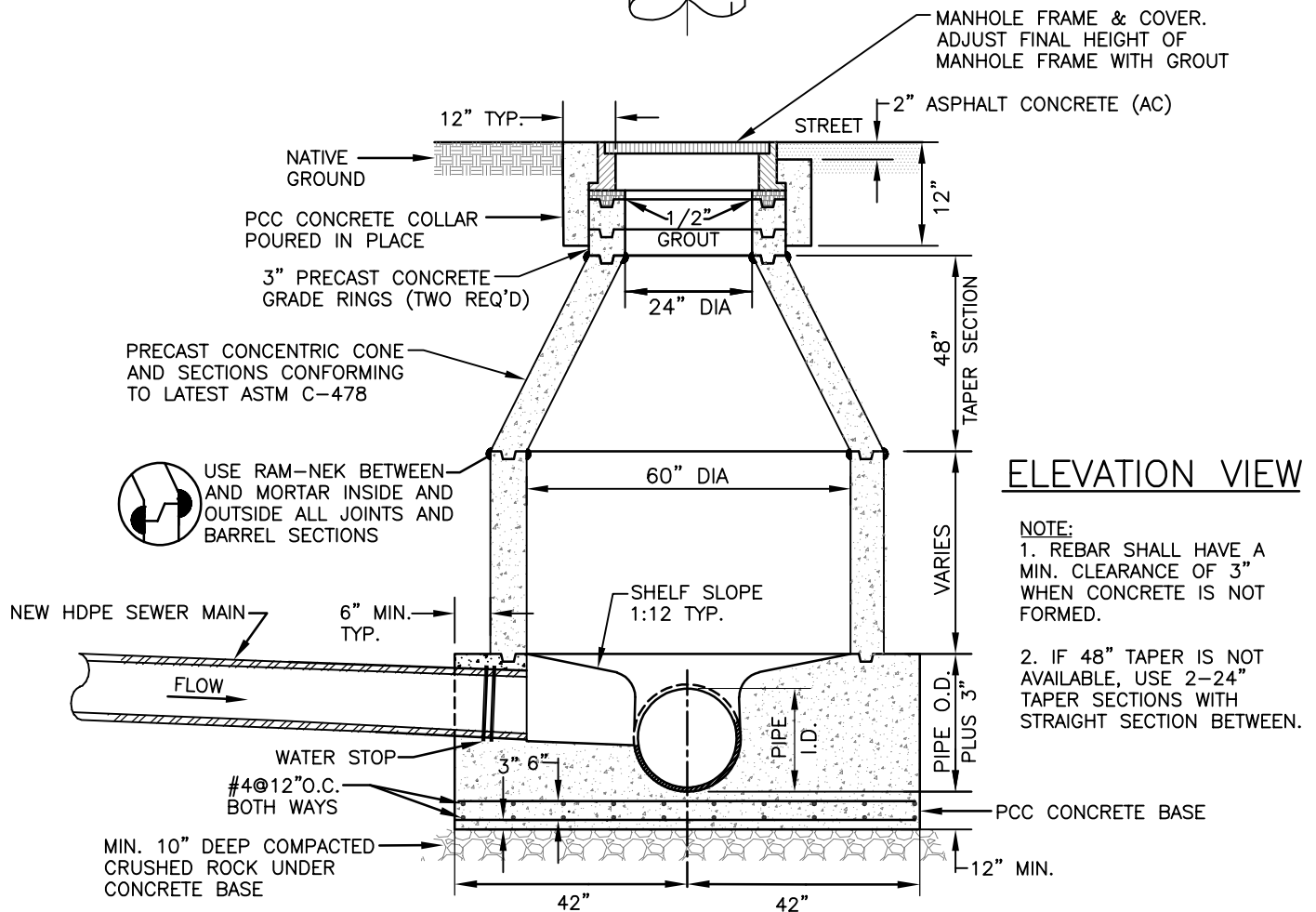
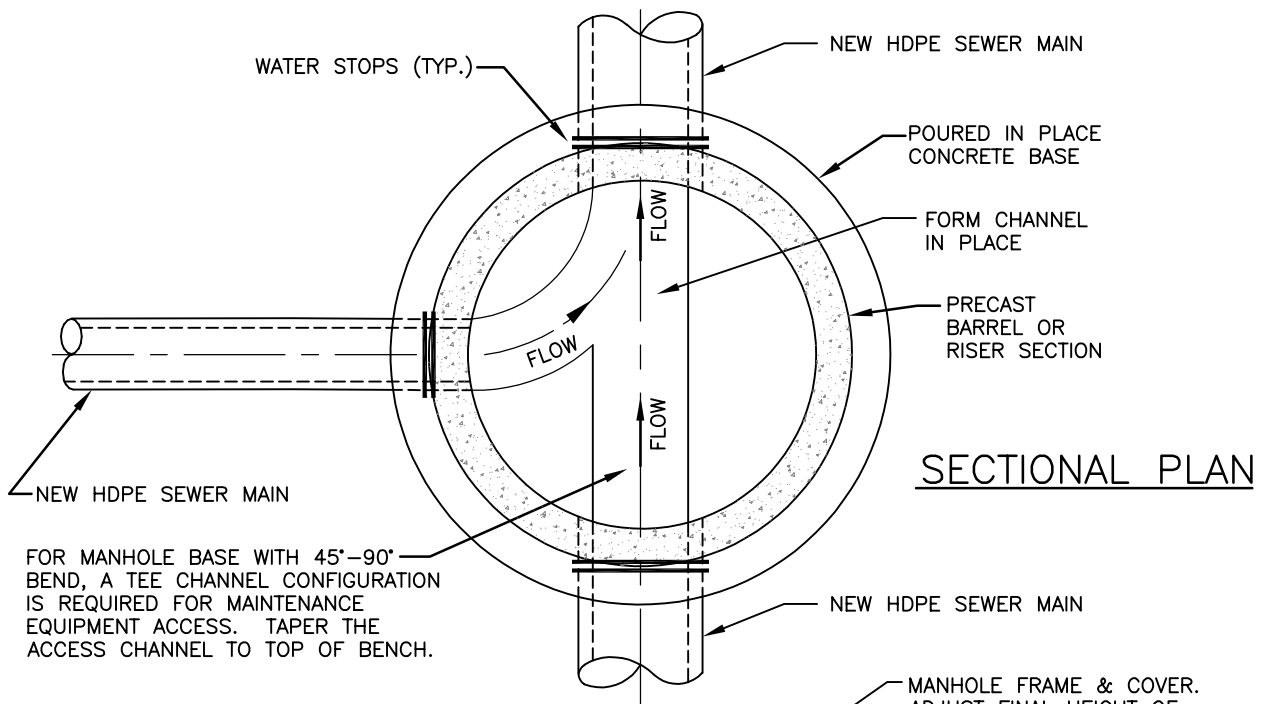
BY		DATE	SANITARY SEWER LATERAL CONNECTION W/ TAP-TITE STANDARD DETAIL	APPROVED: FEBRUARY 26, 2020		SCALE: NONE
DRAWN	EMM	11/18		 SILVIA LEE SANTOS ENGINEERING MANAGER		DWG. NO.
CHECKED	AL	2/20		50674 R.E. NO.		STD. WWD-06
REVIEWED	RA	2/20		CITY OF PALO ALTO, CALIFORNIA		APPENDIX D



BY	DATE	SANITARY SEWER MANHOLE (FOR NEW PIPES 36" AND LESS) STANDARD DETAIL	APPROVED:	SCALE: NONE
DRAWN	EMM 11/18		FEBRUARY 26, 2020	
CHECKED	AL 2/20		<i>Silvia Lee Santos</i> 50674 SILVIA LEE SANTOS R.E. NO. ENGINEERING MANAGER	
REVIEWED	RA 2/20		REVISION: FEBRUARY 26, 2020	
CITY OF PALO ALTO, CALIFORNIA				DWG. NO. STD. WWD-07A APPENDIX D

