



CITY OF
PALO ALTO

Water Gas & Wastewater Utility Standards



2024

Utilities Department

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

The 2024 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. All drawings and specifications for City projects or private development projects within the public right-of-way shall conform to 2024 WGW Utility Standards, unless otherwise approved by the WGW Engineering Manager. Private utilities on private properties fall under the jurisdiction of the City's Planning Department, Building Inspection Division. A new edition of the WGW Utility Standards is anticipated to be issued annually. The electronic downloadable file is available at City of Palo Alto Utilities Engineering website:

https://www.cityofpaloalto.org/files/assets/public/utilities/utilities-engineering/general-specifications/2024-wgw-utility-standards_online-version.pdf

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**SECTION 800
ADDITIONAL PROVISIONS FOR UTILITIES CONTRACTORS**

PART 1 – GENERAL

1.01 DESCRIPTION

The additional provisions in this section apply to work on Utilities Capital Improvement Projects (CIP).

1.02 DEFINITIONS

Capitalized terms which are not otherwise defined in these Standards have the same meaning provided in Article 1 of the City's General Conditions.

1.03 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, as long as the proposed change is of equal or greater performance that meets the original design's performance goal(s). 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.

1.04 TYPICAL TIMELINE AND CONTRACTOR REQUIREMENTS FOR NOTICE OF AWARD, CONTRACT EXECUTION, NOTICE TO PROCEED, PRE-CONSTRUCTION SUBMITTALS, PRE-CONSTRUCTION CONFERENCE, AND COMMENCEMENT OF WORK

The typical or anticipated times provided for City actions in this section are provided solely for the Contractor's convenience, and will not be binding against the City since the actual time for the City's action may vary depending on applicable circumstances.

- A. The Notice of Award typically is issued within ten (10) business days of the City-Council approval date.
- B. Per IFB Part 2 Instructions to Bidders Section 9.3, the Contractor must submit all required documentation, including, without limitation, all bonds and evidence of insurance within ten (10) business days of the date of issuance of the Notice of Award.
- C. The Notice to Proceed is anticipated to be issued within twenty (20) business days from the Notice of Award and when the Contract is fully executed. The Notice to Proceed may specify the pre-construction submittal due date, pre-construction conference date, and the anticipated project commencement date.
- D. The Contractor must submit all pre-construction submittals, as specified in the Contract Documents or listed in the Construction Submittal List in IFB Appendices, for City's approval within ten (10) business days from the Notice to Proceed issuance date.
- E. The pre-construction conference is anticipated to be scheduled for 20 days after the pre-construction submittal deadline.
- F. The commencement of work date is anticipated to be 10 days after the pre-construction conference, when pre-construction submittals are substantially or completely approved.

1.05 SUBMITTALS

In addition to complying with the general submittal requirements in Section 3.12 of the General Conditions, Contractor must meet any specified project milestones by submitting required pre-construction submittals in advance to avoid delays due to submittal review or material lead time. As further specified in Section 6.4 of the Construction Contract, liquidated damages may be assessed if the Contractor fails to meet specified project milestones. All pre-construction submittals must be approved prior to delivery of the material/equipment to the job site that the submittal relates to or starting the portion of work. Unless specifically stated elsewhere in the Contract Specifications, the Contractor shall 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.

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", "MAKE CORRECTIONS NOTED", or "RECEIPT ACKNOWLEDGED", 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 five (5) business 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 resubmittals, 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.

1.06 MEETINGS

A. Pre-Construction Conference/Meeting

City will conduct a mandatory pre-construction meeting when pre-construction submittals are substantially or completely approved, typically 20 business days after the pre-construction submittal due date. The pre-construction submittal due date is 10 business days from the Notice to Proceed issuance date per Section 1.04.D. The Contractor's primary representative and its Superintendent for the project must attend the meeting, which will include discussion of the scope of work, sequence of operations, project milestones if appropriate, and project requirements. The Contractor may include other supervisory personnel and representatives from key subcontractors as well.

Work on the project cannot commence until all required pre-construction submittals have been approved by the City. Contractor will be solely responsible for delay in

authorizing commencement of the work by the planned project start date, milestones, or completion date due to Contractor's failure to provide all pre-construction submittals as specified.

B. Project Meetings

Following commencement of the work, Contractor's Superintendent must attend and participate in regular weekly project meetings as scheduled by the Engineer. The Subcontractor and supplier representatives may only attend the regular project meetings when specifically invited by the Engineer.

The meetings will be conducted by the Engineer, and the Engineer will keep minutes of the proceedings.

The Engineer will establish the agenda for each project meeting, which may include matters including, but not limited to, 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.

1.07 SCHEDULE UPDATE

- A. In addition to the monthly schedule requirements in Section 3.10.3 of the General Conditions, one day prior to each weekly project meeting, Contractor must submit to Engineer an updated and detailed rolling 3-week look-ahead schedule, that is tied to the overall construction schedule.

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 if there is evidence that progress is lagging by a week or more from the last submitted schedule. The Contractor shall provide such updated or revised schedule within two (2) Working Days.

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

1.08 NOTIFICATION

The Contractor shall provide written notification of the work to abutting property owners at least fifteen (15) 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 (2.02.H.2)*.

1.10 PROGRESS PAYMENT

In addition to the provisions of Article 9 of the General Conditions, including Section 9.2 on progress payments, Applications for Payment for Utilities Capital Improvement Program (CIP) projects must also 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 Application for Payment must include all of the following:

- A. GPS survey data collected and furnished in accordance with requirements stated in Section 2740 of these specifications for infrastructure installed within 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 and subsequently every month, with or without an invoice, for the City to validate its accuracy.
- B. The completeness and accuracy of GPS survey data shall be verified by the City before the issuance of each payment to the contractor. If the GPS survey data is found incomplete or inaccurate, the City 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.
- C. Submission of checklists of all notified affected property owners (15 day and 24-hour notices).
- D. Submission of data logger and electrofusion records.
- E. Video on USB flash drive, 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 (if applicable).
- F. List of quantities verified by City Inspection.
- G. Updated construction schedule as specified in Section 3.10 of the General Conditions.
- H. 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.
 - 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. Records of bore logs.

- d. Pre and post construction sewer lateral/main cross bore verification completed, submitted, and accepted in accordance with the procedures stated in Sections 2739 and 2741 of these specifications.
- 3. Wastewater CIP Projects:
 - a. All sewer main/lateral post-construction CCTV inspection per Section 2739.

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 Sections 2400 and 2500 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 Permittor (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. **PUBLIC WORKS STANDARD DRAWINGS AND SPECIFICATIONS:** The latest edition of City of Palo Alto Public Works Standard Drawings and Specifications (The electronic downloadable file is available at <https://www.cityofpaloalto.org/Departments/Public-Works/Engineering-Services/Public-Works-Standard-Drawings-and-Specifications>).
- B. **WATER, GAS, AND WASTEWATER UTILITY STANDARDS:** The latest edition of City of Palo Alto Water, Gas, and Wastewater Utility Standards (The electronic downloadable file is available at <https://www.cityofpaloalto.org/Departments/Utilities/Utilities-Services-Safety/Engineering-and-Operations>).
- C. **CITY OF PALO ALTO TRAFFIC CONTROL MANUAL:** The latest edition of the Traffic Control Requirements is available at <https://www.cityofpaloalto.org/files/assets/public/public-works/engineering-services/webpages/forms-and-permits/other-guidelines/requirements-for-traffic-control-plan-submission-2021.pdf>.
- D. **MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES (MUTCD) – CALTRANS**
- E. **WORK AREA TRAFFIC CONTROL HANDBOOK (WATCH BOOK)**
BNI Publications Inc.
- F. **Tree Technical Manual**
Department of Planning and Community Environment, latest edition
- G. **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
- H. **OSHA** Consultation and Compliance Section
U.S. Department Of Labor
Occupational Safety and Health Administration
71 Stevenson St. Suite 415
San Francisco, California 94105
- I. **CAL-OSHA**
Department of Industrial Relations
State of California
Occupational Safety and Health Administrations
525 Golden Gate Ave.
San Francisco, CA 94102

- J. UPC**
Uniform Plumbing Code
20001 Walnut Drive South
Walnut, CA 91789-2825
- K. UBC**
Uniform Building Code
5360 South Workman Mill Road
Whittier, CA 90601
- L. NEC**
National Electric Code
National Fire Protection Association
Batterymarch Park
Quincy, MA 02269
- M. UFC**
Uniform Fire Code
5360 South Workman Mill Road
Whittier, CA 90601
- N. UL**
Underwriters Laboratories
1655 Scott Boulevard
Santa Clara, CA 95050
- O. AWWA**
American Water Works Association
6666 West Quincy Avenue
Denver, CO 80235-3098
- P. 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 any time 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 installation 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-hour 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, Public Works Standard Drawings and Specifications, and/or Building Code 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).

4.12 Photos/Video of Existing Site Condition

The Contractor shall take photos and video of existing jobsite conditions and temporary storage areas prior to the commencement of work. The Contractor shall be responsible for site restoration to pre-construction conditions if the damage is caused by the Contractor's work or storage. If the Contractor fails to document existing condition of public or private properties prior to construction, the Contractor will be held liable for any damage sustained at the construction sites or storage areas.

4.13 Reporting Requirements of Sanitary Sewer Overflows (SSOs)

- In the event of a SSO that is observed or created by the Contractor, the Contractor will immediately notify the City's Dispatch by calling 650-329-2413 and the assigned City Inspector.
- The following information should be reported to the City's Dispatch: location of the SSO, contact information of the Contractor representative and City Inspector, time Contractor first noticed the SSO, and if SSO is occurring at the time of the call.
- Utility Dispatch may contact Wastewater Operations to respond.
- The Contractor must take appropriate steps to stop, contain, or divert the SSO by using absorbent, portable dams, sandbags, or by-pass equipment.
- The responding Operations' crew may assist the Contractor with stopping, containment, or diversion of SSOs and complete field reports associated with the SSO.

END OF SECTION

**SECTION 860
STREET PAVEMENT SCHEDULE**

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 City's restoration requirements and in accordance with the Public Works Department Standard Drawings and Specifications and Project Drawings.

Existing Pavement Section Table (Example)

| SHEET NUMBER | STREET | BETWEEN | AND | SURFACE TYPE | SURFACE THICKNESS (INCH) | BASE TYPE | BASE THICKNESS (INCH) | Pavement Condition |
|--------------|----------------|----------------|----------------|--------------|--------------------------|-----------|-----------------------|---------------------|
| 5,6 | Geng Rd | Embarcadero Rd | End of Geng Rd | AC | 3 | AB2 | 12 | Poor |
| 7,8,9 | Arboretum Rd | Sand Hill Rd | Orchard Ln | AC | 1 | CRB | 10 | Fair/At-Risk |
| 12 | University Ave | Webster St | Byron St | AC | 4 | DLAC | 8 | Very Good/Excellent |
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Legend for Surface Type:

AB2 – Aggregate Base (Class 2)
AC – Asphalt Concrete
CRB – Crusher Run Base
DLAC – Deep Lift Asphalt Concrete
PCC – Portland Cement Concrete

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

For restoration within other agencies' right-of-way, the Contractor shall contact and follow the direction and requirements of the permitting agency.

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.

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/files/assets/public/public-works/water-quality-control-plant/recycled-water/2021/9.-user-guidelines-and-application.pdf> 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

City Contractors are required to provide their company's Certificate of Liability Insurance as part of the requirements for applying for a permit to claim recycled water. Applicants can request a multi-year permit for multi-year projects for the City of Palo Alto. Permits for recycled water expire every year end (December 31st) regardless of application date except for multiyear permits.

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 (Ground 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

Work Included in this section:

- Traffic Control
- Safety
- Sanitation Facilities
- Storage of Equipment and Materials
- Cleanup
- 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.

All Utilities CIP projects, irrespective of the requirements set forth by the authority having jurisdiction over traffic control, must have a traffic control plan. These plans are mandatory for all on-site work and need to be signed and stamped by a California registered professional traffic engineer.

B. Additional Traffic Control Requirements

In addition to the requirements in Transportation Department's 'Requirements for Traffic Control Plan Submission' manual, all traffic control requirements outlined in this section shall also be followed. 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, as part of the required pre-construction submittals, to the Engineer for City's approval within twenty (20) business days from the Notice of Award issuance date. For projects with critical start and/or completion dates, it is the Contractor's responsibility to meet the requirements by submitting traffic control plans as specified and allow sufficient review time. Liquidated damages will be assessed when Contractor fails to meet the project milestones and/or Substantial completion.

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. The Transportation Department requires site-specific plans on high-volume traffic intersections and arterial streets. For major signalized intersections and arterial/collector streets, 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. See Section 1500.1.02.B.30 for a list of arterial and collector streets. Additional streets may be identified in the 'Requirements for Traffic Control Plan Submission' manual. Some major street intersections are listed below:

- All Intersections with Page Mill Road, Embarcadero Road, Arboretum Road

- Intersections of Charleston Road/Commercial Street and Coyote Hill Road /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 Transportation Department. 'Closed to through traffic' is not permitted on two adjacent parallel streets simultaneously, unless it's an emergency, approved by the Engineer, and the contractor received an approved traffic detour plan from Transportation Department.

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), Requirements for Traffic Control Plan Submission, and all applicable 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 15 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 (15 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. Limited 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. (refer to Section 1.05.A) 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. The construction hours for Utilities CIP project are generally 8 AM to 4:30 PM, Monday through Friday, unless otherwise noted. Refer to City's Traffic Control Manual and Requirements for Traffic Control Plan Submission for further time restrictions in downtown areas, business districts, on arterial streets, in bike lanes, and near schools.
29. **All work within 1500 feet of the school or hospital shall be coordinated with the school or hospital administration.** No work will be permitted within 1500 feet of school grounds or along school routes, as shown on adopted Walk and Roll Maps, until after 8:45 a.m. on school days (see latest PAUSD School Year Calendar). 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.
30. Work on arterial and collector streets will not be permitted between the hours of 7:00 and 9:00 AM and 4:00 and 6:00 PM. The restricted streets include: Alma St, Arastradero Rd, Arboretum Dr, California Ave, Channing Ave, Colorado Ave, E Bayshore Rd, E Charleston Rd, E Meadow Cir, E Meadow Dr, Embarcadero Rd, Fabian Wy, Louis Rd, Middlefield Rd, Palo Alto Ave (west of Alma St), San Antonio Rd, Sand Hill Rd, University Ave, Hansen Wy, Hillview Dr, Park Blvd, Stanford Ave, Quarry Rd, W Charleston Rd, Bayshore Rd W Meadow Dr, and Welch Rd. Any exceptions to these must be approved by both the Public Works Department and Planning and Community Environment Department – Transportation Division.
31. Projects affecting motor vehicle, pedestrian or bicycle traffic in business districts is generally only permitted between the hours of 9:00 AM and 4:00 PM. Business Districts include the following areas:
- **University Ave District (Downtown):**
bounded by Alma St, Webster Ave, Lytton Ave, and Forest Ave
 - **California Ave District:**
bounded by El Camino Real, Caltrain corridor, Sherman Ave, and Cambridge Ave
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. 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.

34. 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.
35. 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.
36. 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.
37. Except in emergency situations, any traffic detour requires five (5) working days advanced notice in order to insure proper advanced planning.
38. 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.
39. 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.
40. 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. Temporary Sanitation facilities shall be on a trailer and transported to-and-from the active jobsite daily. The Contractor shall apply for an encroachment permit where a Temporary Sanitation facility remains unhitched and left at the jobsite beyond the defined work hours. 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. Contractor Off-Site Storage Area

The contractor is required to secure an offsite storage area suitable to store equipment, structures, pipe and granular material. The cost associated with securing an off-site storage area must be included in one or more of the contract bid items.

Furthermore, contractor access and work at the offsite storage area within Palo Alto City limits shall meet [County of Santa Clara](#) and/or [City of Palo Alto's](#) best management practices including but not limited to: tarping new material piles; wetting down storage area to mitigate dust; tarping spoils/offhaul material piles; and off hauling spoils daily. Unless in a commercially zoned area, work hours for access to the storage area shall be limited to 8:00AM-5:00 PM Monday through Friday.

B. 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.

Contractor shall adhere to all of the City's on-site storage policies. The City has the right to revoke storage of materials and equipment within the City's Right-of-Way for non-compliance with the City's storage policies.

Within the City's Right-of-Way, the Contractor is only permitted to store up to four (4) construction vehicles or equipment (excavators, backhoes, wheel loader, skid steer, etc.) beyond the work hours defined for the project, regardless of crew size or location. Paving rollers will only be allowed to be stored within the City's Right-of-Way every two weeks for a maximum duration of two days

and only when paving is scheduled.

Trench plates and backfill material that is planned to be used for the current week's scheduled work may be stored within the Public Right-of-Way beyond the work hours defined for this project.

Contractor shall coordinate with the City's inspector(s) to identify a suitable location to temporarily store material and equipment.

All equipment and material temporarily stored at the construction site, within the Public Right-of-Way, shall be relocated to the active job sites and cannot remain at any given job site after the work is completed. In addition, all granular material shall be removed at the end of each work week and before rainfall starts.

If a complaint from the public is received by the City regarding the Contractor's equipment or materials, the contractor may be directed to relocate or remove all equipment and/or material from the City's 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).

C. 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 private 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 proper permits from Planning & Development Services Department.

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 an Encroachment Permit, but will require the prior approval of the appropriate authority.

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 appropriate authority 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 workday, the Contractor shall provide project signs for the ends of each location/street 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 as the project location changes, 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 of 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:

| | | |
|--|---|---|
|  | <p>CITY OF PALO ALTO UTILITIES</p> | <p>City of Palo Alto Utilities Department (650) 566-4501</p> |
| <p>Project Name Month Year – Month Year Monday- Friday 8 am to 5 pm</p> <p>Contractor's Name Contractor's Local Phone Number</p> | | |
| <p>Project Website: https://www.cityofpaloalto.org/Departments/Utilities/Utilities-Services-Safety/Utilities-Projects</p> | | |

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 WATER AND WASTEWATER MAINS OR SERVICES INSTALLED BY DEVELOPMENT SERVICES APPLICANTS

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. Electronic copy 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 manufacturer's literature on the materials to be used for approval by the Utilities Engineering Department.
- E. PE pipe fusion certification by City-authorized testing company or personnel.

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.

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. The Contractor shall also prepare all submittals required by Public Works Department per [Public Works Standard Drawing and Specifications](#).

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 19-3.02F(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.

Prior to excavation, the Contractor shall verify that all utilities shown in the contract documents or observed in the field from existing aboveground utility features, have been USA-marked. Notify USA and schedule a meet and mark at least three (3) working days prior to excavation, if any utility has not been marked, has been marked differently than what's shown in the project plans, or the marking appears to be inaccurate judging by the existing aboveground features for the utility. If the Contractor is unable to locate identified underground utilities while excavating, based on USA marks or information provided in the contract documents, the Contractor will contact the responsible utility owner to locate those facilities.

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 three working days prior to digging to allow time to resolve the conflict.

If USA re-marking is required due to any reasons, the Contractor shall anticipate up to two (2) working days turn-around time. No additional compensation for standby or waiting time shall be paid to the Contractor, subject to the limitations set forth in Public Contract Code section 7102, if applicable.

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.

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.

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 when the damage is due to the Contractor's failure to exercise reasonable care with utilities that are indicated in the plans and specifications with reasonable accuracy.**

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 the Contractor's sole expense. The repair work must be performed by a licensed

plumber in accordance with the requirements of UPC and City of Palo Alto Building Inspection. The Contractor will be responsible for coordinating access to private property with the owners.

3.2 POTHOLING

The contractor shall locate and pothole all existing crossing utilities and parallel utilities within 5 feet of the designed pipe alignment. The Contractor shall pothole and confirm there is sufficient vertical or horizontal separation between the existing utilities and the designed pipe alignment at least three (3) working days prior to performing any construction activities for the proposed pipe.

- If the existing crossing or parallel utility is at a higher elevation than the designed pipe elevation, the Contractor shall daylight and expose the bottom of the existing pipe/conduit/duct/duct bank.
- If the existing crossing or parallel utility is at a lower elevation than the designed pipe elevation, the Contractor shall expose the top of the existing utility.
- For parallel utilities, the Contractor shall pothole every 100 feet until the utility is beyond the 5-foot parallel zone.
- The Contractor shall allow the Inspector or Engineer to have clear visual of the existing utility in each pothole as the drilling or bursting head passes through the existing utility. This is to ensure that the existing utility/structure is not damaged by the drilling/bursting operation.
- For third party utilities such as PG&E's high pressure gas mains, the Contractor shall comply with the utility owner's potholing requirements.

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 existing utilities at least three (3) working days prior to any construction activities for the proposed pipe 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 a 2-day 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 existing crossing and parallel utilities shall remain exposed and visible throughout the boring or pipe-bursting operation and shall be inspected by the WGW Utilities Inspector and/or Public Works Inspector during the trenchless operation or prior to backfill. It is the Contractor's responsibility to investigate any unknown or conflicting utilities and to contact the public or private utility agency or owner to resolve the conflicts identified during potholing activities. The City is not responsible for any delays or additional costs associated with unmarked third-party utilities.

3.3 Gas Main Replacement Projects

Pre-Installation CCTV Inspection

Prior to installing new gas pipelines by trenchless methods, the Contractor is required to use a CCTV camera through any sewer main meeting the criteria listed below, to accurately document and mark all lateral connection points and identify the alignment of all sewer laterals on public and private properties.

- Sewer mains with any connecting sewer lateral that will be crossed by the proposed gas pipelines.

- Sewer mains with any connecting sewer lateral that is serving the same property as the proposed gas pipeline or stub.
- Sewer mains with any connecting sewer lateral that is on an adjacent property, but within 10 feet of a proposed gas pipeline.

Contractor shall submit the CCTV logs and video footage for each sewer main with the monthly progress payment request.

If the Contractor's CCTV inspection of the sewer pipelines show the pipeline is blocked by roots or debris, Contractor shall clean the sewer pipeline by flushing until CCTV inspection can be completed. See Section 2739 "Cleaning and Video Inspection of Sewer Pipe" for requirements. If there are any obstructions in the sewer main that deemed by the Engineer as unable to be addressed by cleaning, Contractor shall provide City Operations crew 10 business day notice to schedule time to assist Contractor with removal of obstructions.