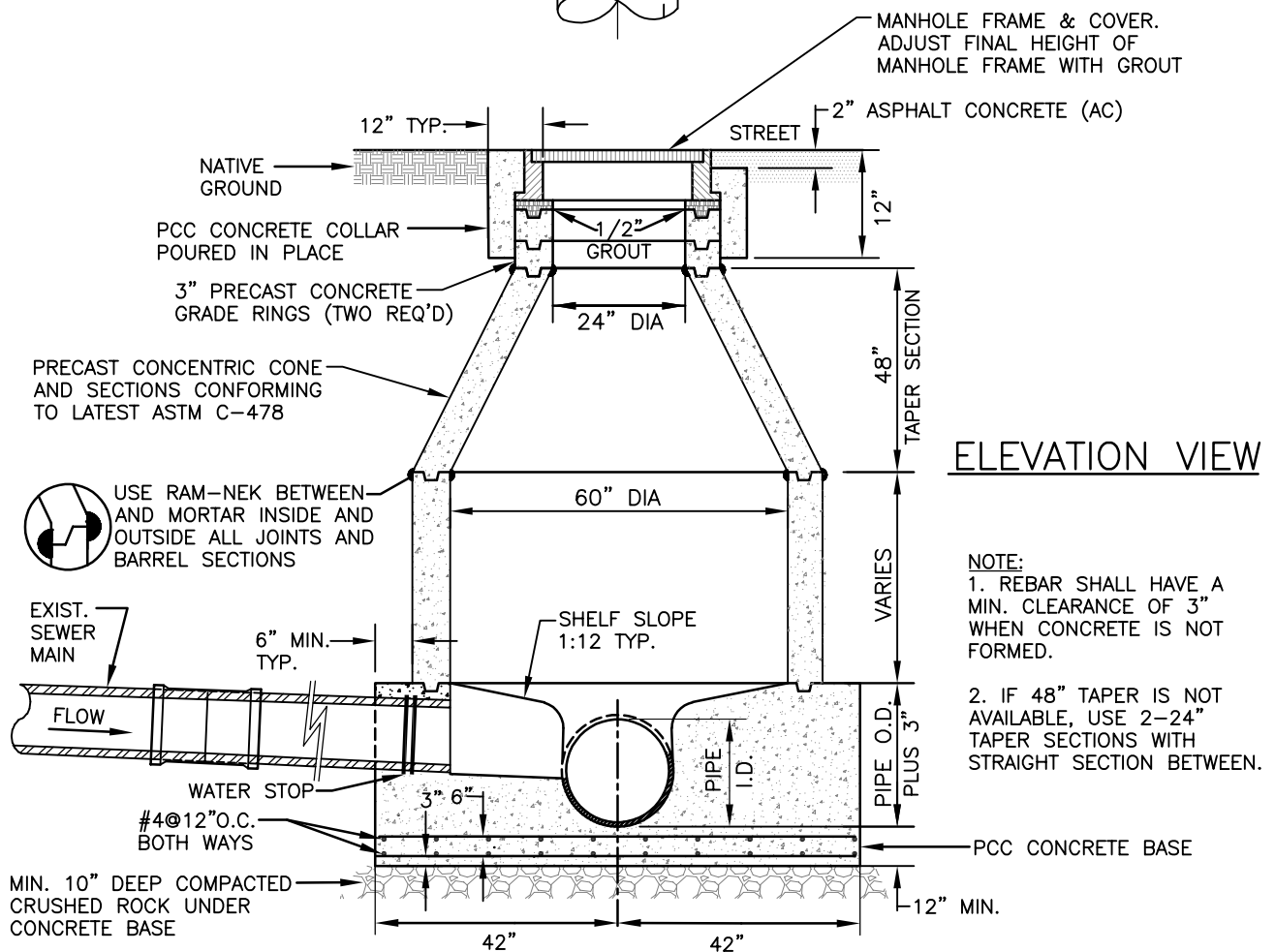
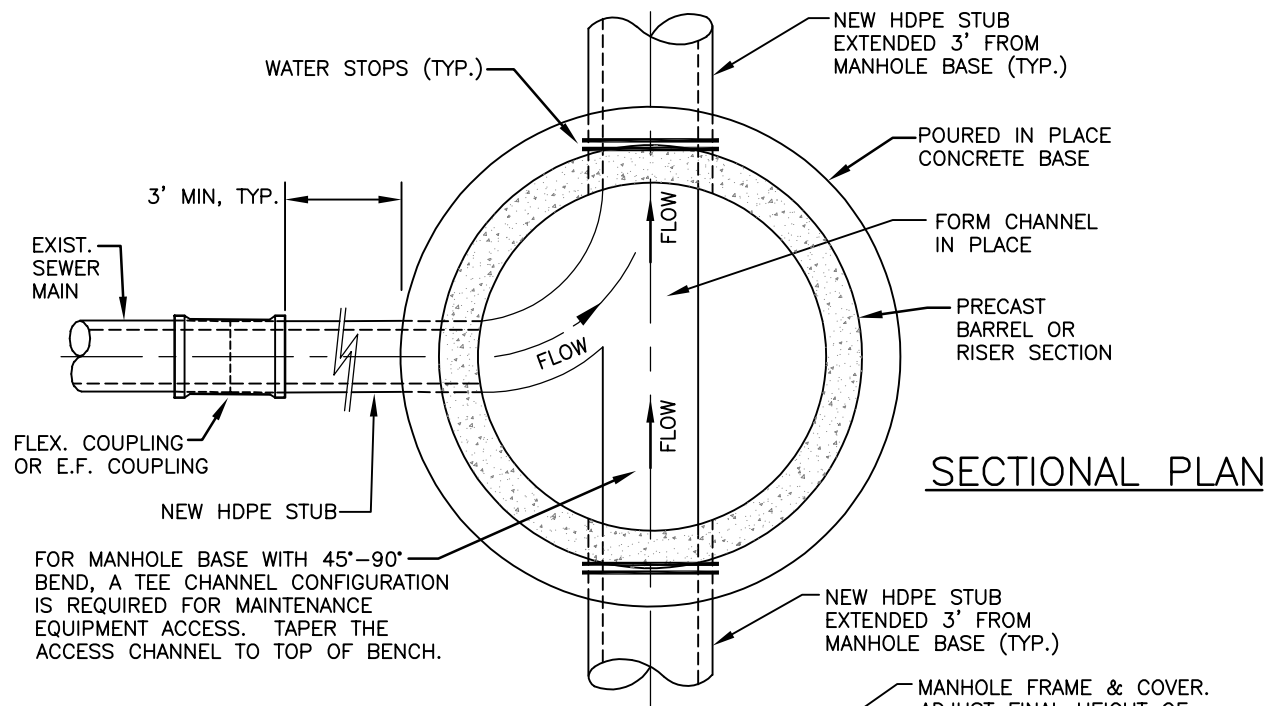


BY		DATE	SANITARY SEWER MANHOLE (FOR EXIST. PIPES 36" AND LESS) STANDARD DETAIL	APPROVED: FEBRUARY 26, 2020		SCALE: NONE	
DRAWN	EMM	11/18		 50674		DWG. NO.	
CHECKED	AL	2/20		SILVIA LEE SANTOS ENGINEERING MANAGER		R.E. NO.	
REVIEWED	RA	2/20		CITY OF PALO ALTO, CALIFORNIA		STD. WWD-07B	
				REVISION: FEBRUARY 26, 2020		APPENDIX D	

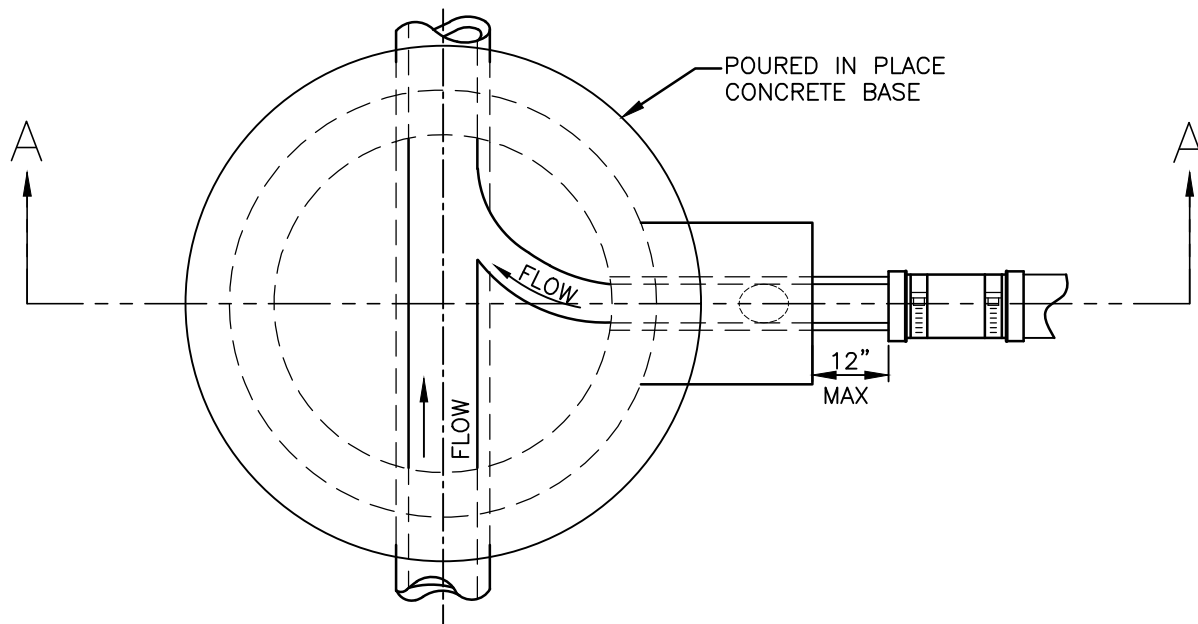


- NOTE:
1. REBAR SHALL HAVE A MIN. CLEARANCE OF 3" WHEN CONCRETE IS NOT FORMED.
 2. IF 48" TAPER IS NOT AVAILABLE, USE 2-24" TAPER SECTIONS WITH STRAIGHT SECTION BETWEEN.

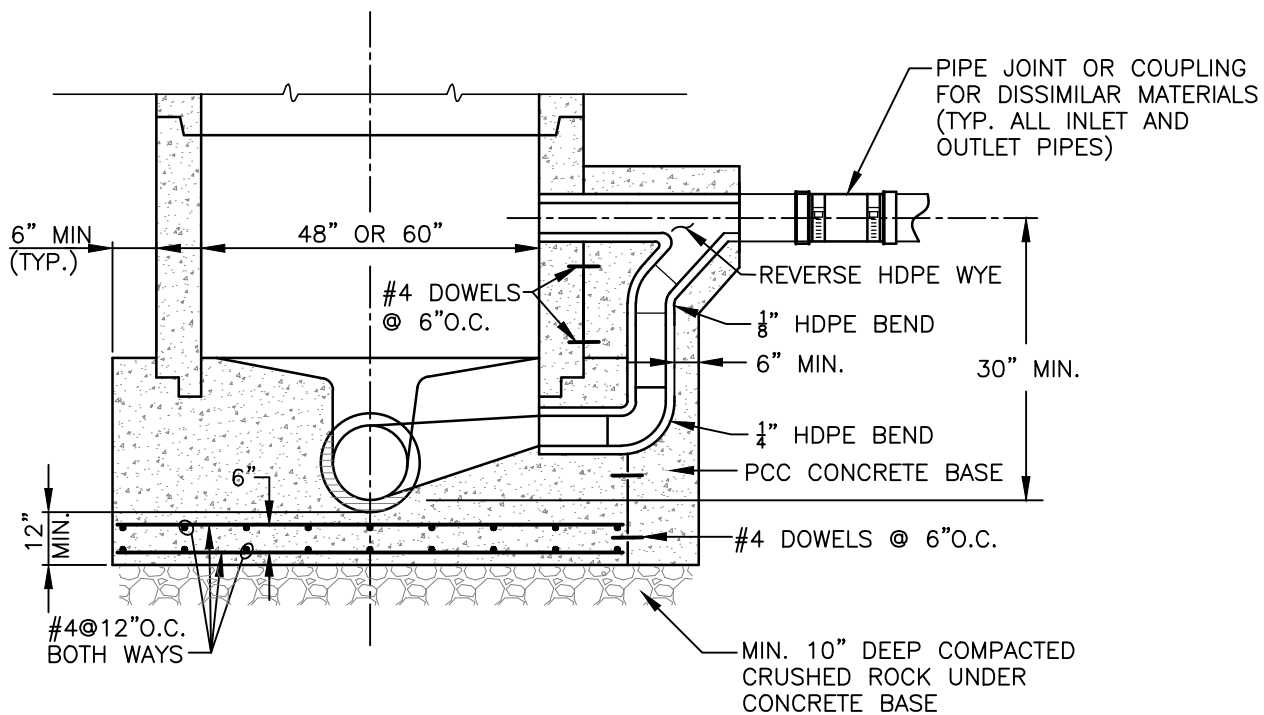
BY		DATE	SANITARY SEWER MANHOLE (FOR NEW PIPES LARGER THAN 36") STANDARD DETAIL	APPROVED: FEBRUARY 26, 2020	SCALE: NONE
DRAWN	EMM	11/18		 50674	DWG. NO. STD. WWD-08A
CHECKED	AL	2/20		SILVIA LEE SANTOS	
REVIEWED	RA	2/20		ENGINEERING MANAGER R.E. NO.	
			CITY OF PALO ALTO, CALIFORNIA	REVISION: FEBRUARY 26, 2020	APPENDIX D



BY	DATE	SANITARY SEWER MANHOLE (FOR EXIST. PIPES LARGER THAN 36") STANDARD DETAIL	APPROVED: FEBRUARY 26, 2020	SCALE: NONE
DRAWN EMM	11/18		 50674 SILVIA LEE SANTOS R.E. NO. ENGINEERING MANAGER	DWG. NO. STD. WWD-08B
CHECKED AL	2/20			
REVIEWED RA	2/20	CITY OF PALO ALTO, CALIFORNIA	REVISION: FEBRUARY 26, 2020	APPENDIX D

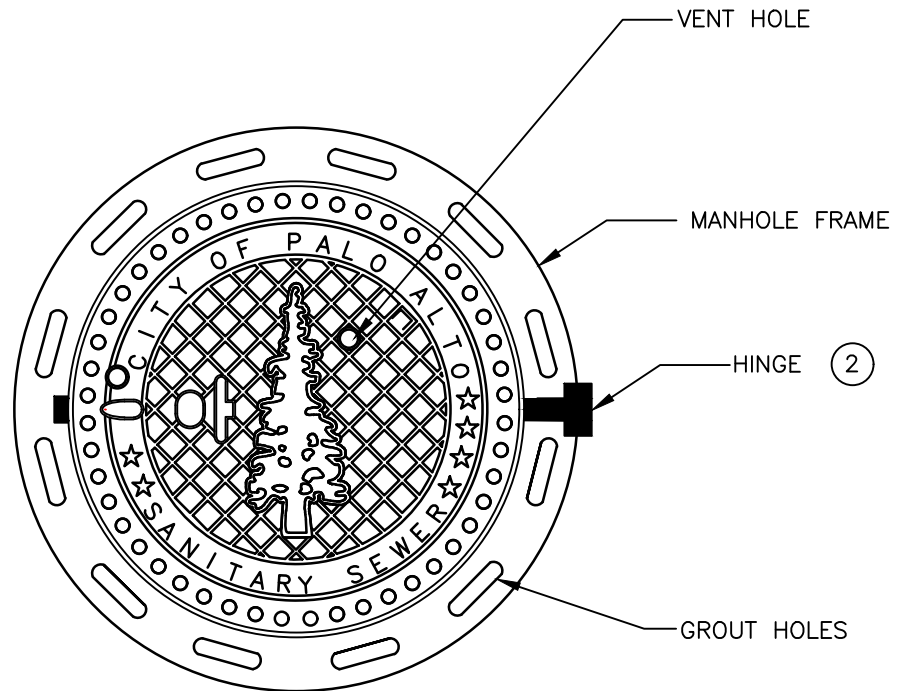


PLAN



SECTION A

BY	DATE	SANITARY SEWER MANHOLE OUTSIDE DROP STANDARD DETAIL	APPROVED:	SCALE:
DRAWN EMM	2/20		FEBRUARY 26, 2020	NONE
CHECKED AL	2/20		<i>Silvia Lee Santos</i> SILVIA LEE SANTOS ENGINEERING MANAGER	DWG. NO. STD. WWD-09
REVIEWED RA	2/20		REVISION: FEBRUARY 26, 2020	APPENDIX D
		CITY OF PALO ALTO, CALIFORNIA		



NOTES:

1. REXUS II 24" DUCTILE IRON MANHOLE FRAME AND COVER WITH SPRING BAR LOCK AS MANUFACTURED BY PAM SAINT-GOBAIN AND DISTRIBUTED BY FAMCON PIPE & SUPPLY, INC. 805-485-4350 (CALIFORNIA REP).
2. THE MANHOLE LID SHALL BE ORIENTED ACCORDING TO THE LOCATION OF THE MANHOLE AS FOLLOWED:
 - a. MIDDLE OF TRAFFIC LANE: HINGE AT DOWNSTREAM OF TRAFFIC
 - b. MIDDLE OF STREET: HINGE AT OUTLET PIPE.
 - c. END OF CUL-DE-SAC: HINGE AT END OF CUL-DE-SAC.
 - d. CENTER OF INTERSECTION: HINGE AT OUTLET PIPE.