Post-Installation CCTV Inspection

On natural gas main and service replacement projects using trenchless installation methods, post-installation cross-bore CCTV inspection must be performed on public and private sewer pipelines when:

- The newly installed gas pipelines cross sewer pipelines.
- The sewer pipelines are serving the same property as the newly installed gas pipeline or stub.
- The sewer pipelines, on an adjacent property, are within 10 feet of a newly installed gas pipeline.

See Section 2741 "Legacy Cross Bore Inspections Guidelines" and Section 2739 "Cleaning and Video Inspection of Sewer Pipe" for requirements.

Once installation of the new gas pipelines has been completed using trenchless installation methods, the Contractor shall perform CCTV inspections to positively verify and document that no sewer pipelines were damaged during installation. City and private sewer clean-outs may not always be accessible or present; therefore, the Contractor shall use lateral-launch and push camera equipment to inspect all sewer pipelines, including sewer pipelines that were not USA marked or shown on the project plans. All sewer pipelines must be CCTV-inspected and cleared of a cross-bore, per Specification Section 2741, prior to the City performing gas tie-ins. The Contractor is also required to perform CCTV inspection of sewer pipelines at all properties where reconnection is specified, regardless of length of newly installed gas service.

The video inspection must include entire length of the sewer lateral from the wastewater main to the foundation of the structure or extend three (3) feet beyond the furthest gas riser, whichever is furthest. Inspection must include sewer lateral branches and cleanout risers. Inspection length will be determined by the City Inspector assigned to the project. For each sewer pipeline inspection, the Contractor shall make at least two attempts using the push camera and at least two attempts using the lateral-launch camera. If using push camera or lateral launch equipment is not successful following the repeated attempts, the Engineer may request the Contractor to pothole to clear the sewer lateral from a cross-bore.

If the Contractor's CCTV inspection of the sewer pipelines show the pipeline is blocked by roots or debris, Contractor shall clean the sewer pipeline by flushing until CCTV inspection can be completed. In the event a portion of the sewer pipeline is not cleared and all efforts to CCTV inspect the sewer pipeline have been exhausted:

- If the sewer pipeline and newly installed gas pipeline crosses, the Contractor will be directed to excavate the crossing and have the City Inspector visually verify the separation between the pipelines.
- If the sewer pipeline and newly installed gas pipeline do not cross, a proximity clearance may be determined by the City Inspector assigned to the project. If a proximity clearance cannot be determined, Contractor may be instructed to excavate and expose the entire length of the gas pipeline for visual inspection.

If the Contractor is unable to find an existing City or private sewer clean-out and inspection efforts have been exhausted, the City may direct the Contractor to expose the sewer lateral and install a sewer cleanout per City Utility Standard Details WWD-02A and WWD-02B to facilitate video inspection. The newly installed sewer cleanout must be inspected and approved by the City Inspector. The Contractor will be compensated for this Work based on the applicable unit pricing.

If the sewer pipeline is blocked by existing damage or protruding taps, Contractor must provide an image and location of each section for City Operations to investigate. In the event City Operations is unable to address the sewer pipeline repair, Contractor may be directed to make the repair on the sewer pipeline to facilitate the video inspection. Contractor shall receive approval from the City prior to attempting to repair, clean or cut roots from the sewer pipelines. The Contractor will be compensated for this Work based on the applicable unit pricing.

3.4 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 workday 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.

3.5 SUBSURFACE CONDITIONS

Please refer to Invitation for Bid (IFB) Package Part 2 – Instructions to Bidders Section 18.0 (Subsurface Conditions) for information for Bidders regarding subsurface conditions.

3.6 EXCAVATION

It is the Contractor's responsibility to fully examine and inspect the project site and documents pertaining to the physical conditions of the project area, prior to submitting the bid, as further specified in Instructions to Bidders Section 6.0 (Pre-Bid Investigation). The Contractor shall include all necessary cost in one or more bid items to perform excavation and complete the work successfully. It is the Contractor's responsibility, prior to construction, to contact all outside agencies or owners if the Contractor becomes aware of any actual or potential discrepancies between existing field conditions and conditions shown on the project plans. Some utilities may 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 CIP projects no more than one crew installing mains or services/laterals, unless approved by the Engineer. Other work such as alignment layout, saw-cutting, potholing, trench plate grinding, excavating, backfilling/restoration, cleaning, or GPS surveying can be performed simultaneously.

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 workday. 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.

3.7 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.

PG&E's transmission pipelines can be reviewed in PG&E's website https://www.pge.com/en_US/safety/how-the-system-works/natural-gas-system-overview/gas-

[transmission-pipeline/gas-transmission-pipelines.page](#). When potholing or working within 10 feet of PG&E mains, the Contractor shall contact PG&E twenty (20) business days prior to start of work to coordinate and schedule standby inspection. Hand digging is required within 2 feet (tolerance zone) on either side, of the outermost edge, of the PG&E mains. The Contractor shall include the cost in one or more bid items and adequate lead time to comply with PG&E requirements such as obtaining applicable permits, scheduling for inspection, locating, hand-excavation, restoration, etc. When parallel boring or trenching is performed outside of the tolerance zone but within 5 feet of the outermost edge of the PG&E facility, then pothole the edge of the PG&E facility, at 50 feet intervals, on the same side of the bore or trench. The Contractor shall contact PG&E to confirm the latest requirements.

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) 496-6914 at least five (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.

3.8 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.

3.9 SHORING FOR UTILITIES CONTRACTS

Pursuant to Section 6705 of the California Labor Code, for any contract over \$25,000 involving a trench or trenches five feet or more in depth, 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.

3.10 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 well-points 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.

3.11 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 spring line 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.

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.

3.12 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.

3.13 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 will not be the basis for a Change Order Request unless the revisions necessarily increase the cost or time to perform the work.

3.14 INSPECTION

All work shall be subject to inspection by the appropriate City departments at all times, and as further specified in the Contract Documents, including the General Conditions. 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. In addition to the payment provisions in Article 9 of the General Conditions, the Contractor shall meet with the City Inspector at the end of each billing period to quantify the work performed for each bid item.

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 established construction hours, unless the overtime work is requested by the City. Construction hours for Utilities CIP projects are 8 AM to 5 PM, Monday through Friday, unless otherwise specified.

Contractors working on private development 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.

3.15 LICENSES, PERMITS AND FEES

The Contractor shall apply, procure, and pay for all licenses and permits, 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. The City will pay for other agency's inspection fees, unless the fees are related to damage caused by the Contractor.

The Contractor is responsible for obtaining, at its sole expense, any licenses required by the contract documents, including the Special Provisions in the Invitation for Bid package. Prior to submitting the bid, the Contractor shall conduct research of each agency's specific requirements to perform work within the agency's right-of-way or near the agency's utility; Contractor's bid will be deemed to include sufficient costs in the bid to comply with all applicable permit requirements. 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.

Contractor's bid is deemed to include all costs and expenses for such licenses and permits. 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.

3.16 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 2 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 performing boring operation below a tree with a tap root, the minimum depth of boring shall be 5' below the ground elevation.

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.

3.17 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.

3.18 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.

3.19 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.

3.20 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 quadrupole 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.)

3.21 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 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 Design and Construction Standards
- 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 0.099" minimum for 1" CTS, SDR 11 for 2" IPS pipe, and SDR 11.5 for 3" 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 black with four (4) longitudinal blue single stripes evenly spaced. Solid blue pipe may be acceptable if the pipe meets Standard Specifications Section 2660 and with prior approval. 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 four (4) longitudinal green single stripes evenly spaced. Solid green exterior color is acceptable if the pipe meets Standard Specifications Section 2735 and with prior approval. 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, yellow polyethylene gas pipe, and black or grey polyethylene sewer pipe (inner wall shall be white or light in color) shall be no older than six (6) months from the date of manufacture to the date of arrival to CPA. All pipes shall be packaged in standard commercial coils or bundles that provide protection from shipping injuries and shipped with pipe caps. When storing the pipe on site, the Contractor shall protect pipe from direct sunlight by UV resistant cover. All pipe must be installed within 3 years of the manufactured date.

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 PARAMETERS

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.

At the Contractor's expense, the Contractor's employees who perform fusion on the projects will be required to attend a fusion class conducted by a certified pipe or equipment manufacturer. Proof of attendance will be required when scheduling fusion testing with the City-authorized testing company or personnel. If construction is expected to last more than one year, the Contractor's employees who perform fusion will also be required to attend annual fusion training classes. Proof of attendance shall be submitted to the Engineer within one year of the original certification date. See Section 2400 (HDPE Water and Sewer Pipe – Fusion Training Procedures and Certification) and Section 2500 (Polyethylene Gas Pipe Fusion Training Procedures and Certification) for additional testing requirements.

The Contractor's employees will perform the qualification testing at the yard of City-authorized testing location. The Contractor shall bring his own equipment and materials to be used on the project for testing (including but not limited to 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 City-authorized testing company or personnel and provide them with two (2) weeks advance notice.

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 time spent retesting each fuser. The Contractor is responsible for any delays in meeting Contract requirements that is attributed to retesting of the Contractor's fusers. No additional contract days, or monies, will be given due to retesting.

A. Underground Clearance: Unless otherwise specified on the Project Drawings or approved by CPA Utilities Engineering, the proposed pipe shall have at least 18" vertical clearance to crossing sewer mains, 12" vertical clearance (outside wall to outside wall of fittings/pipe/structure) to other crossing utility lines or structure, and 48" horizontal clearance to parallel utility lines, duct banks or adjacent foreign structures. The clearance should be measured from outside wall to outside wall of fittings/pipe/structure. In the case of new water construction, the separation between new water mains and existing sewer mains shall be at least 10-feet horizontally and 1-foot vertically per Regional Water Quality Control Board (RWQCB) requirements. If the 10-foot 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 CPA Utilities Engineering is required.

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

1. Mains and services shall be configured 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. POLYETHYLENE PIPE SHALL NOT BE DRAGGED ON THE GROUND OR ON PAVED SURFACES. Support stands and rollers must always be used to keep the pipe above paved surfaces/ground level, including but not limited to fusing, transporting, lowering pipe into the trench or bore hole, during directional boring pull-in or pipe-bursting operations, etc.

- 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 sections of pipe. The WGW Inspector must be notified of all defects and subsequent repairs. The Contractor is responsible for the cost to replace damaged pipe if it is a result of not using stands, rollers, spooling devices, or other means to protect the pipe during installation.
- 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. See Section 2.03.A.4 for maximum pull forces.

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 Sections 2400 and 2500 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 ensure 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.

Records of all non-manual butt fusions shall be uploaded daily by the Contractor to the cloud server, in a sub-account to be created by the City for the Contractor, under the City's account. City will provide Contractor login info. The City may require paper record copies of

manual fusions.

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.

2.03 POLYETHYLENE PIPE INSTALLATION METHODS

A. BORING

The Contractor shall not change the installation method from direction boring or pipe bursting to open trench without the Engineer's approval. See WGW Utility Standards Section 2735 for sanitary sewer projects.

The pilot bore for utility mains and services shall be a minimum of 24" clear from other underground facilities. The Contractor shall install pipe by directional boring method only when a minimum of 24" separation is achieved, unless otherwise approved by the Engineer.

1. Boring Machine

The contractor shall provide a utility line boring machine(s) capable of installing 1" thru 8" pipe by directional boring.

- a. **Service Line Boring Machine:** The contractor shall provide a boring machine or pneumatic gopher capable of installing 1", 1-1/2", and 2" pipe.
- b. **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.

- c. 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.
- d. 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.
- e. Maximum diameter of the pilot drill bit shall not exceed 3.5 inches in diameter, unless approved by the Engineer.

2. Directional Boring Method

- a. 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.
- b. 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. Reamer sizes are listed below.

| Pipe size (in.) | Minimum Reamer Size (in.) |
|--------------------|--|
| 2 | 4 |
| 4 | 8 |
| 6 | 12 |
| 8 | 14 |
| 10 and 12 | 18 |
| >12 | >50% of pipe diameter and approved by the Engineer |

A commercially available weak link approved by the Engineer shall be used between the puller and the pipe, in accordance with manufacturer's recommendations, no matter the material or size of the pipeline being pulled.

- c. 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. Prior to pipe pulling, an end cap and tracer wire must be attached.

- d. The Contractor is required to protect pipe from scratching and gouging on edges of trench, plates or pavement during pull in. Rollers shall be used at all bend points in the launching pit and every 15' along the pipe. Methods of protection shall be submitted for review and approved by the Engineer prior to performing the Work. Dragging of the pipe on paved surfaces is not allowed.
- e. After the pipe is pulled in, verify the lead edge of pipe is free of gouges greater than 10% of the pipe wall thickness. Check continuity of tracer wire to ensure tracer wire remained intact during pull in.
- f. Pressure test pipe with air or water per the respective utility.

3. 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.

4. Maximum Pull Force

The allowable tensile load is calculated based on $f_Y = 0.40$; $f_r = 1$ hour; $T_Y @ 100^\circ\text{F}$. Refer to Section 2300.1.03 for SDRs for each type of pipe.

$$ATL = f_Y f_T T_Y \pi (OD)^2 \left(\frac{1}{DR} - \frac{1}{(DR)^2} \right)$$

- i. MDPE 2406 (gas pipe):

| Pipe size (in.) | Maximum Allowable Pull Force (lb.) |
|--------------------|---------------------------------------|
| 1 | 300 |
| 2 | 1,600 |
| 4 | 4,640 |

| | |
|---|--------|
| 6 | 10,060 |
| 8 | 17,060 |

ii. HDPE 4710 (water or gas* pipe):

| Pipe size (in.) | Maximum Allowable Pull Force (lb.) |
|--------------------|---------------------------------------|
| 2 | 2,020 |
| 4 | 6,090 |
| 6 | 13,210 |
| 8 | 22,390 |
| 10 | 34,780 |
| 12 | 48,930 |
| 14 | 59,000 |
| 16 | 77,060 |
| 18 | 97,530 |

*HDPE gas pipe shall only be used for special cases upon Engineer's request and approval.

iii HDPE 4710 (sewer pipe):

| Pipe size (in.) | Maximum Allowable Pull Force (lb.) |
|--------------------|---------------------------------------|
| 4 | 4,080 |
| 6 | 8,850 |
| 8 | 15,000 |
| 10 | 23,300 |
| 12 | 32,780 |
| 14 | 39,520 |
| 16 | 51,620 |
| 18 | 65,330 |
| 20 | 80,660 |

iv Steel Pipe pull forces shall be approved by the Engineer prior to pulling.

B. DIRECT BURIAL

1. Excavate to the required depth and ensure trench bottom is level and free of sharp objects, rocks, or other materials that may damage pipe. Shade excavation with 4" to 6" sand or ½" crushed rock bed and level sand or crushed rock as needed. Refer to Utility Standard Detail WGW-02 for bedding requirements.
2. Install pipe in excavation, with #10 tracer wire on top, and snake pipe. Observe pipe during installation for scratches, gouges, or other defects. Avoid dragging pipe over rough surfaces.
3. Backfill to top of pipe with sand or ½" crushed rock and haunch the sides. Continue backfilling pipe with sand or ½" crushed rock to 12" above top of pipe and install warning tape. Backfill remaining excavation in 12" lifts and compact to 95% compaction.

END OF SECTION

SECTION 2400
FUSION PROCEDURES AND CERTIFICATION (WATER AND SEWER)
7/19/21

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CITY OF PALO ALTO: HDPE Water and Sewer Pipe Fusion Procedures

It is the 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 arrival to CPA for black with blue stripe polyethylene water pipe or grey with green stripe 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. Barcode wand or Hand-held Scanner

This device reads the uniform product code UPC sticker on the fitting.

c. Electrofusion (E.F.) 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 (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).

NOTE: DO NOT adjust the heating iron for the AutoMac unit as it is regulated (controlled) by the microprocessor.

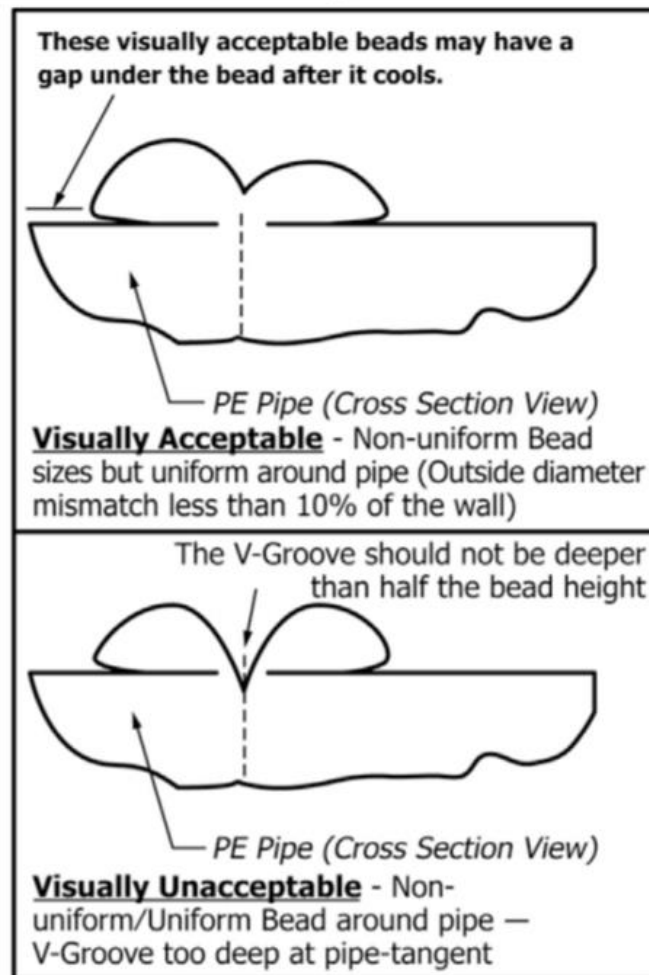
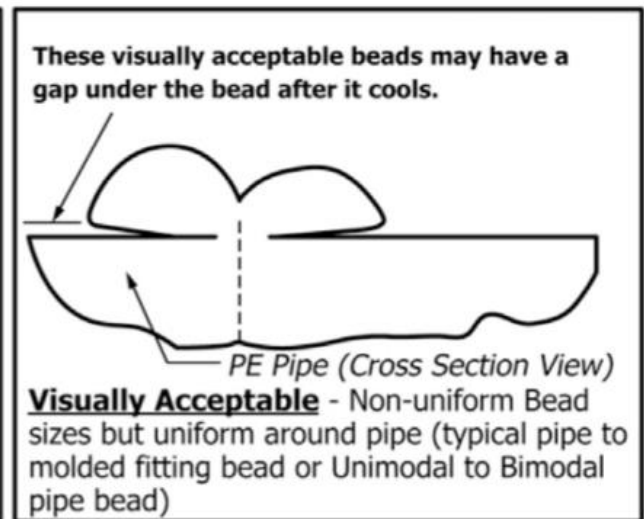
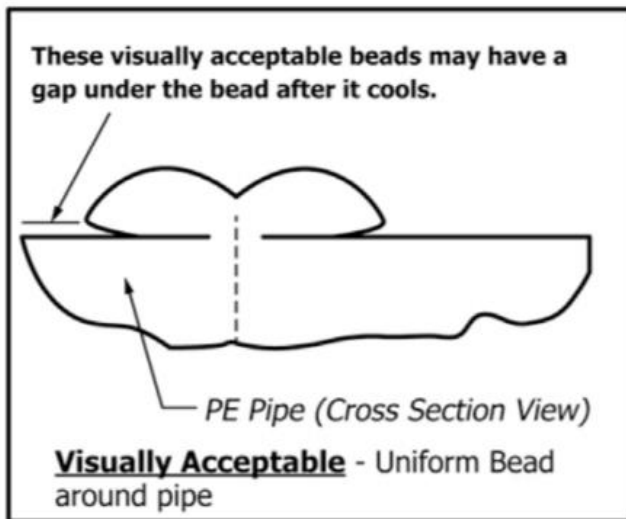
2. Install the proper size alignment clamp inserts if required.
3. Inspect the pipe and/or fitting ends and cut off any damaged or flattened portions.
4. Clean each pipe/fitting end with a clean cotton cloth and place them in the alignment clamps. Pipe ends should overlap the alignment clamps by approximately 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 ensure 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 sub-quality 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) |
|-----------|----------------|------------------------|---------------------|------------------------|
| 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 |



Ref: https://isco-pipe.com/wp-content/uploads/2019/10/2018-ISCO_FusionManual_final.pdf

C. HYDRAULIC BUTT FUSION PROCEDURES

Follow the appropriate manufacturer's procedures when producing butt fusions with hydraulic 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. 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 McElroy Pit Bull 14 (City Staff Only)
- 6" pipe (DR specific), 6' long for hydraulic fusion on a McElroy 28, 618 or Acrobat 180 fusion machine (Contractor and City Staff)
- 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 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.
- McElroy 2LC fusion machine up to 2" or McElroy Pit Bull 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
- McElroy 28, 618 or Acrobat 180 fusion machine– 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 with supporting service maintenance history. 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 latest 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 (CITY STAFF ONLY)**

- ☐ 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

SECTION 2500
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 arrival 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. Barcode Wand or Hand-held Scanner

This device reads the uniform product code UPC sticker on the fitting.

d. Electrofusion 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 ensure 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. A 2" butt fusion on a hydraulic machine with a Data Logger using a McElroy DL5 or higher may be required if 2" Polyethylene pipe will be installed.

Each fusion applicant must bring the following to the test:

- 2" pipe (DR 11), 6' long and performed on a hydraulic fusion machine (if applicable)
- 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, 618 or Acrobat 180 – 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 (CITY STAFF)**

- ☐ 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

**SECTION 2660
WATER DESIGN AND CONSTRUCTION STANDARDS**

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

Section 2200: Excavation, Backfill and Restoration

PART 2 – DESIGN STANDARDS**2.01 PIPE SIZE****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 size of new service:

The minimum size of new HDPE water service shall be 2" (I.D. = 1.815), SDR 9.

C. Calculating Service Size:

The service size calculation must be based on the Hazen-Williams Formula to calculate the head loss due to pipe friction.

2.02 COVER AND CLEARANCES**A. Minimum/Maximum Cover:**

1. 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.
2. 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".

B. 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 installation.

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.