BY	DATE	SANITARY SEWER MANHOLE FRAME AND COVER STANDARD DETAIL	APPROVED: FEBRUARY 26, 2020	SCALE: NONE
DRAWN EMM	11/18		<i>Silvia Lee Santos</i> SILVIA LEE SANTOS ENGINEERING MANAGER	DWG. NO.
CHECKED AL	2/20		50674 R.E. NO.	STD. WWD-10
REVIEWED RA	2/20		REVISION: FEBRUARY 26, 2020	APPENDIX D

APPENDIX E
FUSION PROCEDURES AND CERTIFICATION (WATER AND SEWER)
7/1/16

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HDPE Fusion Practical Test (Sample)	11

CITY OF PALO ALTO: HDPE Water and Sewer Pipe Fusion Procedures

It is responsibility of a fuser to verify that polyethylene pipe and fittings are in conformance with the specifications requirements and no older 3 years from the date of manufacture to the date of shipment to CPA for black polyethylene water pipe or grey polyethylene sewer pipe.

A. HEAT FUSION TOOLS**1. BUTT FUSION**

NOTE: The manufacturer's operating instructions must be adhered to insure acceptable fusions.

a. Heating Iron

The heating irons are NOT EXPLOSION PROOF and shall not be used in any area with gas present while still connected to a power source.

An electrically resistive coil in the heating iron maintains the temperature at a level sufficient for fusion. The irons operate on 110 volts A.C. with power requirements ranging from 1200 watts McElroy No. 14 to 1750 watts McElroy No. 28 Auto Mac. Teflon coated faces are utilized on both sides of the iron. Extreme care must be exercised to avoid scratching the faces; only cotton cloths should be used for cleaning. The faces are either an integral part of the iron or are detachable and must be recoated when scratched. A dial type thermometer is placed next to the handle. The iron temperature can be adjusted by changing the calibration set screw. The heating iron for the Auto Mac must be connected to the proper outlet on the butt fusion machine, DO NOT attach the iron to any other source as it does not self regulate and it will be burned out.

b. Butt Fusion Machine

The butt fusion machine consists of mobile and stationary alignment clamps that hold the pipe ends during the fusion process. These clamps transfer the force and associated pressure required to fuse the pipe.

c. Alignment Clamp Inserts

Two sizes of inserts are supplied for the 4" machines (2" and 3" IPS). The No. 28 machine also has two inserts (4" and 6" IPS).

d. Facer

Either manual or electrical facers are provided for the butt fusion machines. The electrical facers are NOT EXPLOSION PROOF and shall not be used in any area with gas present.

2. ELECTRO FUSION

NOTE: The manufacturer's operating instructions must be adhered to insure acceptable fusions.

a. Universal Control Box

This unit controls the fusion process. It processes information received from the optical wand that is used to determine the fitting manufacturer and appropriate fusion times. It also stores fusion

related information, which can be downloaded for record information.

b. Optical Wand

This device reads the uniform product code UPC sticker on the fitting.

c. Couplings

A resistant wire embedded in the coupling provides the energy required for fusion.

i. Alignment Clamps

Only required for 2" and larger sizes. These devices align and immobilize the pipe ends and coupling during the fusion and cool down periods.

ii. Pipe Scrapers

Three types of scrapers are used to remove oxidation and contaminants from the outside pipe wall prior to electro fusion coupling installation. A paint scraper may be used on 1/2" and 1" CTS sizes only. Virax type or interior anchored pipe scraper can be used on 1/2" CTS - 6" IPS sizes. Additionally, full encirclement Scrapers can be used on 2" - 8" pipe sizes.

d. Tapping Tees

The tees also have a resistant wire coil that provides the energy for fusion. They require either a back up under saddle or a ratchet operated clamp to fix the tee to the main during fusion. A threaded cutter is included for tapping the main.

i. Service Line Alignment Clamp

When applying the service line to the outlet of a tapping tee an alignment clamp shall be used to insure that the outlet and the service line are straight. This unit also immobilizes the coupling during the fusion and cool down periods.

ii. Ratchet Clamp

All pipe sizes require the use of a hold down clamp or backing plate to secure the tapping tee onto the main during fusion.

3. MISCELLANEOUS TOOLS

a. Pipe Cutters

- i. "Plier" type cutters for use on 1/2" CTS - 2" IPS sizes.
- ii. A guillotine type cutter shall be used on 3" and larger sizes.

b. Pipe Squeeze Off Tools

- i. Manual squeeze off tools are provided for 1/2" CTS - 2" IPS sizes. These tools are equipped with stops for each pipe size that prevent over squeezing of the pipe.

- ii. Hydraulic squeeze off tools are necessary for the larger pipe sizes, 3" - 8". These tools are also equipped with stops for each pipe size.

c. Pyrometer

The pyrometer is used to check the surface temperature of the heating irons. It consists of a hand held display unit and an attached surface probe.

B. MANUAL BUTT FUSION PROCEDURES

1. Energize the heating iron. Once the heater has reached maximum temperature, generator cycles off, check the thermometer for $425^{\circ} \pm 25^{\circ}\text{F}$.

At the start of each day, the reading of the dial thermometer shall be checked against the surface temperature by use of the pyrometer and the heating iron calibration set screw adjusted accordingly (manual machines only).

NOTE: DO NOT adjust the heating iron for the AutoMac unit as it is regulated (controlled) by the microprocessor.

2. Install the proper size alignment clamp inserts if required.
3. Inspect the pipe and/or fitting ends and cut off any damaged or flattened portions.
4. Clean each pipe/fitting end with a clean cotton cloth and place them in the alignment clamps. Pipe ends should overlap the alignment clamps by approximately 1".
5. Place the manual or the motorized facer on the guide rods and bring the pipe ends in contact with it. Turn the manual facer in the direction of the arrow or turn the motorized facing unit on and apply light force on the carriage lever to advance the pipe ends. The motorized facer speed will increase when the pipe has bottomed out.
6. Retract the carriage lever and remove the facer. Discard the strips of material from the pipe ends taking care not to touch the clean surfaces. Check the discarded strips to insure that a continuous length from the entire diameter has been removed.
7. Check alignment of the pipe ends and adjust for high-low if necessary. If an adjustment is made or a visible gap exists between the pipe ends, repeat the procedures from Step 4.
8. Wipe heater with a non-synthetic clean dry cloth and place it on the guide rod(s) and bring the pipe ends into contact with it. Maintain a light force on the carriage until a small melt bead forms around the entire circumference of both pipe ends. Relax the force on the carriage but keep both pipe ends in contact with the heater and start the melt time cycle. Refer to Table 1 for proper melt times.
9. After the melt time has been observed snap the carriage back (open) and quickly remove the heater being careful not to hit the melt.
10. Inspect the pipe ends for complete melt. Bring the pipe ends together quickly, DO NOT SLAM, applying only enough pressure to form a double roll back bead. The proper bead thicknesses are shown in Table 1. Over-pressuring the melt will cause the bead to overlap itself resulting in a subquality fusion due to displacement of the melt to the OD and ID of the joint leaving a cold ring in the center. Under pressuring can result in inadequate fusion due to insufficient contact pressure in the melt area.

11. Maintain the pressure exerted on the fusion area for one minute for 1/2"-4" sizes and for three minutes for 6". Relaxing the pressure prior to expiration of the cooling time can result in porous fusion joints.
12. Allow the joint to cool for additional three to four minutes (see Table 1) prior to removal from the alignment clamps. The pipe can now be handled with care. Complete cooling requires approximately thirty minutes.
13. Check the melt bead for uniformity and size. If the joint exhibits poor characteristics, determine the cause, make the necessary corrections, cut out the suspect joint, and repeat the procedure from Step 4.
14. Clean the heater faces with a clean cotton cloth. DO NOT use synthetic cloths or metal implements.

TABLE 1: Manual Butt Fusion Parameters

Pipe Size	Melt Bead Size	Heating Time (seconds)	Hold Time (seconds)	Cooling Time (minutes)
1/2" CTS	1/16"	3-6	60	3
1" CTS	1/16"	5-9	60	3
2" IPS	1/16"-1/8"	15	60	4
3" IPS	1/8"	20	60	4
4" IPS	1/8"	20	60	4
6" IPS	3/16"	30	180	5

C. AUTOMATED BUTT FUSION PROCEDURES

Follow the appropriate manufacturer's procedures when producing butt fusion with automatic equipment.