2.03 LOCATIONS

- A. 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.
- B. Water services shall be installed perpendicular from the water main, in the shortest straight line to the water meter.
- C. The minimum distance between service taps shall be 24 inches.
- D. Water meters and services shall be installed 5-feet minimum from trees, edge of driveway, and the sanitary sewer house lateral.
- E. 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.
- F. Water meters larger than two inches in size shall be installed on the customer's property, adjacent to the customer's property line.
- G. The meter location and installation shall conform to the WGW Utility Standard Details.

2.04 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.

2.05 AVAILABLE PRESSURE

The water pressures in the distribution system vary with elevations of the area served. During average demand conditions, pressures range from 40 to 125 psi, with an average of approximately 50 psi. The lowest design pressure that should be used is 40 psi. However, the City does not guarantee a specific 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.

For the design of fire protection systems requirements and request of Fire Hydrant Flow Data, the service designer must consult the Palo Alto Fire Prevention Bureau at the Development Center

located at 285 Hamilton Avenue, 1st Floor, Palo Alto, CA 94301, Phone (650) 617-3184. For an estimate of static pressure at the water supply main, contact WGW Utilities Engineering Development Services at (650) 566-4501.

2.06 VALVES

A. Main Valves:

All main line valves shall be installed per Section 4.01A.13 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 City's right-of-way line projection at the intersection. Valve spacing shall not exceed 500 LF unless approved by the City. See Figure 1 below. 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 2.10 of this Specification.

Where no permanent road features are available in the right-of-way, the valves shall be located by a "blue" 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.

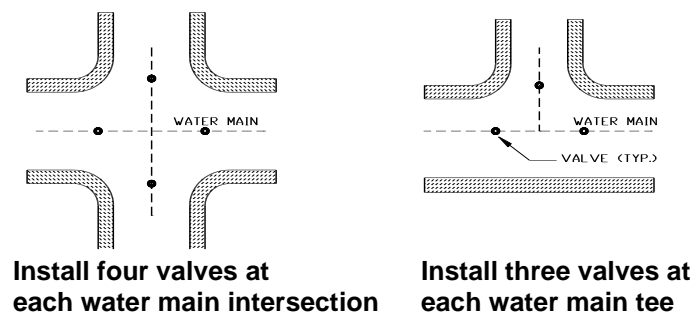


Figure 1.

B. 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.

C. 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.

2.07 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 Utilities

Rule and Regulation 21.

2.08 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.

2.09 MAXIMUM VELOCITY OF FLOW

- A. 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. Maximum distribution pipeline velocity for maximum day demand plus fire flows shall not exceed 12 feet per second.
- B. For water services: 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. Maximum design flow velocity for dedicated fire services shall not exceed 12 feet per second, based on fire flow demands.

2.10 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 4.01A.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. Gate Valves: Gate valves per Section 4.01A.13 of this Specification.
- D. 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.
- E. Service Saddle: Shall be Mueller BR2B series.

2.11 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.

2.12 NEW DEVELOPMENTS

The applicant's engineer shall provide the required plans submittals (see list in 2.12.B) including the estimated water demand needed for the review. City of Palo Alto has developed a Domestic Water System Hydraulic Model of the entire water supply and distribution system. This model will be utilized by City of Palo Alto Utilities staff and/or a City consultant to verify the size of the domestic water system facilities required for each development at the developers cost. When the City deems it necessary, the Developer will be required to provide a water model of the on-site development, showing that the development can operate under the provided pressure and load parameters identified by the City.

- A. The recommendations for the new development water system improvements shall include a cost estimate and suggested design criteria. Development Services staff reserves the right to determine the system design criteria for each water system based upon conditions that may exist for a particular location, anticipated level of development, planned use or other criteria.
- B. Plan Check Submittal Requirements: All plans or inquiries should be submitted to Development Services of the engineering department for routing to the appropriate staff for review.
 1. The developer/engineer must submit a preliminary utility plan showing the proposed location of the services (domestic, irrigation, fire service), meters, and backflow devices.
 2. Expected average day, maximum day, and peak hour water demand in gallons per minute (gpm) for domestic and irrigation of the entire development. All assumptions must be explicitly stated and properly documented.
 3. Minimum expected fire flows in gpm required by the Fire Department.
 4. Documentation or written correspondence with conditions of approval from Palo Alto Fire Marshall indicating the development's fire flow requirements stated in gpm, duration in hours and residual pressure in psi.
 5. Information to determine number of equivalent dwelling units:
 - a. Raw acreage of the development
 - b. Number and type of residential units
 - c. Building square feet (SF) of commercial, retail, industrial, hotel, etc.
 6. Changes to the development (units, land use, project or construction phasing, etc...) may require the City hydraulic model be re-run at the Developers expense.
 7. The service design load shall be the total present (and additional future) water demand as presented on the Utilities Application - Load Sheet.
 8. Hydraulic modeling analysis comments are for plan check purposes only. The ultimate design responsibility resides with the developer's Engineer-of-Record for the Project.

2.13 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 Utility Rate Schedule W-5.

PART 3 – REGULATORY STANDARDS**3.01 CROSS CONNECTION CONTROL**

Cross Connection Control shall be installed per City of Palo Alto Utility Rule and Regulation 21 Section E "Water System Protection" in the SPECIAL WATER UTILITY REGULATION, 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.

A. 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).

B. 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.

C. Parallel Reduced Pressure Principle Assemblies:

Parallel reduced pressure principle assemblies shall be installed at all locations where the water cannot 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.

PART 4 - MATERIALS**4.01 WATER DISTRIBUTION SYSTEM MATERIALS**

"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.

A. Polyethylene (HDPE) Pipe and Fittings:

1. **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 four (4) equally spaced, single longitudinal blue stripes. Solid blue pipe may be used, but require prior approval. All water service pipes shall be black with four (4) equally spaced, single longitudinal blue stripes. Solid blue pipe may be used, but require prior approval. 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: The City of Palo Alto approved PE pipe manufacturer is CP CHEM Performance Pipe, CSR Poly Pipe Industries, WL Plastics, JM Eagle. Any other PE pipe manufacturer must receive prior approval.

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 |

2. **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:** The City of Palo Alto approved PE pipe manufacturers are CP CHEM Performance Pipe and Integrity Fusion Products Inc. Any other PE fitting

manufacturer such as CSR Poly Pipe Industries, Central Plastics/Georg Fischer, ISCO, or equal must receive prior approval.

B. 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.

C. 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).

D. Main Tapping Hardware: All hardware must be ANSI/NSF 61 listed.

1. Tapping Sleeve
 - a. 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.
 - b. 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:
 - i. CIP/DIP/PVC: Tapping sleeve shall be JCM 6432 all 316 stainless steel, or approved equal.
 - ii. ACP: Tapping sleeve shall be JCM 6432 all 316 stainless steel, or approved equal.
 - iii. CCP: Tapping sleeve shall be JCM 415, or approved equal.
 2. 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.
- E. Main Joining Hardware: All hardware must be ANSI/NSF 61 listed.
1. 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.
 2. 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. MJ adapters shall have AWWA C110 heavy-weight metal glands and stainless steel stiffeners.
 3. 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. Outside pipe diameter shall be confirmed in the field prior to ordering mechanical couplings.
 - a. 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.
 - b. 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:
 - i. Sleeve: Ductile Iron ASTM A-536 designed for high strength/weight ratio. Ends shall have smooth inside taper for uniform gasket seating.

- ii. Gaskets: Nitrile (Buna N)
 - iii. Follower Flanges: Ductile Iron ASTM A-536 designed for high strength/weight ratio. Thickness determined by coupling size.
 - iv. Bolts & Nuts: 304 Stainless.
 - v. Finish: Fusion bonded epoxy coating in accordance with AWWA C213.
- c. 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.
- d. 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.
- e. CCP to DIP or other pipe: Mechanical coupling or coupling adaptor shall comply with AWWA C219. Confirm the thickness of the steel cylinder pipe. For pipe less than 1/4" steel cylinder thickness use adaptors with a welded buttstrap. Follow manufacturer's recommendations for both couplings and adaptors. The coupling or adaptor shall be Romac 400 series or approved equal.
4. 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.
5. 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.
6. 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 requirements specified in Subsection 7 and 8 for bolts, nuts and gaskets.
- a. .
7. Bolts and Nuts For 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. Nuts shall be 304 stainless steel.
8. Gaskets for Flanged Joints: Gaskets for flanged joints shall be 1/8" full face gasket designed to be used with water system, conforming to AWWA C207 and NSF 61 standards. Gasket shall be US Pipe Full Face Flange-Type gasket. Gaskets by other manufacturers need approval by the Engineer. For gasket installation requirements in contaminated areas, see Section 2.10 of this Specification.
9. 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.

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

1. HDPE Water Main Connection

- a. 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.
- b. Ball Valve (HDPE Service): Ball valve shall be 2" IPS DR 9, HDPE 4710 Class 200 Poly-Water Valve manufactured by Polyvalve, or approved equal.
- c. 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.
- d. 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.

- e. Corporation Stops (Copper Service): Corporation Stops for connection to non-HDPE mains shall be Mueller B-25000N or AY McDonald 74701B with AWWA taper thread and copper flare straight connection outlets, or approved equal.
 - f. Three Part Unions (Copper Service): Three part unions shall be Mueller H-15400 with copper flare nut on both ends, or approved equal.
- 2. 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.
 - 3. Angle Meter Stop: Angle meter stop shall be AY McDonald 74602B (FLR x Meter) for 1" and smaller services and AY McDonald 74602B (FLR x Oval Flange) for 1-1/2" and 2" services, or approved equal.
 - 4. Ball Straight Meter Valve: Ball straight meter valve shall be Mueller B-20287N, or approved equal.
 - 5. 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), Cover (Part No. A6000489T-H7), Assembly with Drop-In Lid (Part No. A6000487T) and Plug (Part No. A60000H7-PLUG-CPA) 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), Cover (Part No. A6001947TDZ), Assembly with Drop-In Lid (Part No. A6000482T-H7) and Plug (Part No. A60000H7-PLUG-CPA) 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), Cover (Part No. A6001975TDZ), Assembly with Drop-In Lid (Part No. A6000482T-H7), and Plug (Part No. A60000H7-PLUG-CPA) for 1" meters with 1" double headers (Box Assembly Part No. A6001974TAPCX12CPA).

Armorcast 30" x 48" x 18" Polymer Concrete Box (Part No. A6001430PCX18), two (2) Covers (Part No. A6001470TDZ) with two (2) Drop-In Lids (Part No. A6000482T-H7) and two (2) Plugs (Part No. A60000H7-PLUG-CPA) 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 with three (3) piece cover and two plugs for 4" and 6" water meter sets with 2" by-pass, and where combination fire/domestic water services are installed (Box Assembly Part No. A6001449TAPCAX48CPA. 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, reading lids, and plugs. Box and lid shall have a minimum 20K rating (Tier 22) for all applications. Meter boxes shall not be installed in driving lanes of public or private streets. 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".

G. 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:

1. Hydrants: Hydrants shall be AVK Series 24 Wet Barrel Hydrant in residential, commercial, and heavy industrial areas. Any other hydrant manufacturer such as Clow or equal must receive prior approval. AVK Series 24 Wet Barrel 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.
2. 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.
3. 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.
4. 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.
5. 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.

H. Gate Valves (Hydrants and Mains):

1. 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.
2. 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.

3. 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.
- I. Butterfly Valves (Transmission Mains):
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.
- J. 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.
- K. 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.
- L. Air Release and Air/Vacuum Valves:
 1. 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.

2. 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.
- M. 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:
1. Permanent Insertion Valves (for pipes with smooth interior walls): valve box and operational 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.
 2. 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.
 3. HDPE Squeezing: HDPE pipe, up to 8" diameter and not exceeding an operating pressure of 100psig, may be squeezed-off per the manufacturer's recommended procedures. 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 Footage or an approved equal.
- N. 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.
- O. 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.
- P. 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 corresponding WGW Utility Standard Details. 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.

Q. 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).

R. Anode Boxes:

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

4.02 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.

4.03 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.

4.04 MATERIAL INSPECTION

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

PART 5 - EXECUTION**5.01 HDPE WATER MAIN SYSTEM INSTALLATION****A. Valve Boxes/Valve Pits:**

Main line valve boxes shall be installed per Section 4.01A.16 of this Specification.

B. 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:** Squeezing and releasing rates are key elements in squeezing off HDPE correctly. Squeeze pipe slowly to close, no faster than 2 inches per minute (2ipm) based on the pipelines outside dimension, release squeeze tool at a rate, no faster than 0.5ipm based on the pipelines outside dimension, and allow the pipe to naturally rebound. Do not squeeze-off pipe within 12" or 3x the pipe diameter, whichever is greater, from other fittings or previous squeezes. After squeeze-off is complete wrap vinyl tape at the squeeze off location to 6 inches on each side and mark the pipe "Squeeze Off" for future reference.

C. 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.

D. 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. See Section 2300 for maximum allowable pull force for PE 4710 HDPE.

5.02 HDPE WATER SERVICE INSTALLATION

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.

5.03 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, services, and small/large meter vaults including by-passes.
 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.

5.04 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.

5.05 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-hour 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 highly chlorinated water and until the residual chlorine concentration reaches normal distribution system levels. If discharging to storm drainage system, Contractor shall first obtain approval from the City. 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 C651-14, 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.

5.06 Water Service Abandonment Procedure

- A. Excavate 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 650/566-4501 five working days before start of abandonment.

5.07 Procedure for Disconnecting Large Service with Tapping Tee and Valve

- A. Provide a 72-hour notification of service interruption to all affected water customers. Coordinate water shutdown with affected customers and Utilities Engineering/Operations staff. The shutdown plan must be approved by the City prior to shutting down the water service.
- B. Shut down the main and excavate existing fire hydrant or service at the main.

- C. For hydrant service 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.
- D. For service with a tee, remove the tee and replace the section with HDPE or PVC C-900 straight pipe. Use fully-restrained mechanical couplings for straight pipe connections to existing non-HDPE pipe. Couplings model and manufacturer shall be approved by City.

5.08 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"** and Management Information Sheets for each year requested by the City Project Manager.

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 pipe, 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.
 - a. In special circumstances and upon approval, High Density Polyethylene (HDPE) 4710 pipe, uniformly black in color with four (4) equally placed stripes, conforming to the latest edition of ASTM D3350 "Standard Specification for Polyethylene Plastics Pipe and Fittings Materials", cell classification 445574C, may be used.
 - 2. **Pipe dimensions and tolerances:** The outside diameter and wall thickness shall be within the limits specified in Table 1 for MDPE pipe.
 - 3. **Markings:** All 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.

- 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:

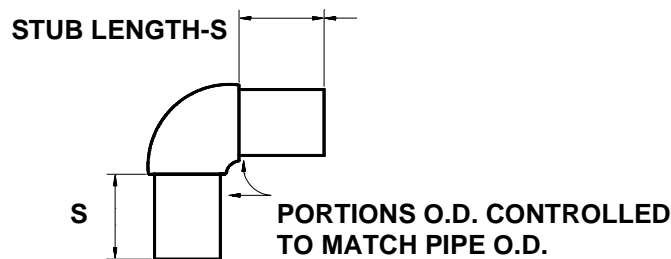
1. All fittings shall be Medium Density Polyethylene (MDPE) 2708 fittings, uniformly yellow in color, conforming to the latest edition of ASTM D3350 "Standard Specification for Polyethylene Plastics Pipe and Fittings Materials", cell classification 234373E. molded from one of the following: Performance Pipe Company Marlex HHM TR-418Q Resin; or Ineos Fortiflex® K38-20-160 Resin.
 - a. In special circumstances and upon approval, High Density Polyethylene (HDPE) 4710 fittings, uniformly black in color, conforming to the latest edition of ASTM D3350 "Standard Specification for Polyethylene Plastics Pipe and Fittings Materials", cell classification 445574C (Black), may be used.
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.

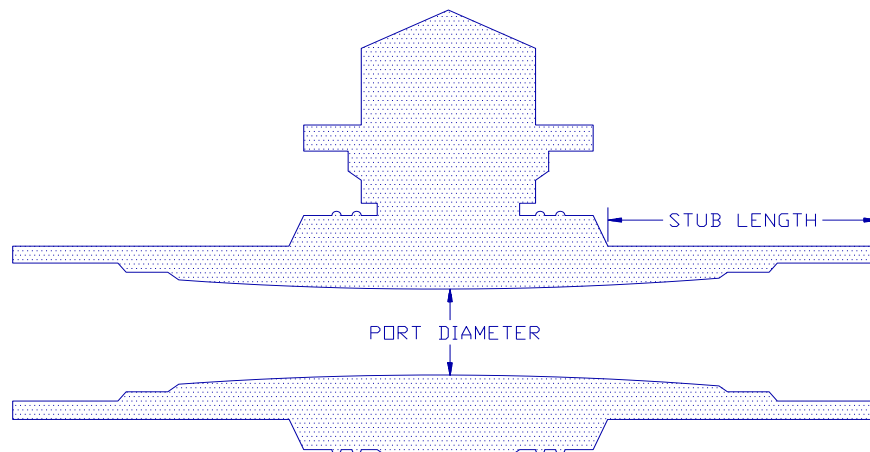
6. **Approved Manufacturers:** The City of Palo Alto approved PE gas valve manufacturer is Flowserve Corp. Polyvalve Poly-Gas (Formally Nordstrom Valves). Any other pipe manufacturer such as Kerotest Manufacturing Corp (PolyBall), or Broen, Inc. (Ballomax) CSR Poly Pipe Industries or equal must receive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

Table 3: Dimensional Standards for Full Port Polyethylene Valves

| VALVE SIZE | SDR | MIN. PORT DIA.* | MIN. STUB LENGTH* |
|------------|------|-----------------|-------------------|
| 2" | 11 | 1.82" | 4.2" |
| 4" | 11.5 | 3.62" | 3.1" |
| 6" | 11.5 | 5.20" | 3.9" |
| 8" | 11.5 | 6.60" | 7.0" |

*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. Bypass valves shall be non-insulated Mueller H-11175 (3/4", 1-1/4", or 2") with a 3/4", 1-1/4", or 2" steel plug. The City of Palo Alto approved meter valve manufacturer is Mueller Company. 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 confirming 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.
 - a. **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 |

b. **DESIGNATION:**i. **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.

ii. **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 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.

iii. **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. Meter boxes and lid shall have H-20 load rating and shall not be installed in driving lanes of public or private streets. Lids shall have "GAS" marked on them.
- Armorcast 24"x36"x18" Polymer Concrete Box Assembly (Part No. A6001974PCX18-1 Each/Assembly), Polymer Concrete Cover (Part No. A6001975TDZ-1 Each/Assembly), RPM Drop-In Reading Lid Marked as "GAS" (Part No. A6000482T-H7-1 Each/Assembly), Polymer Concrete Plug (Part No. A60000H7-PLUG-CPA – 1 Each/Assembly), and Box Extension (Part No. A6001974PCX12-3 Each).
 - Armorcast 30"x60"x36" Polymer Concrete Vault Assembly (Part No. A6001460PCX36-1 Each/Assembly), Polymer Concrete Cover (Part No. A6001456TDZ-2 Each/Assembly), RPM Drop-In Reading Lid Marked as "GAS" (Part No. A6000482T-H7-2 Each/Assembly), Polymer Concrete Plug (Part No. A60000H7-PLUG-CPA – 2 Each/Assembly), and Box Extension (Part No. A6001974PCX12-1 Each).
- 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 again 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 alpha-numeric 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 if full port is unavailable. Each valve shall be manufacture air tested to ensure integrity and leak tightness. The valves shall be shipped with 2" operating squares (2" through 6") and gear operator (8" 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" - 18.00" (full port)
- 10" – 21.50" (full port)
- 12" – 23.50" (full 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 for 2" through 6" is Kerotest Weldball and for 8" through 12" is Cameron (T31). 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):

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":

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-17260, H-17355)

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 must 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.
- M. **Repair Clamp:** Clamp shall be used as a temporary repair only and shall not remain in service for extended periods of time. Components should be resistant to corrosion and gaskets must be gridded, Nitrile (Buna-N) and resistant to natural gas. The clamp shall be rated for an operating pressure greater than the system pressure it is being installed on.
 - a. 3/4" through 1-1/4" diameter:
 - i. Smith Blair Redi-Clamp model 244, full circle band with gasket.
 - b. 2" through 12" diameter:
 - i. Mueller model 220, regular gasket coverage. Bolts should be torqued to manufacturer specifications depending on size: 2"-4" (175psig), 6"-8" (100psig), 10"-12" (75psig).

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.

1. Line Stopper Fittings:

- a. 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.
- b. 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.

2. **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.
3. **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 meters, regulators, and pipe nipples and fittings required to connect the gas meter to the new riser.

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, irrigation, 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 to 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 48 inches horizontally, unless a reduced separation is approved by Engineering, 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. Sandbed 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 each section of Polyethylene pipe. All tracer wire connections shall be made with the Nicotap T-102-D lateral splice sleeve wrapped with 3M Scotch-Seal Mastic Tape Compound 2229 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. Ensure ends of steel casing are free from debris that may damage the PE pipe.
- B. Install new 1" PE service by pushing the new PE pipe through casing by hand.
- C. Install new riser and connect new 1" PE service to main.
- D. Pressure test the entire length of inserted pipe, fittings, and appurtenances for a minimum period of 24 hours at a minimum pressure of 100 psig with air.
- E. Perform all required house plumbing modifications.

Inserting new PE pipe into an existing (abandoned) pipe is not a typical installation method performed on the City of Palo Alto natural gas distribution system and approval must be granted 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 Section 2500 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 Section 2500 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 Section 2500 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 Section 2500 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 Section 2500 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 Section 2500 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: When required, Contractor must apply for plumbing permits and coordinate approval of houseline pressure test with Building. All materials and installation methods must comply with the latest City adopted version of the 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 42" 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. **General Conditions:** The Contractor shall have qualified persons to perform covered tasks on the project, including polyethylene pipe joining as per Section 2500 of these standards and CFR Title 49, Part 192, Subpart F "Joining of Materials Other Than by Welding".
- B. **Qualification Testing:** The Contractor shall secure a software license with Industrial Training Services (ITS) to test and maintain Operator Qualifications (OQ) for each employee assigned to perform covered tasks on City of Palo Alto gas projects. The Contractor shall provide the City OQ Administrator access to Contractor's system, for retrieval of documentation on qualified Contractor employees.

Operator testing and qualification is required for all Contractor employees performing covered tasks on City of Palo Alto natural gas pipelines. Individual employee will be deemed the qualified person and shall only perform the individual task they are qualified for. The City does not recognize span of control for Contractor personnel. The Contractor will perform the qualification testing using their own equipment and materials, equipment for qualifying shall be the same equipment used on the project, and all testing shall be done at the Contractors expense. At the discretion of the City, the Contractor may be required to obtain qualification through the City or with a City approved ITS third-party evaluator. Contractor will be required to successfully complete the training and written exam for each task and exam may be proctored by Contractor's approved ITS evaluator. Contractor must perform the hands-on exam with the City or with a City

approved ITS third-party evaluator. Contractor will be responsible for all labor, material, and travel cost required to build props or stations and test, regardless of where the testing is located (Contractors facility or offsite).

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
- I07.0051 – Installation of Exothermic 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 Section 2500 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

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

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.

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

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).

A. LOCATION

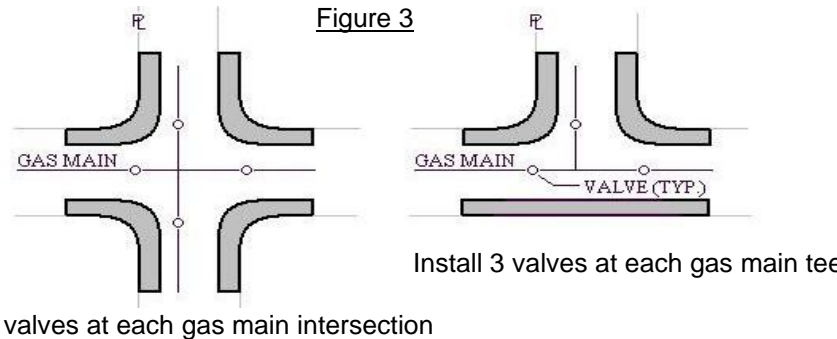
1. Gas mains shall be located two (2) feet off the lip of gutter on the north and east side of streets, unless otherwise specified on the Project Drawings. Gas mains shall be twenty-four (24) inches minimum from any parallel utility line, or as determined by the City. Gas mains and services shall have 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.

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

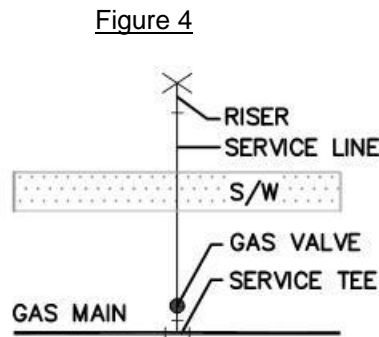
1. The depth of new gas mains shall be installed with a minimum cover of 30", as measured vertically from the top of pipe to the top of pavement.
2. The depth of new gas services shall be installed with a minimum cover of 24", as measured vertically from the top of pipe to the top of pavement.
3. If it is not possible to maintain the above minimum cover depth requirements for new gas mains or services, City Engineering must approve additional protection devices to be installed that adequately prevent damage to the pipe by external forces (steel plate, casing or concrete cap).

C. MINIMUM SIZE OF NEW MAINS AND SERVICES: The minimum new gas main size is 2" (minimum wall thickness = 0.216", SDR 11.0). The minimum service size for new construction is 1" (minimum wall thickness = 0.099")

- D. **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.



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.



- E. **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.
- F. **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.

G. **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 stub out location.

4.05 TESTING OF CUSTOMER OWNED GAS PIPING

When required, Contractor must apply and pay for all plumbing permits, 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 houseline 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 AND CONSTRUCTION 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 connection's impacts on the hydraulic characteristics of the downstream pipes within the drainage 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:

$$DF = (PBWF \times 0.75) + GWI + RDI$$

$$DF = PBWF + GWI$$

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.

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

where ABWF is in million gallons per day (mgd). The Peaking Factor has a maximum of 4.0 and a minimum of 1.0.

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:

1. Not over 36 feet on center for grades of 20 to 35 percent;
 2. Not over 24 feet on center for grades of 35 to 50 percent;
 3. 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 temporarily convey the sewage or to divert the flow of wastewater for pipe replacement/rehabilitation around the sewer reach in which work is or to be performed.

- A. Temporary bypass in open pits at manhole, cleanout, and lateral-connection locations: Contractor shall maintain uninterrupted sewer service to all properties connected to the sewer being replaced. Appropriate rigid pipe or flexible tubing shall be used, before the end of EACH workday, to make temporary connections to convey sewage where permanent connections could not be made at manhole, cleanout, and/or lateral to main locations. It is prohibited to leave standing sewage overnight in manhole and cleanout excavations.
- B. Flow By-Pass: It shall be the Contractor's responsibility to provide a pumping system with 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.

If the City must set up flow bypass or perform bypass pumping, whether because of contractor's failure to set up flow bypass or to install needed pumps, the City will deduct the cost of flow bypass or pumping from contractor's monthly progress payments.

Temporary bypass pipe used within truck-route roadways shall be installed below the street surface and properly plated. Plugs shall be so designed that all or any portion of the wastewater can be released. Plugs shall be provided with a tag line.

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, equipment shall be sound-attenuated 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 to the Engineer for review as part of the submittal process prior to the issuance of Notice to Proceed. 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.

Bypass 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., Valley Water, SFPUC, 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 completely filled with CDF conforming to Water, Gas, and Wastewater Utility Standards Section 2200.2.5, "Controlled Density Fill". Cost of sewer main abandonment shall be included in one or more bid items.

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 between manholes. Greater spacing between manholes may be permitted as approved by the Engineer.

The minimum inside diameter of manhole barrel sections shall be 48 inches. A minimum inside diameter of 24 inches for concrete grade rings shall be provided to allow man-entry access. 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 water stop 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. Sewer main crossing streams shall be installed in a casing at a sufficient depth below the natural bottom of the stream bed to protect the sewer main. If jack and bore method is used, the design of steel casing 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.

1.10 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 to correct condition defects such as broken pipe, pipe with sever cracks, protruding lateral, sag, offset joint, missing pipe, etc. 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, shielded couplings with stainless steel screws, nuts, housings, and anti-radial shear (ARC) bands. Mission Rubber Company "Calder Style Coupling", Fernco Inc. "Shielded Coupling" 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.

When an existing VCP sewer main pipe is entering or leaving a newly constructed manhole, Contractor shall replace in kind, a small section of new VCP pipe and connect to the existing VCP pipe with a Anti-Radial (ARC) flexible coupling. Contractor shall remove the bell by making straight cuts on both sides of new VCP pipe, refer to standard detail WWD-07B & 08B for specifications on pipe length.

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.

Couplings: Anti-Radial Shear "Calder-Style" flexible couplings. Flexible couplings with mechanical clamps shall be used to connect two plain end PVC pipes of the same OD. 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
SEWER CONSTRUCTION WITH POLYETHYLENE PIPE**

1.01 GENERAL

A. Scope: This section covers the installation of new high density polyethylene sewer pipe (HDPE) by pipe bursting or open trench method (if applicable). 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 or open trench)

Qualifications of Bidders:

1. All sewer main installation work by open trench method shall be performed by an experienced contractor or subcontractor who has completed at least 10,000 feet of 8-inch in diameter or larger pipes within the last three years.
2. All sewer main installation work by pipe-bursting method 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.
 - d. The contractor shall submit the pipe-bursting operator's certification of training by the pipe bursting system manufacturer. The operator shall be trained in the use of the pipe bursting equipment by an authorized representative of the manufacturer. Training shall include handling and installation of pipe and use of equipment.
3. All sewer lateral installation work by open trench method shall be performed by an experienced contractor or subcontractor who has completed at least 1,000 feet of 4-inch in diameter or larger pipes within the last three years.
4. All sewer lateral installation work by pipe-bursting method shall be performed by an experienced contractor or subcontractor who has completed at least 15,000 feet of 4-inch in diameter or larger pipes within the last three years

The following data shall be submitted with the bid, using the City-provided form #2735-1, for the company and staff experience with open trench construction:

Contractor/Subcontractor Open Trench Construction 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 open trench construction experience as described above on 8 inch or larger pipe.

The following data shall be submitted with the bid, using the City-provided form #2735-2, for the staff experience with open trench construction:

On-site Superintendent and/or Foreman Open Trench Construction Experience

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

The following data shall be submitted with the bid, using the City-provided form #2735-3, for the company experience with pipe-bursting construction:

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 with the bid, using the City-provided form #2735-4, for the staff experience with pipe-bursting construction:

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.

- 5. 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.
- B. Certification by the manufacturer that all pipe and fittings furnished under this specification were manufactured, sampled, tested, and inspected in accordance with the latest version of ASTM F714-85 and ASTM D3350 (for cell classification). 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. Pipe bursting operator's training certification by an authorized representative of the equipment manufacturer.
- D. Fusion Certifications by City of Palo Alto – provide names and copies of cards issued to all operators.
- E. Access pit locations.
- F. Access to Contractor's Datalogger Vault.
- G. Flow bypass plan, if applicable.

1.03 MATERIALS AND EQUIPMENT

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

- A. **Service Saddles:** All service saddles shall be electrofusion type saddles by Central, Frialen by Friatec, or approved equal.
- B. **Pipe Bursting Equipment:** Equipment manufacturers have developed a vast array of different tools and equipment to meet the wide variety of demands for pipe bursting projects. Pneumatic and static pipe bursting are the two primary methods of pipe bursting projects performed in North America. Contractors shall select pipe bursting equipment based on project design application, pipe material to be installed, clearance to adjacent or crossing utilities, soil conditions, noise, risk mitigation, etc. Static pipe bursting equipment shall be used to avoid damage where existing underground pipes are in proximity.

- a. Pneumatic Pipe Bursting
 - 1. Winch Assembly
 - 2. Pneumatic "Hammer" Pipe Bursting Tool & Expander Head
 - 3. Air Compressor and Hose Assembly
- b. Static Pipe Bursting
 - 1. Static machine Assembly
 - 2. Rod, Cable, chain & Expander Head
 - 3. Series of Cutters, Splitters, or other tools placed in front of expander head
- C. Pipe and Fittings:** SDR-17 Extra High Molecular Weight, High Density Polyethylene PE 4710, Cell Class PE445574C/E (inner wall shall be white or light in color) per ASTM D3350 in IPS sizes. Performance Pipe "DriscoPlex 4600" with four (4) equally spaced green single stripes 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, D3035, D3350 (cell 445574C).

| TABLE 1 | | |
|--------------------------|------------------------|--|
| Nominal Size (inches) | Nominal OD (inches) | Minimum Wall Thickness SDR17 (inches) |
| 4 | 4.500 | 0.265 |
| 6 | 6.625 | 0.390 |
| 8 | 8.625 | 0.507 |
| 10 | 10.750 | 0.632 |
| 12 | 12.750 | 0.750 |

| TABLE 1 | | |
|--------------------------|------------------------|--|
| Nominal Size (inches) | Nominal OD (inches) | Minimum Wall Thickness SDR17 (inches) |
| 14 | 14.000 | 0.824 |
| 16 | 16.000 | 0.941 |
| 18 | 18.000 | 1.059 |
| 20 | 20.000 | 1.176 |
| 22 | 22.000 | 1.294 |
| 24 | 24.000 | 1.412 |
| 26 | 26.000 | 1.529 |
| 28 | 28.000 | 1.647 |
| 30 | 30.000 | 1.765 |
| 32 | 32.000 | 1.882 |
| 34 | 34.000 | 2.000 |
| 36 | 36.000 | 2.118 |
| 42 | 42.000 | 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 F714 and ASTM D3350, 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 four (4) longitudinal green stripes evenly spaced. 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. Contractor shall factor in lead times for ordering compliant pipe to meet project requirements.

Fittings shall be marked with the manufacturer's name (or trademark), the designation ASTM D3350 and ASTM F714, and the manufacturer's code identifying the resin manufacturer, lot number, and date of manufacture.

- E. Electrofusion Couplings:** Electrofusion couplings shall be manufactured by Friatec (Frialen Safety Fittings). Any other electrofusion manufacturer such as Central, Kerotest (Innogaz Electrofusion Products) or equal must receive prior approval. Electrofusion couplings to join sewer mains shall only be used upon Engineer's approval.

F. Other 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

Subsurface Condition: Refer to Invitation for Bid (IFB) Package Part 2 – Instructions to Bidders Section 17.0 for subsurface condition.

A. 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 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 main during installation. 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:** To ensure structural integrity and reduce risk for future leaks, installation of unnecessary electrofusion or mechanical couplings should be avoided. Accordingly, with respect to sewer mains with upstream and downstream manholes that are within 500 linear feet apart, the use of couplings is not allowed, unless approved by the Engineer for unavoidable circumstances. The Contractor shall plan and schedule the pipe-bursting work to replace each reach of sewer main from manhole to manhole completely in one working day during the work hours. The Contractor shall schedule all pipe-bursting preparation work and adjust the bursting speed to meet all requirements. The Contractor should include the cost to use 'pre-burst' or 'double-pull' method, if deemed necessary to successfully replace the sewer main and meet all requirements. The use of lubricant mud to reduce the friction is allowed when hard and very dense soil is encountered.

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.

If there is no adequate staging area to store the entire reach of fused-pipe, the Contractor shall perform fusion work to connect two or three previously fused-pipe segments on the day of pipe-bursting. The Contractor shall allow an additional 30-minute cool-down time for each fused-joint before rough-handling or resuming pipe-burst operation. Internal beads at pipe joints can only be left in place, with Inspector's approval, when it is not feasible to fuse the entire reach of pipe prior to pipe-bursting. Only one internal bead for every 200 feet of pipe is allowed.

If a manhole at one end of the pull is not intended to be replaced, 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 pneumatic or static method, 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 existing ground conditions. The Contractor shall use lubricating fluids, such as bentonite or polymer slurry, injected behind the bursting head for pipe diameters greater than 16". Lubricating fluids can also be used if hard/dense soil condition is encountered. The Contractor must clean the lubricant mud from the pipe at each lateral connection for proper fusion saddle adhesion.

When the tool is pulled along the existing pipe, the pipe shall be broken up into small fragments and these fragments driven into the surrounding pipe zone. The tool shall then install the new pipe by pulling it into place.

The new sewer main shall be installed without any horizontal or vertical offsets. The invert of the new sewer pipe should match the invert of the existing sewer at the exit of the upstream manhole and at 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 HDPE 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 pipes crossing the pipe bursting alignment where the invert of the existing sewer main being replaced is 6 feet deep or less. In addition, Contractor shall pothole crossings with ACP water mains and primary electric lines/duct bank where the invert of the existing sewer main being replaced is 8-1/2 feet deep or less.

Potholed utility pipes shall be fully exposed during pipe bursting for the Inspector to observe while the new sewer main is passing under the potholed pipes. The pothole excavation shall be extended to 1 foot below the bottom of crossing pipes and 2 feet below the bottom of crossing ACP water mains or primary electric lines/duct bank. 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, the Contractor shall allow the pipe to relax before cutting the ends of the new main or the lateral connection holes. The rest period for the pipe shall be at least 24 hours and shall comply with pipe manufacturer's recommendation. The Contractor shall reconnect or replace all active sewer laterals along the new main within 2 business days after the new pipe has been relaxed.

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

B. Open Trench

1. **Trench Excavation:** The trenches 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 main during installation. Care shall be taken to protect existing utilities. Refer to Utility Standards Section 2200 3.4 for additional requirements.
2. **Installation of the new main:** Complete length of pipe from manhole to manhole, free of any couplings (mechanical or electro-fusion), with exception to service connections at the main.
3. **Service Connections:** The Contractor shall reconnect or replace all active sewer laterals within 2 business days after the new main is installed. New sewer pipe shall be installed without any horizontal or vertical offsets. Unless otherwise noted, the invert of the new sewer pipe should match the invert of the existing sewer at the exit of the upstream manhole and at the entrance into the downstream manhole, regardless of the size and alignment of the existing pipe.

Electrofusion saddles shall be installed per Utility Standards 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 Inspector or Engineer.
- 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

Prior to replacing the sewer mains, the Contractor shall clean and video-inspect the existing sewer mains. Based on the lateral connections to the main observed from the video inspection, the Contractor shall accurately identify all active sewer laterals and verify each active lateral's

location and/or alignment. The cost to identify active sewer laterals shall be included in one or more bid items.

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 Water Gas and Wastewater Utility Standards. The Contractor shall repair all defects at no additional cost to the City.

END OF SECTION

OPEN TRENCH CONTRACTOR / SUBCONTRACTOR EXPERIENCE

(use multiple sheets if necessary)

| | Project 1 | | | | Project 2 | | | |
|--|---------------|-------|-------|-------|-----------|-------|-------|-------|
| Name of Contractor / Subcontractor | | | | | | | | |
| Name of Project | | | | | | | | |
| Project Location | | | | | | | | |
| Project Dollar Amount | \$ | | | | \$ | | | |
| Year of Construction | | | | | | | | |
| Owner of Project | | | | | | | | |
| Owner Contact and Phone Number | Name: | | | | | | | |
| | Phone Number: | | | | | | | |
| Open Trench Construction Project | | | | | | | | |
| Size and Footage of Pipes ($\geq 8'' \varnothing$) | 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 Project | | | | | | | | |
| Project Location | | | | | | | | |
| Project Dollar Amount | \$ | | | | \$ | | | |
| Year of Construction | | | | | | | | |
| Owner of Project | | | | | | | | |
| Owner Contact and Phone Number | Name: Phone Number: | | | | | | | |
| Open Trench Construction Project | | | | | | | | |
| Size and Footage of Pipes ($\geq 8'' \varnothing$) | Size: | Feet: | Size: | Feet: | Size: | Feet: | Size: | Feet: |
| Bypass-pumping Capacity (MGD) | MGD | | MGD | | MGD | | MGD | |

OPEN TRENCH SUPERINTENDENT AND/OR FOREMAN EXPERIENCE

(use multiple sheets if necessary)

On-site Superintendent Qualification

| | | | | | | |
|--|------------------------|-------|-----------|-------|-----------|-------|
| Name of On-Site Superintendent | | | | | | |
| Years of Pipe Installation Experience by Open Trench Method | Years | | | | | |
| | Project 1 | | Project 2 | | Project 3 | |
| Name of Project | | | | | | |
| Project Location | | | | | | |
| Year of Construction | | | | | | |
| Owner of Project | | | | | | |
| Owner Contact and Phone Number | Name: Phone Number: | | | | | |
| Size and Footage of Pipes ($\geq 8'' \varnothing$) (by open trench method) | Size: | Feet: | Size: | Feet: | Size: | Feet: |

On-site Foreman Qualification

| | | | | | | |
|--|------------------------|-------|-----------|-------|-----------|-------|
| Name of On-Site Foreman | | | | | | |
| Years of Pipe Installation Experience by Open Trench Method | Years | | | | | |
| | Project 1 | | Project 2 | | Project 3 | |
| Name of Project | | | | | | |
| Project Location | | | | | | |
| Year of Construction | | | | | | |
| Owner of Project | | | | | | |
| Owner Contact and Phone Number | Name: Phone Number: | | | | | |
| Size and Footage of Pipes ($\geq 8'' \varnothing$) (by open trench method) | Size: | Feet: | Size: | Feet: | Size: | Feet: |

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 Projects | | | | | | | | |
| 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 Projects | | | | | | | | |
| 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 | |

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 and Footage of Pipes ($\geq 8'' \varnothing$) (by pipe-bursting method) | Size: | Feet: | Size: | Feet: | Size: | Feet: |

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 and Footage of Pipes ($\geq 8'' \varnothing$) (by pipe-bursting method) | Size: | Feet: | Size: | Feet: | Size: | Feet: |

**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, bypass setup & spill mitigation plan, and site assessment responsibilities shall be factored into the proper CIPP installation process.
4. Refer to Water, Gas, and Wastewater Utility Standards Section 2730 for requirements of flow bypass plan.
5. 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.
6. 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 liner which is first impregnated with a thermosetting resin. The liner 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 liner is cured by circulating hot water, ultra-violet light or, introducing controlled air or steam throughout the length of the liner 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. Flow bypass plan.
- G. 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.
- H. 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.
- I. 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. **Liner:** 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 CCTV 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 footage 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 -lbf/in ²) | Maximum Allowable Depth of Groundwater Above Invert. ² (Feet) |
|--------------------------------------|--|--|
| 6 | 328 | 238 |
| 8 | 328 | 96 |
| 10 | 328 | 48 |
| 12 | 328 | 27 |
| 12 | 1109 | 96 |
| 15 | 1109 | 48 |
| 18 | 1109 | 27 |

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 liner 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, sewage bypass setup, 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 installation.

The host pipeline shall be cleaned and televised prior to CIPP installation. There will be debris and/or root balls encountered that 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 host pipe to ensure a successful liner installation. 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 liner being inserted shall be properly sized to allow for expansion so that the CIPP liner can fit tightly against the host pipe.

The liner 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 liner 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 liner, the Contractor shall reinstate all active sewer lateral connections (SLC) within 24-hours. Appropriate temporary flow control shall be setup if needed, before the laterals are reinstated, to convey sewage and prevent sewer backup/overflow.

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 liner in the mainline centered at the SLC with the liner 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 liner 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 liner section extending into the lateral. The length of the liner extending into the lateral shall be a minimum of 4-inches from the mainline.

The fiberglass or felt material and liner 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 liner 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: | | Name: Phone Number: | |
| Size and Footage of Pipes ($\geq 8'' \varnothing$) | Size: | Footage: | Size: | 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: | | Name: Phone Number: | |
| Size and Footage of Pipes ($\geq 8'' \varnothing$) | Size: | Footage: | Size: | 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 and Footage of Pipes ($\geq 8'' \varnothing$) | Size: | Footage: | Size: | Footage: | Size: | 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 and Footage of Pipes ($\geq 8'' \varnothing$) | Size: | Footage: | Size: | Footage: | Size: | 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, 445574C 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 Anti-Radial Shear "ARC" Couplings:** Neoprene flexible, shielded, anti-radial shear coupling per ASTM C1173 with 300 series stainless steel clamp band, housing, screws, shield and eyelet. Fernco Inc. "RC SERIES", or approved equal.
 - a. **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. **Flexible Tap Saddles with Pressure Kit:** Specially formulated high durometer PVC flexible saddle with stainless steel clamps per ASTM D5926 by Fernco, Inc., or T-Flex Sewer Saddle by Mission Rubber Co.
 - a. **Note:** Pressure Kit by Fernco, Inc. contains bentonite tape water seal, plastic-coated steel reinforcing bars and stainless steel clamps. This kit creates a water tight seal on all four sides of tap saddle.
- 4. **T Cone Plugs:** Expandable pipe plug with no metal parts by ETCO Specialty Products, Inc., or approved equal.
- 5. **Cleanout Box:** Christy F08 curb valve box with F08C cast iron lid or G05T (Traffic Rated for driveways and approaches) with G05CT cast iron lid or approved equal.
- 6. **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.
- F. If lubricant mud was used to replace the sewer main by pipe-bursting, extra precaution shall be used to thoroughly clean the sewer main from lubricant mud at each service connection for proper fusion saddle adhesion.