Review Joint Report generated by DataLogger™ to confirm fusion success.

D. ELECTRO FUSION PROCEDURES

NOTE: See the Universal Control Box Manufacturer's literature for fusion information. The manufacturer's literature must be adhered to insure acceptable fusions.

In the event that the supply voltage varies outside of the stated limits the fusion cycle will be interrupted. A new cycle can be started after a ten-minute cool down period has been observed. The fusion system will automatically adjust the duration of the cycle to compensate for the previously aborted attempt. A maximum of three attempts may be tried. If the tapping tee has already been tapped, NO retries are allowed.

E. MAIN INSTALLATION PROCEDURES**1. DIRECT BURIAL**

- a. Excavate 34" plus pipe diameter deep trench.
- b. Make sure trench bottom is level and free of sharp objects, rocks or other materials that may damage pipe.
- c. Shade trench with 4" min. sand bed and level sand as needed.
- d. Install a #10 copper tracer wire adjacent to pipe.
- e. Install pipe in trench and snake it. Observe pipe during installation for scratches, gouges or others defects. Avoid dragging pipe over rough surfaces and scratching it.
- f. Pressure test pipe with PSI water for 5 hours for water main installation, and 3.5 PSI for 5 minutes for sewer main installation.
- g. Backfill to top of pipe and haunch the sides.
- h. Backfill trench with 12" lifts of sand and compact to 95% compaction.
- i. Purge pipe.

2. INSERTION

- a. Two methods may be used to identify possible obstructions in the pipe to be inserted:
 - Video inspection of the existing pipe
 - Pulling of a proof piece of similar diameter pipe through the section to be inserted and inspection of it for damage.

All obstruction must be removed prior to insertion of HPDE main.
- b. At the location of all service tees a section of main must be removed prior to insertion to allow installation of a tapping tee.
- c. Deburr casing ends, run mechanical brush, and use compressed air to blow debris out of casing. Install a suitable casing cable protector on the casing end to protect the pipe coating from damage.
- d. Attach a #10 copper tracer wire to existing steel pipe casing. If the casing is plastic attach the tracer to the new pipe.
- e. Seal end of the pretested pipe to be inserted with an end cap. Insert the pretested pipe into existing casing taking care not to scrape it at the entrance. Pipe shall be extended at least two feet past the casing end and inspected for gouges and scratches. If damaged, replace the pipe and go back to Step a.
- f. Pressure test pipe with 150 PSI water for 5 hours for water main installation, and 3.5 PSI for 5

minutes for sewer main installation.

- g. Purge pipe.

3. DIRECTIONAL BORING

- a. Prospect/expose all existing underground utility services/facilities prior to boring.
- b. After establishing the pilot hole, a back reamer/compactor must be used. The back reamer/compactor must be a minimum 2 times larger than the nominal diameter of the pipe that will be pulled in.
- c. A commercially available weak link must be used on the pull head to avoid damaging the pipe during pull in.
- d. Attached an end cap and tracer wire to the pipe prior to pull in.
- e. Care must be taken to avoid scraping or gouging the pipe during pull in. Rollers shall be used at all bend points in the launching pit and every 15' along the pipe. Polyethylene water pipe shall not be dragged on street surface. For sewer installation, polyethylene pipe may be dragged on the ground or paved surface for a maximum two City blocks as long as the resulting pipe scratches or cuts do not exceed 20% of the total wall thickness.
- f. After pull in, check continuity of tracer wire.
- g. Install service tees and bore in service and lateral lines.
- h. Pressure test pipe with 150 PSI water for 5 hours for water main installation, and 3.5 PSI for 5 minutes for sewer main installation.
- i. Care must be exercised, when filling service and sewer pits, to insure proper backfill and support of installed pipe. Fill pits up to the top of pipe and hand tamp backfill around pipe haunch.

F. SERVICE INSTALLATION PROCEDURES

1. DIRECT BURIAL

- a. Excavate 24" plus pipe diameter deep trench.
- b. Make sure trench bottom is level and free of sharp objects, rocks or others materials that may damage pipe.
- c. Install a #10 copper tracer wire adjacent to pipe.
- d. Install pipe in trench. Always "snake" the pipe in the trench bottom during installation (This insures that when the pipe contracts at lower temperatures it won't pull out from connections). Observe the pipe during installation for scratches, gouges or others defects.
- e. Attach ASR or insert existing riser.
- f. Install tapping tee and connect service line or lateral to it.

- g. Pressure test water service pipes with 150 PSIG water for 5 hours. Pressure test sewer laterals with 3.5 PSI for 5 minutes. Check all connections for leaks.
- h. Tap main and purge pipe.
- i. Backfill pipe and replace the landscape in kind.

2. INSERTION

- a. Deburr casing ends and use compressed air to blow debris out of casing. Install a suitable casing cable protector on the casing end to protect the pipe coating from damage.
- b. Attach a #10 copper tracer wire to existing steel pipe casing. If the casing is plastic attach the tracer to the new pipe.
- c. Seal end of pipe to be inserted with an end cap. Insert pipe into existing casing taking care not to scrape it at the entrance. Pipe shall be extended at least two feet past the casing end and inspected for gouges and scratches. If damaged, replace the pipe and go back to Step a.
- d. Install tapping tee and connect service line or lateral to it.
- e. Pressure test water service pipes with 150 PSIG water for 5 hours. Pressure test sewer laterals with 3.5 PSI for 5 minutes. Check all connections for leaks.
- f. Tap main and purge pipe.

3. BORE

- a. Establish a service bore hole with a pneumatic or similar gopher type boring device.
- b. Verify depth at meter end of bore hole. If bore hole is less than 24" deep, restart procedure from Step a.
- c. Install an end cap and attach a #10 tracer wire to service line.
- d. Insert service line into bore hole.
- e. Attach an ASR to the meter end of service line.
- f. Install a service tee and connect the service line or lateral to it.
- g. Pressure test water service pipes with 150 PSIG water for 5 hours. Pressure test sewer laterals with 3.5 PSI for 5 minutes. Check all connections for leaks.
- h. Tap main and purge pipe.

G. ADDITIONAL TOPICS**1. SQUEEZE OFF**

- a. Set the pipe stops to the appropriate diameter.

- b. Ground the squeeze machine and the pipe end.
- c. Take your time while squeezing the pipe, advance the squeeze a little bit each time and then allow the pipe to conform to the new set before continuing the process. Complete shut off may not be achieved in the larger sizes.
- d. Perform the repair.
- e. Remove the squeezer, allowing for the pipe to expand in steps during the removal.

2. MAIN REPAIRS (SEWER ONLY)

Depending on the cause, either install a clamp or cut out the damaged portion and install a short section of PE. If working on PE use two electro fusion couplings to make connections. With materials other than PE use two Maxi Grip Couplings and required stiffeners.

3. SERVICE/LATERAL REPAIRS

If the service or lateral piping material is ABS, ACP, Copper, or Tenite, replace the entire pipe with PE, including retapping the main with a new service tee. Abandon the old tee at the main. If the service pipe is PE and the failure is pull out related (either by a third party or temperature contraction) replace the entire line. With dig in situations, control the flow and use either of the approved fusion methods to repair the line.

Emergency repairs can be conducted to restore service temporary and followed by permanent repair or replacement.

H. REQUIREMENTS FOR HDPE FUSION TESTING

Applicants for testing will need to demonstrate a working knowledge of HDPE fusion and equipment without any assistance. The test will be given as a whole. The Contractor will be required to complete a minimum 4" butt fusion on a hand machine, a 6" butt fusion on a hydraulic machine with a Data Logger using a McElroy DL5 or higher, a 4" electrofusion coupling, and a 4x8 electric fusion saddle.

Each fusion applicant must bring the following to the test:

- 4" pipe (DR specific), 6' long for hand fusion using a Pitbull 14
- 6" pipe (DR specific), 6' long for hydraulic fusion on a 28 or 618 machine
- Minimum of 1 each 4" electrofusion coupling and 4x8 electrofusion saddle (recommend at least 2 each, per person tested)
- 3' of 8" pipe (DR specific)
- Proper tools required to do the work (scraper cutter, lint free cotton towels, etc.)
- Isopropyl alcohol 95% or greater (99% preferred)
- A working contact or infrared pyrometer, and working generator to power the electrofusion box (with fuel)
- A working sawzall and blades to cut the pipe
- Extension cords and any other saws or cutters you plan to use on the job. Chainsaws are not permitted.
- 2LC or up to 2" or PitBull 14 – note that irons must have stripper bars and be clean and in good condition. Facer blades must be clean and in good condition in accordance with the Manufacturer's specifications. Any machine not meeting these standards will need to be repaired by an authorized

- service center that is recognized by the manufacturer
- 28 or 618 – must be clean and in good condition. Facer blades must be clean and in good condition in accordance with the Manufacturer's specifications. Any machine not meeting these standards will need to be repaired by an authorized service center that is recognized by the manufacturer.
- A working electrofusion box. Not a rental.

The City of Palo Alto's electrofusion test is in place to test the operator and the equipment that will be used on the job. **All equipment must meet manufacturer's standards per ASTM D2657.** Contractor shall note that the fusion testing process is a separate process from the City's project review and acceptance process.

It is the Contractor's responsibility to ensure that all equipment is fueled prior to the test being administered. **All equipment must have a serial number or equipment number.** Any missing tools or equipment will result in no test being conducted, or a FAIL will be given. All materials should be what will be used on the project of which the Contractor is being certified.

See Specification 2300 (Polyethylene Pipe Installation for Water, Gas and Wastewater) for additional testing requirements.

CITY OF PALO ALTO: HDPE Fusion Practical Test (Sample)

Applicants for fusion certification will be required to pass both a physical and written exam prior to being certified.

Name: _____
Title: _____

Date: _____
Company: _____

Individual should be tested on all procedures he/she is to be certified under. (Unmarked boxes constitute failure in that type procedure).

☐ **ELECTRO FUSION COUPLINGS**

- ☐ 1. Pipe ends were cut square and even.
- ☐ 2. Cleaned pipe ends inside and out.
- ☐ 3. Measured and marked pipe ends.
- ☐ 4. Scraped pipe ends.
- ☐ 5. Took proper precautions to avoid contamination of pipe ends.
- ☐ 6. Cleaned fitting and pipe ends with alcohol.
- ☐ 7. Centered fitting between marks.
- ☐ 8. Connected control box to proper 110 volt A.C. power source in correct sequence.
- ☐ 9. Had thorough understanding of operation sequence and warning light functions.
- ☐ 10. Noted time that FUSION START BUTTON was depressed.
- ☐ 11. Marked time of day on pipe at end of fusion.
- ☐ 12. Removed leads from fitting 30 seconds or longer after fusion was over.
- ☐ 13. Allowed fitting to cool in secured position for recommended time.

☐ **ELECTRO FUSION TAPPING TEES**

- ☐ 1. Cleaned pipe around fusion zone.
- ☐ 2. Scraped entire pipe surface that will fall under tee.
- ☐ 3. Took proper precautions to avoid contamination of scraped pipe.
- ☐ 4. Cleaned fitting and scraped area with alcohol.
- ☐ 5. Placed tee on scraped area.
- ☐ 6. Properly installed under-saddle/hold-down clamp.
- ☐ 7. Connected control box to proper 110 volt A.C. power source in correct sequence.
- ☐ 8. Had thorough understanding of operation sequence and warning light functions.
- ☐ 9. Swiped fitting UPC with optical wand.
- ☐ 10. Noted time that FUSION START BUTTON was depressed.
- ☐ 11. Marked time of day on pipe at end of fusion.
- ☐ 12. Removed leads from fitting 30 seconds or longer after fusion was over.
- ☐ 13. Allowed fitting to cool in secured position for recommended time.

☐ **BUTT FUSION MANUAL**

- ☐ 1. Pipe ends were faced properly to the facer stops.
- ☐ 2. Removed cuttings from interior of pipe.
- ☐ 3. Aligned pipe ends for "high-low", refaced if needed.
- ☐ 4. Cleaned heater face and verified heating iron surface temperature with pyrometer.
- ☐ 5. Observed recommended melt bead prior to timing.
- ☐ 6. Observed recommended melt time.
- ☐ 7. Maintained pressure on fusion during recommended cool down period.

- ☐ 8. Allowed joint to cool in machine for recommended period.
- ☐ 9. Knowledge of rough handling time.

☐ **BUTT FUSION HYDRAULIC**

- ☐ 1. Completed an inspection of equipment for cleanliness and proper operation.
- ☐ 2. Cleaned pipe ends inside and out.
- ☐ 3. Pipe ends were faced properly to the facer stops.
- ☐ 4. Shavings and chips removed after facing pipe.
- ☐ 5. Pipe ends brought together under facing pressure, no visual gaps observed.
- ☐ 6. Aligned pipe ends for "high-low", refaced if needed.
- ☐ 7. Checked for pipe slippage at fusion pressure and pipe ends kept closed.
- ☐ 8. Calculated drag pressure properly. Drag Pressure _____psi.
- ☐ 9. Theoretical Fusion Pressure Calculated. Theoretical pressure _____psi.
 - ☐ DataLogger ☐ Fusion Pressure Calculator
 - ☐ McCalc ☐ Formula

Observed gauge pressure (theoretical fusion pressure + drag) used to fuse the pipe
_____psi.

- ☐ 10. Cleaned heater face and verified heating iron surface temperature with pyrometer.
- ☐ 11. Recommended shift sequence followed.
- ☐ 12. Bead size against the heater meet standard before heater removal.
- ☐ 13. Inspected pipe interfacial area after heater removal.
- ☐ 14. Removal of heater completed in allotted time.
- ☐ 15. Completed cooling cycle time (under fusion pressure).
- ☐ 16. Operator proficient with Data Logger setup and operation.

JOINT EVALUATION

Visual Examination (During and after assembly. Compare to Photograph or sample of acceptable joint.)

Procedure/Joint Appearance

PROCEDURE		JOINT APPEARANCE		ADDITIONAL INSTRUCTION REQUIRED IN
		PASS	FAIL	
BUTT FUSION (MANUAL) _____"				
BUTT FUSION (HYDRAULIC) _____"				
ELECTRO	COUPLING _____"			
FUSION	TAPPING TEE _____"			

☐ DEFORMATION TEST $\leq 3"$

TENSILE TEST $\geq 4"$

☐ Specimen cut into test template or longitudinal straps. (Joint should be free of voids or unbonded areas on surface.)

Joint Evaluation (Visual)(Deform joint by bending or tensile test)

PROCEDURE		JOINT APPEARANCE		ADDITIONAL INSTRUCTION REQUIRED IN
		PASS	FAIL	
BUTT FUSION (MANUAL) _____"				
BUTT FUSION (HYDRAULIC) _____"				
ELECTRO	COUPLING _____"			
FUSION	TAPPING TEE _____"			

Certification obtained in the following utility (s)

☐ Water

☐ Wastewater

RECOMMENDATION:

- ☐ Retest Required.
- ☐ Certification Card Issued/Date _____
- ☐ Re-Certification Card Issued/Date _____

Certified in the following application(s):

- ☐ Butt Fusion
- ☐ Couplings
- ☐ Tapping Tees

Employee Signature

Date

Evaluator Name and Title

Evaluator Signature

Date

APPENDIX F
FUSION PROCEDURES AND CERTIFICATION (GAS)
Revised 02/26/20

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CITY OF PALO ALTO: Polyethylene Gas Pipe Fusion Procedures

It is responsibility of a fuser to verify that polyethylene pipe and fittings are in conformance with the specifications requirements and no older than 6 months from the date of manufacture to the date of shipment to CPA.

A. HEAT FUSION TOOLS**1. BUTT FUSION**

NOTE: The manufacturer's operating instructions must be adhered to insure acceptable fusions.

a. Heating Iron

The heating irons are NOT EXPLOSION PROOF and shall not be used in any area with gas present while still connected to a power source.

An electrically resistive coil in the heating iron maintains the temperature at a level sufficient for fusion. The irons operate on 110 volts A.C. with power requirements ranging from 1200 to 1750 watts. Teflon coated faces are utilized on both sides of the iron. Extreme care must be exercised to avoid scratching the faces; only lint free cloths should be used for cleaning. The faces are either an integral part of the iron or are detachable and must be replaced when scratched. A dial type thermometer is placed next to the handle. The iron temperature can be adjusted by changing the calibration set screw.

b. Butt Fusion Machine

Machine shall be the hydraulic fusion machine with built-in hydraulic pipe lift to assist with the pipe handling and incorporating centerline guidance system and DataLogger™ compatible, and capable of butt fusion of most fittings without special holders or removal of jaw. Contractor to provide hydraulic McElroy butt fusion machine or approved equal.

c. Alignment Clamp Inserts

Sufficiently sized alignment clamps must be included with the butt fusion machine for the diameter of pipe(s) to be fused.

d. Facer

1. Electrical facers must be used with the butt fusion machines. Facer shall have sharp properly aligned blades. The electrical facers are NOT EXPLOSION PROOF and shall not be used in any area with gas present.