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. The preferred method of sewer lateral connection to existing manhole wall or base is core drilling. Hammering of holes is acceptable but limited to a maximum size of sixty-pound

jackhammers. The use of precision "chipping" equipment will only be acceptable with prior approval from the on-site field Inspector.

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 cement sock or T-cone plug. 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 cement sock or T-cone plug 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 current Water, Gas & Wastewater and Public Works Standards.

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

1.07 TESTING

- A. The pipe shall be tested with low pressure air 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 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
CONCRETE MANHOLES****1.01 SCOPE**

This section covers the installation of new concrete sanitary sewer manholes and rehabilitation of existing 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 the latest ASTM C 478 or ASTM C 361.
- C. Mix design of the concrete used for the pour-in-place manhole base.

1.03 MATERIALS

The 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 (upon Engineer's approval only):** ASTM C 478. Forterra, Old Castle Precast, or approved equal.
- C. **Sealant:** Ram-Nek, K.T. Snyder Company, Inc., or approved equal. Approved equal shall meet or exceed all requirements of ASTM C990 Standard Specification for joints, concrete pipe, manholes and precast box sections, using Preformed Flexible Joint Sealants. Meets requirements of Federal Specifications SS-S210-A, "Sealing Compound Preformed Plastic For Pipe Joints", Type 1, Rope Form
- 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:** CalTrans Standard Specification Section 90 Concrete.
- 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 water stops by Mission Rubber, Newby Rubber, or approved equal.

H. Drop Manholes: Drop manholes shall be installed whenever a pipe centerline entering a manhole has an invert elevation 30 inches or more above the invert elevation of the outlet pipe in the manhole base. See standard detail WWD-09.

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.

When an existing VCP sewer main pipe is entering or leaving a newly constructed manhole, Contractor shall replace in kind, a small section of new VCP pipe and connect to the existing VCP pipe with a Anti-Radial (ARC) flexible coupling. Contractor shall remove the bell by making straight cuts on both sides of new VCP pipe, refer to standard detail WWD-07B & 08B for specifications on pipe length.

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.

1.05 NEW MANHOLE TESTING

The Contractor shall conduct a vacuum test (prior to manhole backfill) or an exfiltration test (after manhole backfill) 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.

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. Vacuum tests shall be conducted in accordance with ASTM 1244-11 "Standard Test Method for Concrete Sewer Manholes by the Negative Air Pressure (Vacuum) Test Prior to Backfill" as follows.

1. Contractor shall furnish all materials and equipment used for vacuum test.

2. Contractor shall furnish a vacuum test gauge that has a range of 0 to 30" Hg that can be accurately read to 0.5 inch Hg and is in good working order; and a reliable source of vacuum as needed to conduct the test.
3. Plug all manhole penetrations including lifting holes. Each plug must be installed at a location beyond the manhole/pipe gasket (i.e., outside the manhole wall), and shall be braced to prevent the plug or pipe from being drawn into the manhole.
4. Install the test head (e.g., a rubber ring "donut" type plug) inside the rim of the cast iron frame at the top of the manhole and inflate it in accordance with the manufacturer's recommendations.
5. Apply a vacuum to the test assembly and lower the internal pressure to approximately 10-inch Hg vacuum. Permit the vacuum to stabilize for 1 minute, disconnect the vacuum source and begin timing the test.
6. The time shall be measured for the vacuum to drop from 10-inches Hg to 9-inches Hg. The manhole must maintain vacuum such that no greater than 1 inch Hg of vacuum is lost during the specified test period per the following table:

| Manhole Depth (Feet) | Test Period Based On Manhole Size (seconds) | | |
|-------------------------|---|---------------------|---------------------|
| | 48 inch Diameter | 60 inch Diameter | 72 inch diameter |
| Up to 8 | 20 | 26 | 33 |
| 10 | 25 | 33 | 41 |
| 12 | 30 | 39 | 49 |
| 14 | 35 | 46 | 57 |
| 16 | 40 | 52 | 67 |
| 18 | 45 | 59 | 73 |
| 20 | 50 | 65 | 81 |
| >20 | 74 | 98 | 121 |

7. The manhole is acceptable if the time for the vacuum reading to drop from 10-inches Hg to 9-inches Hg is greater than the test period. Manholes that fail the test shall be patched as required and retested at no additional cost to the City.
8. Remove all temporary plugs and braces after each test.

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.

1.06 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 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.

3. Test Requirement for Coated Manhole: Testing of coated manholes shall follow epoxy manufacturer's recommended testing method and procedures.

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.

1.07 CONNECTIONS TO EXISTING MANHOLES

The preferred method of sewer lateral connection to existing manhole wall or base is core drilling. Hammering of holes is acceptable but limited to a maximum size of sixty-pound jackhammers. The use of precision "chipping" equipment will only be acceptable with prior approval from the on-site field Inspector.

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. Subject to manhole testing as described in Section 1.05.

1.08 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.

1.09 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 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. The Contractor shall submit the first 1,000 LF of video inspected by each operator for Engineer's review and acceptance, before continuing the work, to ensure the quality and adequacy of the output.
- C. The Contractor shall submit colored-video, audio, and NASSCO condition assessment report for completed work on USB flash drive, hard drive, or provided through a Cloud platform with the monthly progress payment requests. The video must be in 19x20 MP4 file format. Work will not be considered accepted until these items have been received and approved by the Engineer.

1.03 CAMERA OPERATOR QUALIFICATION

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. Hydro-Jetting
 - 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 must 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 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. Video Codeset – Video codeset shall be PACP 4.2, 4.4, or 6.0 formatted data.

1.05 VIDEO INSPECTION AND CLEANING**Pre-Construction:**

For all water, gas, and wastewater CIP projects, the contractor shall perform pre-construction cleaning and video inspection of existing wastewater pipelines to identify active sewer laterals. Prior to performing sewer main pipe-bursting operation, the Wastewater CIP contractor shall also perform pre-construction cleaning and video inspection of existing sewer mains and laterals to verify no cross-bore is present and to identify/evaluate sags in the existing sewer main and discuss with the Engineer to determine whether spot repair is required. Refer to Section 2739, 1.05 B Obstructions and Cleaning. The cost for pre-construction cleaning and video-inspecting work shall be included in one or more bid items.

Post-Construction:

For water and gas utilities installed by drilling or other trenchless installation method, the contractor shall perform post-installation video inspection of sewer mains and laterals to verify that there is no cross-bore present. For wastewater CIP projects, the contractor shall perform post-installation cleaning and video-inspection of the newly installed sewer mains. The cost for post-construction cleaning and video-inspecting work shall be included in one or more bid items.

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-televiser 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 cross bore is encountered, the Contractor shall notify the Engineer and provide a still-image of the cross bore 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 cross bore(s).

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 SURVEY DATA COLLECTION

1.01 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.

1.02 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 in .csv format with benchmarks, surveyed points, and feature codes shall be submitted monthly or with each progress payment request. Refer to Section 800 Additional Provisions for additional requirements for Utilities CIP Projects. 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 |
| 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 |

SURVEY DATA COLLECTION**SECTION 2740**

| | | |
|-----------------------------|----------|--|
| 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 11 | WTELB11 | Center of fitting (point of turn) 11 degrees |
| Horizontal Elbow 22 | WTELB22 | Center of fitting (point of turn) 22 degrees |
| Horizontal Elbow 45 | WTELB45 | Center of fitting (point of turn) 45 degrees |
| Horizontal Elbow 90 | WTELB90 | Center of fitting (point of turn) 90 degrees |
| Vertical Elbow 11 | WTELBV11 | Center of fitting (point of turn) 11 degrees |
| Vertical Elbow 22 | WTELBV22 | Center of fitting (point of turn) 22 degrees |
| Vertical Elbow 45 | WTELBV45 | Center of fitting (point of turn) 45 degrees |
| Vertical Elbow 90 | WTELBV90 | Center of fitting (point of turn) 90 degrees |
| 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 |

1.03 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 should only be submitted for the City-owned portion of the laterals (lower sewer lateral). Only crossbore-inspection videos should be submitted for the private sewer laterals (upper sewer lateral) including laterals in private easements or non-City-owned laterals.

“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. Lateral launch cameras shall have a steering arm to provide navigation through wyes and tees in the sewer lateral.

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. A 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 pipes. 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 psi and a maximum of 4000 psi (pounds per square inch) of water pressure and a maximum output of 18 gallons per minute.
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. The 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. The Contractor is required to bring extra cleanout covers/plugs of varying sizes to replace damaged cleanout covers/plugs during the inspection.

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 program.

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 the capability of traversing a minimum of 150 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 or vice versa. 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, harnesses, and any other equipment required to safely perform the push camera inspection.
 - b. The Contractor is responsible for any damages that 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.

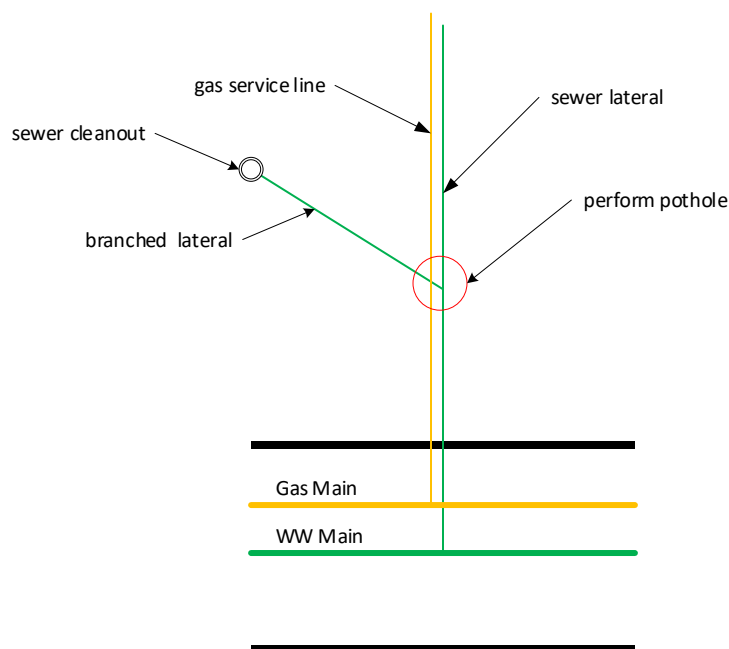
D. WATER JETTING AND MECHANICAL CLEANING

1. If an obstruction such as roots, debris, deposits, fat, oil, and grease prevents lateral launching or using a push camera, the Contractor will perform hydro flushing as needed to allow passage of the 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 the proper cleanup of SSO.
5. The City will not be responsible for the pre-cleaning of the wastewater mains. 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 a 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 refer the Water, Gas, & Wastewater Utility Standards for excavation, backfill, and restoration.
4. The Contractor shall only perform the potholing in the presence of the City Inspector.
5. The Contractor shall follow all established safety procedures as per CAL OSHA for digging around underground utilities.

F. SURFACE MARKING

1. The Contractor shall place marking chalk or paint on paved surfaces and flags or feathers on

unpaved surfaces. 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 the 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 the diameter of 12-inches or larger.
5. Where a protruding lateral prohibit 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 and submit the Contractor's Zoho form with the photo of the cross bore. 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 completed.
 - b. If the gas pipe conflicting with the sewer pipe impedes the inspection camera, the Contractor shall stop the 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 shall 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. The report will also include documentation of the footage traveled during sewer lateral inspection.
2. The Contractor shall fill out and provide a Zoho Form report for cross bores and reasons for an incomplete inspection with inspection pictures attached to the form.

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” for one complete video of both the Private lateral and City lateral.

OR

“StreetName_House#_FID_MMDDYYYY_PVT” and

“StreetName_House#_FID_MMDDYYYY_CITY” for two separate video reports of the Private lateral and City Lateral

Report Name: “NASSCO_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_PVT”

7. All NASSCO and video reports 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 exceeds 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 NASSCO-compatible 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 the quality of work is found to be unsatisfactory.
8. The Contractor shall indicate footage of sewer pipe inspected in deliverables. The footage counter shall be displayed although out the video inspection.

9. The Contractor QC personnel shall review one hundred percent (100%) of all video inspections.

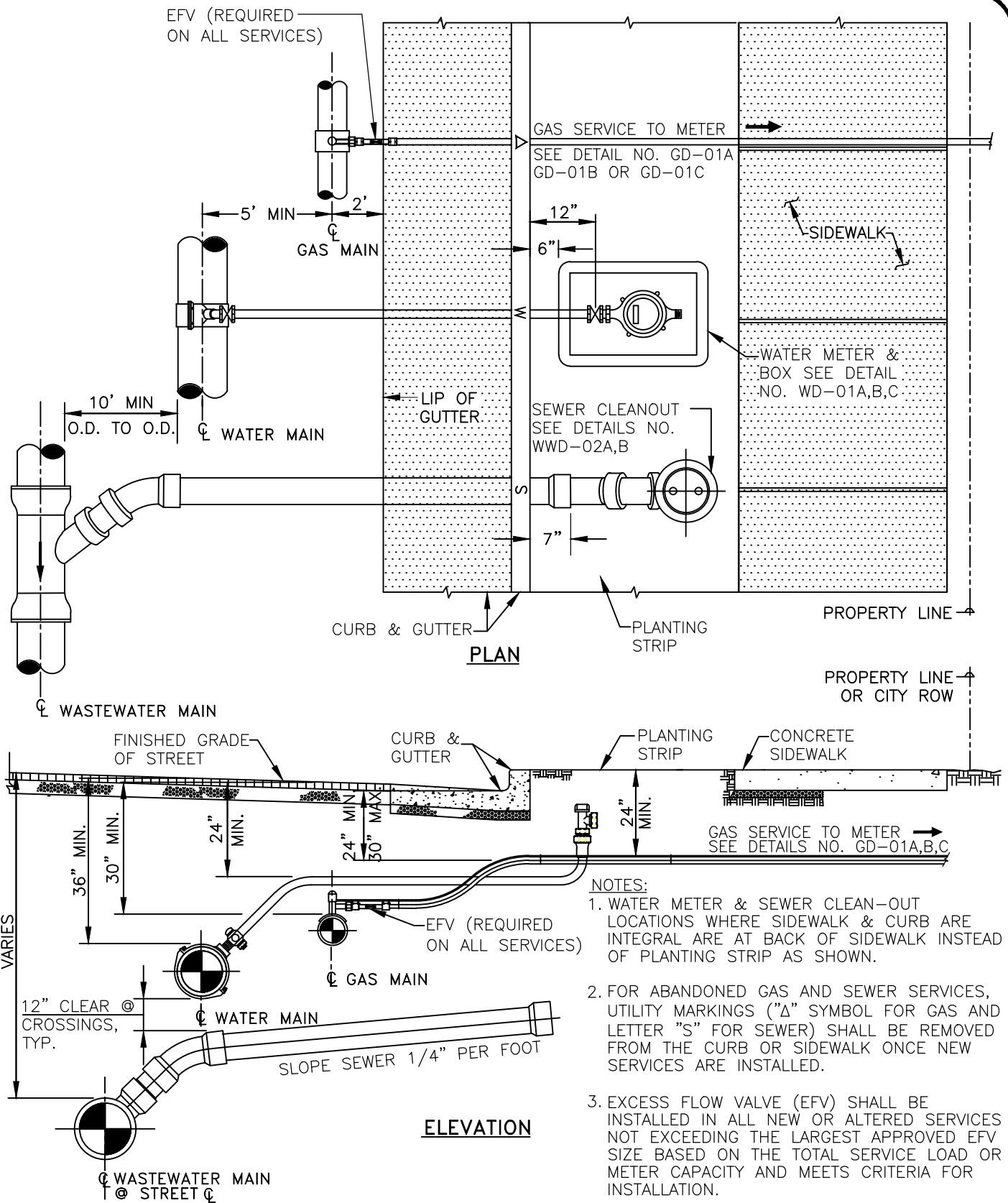
PART 4 – SUBMITTALS**4.01 DELIVERABLES**

- 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. PACP Structural and O&M pipe assessment condition grading form for each inspected lower sewer lateral. If a defect is identified in the lower sewer lateral, an image of the defect must be included on the form.
 - b. WWOPS - LACP Checklist form for each lower sewer lateral.
 - c. Contractor Zoho forms per address inspected. The Contractor Zoho forms shall provide required information about the inspection (property address, FID, total footage, inspection details, and necessary pictures, attached to the form, regarding the inspection)
 3. Weekly cross bore spreadsheet for anticipated work. The spreadsheet will be provided by the City and must be completed by the Contractor.
 4. Weekly invoices for completed work to process 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 are not limited to, truck, generator, camera, etc.

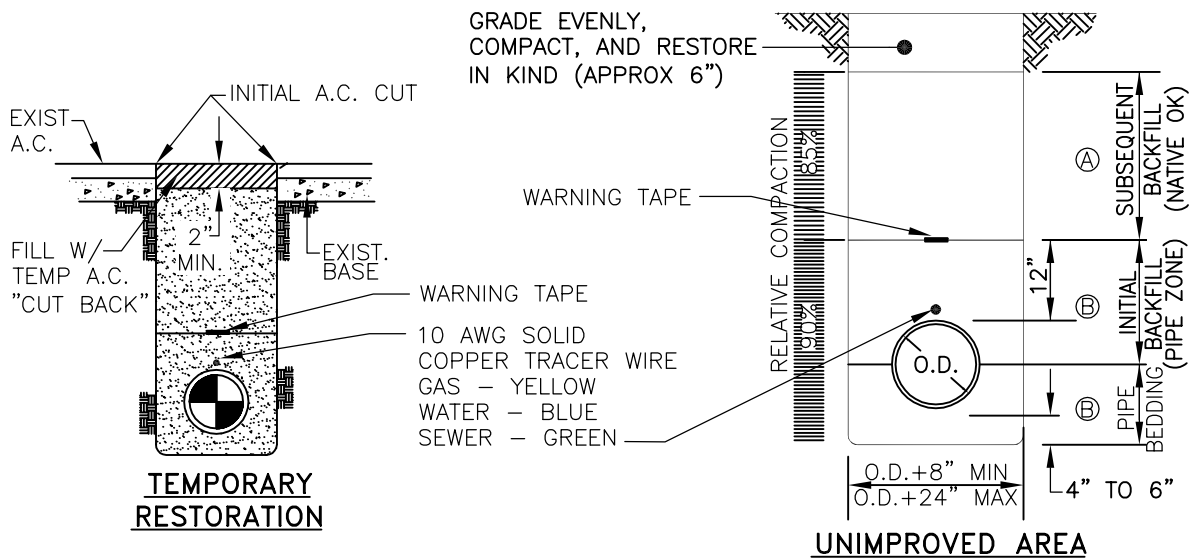
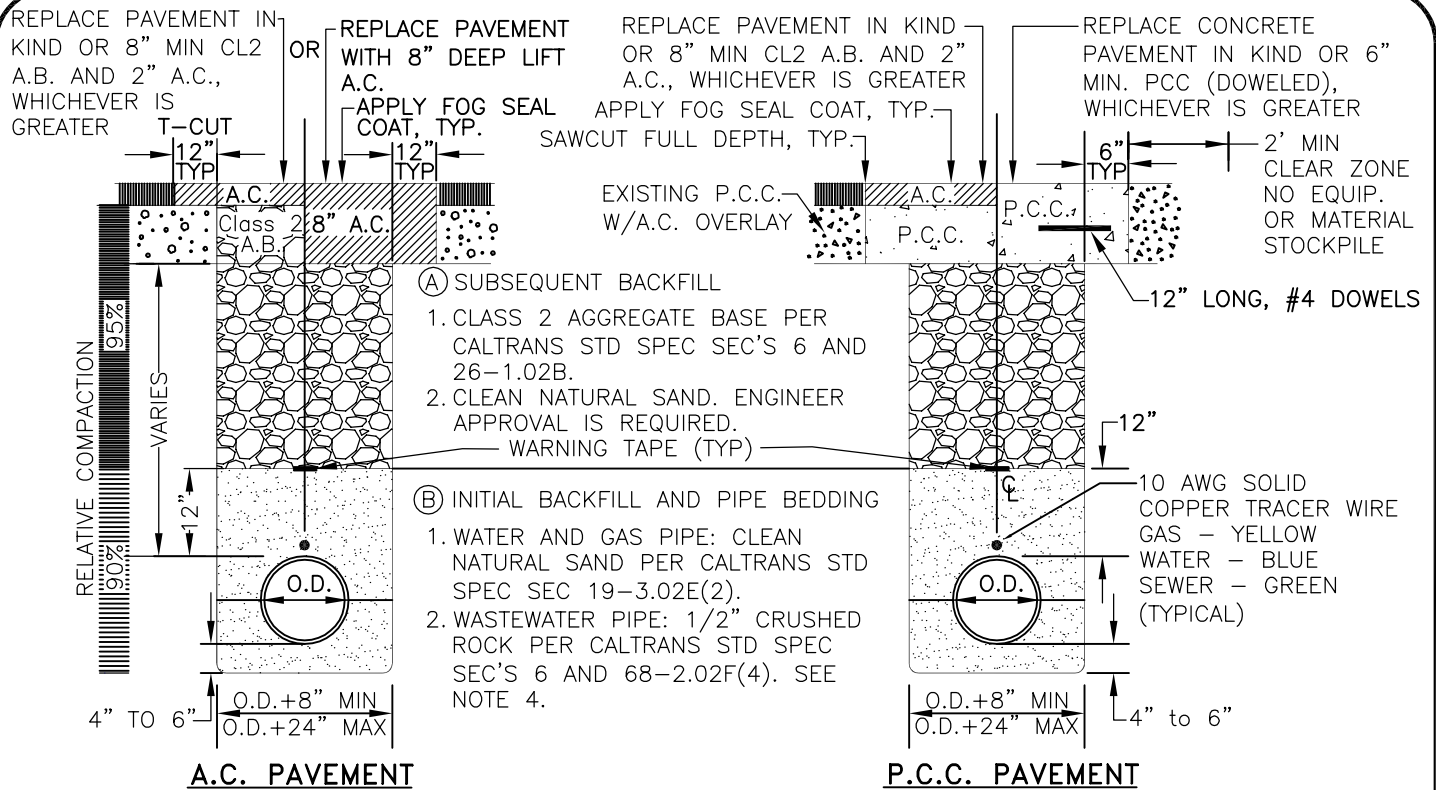
END OF SECTION