2. ELECTRO FUSION

NOTE: The manufacturer's operating instructions must be adhered to insure acceptable fusions. All electrofusion boxes must be calibrated at intervals not exceeding 3 years, or more often if manufacturer recommends accelerated calibration interval.

a. Universal Control Box

The Contractor shall provide a universal electrofusion control box, capable of storing a minimum of 100 fusion records. All previous fusions must be completely cleared from the box memory prior to arriving for testing.

b. Electric Generator

Contractor shall provide the necessary power supply to meet the power requirements as specified by the manufacturer of the fusion equipment. Generator shall be in new condition and have a minimum rated capacity of 5 kW for 8" and smaller and 10 KW for 10" and larger.

c. Optical Wand

This device reads the uniform product code UPC sticker on the fitting.

d. Couplings

A resistant wire embedded in the coupling provides the energy required for fusion.

i. Alignment Clamps

Are required for 1" and larger diameter pipelines. These devices align and immobilize the pipe ends and coupling during the fusion and cool down periods.

ii. Pipe Scrapers

Three types of scrapers are used to remove oxidation and contaminants from the outside pipe wall prior to electro fusion coupling installation. Virax type or interior anchored pipe scraper can be used on 1/2" CTS - 6" IPS sizes. Additionally, full encirclement Scrapers can be used on 2" - 8" pipe sizes.

e. Tapping Tees

The tees also have a resistant wire coil that provides the energy for fusion. They require either a back up under saddle or a ratchet operated clamp to fix the tee to the main during fusion. A threaded cutter is included for tapping the main.

i. Service Line Alignment Clamp

When applying the service line to the outlet of a tapping tee an alignment clamp shall be used to insure that the outlet and the service line are straight. This unit also immobilizes the coupling during the fusion and cool down periods.

ii. Ratchet Clamp

All pipe sizes require the use of a hold down clamp or backing plate to secure the tapping tee onto the main during fusion.

3. MISCELLANEOUS TOOLS**a. Pipe Cutters**

i. "Plier" type cutters may be used for pipelines 1/2" CTS - 2" IPS in diameter.

ii. For 3" – 12" diameter pipe, guillotine style pipe cutter outfitted with a ratchet drive or power driven designed to cut medium density polyethylene pipe may be used. A reciprocating saw may be used to cut pipe, as long as all cleaning and pipe facing applications are performed.

b. Pyrometer

The Contractor shall provide a pyrometer capable of testing the temperature of the heating iron, while at fusion temperature, to an accuracy of 0.5% ($\pm 3^{\circ}\text{F}$). The fusion temperature of the heating iron shall be verified prior to testing. A handheld display unit with infrared beam or attached surface probe may be used.

B. MANUAL BUTT FUSION PROCEDURES (CITY STAFF ONLY)

1. Energize the heating iron. Once the heater has reached maximum temperature, generator cycles off, check the thermometer for $425^{\circ} \pm 25^{\circ}\text{F}$.

At the start of each day, the reading of the dial thermometer shall be checked against the surface temperature by use of the pyrometer and the heating iron calibration set screw adjusted accordingly (manual machines only).

2. Install the proper size alignment clamp inserts if required.
3. Inspect the pipe and/or fitting ends and cut off any damaged or flattened portions.
4. Clean each pipe/fitting end with a clean lint free cloth and place the pipe in the alignment clamps. Pipe ends should overlap the alignment clamps by approximately 1".
5. Place the manual or the motorized facer on the guide rods and bring the pipe ends in contact with it. Turn the manual facer in the direction of the arrow or turn the motorized facing unit on and apply light force on the carriage lever to advance the pipe ends. The motorized facer speed will increase when the pipe has bottomed out.
6. Retract the carriage lever and remove the facer. Discard the strips of material from the pipe ends taking care not to touch the clean surfaces. Check the discarded strips to insure that a continuous length from the entire diameter has been removed.
7. Check alignment of the pipe ends and adjust for high-low if necessary. If an adjustment is made or a visible gap exists between the pipe ends, repeat the procedures from Step 4.
8. Wipe heater with a non-synthetic clean lint free cloth and place it on the guide rod(s) and bring the pipe ends into contact with it. Maintain a light force on the carriage until a small melt bead forms around the entire circumference of both pipe ends. Relax the force on the carriage but keep both pipe ends in contact with the heater and start the melt time cycle. Refer to Table 1 for proper melt times.
9. After the melt time has been observed snap the carriage back (open) and quickly remove the heater being careful not to hit the melt.
10. Inspect the pipe ends for complete melt. Bring the pipe ends together quickly, DO NOT SLAM, applying only enough pressure to form a double roll back bead. The proper bead thicknesses are shown in Table 1. Over-pressuring the melt will cause the bead to overlap itself resulting in a subquality fusion due to displacement of the melt to the OD and ID of the joint leaving a cold ring in the center. Under pressuring can result in inadequate fusion due to insufficient contact pressure in the melt area.
11. Maintain the pressure exerted on the fusion area for one minute for 1/2"-4" sizes and for three minutes for 6". Relaxing the pressure prior to expiration of the cooling time can result in porous fusion joints.
12. Allow the joint to cool for additional three to four minutes (see Table 1) prior to removal from the alignment clamps. The pipe can now be handled with care. Complete cooling requires approximately

thirty minutes.

13. Check the melt bead for uniformity and size. If the joint exhibits poor characteristics, determine the cause, make the necessary corrections, cut out the suspect joint, and repeat the procedure from Step 4.
14. Clean the heater faces with a clean cotton cloth. DO NOT use synthetic cloths or metal implements.

TABLE 1: Manual Butt Fusion Parameters

Pipe Size	Melt Bead Size	Heating Time (seconds)	Hold Time (seconds)	Cooling Time (minutes)
1/2" CTS	1/16"	3-6	60	3
1" CTS	1/16"	5-9	60	3
2" IPS	1/16"-1/8"	15	60	4
3" IPS	1/8"	20	60	4
4" IPS	1/8"	20	60	4
6" IPS	3/16"	30	180	5

C. HYDRAULIC BUTT FUSION PROCEDURES

1. Energize the heating iron. Once the heater has reached maximum temperature, generator cycles off, check the thermometer for $425^{\circ} \pm 25^{\circ}\text{F}$.

At the start of each day, the reading of the dial thermometer shall be checked against the surface temperature by use of the pyrometer and the heating iron calibration set screw adjusted accordingly (manual machines only).

2. Install the proper size alignment clamp inserts if required.
3. Inspect the pipe and/or fitting ends and cut off any damaged or flattened portions.
4. Clean each pipe/fitting end with a clean lint free cloth and place the pipe in the alignment clamps. Pipe ends should overlap the alignment clamps by approximately 1".
5. Place the motorized facer on the guide rods and bring the pipe ends in contact with it. Turn on the motorized facing unit and advance the pipe ends into the facing unit. The motorized facer speed will increase when the pipe has bottomed out.
6. Retract the carriage and remove the facer. Discard the strips of material from the pipe ends taking care not to touch the clean surfaces. Check the discarded strips to insure that a continuous length from the entire diameter has been removed.
7. Check alignment of the pipe ends and adjust for high-low if necessary. If an adjustment is made or a

visible gap exists between the pipe ends, repeat the procedures from Step 4.

8. Wipe heater with a non-synthetic clean lint free cloth and place it on the guide rod(s) and bring the pipe ends into contact with it. The carriage should be placed in heat soak until a small melt bead forms around the entire circumference of both pipe ends. Refer to Table 1 for proper melt times.
9. After the melt time has been observed the carriage should be opened and quickly remove the heater being careful not to hit the melt.
10. Inspect the pipe ends for complete melt. Bring the pipe ends together quickly until a double roll back bead is formed. The proper bead thicknesses are shown in Table 1.
11. Maintain the pressure exerted on the fusion area until required.
12. Allow the joint to cool for additional three to four minutes (see Table 1) prior to removal from the alignment clamps. The pipe can now be handled with care. Complete cooling requires approximately thirty minutes.
13. Check the melt bead for uniformity and size. If the joint exhibits poor characteristics, determine the cause, make the necessary corrections, cut out the suspect joint, and repeat the procedure from Step 4.
14. Clean the heater faces with a clean cotton cloth. DO NOT use synthetic cloths or metal implements.

D. ELECTRO FUSION PROCEDURES

NOTES: See the Universal Control Box Manufacturer's literature for fusion information. The manufacturer's literature must be adhered to insure acceptable fusions.

In the event that the supply voltage varies outside of the stated limits the fusion cycle will be interrupted. A new cycle can be started after a ten-minute cool down period has been observed. The fusion system will automatically adjust the duration of the cycle to compensate for the previously aborted attempt. A maximum of three attempts may be tried. If the tapping tee has already been tapped, NO retries are allowed.

E. REQUIREMENTS FOR PE FUSION TESTING

Applicants for testing will need to demonstrate a working knowledge of Polyethylene pipe fusion procedures and equipment without any assistance. The test will be given as a whole. The Contractor will be required to complete a minimum 6" butt fusion on a hydraulic machine with a Data Logger using a McElroy DL5 or higher, a 4" electrofusion coupling, and a 2"x6" electrofusion service tee saddle.

Each fusion applicant must bring the following to the test:

- 6" pipe (DR 11.5), 6' long and performed on a hydraulic fusion machine
- Minimum of 1 each 6" electrofusion coupling and 2"x6" electrofusion service tee saddle (recommend at least 2 each, per person tested)
- Proper tools required to do the work (scraper cutter, lint free cloths, etc.)
- Isopropyl alcohol 95% or greater (99% preferred)
- A working contact or infrared pyrometer, and working generator to power the electrofusion box (with fuel)
- A working reciprocating saw and blades to cut the pipe
- Extension cords and any other saws or cutters you plan to use on the job. Chainsaws are not permitted.

- For manual fusion only (City Staff) 2LC or up to 2" or PitBull 14 – irons must have stripper bars and be clean and in good condition. Facer blades must be clean and in good condition in accordance with the Manufacturer's specifications. Any machine not meeting these standards will need to be repaired by an authorized service center that is recognized by the manufacturer
- For hydraulic fusion only (Contractor and City Staff) 28 or 618 – irons must have stripper bars and be clean and in good condition. Facer blades must be clean and in good condition in accordance with the Manufacturer's specifications. Any machine not meeting these standards will need to be repaired by an authorized service center that is recognized by the manufacturer.
- A calibrated and working electrofusion box. Not a rental.

The City of Palo Alto's electrofusion test is in place to test the operator and the equipment that will be used on the job. **All equipment must meet manufacturer's standards per ASTM F1055 and F2620.** Contractor shall note that the fusion testing process is a separate process from the City's project review and acceptance process.

It is the Contractor's responsibility to ensure that all equipment is fueled prior to the test being administered. **All equipment must have a serial number or equipment number.** Any missing tools or equipment will result in no test being conducted, or a FAIL will be given. All equipment used for Contractor certification, should be the same equipment used on the project.

See Specification 2300 (Polyethylene Pipe Installation for Water, Gas and Wastewater) for additional testing requirements.

CITY OF PALO ALTO: Polyethylene Gas Pipe Fusion Practical Test (Sample)

Applicants for fusion certification will be required to pass both a physical and written exam prior to being certified.

Name: _____
Title: _____

Date: _____
Company: _____

Individual should be tested on all procedures he/she is to be certified under. (Unmarked boxes constitute failure in that type procedure).

☐ **ELECTRO FUSION COUPLINGS**

- ☐ 1. Pipe ends were cut square and even.
- ☐ 2. Cleaned pipe ends inside and out.
- ☐ 3. Measured and marked pipe ends.
- ☐ 4. Scraped pipe ends.
- ☐ 5. Took proper precautions to avoid contamination of pipe ends.
- ☐ 6. Cleaned fitting and pipe ends with alcohol.
- ☐ 7. Centered fitting between marks.
- ☐ 8. Connected control box to proper 110 volt A.C. power source in correct sequence.
- ☐ 9. Had thorough understanding of operation sequence and warning light functions.
- ☐ 10. Noted time that FUSION START BUTTON was depressed.
- ☐ 11. Marked time of day on pipe at end of fusion.
- ☐ 12. Removed leads from fitting 30 seconds or longer after fusion was over.
- ☐ 13. Allowed fitting to cool in secured position for recommended time.

☐ **ELECTRO FUSION TAPPING TEES**

- ☐ 1. Cleaned pipe around fusion zone.
- ☐ 2. Scraped entire pipe surface that will fall under tee.
- ☐ 3. Took proper precautions to avoid contamination of scraped pipe.
- ☐ 4. Cleaned fitting and scraped area with alcohol.
- ☐ 5. Placed tee on scraped area.
- ☐ 6. Properly installed under-saddle/hold-down clamp.
- ☐ 7. Connected control box to proper 110 volt A.C. power source in correct sequence.
- ☐ 8. Had thorough understanding of operation sequence and warning light functions.
- ☐ 9. Swiped fitting UPC with optical wand.
- ☐ 10. Noted time that FUSION START BUTTON was depressed.
- ☐ 11. Marked time of day on pipe at end of fusion.
- ☐ 12. Removed leads from fitting 30 seconds or longer after fusion was over.
- ☐ 13. Allowed fitting to cool in secured position for recommended time.

☐ **BUTT FUSION MANUAL**

- ☐ 1. Pipe ends were faced properly to the facer stops.
- ☐ 2. Removed cuttings from interior of pipe.
- ☐ 3. Aligned pipe ends for "high-low", refaced if needed.
- ☐ 4. Cleaned heater face and verified heating iron surface temperature with pyrometer.
- ☐ 5. Observed recommended melt bead prior to timing.
- ☐ 6. Observed recommended melt time.
- ☐ 7. Maintained pressure on fusion during recommended cool down period.
- ☐ 8. Allowed joint to cool in machine for recommended period.
- ☐ 9. Knowledge of rough handling time.

**BUTT FUSION HYDRAULIC**

- ☐ 1. Completed an inspection of equipment for cleanliness and proper operation.
 - ☐ 2. Cleaned pipe ends inside and out.
 - ☐ 3. Pipe ends were faced properly to the facer stops.
 - ☐ 4. Shavings and chips removed after facing pipe.
 - ☐ 5. Pipe ends brought together under facing pressure, no visual gaps observed.
 - ☐ 6. Aligned pipe ends for "high-low", refaced if needed.
 - ☐ 7. Checked for pipe slippage at fusion pressure and pipe ends kept closed.
 - ☐ 8. Calculated drag pressure properly. Drag Pressure _____psi.
 - ☐ 9. Theoretical Fusion Pressure Calculated. Theoretical pressure _____psi.
 - ☐ DataLogger ☐ Fusion Pressure Calculator
 - ☐ McCalc ☐ Formula
- Observed gauge pressure (theoretical fusion pressure + drag) used to fuse the pipe
_____psi.
- ☐ 10. Cleaned heater face and verified heating iron surface temperature with pyrometer.
 - ☐ 11. Recommended shift sequence followed.
 - ☐ 12. Bead size against the heater meet standard before heater removal.
 - ☐ 13. Inspected pipe interfacial area after heater removal.
 - ☐ 14. Removal of heater completed in allotted time.
 - ☐ 15. Completed cooling cycle time (under fusion pressure).
 - ☐ 16. Operator proficient with Data Logger setup and operation.

JOINT EVALUATION

Visual Examination (During and after assembly. Compare to Photograph or sample of acceptable joint.)

Procedure/Joint Appearance

PROCEDURE		JOINT APPEARANCE		ADDITIONAL INSTRUCTION REQUIRED IN
		PASS	FAIL	
BUTT FUSION (MANUAL) _____"				
BUTT FUSION (HYDRAULIC) _____"				
ELECTRO	COUPLING _____"			
FUSION	TAPPING TEE _____"			

☐ DEFORMATION TEST $\leq 3"$

TENSILE TEST $\geq 4"$

☐ Specimen cut into test template or longitudinal straps. (Joint should be free of voids or unbonded areas on surface.)

Joint Evaluation (Visual)(Deform joint by bending or tensile test)

PROCEDURE		JOINT APPEARANCE		ADDITIONAL INSTRUCTION REQUIRED IN
		PASS	FAIL	
BUTT FUSION (MANUAL) _____"				
BUTT FUSION (HYDRAULIC) _____"				
ELECTRO	COUPLING _____"			
FUSION	TAPPING TEE _____"			

Certification obtained in the following utility (s)

☐ Gas

RECOMMENDATION:

- ☐ Retest Required.
- ☐ Certification Card Issued/Date _____
- ☐ Re-Certification Card Issued/Date _____

Certified in the following application(s):

- ☐ Butt Fusion
- ☐ Couplings
- ☐ Tapping Tees

Employee Signature

Date

Evaluator Name and Title

Evaluator Signature

Date