**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 Mains |
| WGW-04 | Pipe Casing and Vent Pipe |
| WGW-05A | Residential Bollard |
| WGW-05B | Commercial Bollard |
| WGW-06 | Gas/Water Valve Concrete Collar and Steel Rebar in Existing Street |



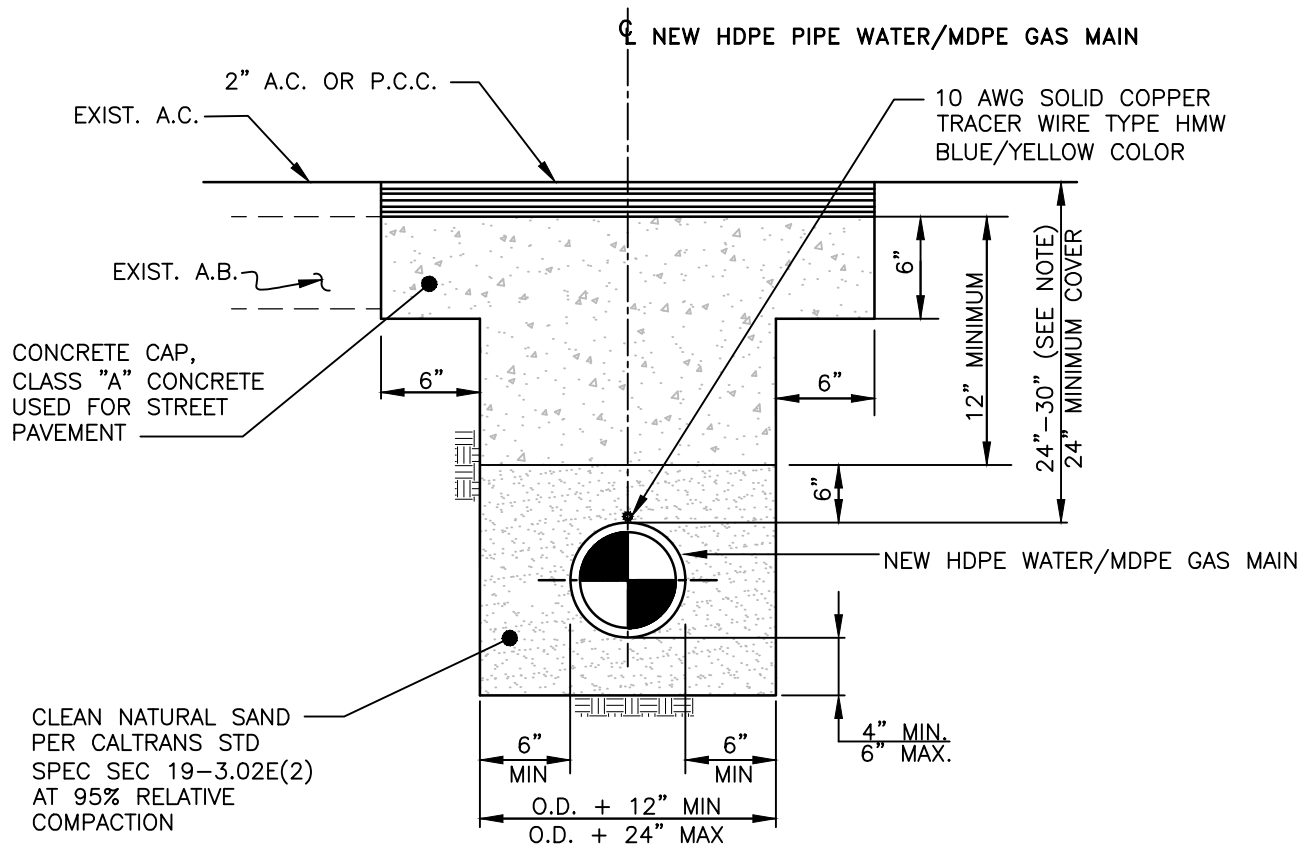
| | | | | |
|-------------------------------|-------|--|--|----------------|
| BY | DATE | WATER, GAS & WASTEWATER UTILITY CONFIGURATIONS STANDARD DETAIL | APPROVED: MAY 20, 2022 | SCALE: NONE |
| DRAWN J.J. | 9/92 | | <i>Silvia Lee Santos</i> 50674 | DWG. NO. |
| CHECKED J.J. | 02/20 | | SILVIA LEE SANTOS ENGINEERING MANAGER | STD. GWG-01 |
| REVIEWED A.P. | 05/21 | | REVISION: MAY 5, 2021 | APPENDIX A |
| CITY OF PALO ALTO, CALIFORNIA | | | | |



NOTES:

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.

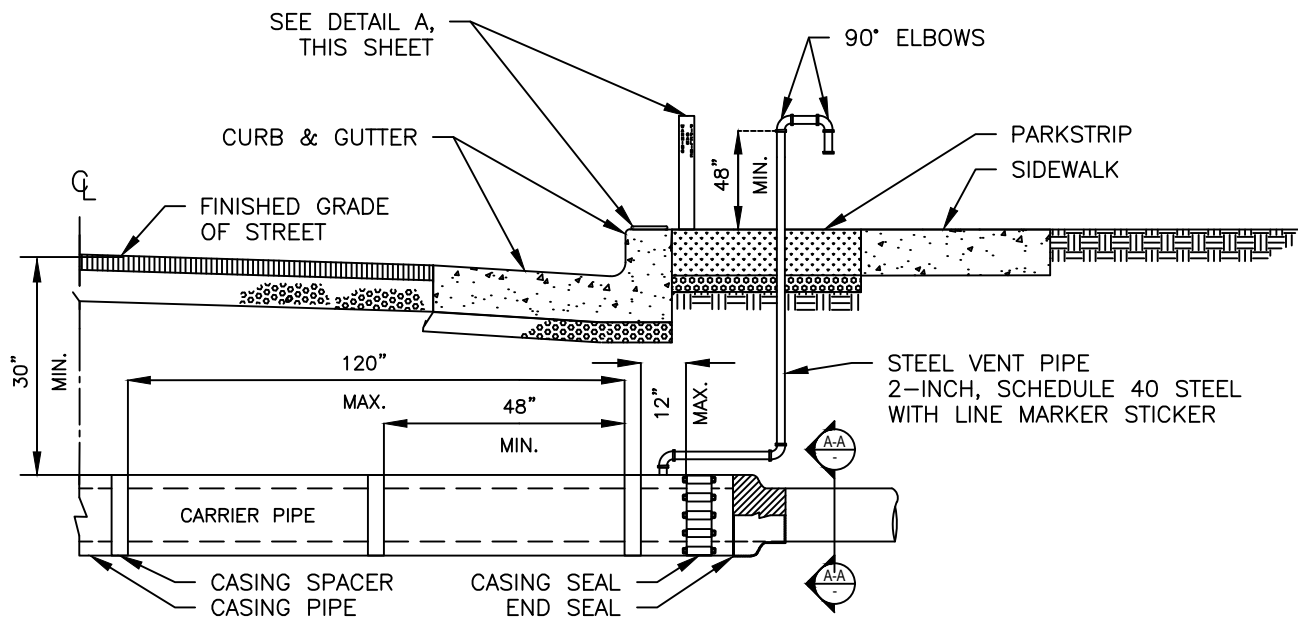
| | | | | |
|---------------|-------|------------------------------------|--|----------------|
| BY | DATE | TRENCH BACKFILL STANDARD DETAIL | APPROVED: MAY 16, 2022 | SCALE: NONE |
| DRAWN E.L. | 9/92 | | <i>Silvia Lee Santos</i> 50674 SILVIA LEE SANTOS R.E. NO. | DWG. NO. |
| CHECKED R.A. | 05/22 | | ENGINEERING MANAGER | STD. WGW-02 |
| REVIEWED S.S. | 05/22 | | REVISION: MAY 16, 2022 | APPENDIX A |
| | | CITY OF PALO ALTO, CALIFORNIA | | |



NOTES:

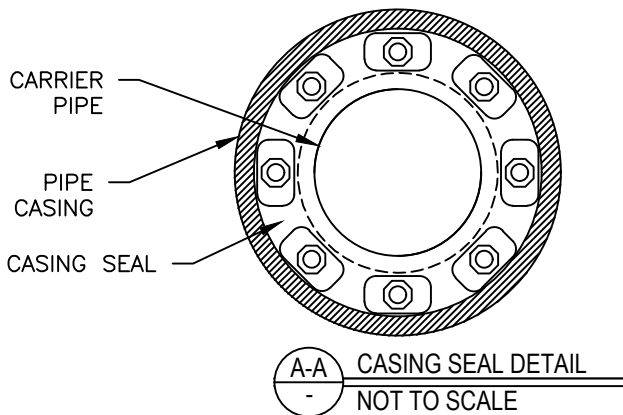
1. THIS DETAIL APPLIES WHERE PIPE COVER IS LESS THAN 30" (INCHES), AND AS APPROVED BY THE ENGINEER.
2. 24" MINIMUM COVER REQUIRED FOR WATER AND GAS MAINS OR SERVICES.
3. POTABLE WATER: CLASS 52 DUCTILE IRON PIPE SHALL BE USED WHEN HYDROCARBONS ARE PRESENT IN CONTAMINATED SOIL USING FLUOROELASTOMER GASKETS.
4. EXTEND CONCRETE CAP UNTIL COVER EXCEEDS 30 INCHES.

| | | | | |
|---------------|-------|---|---|-------------------------|
| BY | DATE | <p style="text-align: center;">TRENCH BACKFILL FOR SHALLOW MAINS STANDARD DETAIL</p> | APPROVED: MAY 16, 2022 | SCALE: NONE |
| DRAWN E.L. | 9/92 | |  50674 SILVIA LEE SANTOS ENGINEERING MANAGER R.E. NO. | DWG. NO. STD. WGW-03 |
| CHECKED R.A. | 05/22 | | REVISION: MAY 16, 2022 | APPENDIX A |
| REVIEWED S.S. | 05/22 | CITY OF PALO ALTO, CALIFORNIA | | |



NOTES:

1. VENT PIPE SHALL BE 2-INCH, SCHEDULE 40 STEEL AND BE PAINTED METER GRAY.
2. VENT PIPE CONNECTION TO CASING SHALL BE PLACED BETWEEN THE LINK SEALS AT BOTH ENDS AND AS CLOSE AS POSSIBLE TO THE LINK SEAL, AS SPACE PERMITS.
3. VENT PIPE AT BOTH ENDS OF THE CASING TO BE CONNECTED TO TOP OF CASING PIPE.
4. CASING SEALS AND END SEALS ARE REQUIRED AT EACH END. CASING SEAL SHALL BE GPT LINK-SEAL OR APPROVED EQUAL.
5. MARKER TO INDICATE LOCATION OF PIPELINE. SEE DETAIL A, THIS SHEET.
6. CASING SPACERS SHALL BE PLACED AT MINIMUM OF 48-INCHES APART, BUT SHALL NOT EXCEED 120-INCHES, MAXIMUM. THE CASING SPACER AT EACH END OF THE CASING SHALL BE PLACED AT A MAXIMUM OF 12-INCHES FROM THE CASING SEAL.



NOTES:

1. CASING SEAL SHALL BE GPT LINK-SEAL OR APPROVED EQUAL.
2. SIZING OF CASING SEAL SHALL BE BASED ON THE ANNULAR SPACE BETWEEN THE INTERNAL DIAMETER OF THE CASING AND THE OUTER DIAMETER OF THE CARRIER PIPE, AND THE FREE STATE AND EXPANDED THICKNESS OF THE CASING SEAL.

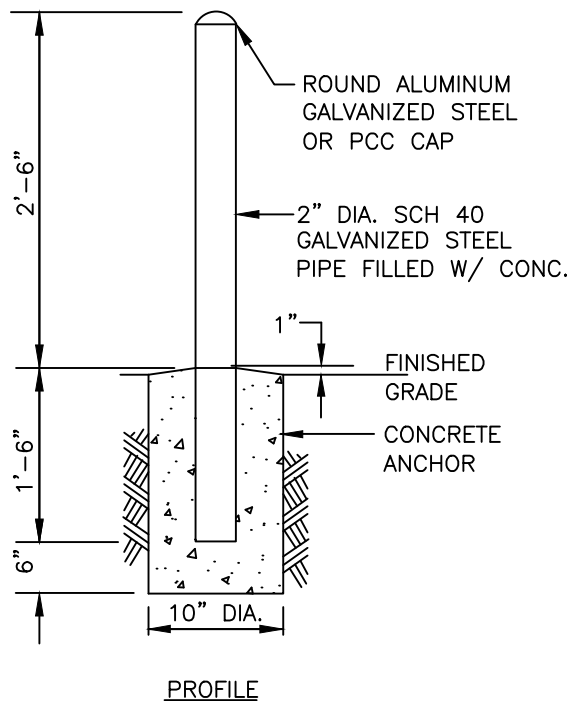
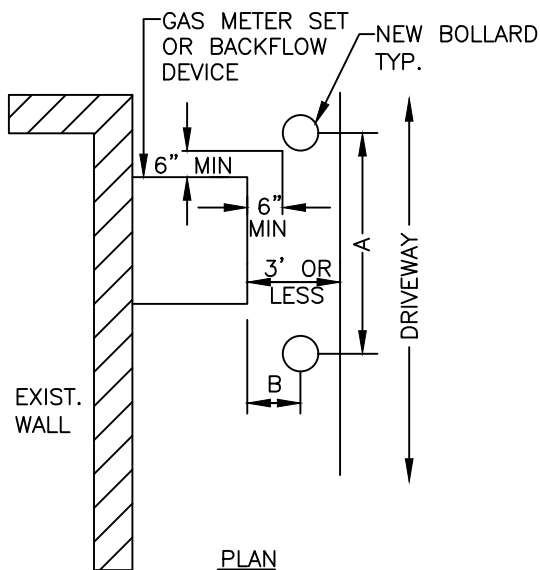


NOTES:

1. LINE MARKERS SHALL BEAR TERMINOLOGY "WARNING", "CAUTION", OR "DANGER" FOLLOWED BY "CITY OF PALO ALTO GAS PIPELINE".
2. LETTERS SHALL BE ONE INCH IN HEIGHT AND 1/4-INCH STROKE



| | | | | |
|---------------|-------|--|--------------------------------|----------------|
| BY | DATE | PIPE CASING AND VENT PIPE STANDARD DETAIL | APPROVED: MAY 16, 2022 | SCALE: NONE |
| DRAWN M.T. | 06/20 | | <i>Silvia Lee Santos</i> 50674 | DWG. NO. |
| CHECKED R.A. | 05/22 | | SILVIA LEE SANTOS R.E. NO. | STD. GWG-04 |
| REVIEWED S.S. | 05/22 | | REVISION: MAY 16, 2022 | 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)

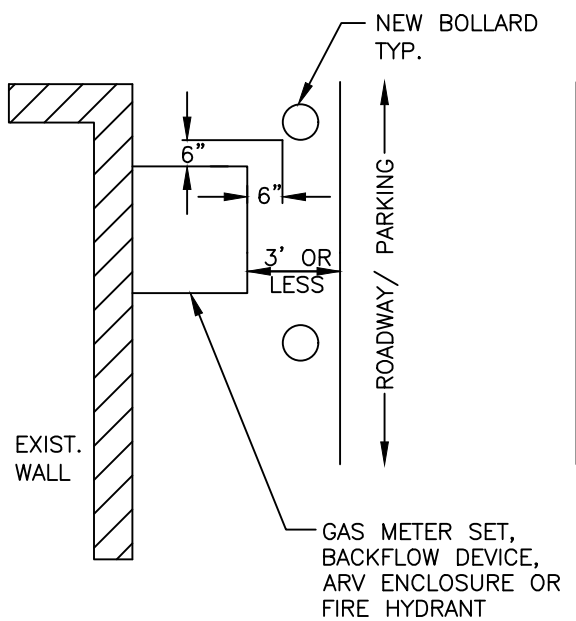
B = PERPENDICULAR CLEARANCE (IN)

NOTE: FOR NARROW DRIVEWAYS WHERE RESIDENTIAL VEHICLE HAZARDS EXIST PARALLEL TO THE LINE OF BOLLARDS; A = 30 INCHES, B = 7 INCHES.

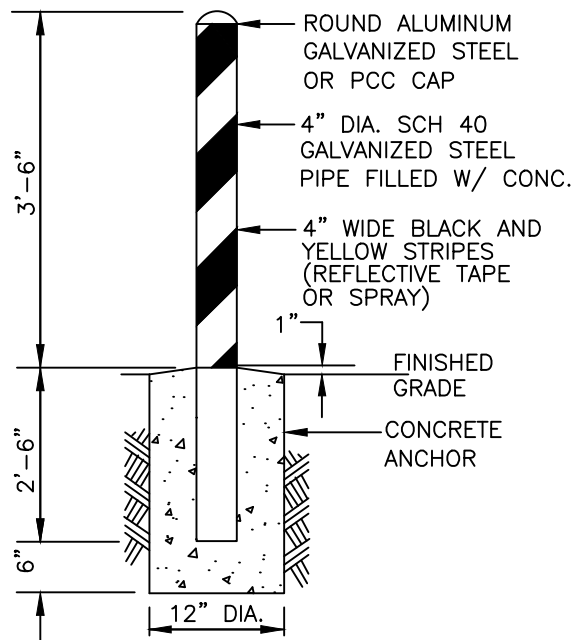
NOTES:

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: MAY 20, 2022 | SCALE: NONE | |
|----------|------|-------|--|---|--------------------------|------------|
| DRAWN | J.J. | 8/92 | |  50674 | DWG. NO. | |
| CHECKED | J.J. | 02/20 | | SILVIA LEE SANTOS ENGINEERING MANAGER | R.E. NO. STD. GWG-05A | |
| REVIEWED | J.J. | 02/20 | | CITY OF PALO ALTO, CALIFORNIA | REVISION: MAY 5, 2021 | APPENDIX A |
| | | | | | | |



PLAN

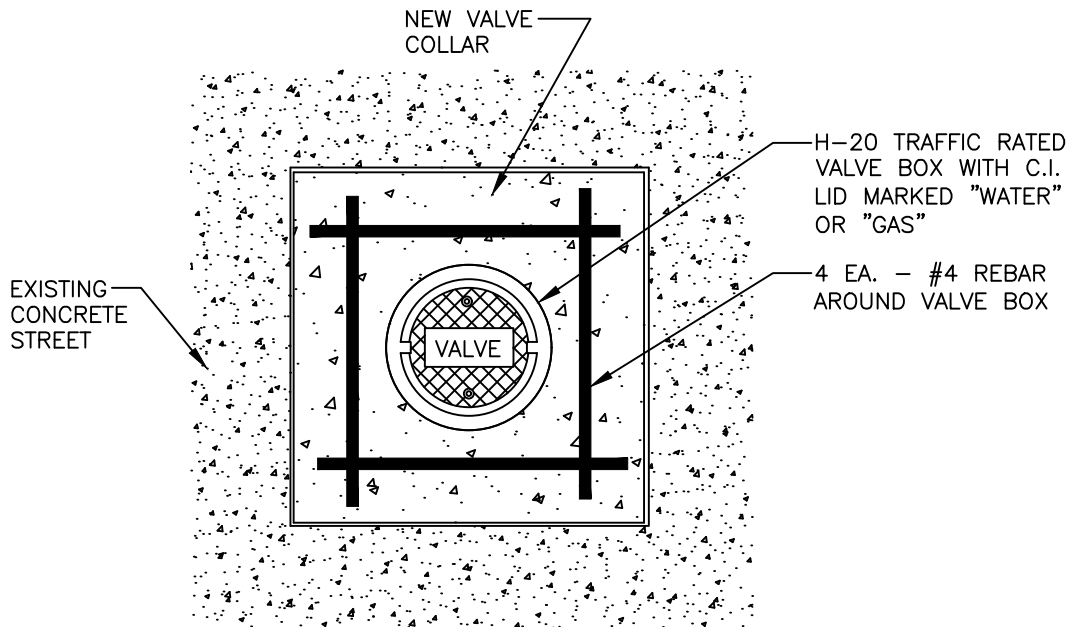


PROFILE

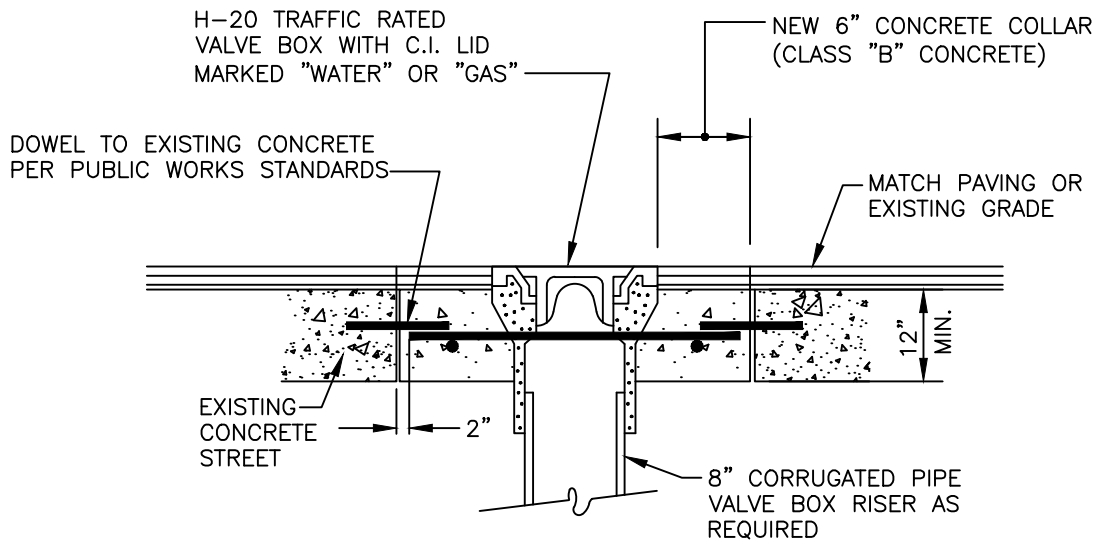
NOTE:

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.

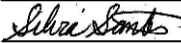
| | | | | |
|---------------|-------|---------------------------------------|--|-------------------|
| BY | DATE | COMMERCIAL BOLLARD STANDARD DETAIL | APPROVED: MAY 20, 2022 | SCALE: NONE |
| DRAWN J.J. | 8/92 | | <i>Silvia Lee Santos</i> | DWG. NO. |
| CHECKED J.J. | 02/20 | | SILVIA LEE SANTOS ENGINEERING MANAGER | 50674 R.E. NO. |
| REVIEWED J.J. | 02/20 | | REVISION: MAY 5, 2021 | APPENDIX A |
| | | CITY OF PALO ALTO, CALIFORNIA | | |



PLAN

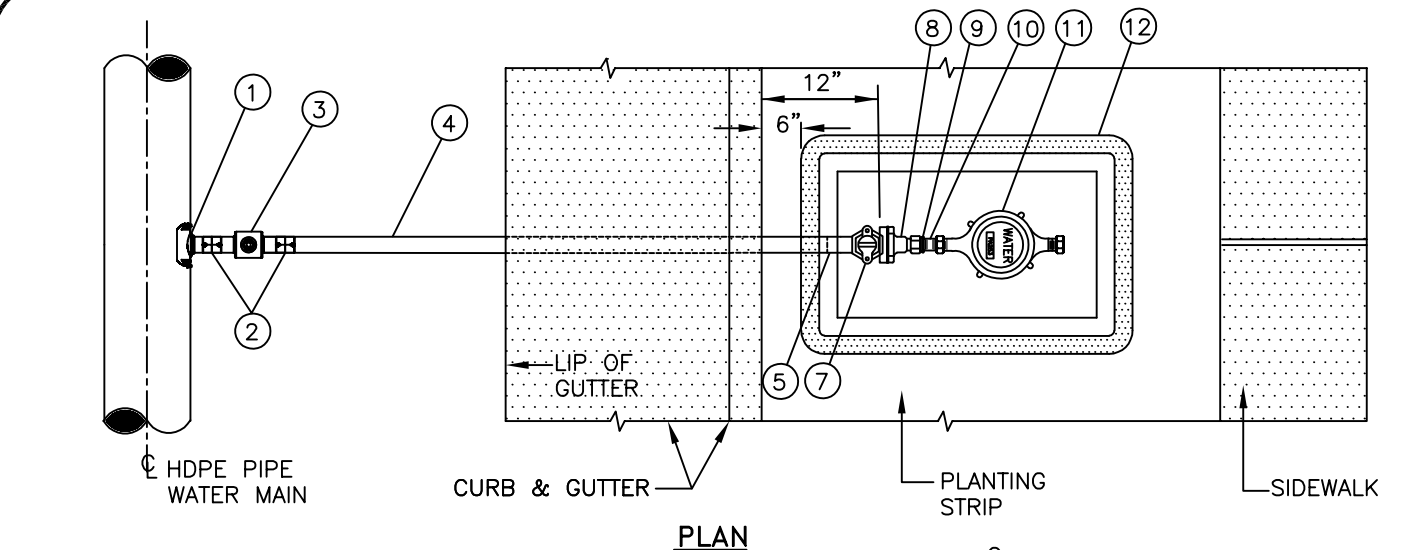


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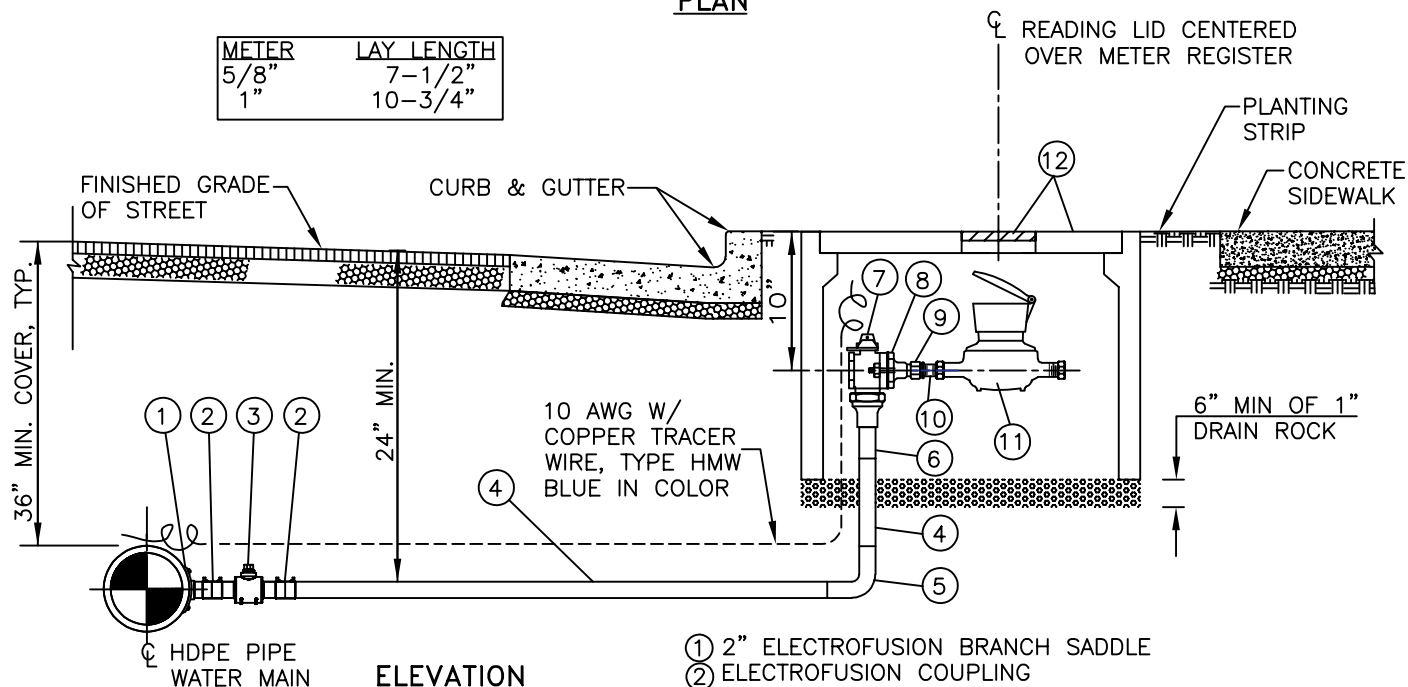
| | | | | |
|---------------|-------|--|--|-------------------------|
| BY | DATE | GAS/WATER VALVE CONCRETE COLLAR AND STEEL REBAR IN EXISTING STREET STANDARD DETAIL | APPROVED: MAY 16, 2022 | SCALE: NONE |
| DRAWN R.E. | 12/04 | |  50674 SILVIA LEE SANTOS ENGINEERING MANAGER R.E. NO. | DWG. NO. STD. WGW-06 |
| CHECKED R.A. | 05/22 | | | |
| REVIEWED S.S. | 05/22 | | REVISION: MAY 16, 2022 | APPENDIX A |
| | | CITY OF PALO ALTO, CALIFORNIA | | |

**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 Domestic or 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) |



| METER | LAY LENGTH |
|-------|------------|
| 5/8" | 7-1/2" |
| 1" | 10-3/4" |

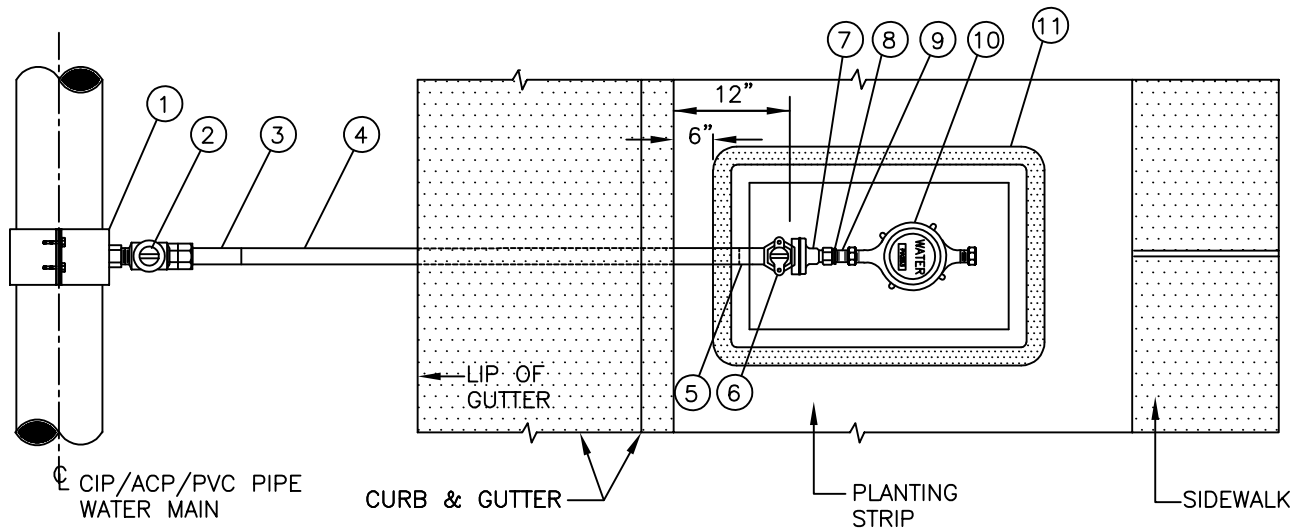


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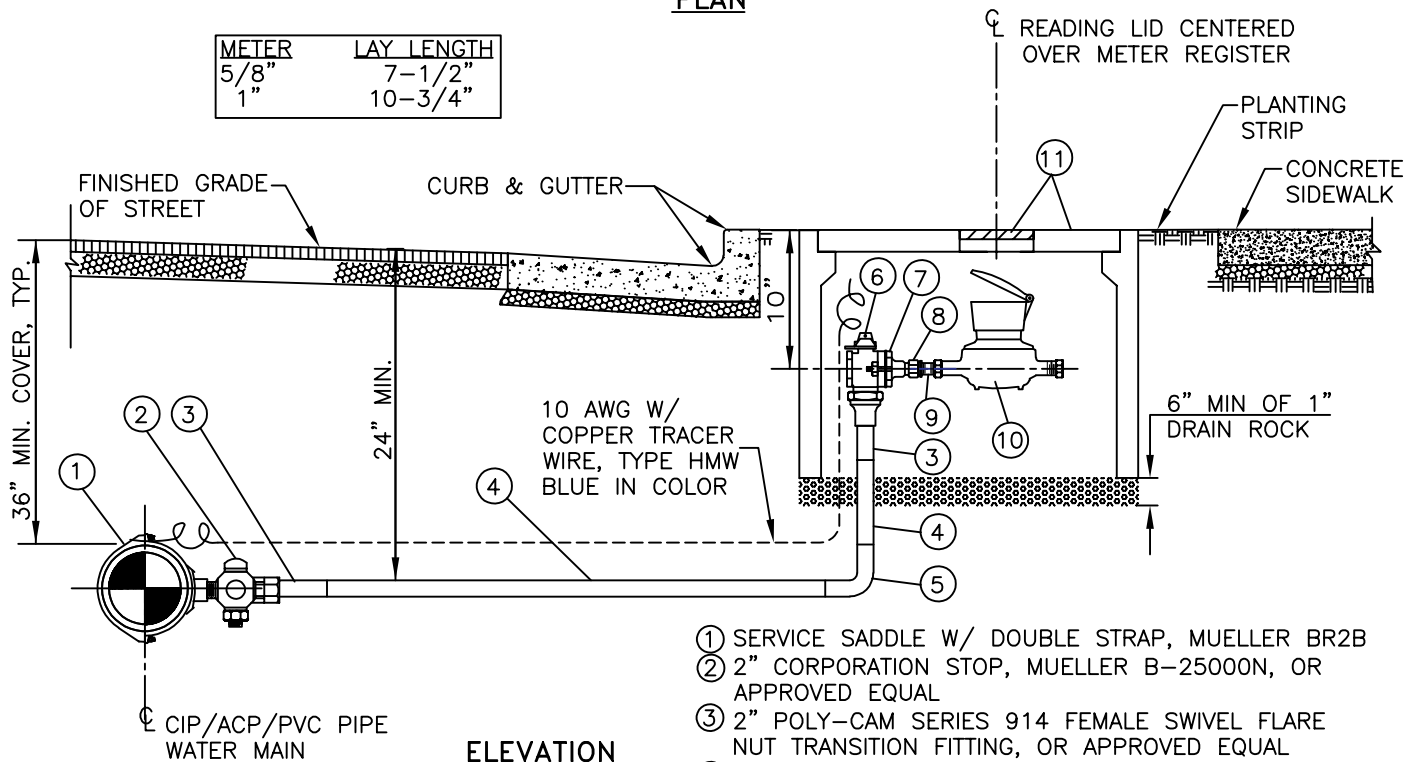
- METER LOCATION WHERE SIDEWALK & CURB ARE INTEGRAL IS AT BACK OF SIDEWALK INSTEAD OF BACK OF CURB AS SHOWN.
- METER BOX TO BE LOCATED IN THE CITY RIGHT-OF-WAY OR P.U.E. NEAR TO WATER MAIN
- AVOID VEHICLE TRAVEL AREAS WHEN POSSIBLE. METER BOX SHALL HAVE 20K (TIER 22) LOAD RATING.
- LIDS SHALL HAVE "WATER" MARKED ON THEM AND MAGNET IMBEDDED IN COVER.
- WRAP CORP VALVE WITH AN 8 MIL POLYETHYLENE ENCASEMENT WRAP, OR APPROVED EQUAL. WRAP SHALL EXTEND A MINIMUM OF 12" ON EITHER SIDE OF THE CORP VALVE. TAPE SEAMS AND OVERLAPS WITH 2" PVC PIPE SEALANT TAPE.

- 2" ELECTROFUSION BRANCH SADDLE
- ELECTROFUSION COUPLING
- 2" HDPE FULL PORT BALL VALVE BY GEORG FISCHER CENTRAL PLASTICS, OR APPROVED EQUAL, WRAPPED IN POLYETHYLENE ENCASEMENT WRAP, SEE NOTE 5
- 2" HDPE 4710 SDR 9 WATER PIPE
- BUTT FUSION SWEEP OR 90° ELL
- 2" POLY-CAM SERIES 914 FEMALE SWIVEL FLARE NUT TRANSITION FITTING, OR APPROVED EQUAL
- 2" ANGLE METER STOP FLARE X OVAL FLANGE, A.Y. McDONALD 74602B, OR APPROVED EQUAL
- 2" OVAL FLANGE NL METER COUPLING WITH 1" METER SPUD, A.Y. McDONALD 710J47
- 1" X 3/4" BRASS BUSHING ADAPTER FOR 5/8" METER
- STRAIGHT METER COUPLING FOR 5/8" METER
- 5/8" OR 1" BADGER DISC METER (CITY PROVIDED)
- 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: MAY 16, 2022 | SCALE: NONE |
| DRAWN J.J. | 02/19 | | <i>Silvia Lee Santos</i> 50674 | DWG. NO. |
| CHECKED P.L. | 05/22 | | SILVIA LEE SANTOS ENGINEERING MANAGER | STD. WD-01A |
| REVIEWED R.D. | 05/22 | | REVISION: MAY 16, 2022 | APPENDIX B |



| METER | LAY LENGTH |
|-------|------------|
| 5/8" | 7-1/2" |
| 1" | 10-3/4" |

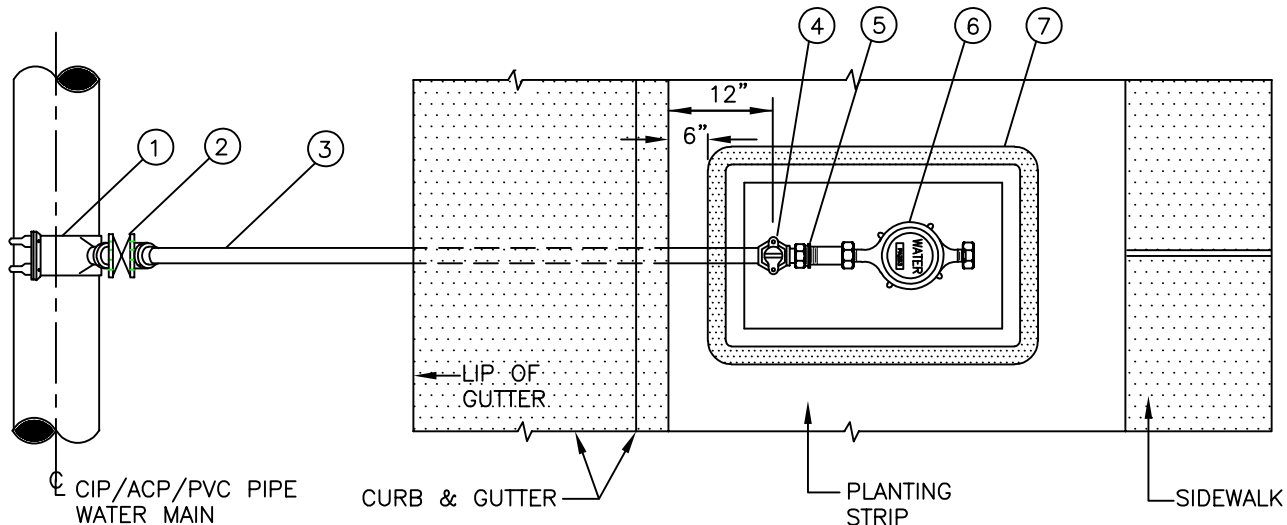


NOTES:

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. METER BOX SHALL HAVE 20K (TIER 22) LOAD RATING.
4. LIDS SHALL HAVE "WATER" MARKED ON THEM AND MAGNET IMBEDDED IN COVER.

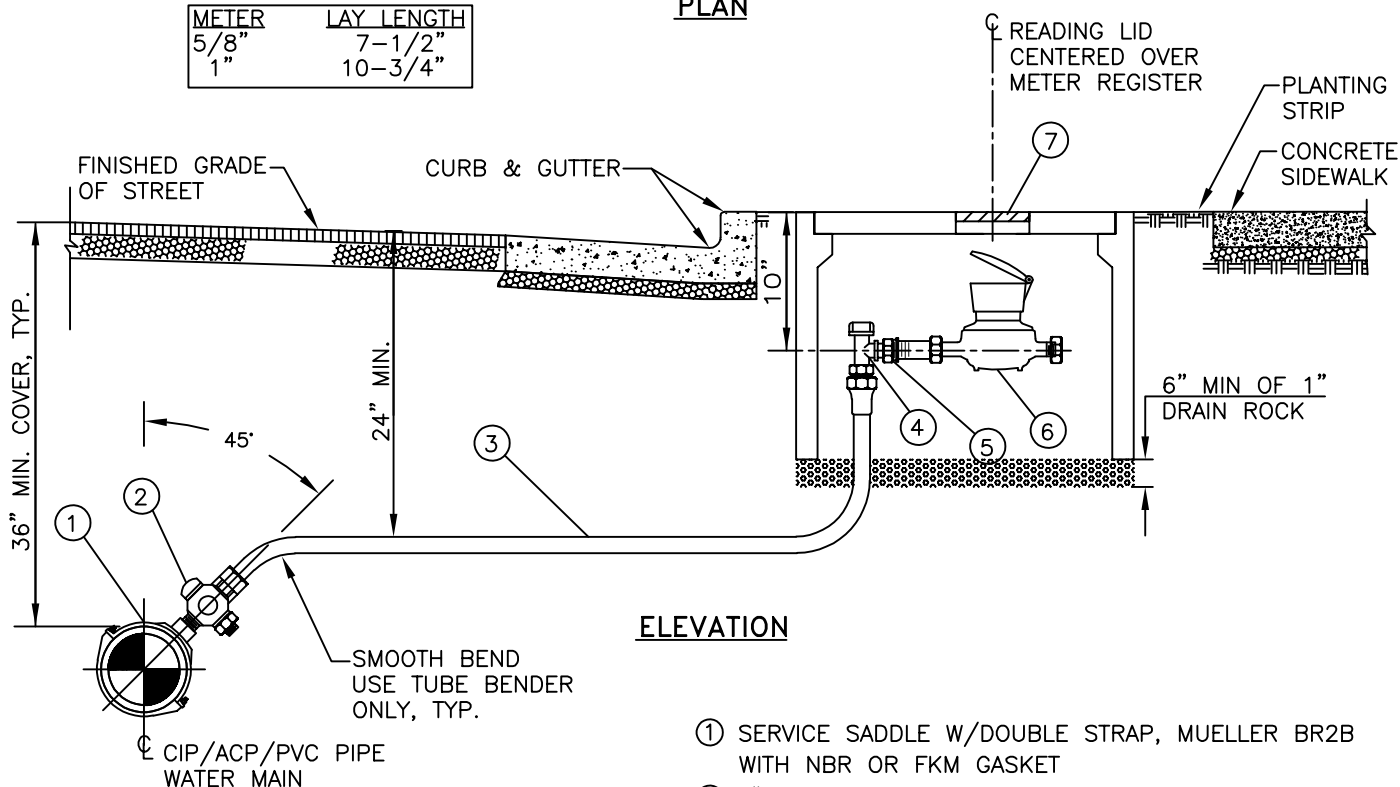
- ① SERVICE SADDLE W/ DOUBLE STRAP, MUELLER BR2B
- ② 2" CORPORATION STOP, MUELLER B-2500N, OR APPROVED EQUAL
- ③ 2" POLY-CAM SERIES 914 FEMALE SWIVEL FLARE NUT TRANSITION FITTING, OR APPROVED EQUAL
- ④ 2" HDPE 4710 SDR 9 WATER PIPE
- ⑤ BUTT FUSION SWEEP OR 90° ELL
- ⑥ 2" ANGLE METER STOP FLARE X OVAL FLANGE, A.Y. McDONALD 74602B, OR APPROVED EQUAL
- ⑦ 2" OVAL FLANGE NL METER COUPLING WITH 1" METER SPUD, A.Y. McDONALD 710J47
- ⑧ 1" X 3/4" BRASS BUSHING ADAPTER FOR 5/8" METER
- ⑨ STRAIGHT METER COUPLING FOR 5/8" METER
- 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: MAY 16, 2022 | SCALE: NONE |
| DRAWN | J.J. 02/19 | | <i>Silvia Lee Santos</i> SILVIA LEE SANTOS ENGINEERING MANAGER | DWG. NO. STD. WD-01B |
| CHECKED | P.L. 05/22 | | 50674 R.E. NO. | |
| REVIEWED | R.D. 05/22 | | REVISION: MAY 16, 2022 | APPENDIX B |
| | | CITY OF PALO ALTO, CALIFORNIA | | |



| METER | LAY LENGTH |
|-------|------------|
| 5/8" | 7-1/2" |
| 1" | 10-3/4" |

PLAN



ELEVATION

NOTES:

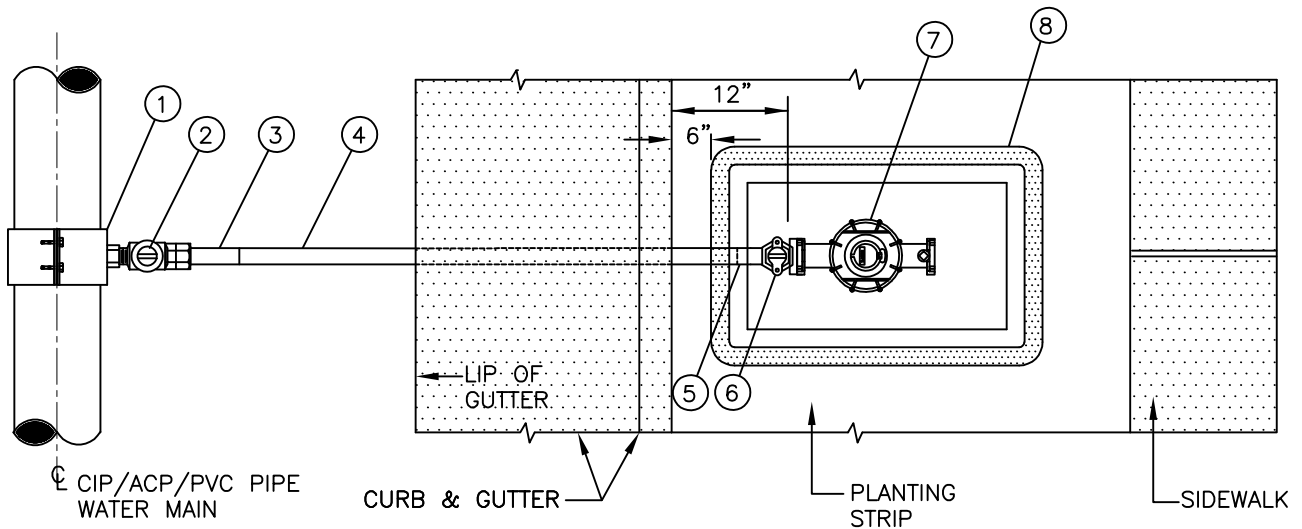
1. METER LOCATION WHERE SIDEWALK & CURB ARE INTEGRAL IS AT BACK OF SIDEWALK INSTEAD OF BACK OF CURB AS SHOWN.
2. METER BOX TO BE LOCATED IN THE CITY RIGHT-OF-WAY OR P.U.E. NEAR TO WATER MAIN
3. AVOID VEHICLE TRAVEL AREAS WHEN POSSIBLE. METER BOX SHALL HAVE 20K (TIER 22) LOAD RATING.
4. LIDS SHALL HAVE "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 FLARE X METER, A.Y. MCDONALD 74602B
- 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: MAY 16, 2022 | SCALE: NONE |
| DRAWN J.J. | 2/92 | | <i>Silvia Lee Santos</i> 50674 | DWG. NO. |
| CHECKED P.L. | 5/22 | | SILVIA LEE SANTOS ENGINEERING MANAGER | STD. WD-01C |
| REVIEWED R.D. | 5/22 | CITY OF PALO ALTO, CALIFORNIA | REVISION: MAY 16, 2022 | APPENDIX B |

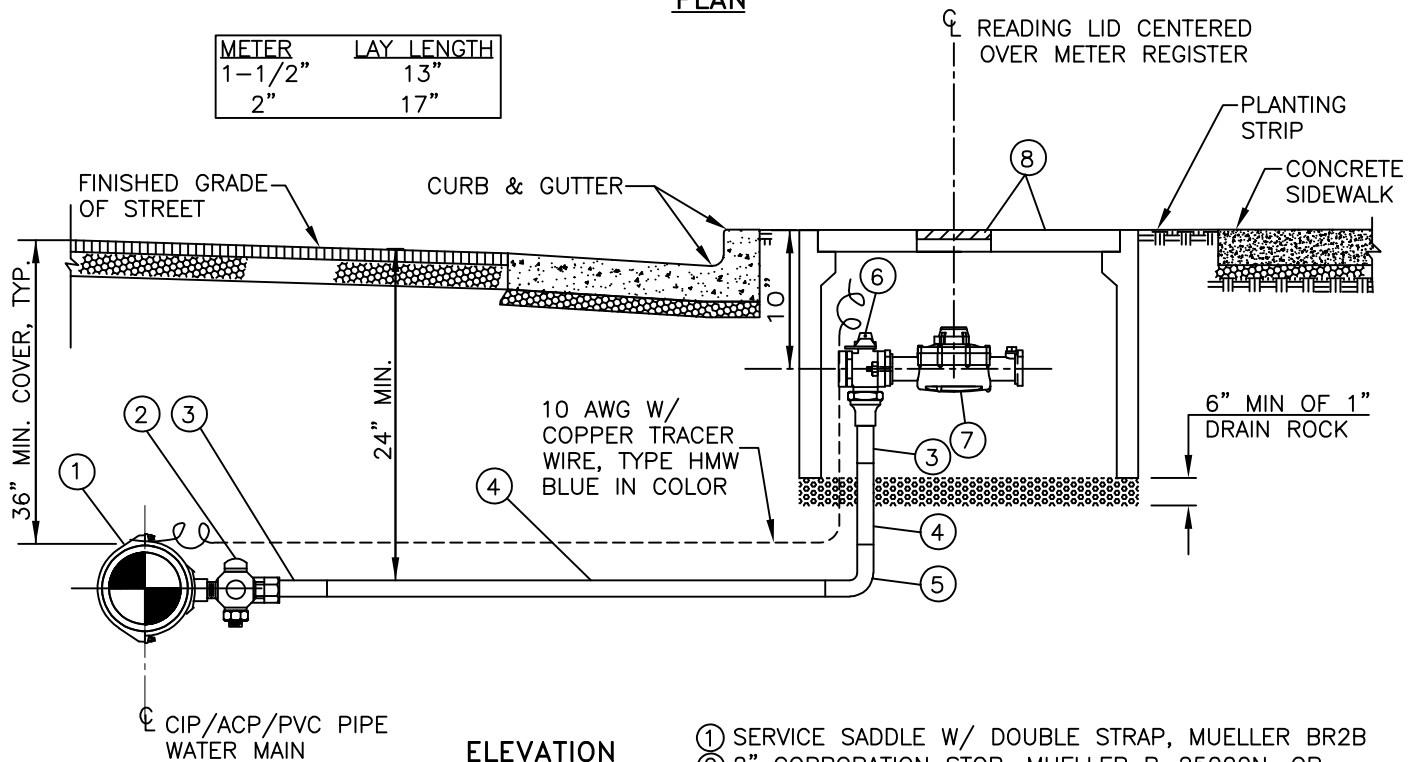


- ① 2" ELECTROFUSION BRANCH SADDLE
- ② ELECTROFUSION COUPLING
- ③ 2" HDPE FULL PORT BALL VALVE BY GEORG FISCHER
CENTRAL PLASTICS, OR APPROVED EQUAL, WRAPPED IN
POLYETHYLENE ENCASUREMENT WRAP, SEE NOTE 5.
- ④ 2" HDPE 4710 SDR 9 WATER PIPE
- ⑤ BUTT FUSION SWEEP OR 90° ELL
- ⑥ 2" POLY-CAM SERIES 914 FEMALE SWIVEL FLARE
NUT TRANSITION FITTING, OR APPROVED EQUAL
- ⑦ 2" ANGLE METER STOP FLARE X OVAL FLANGE, A.Y.
MCDONALD 74602B OR APPROVED EQUAL
- ⑧ 1-1/2" OR 2" BADGER DISC METER (CITY PROVIDED)
- ⑨ ARMORCAST 17"x30"x12" POLYMER CONCRETE METER BOX
& COVER W/DROP-IN LID (PART# A6001640TAPCX12CPA)



PLAN

| METER | LAY LENGTH |
|--------|------------|
| 1-1/2" | 13" |
| 2" | 17" |



ELEVATION

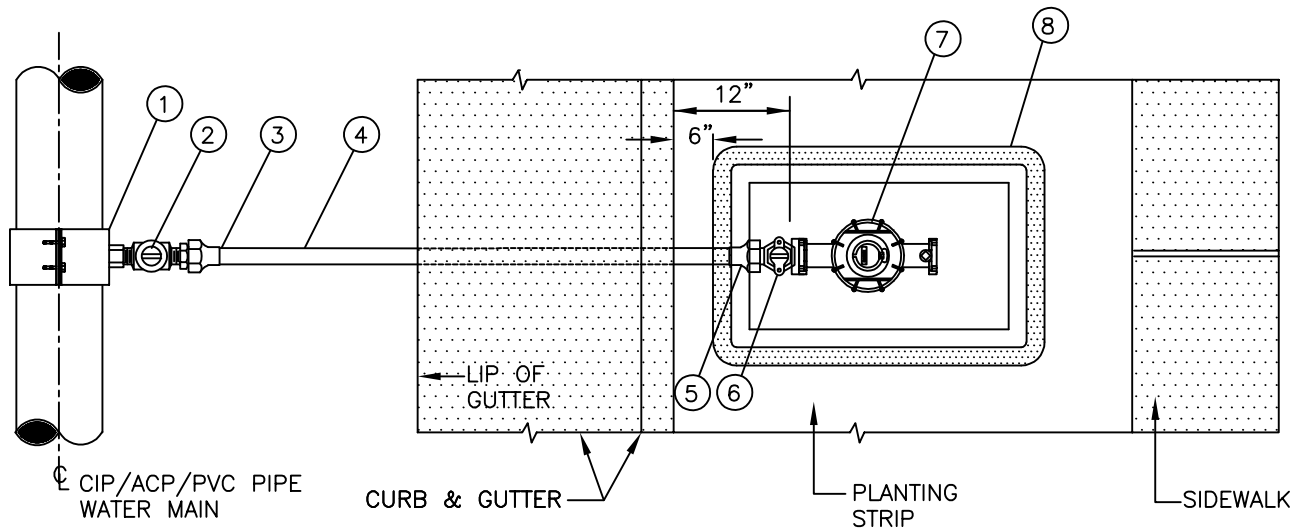
NOTES:

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. 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-25000N, 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 FLARE X OVAL FLANGE, A.Y. MCDONALD 74602B, OR APPROVED EQUAL
- ⑦ 1-1/2" X 2" BADGER DISC METER (CITY PROVIDED)
- ⑧ ARMORCAST 17"x30"x12" POLYMER CONCRETE METER BOX & COVER W/DROP-IN LID (PART #A6001640TAPCX12CPA)

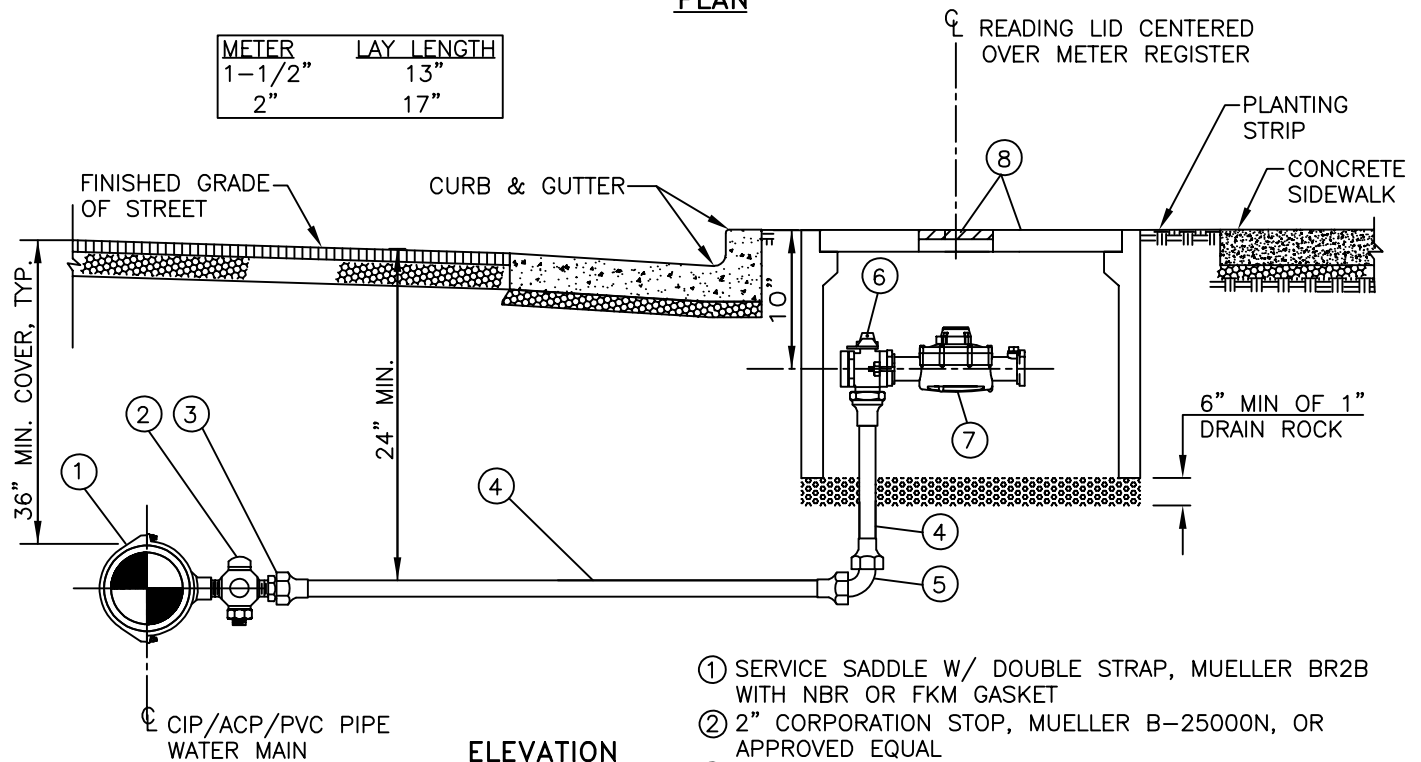
| | | | | |
|----------|------------|---|---|----------------|
| BY | DATE | 2" HDPE WATER SERVICE (NON-HDPE MAIN) WITH 1-1/2" OR 2" METER STANDARD DETAIL | APPROVED: DECEMBER 20, 2023 | SCALE: NONE |
| DRAWN | J.J. 02/19 | | <i>Silvia Lee Santos</i> 50674 | DWG. NO. |
| CHECKED | D.B. 10/23 | | SILVIA LEE SANTOS ENGINEERING MANAGER R.E. NO. | STD. WD-02B |
| REVIEWED | A.P. 12/23 | | REVISION: DECEMBER 20, 2023 | APPENDIX B |

CITY OF PALO ALTO, CALIFORNIA



PLAN

| METER | LAY LENGTH |
|--------|------------|
| 1-1/2" | 13" |
| 2" | 17" |



ELEVATION

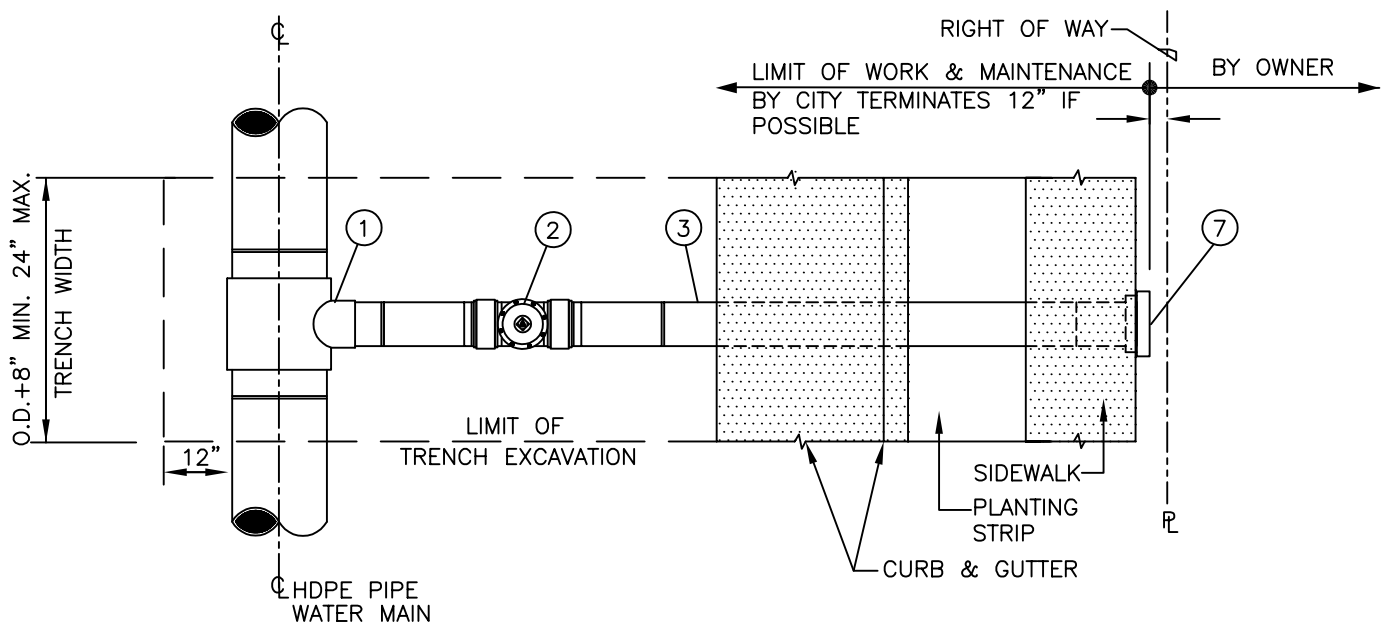
NOTES:

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. METER BOX SHALL HAVE 20K (TIER 22) LOAD RATING.
4. LIDS SHALL HAVE "WATER" MARKED ON THEM AND MAGNET IMBEDDED IN COVER.

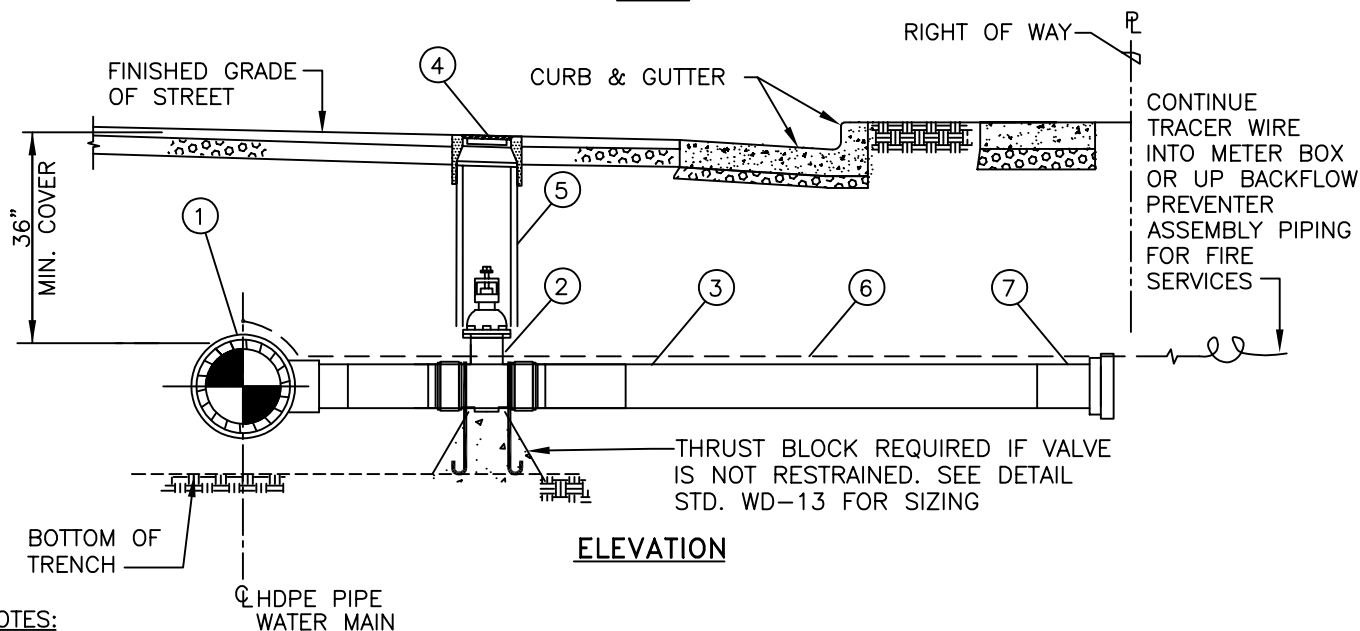
- ① SERVICE SADDLE W/ DOUBLE STRAP, MUELLER BR2B WITH NBR OR FKM GASKET
- ② 2" CORPORATION STOP, MUELLER B-25000N, OR APPROVED EQUAL
- ③ 2" COUPLING CONNECTOR, BRASS MIPTxCU
- ④ 2" COPPER PIPE TYPE "K"
- ⑤ 2" 90° ELL, BRASS
- ⑥ 2" ANGLE METER STOP FLARE X OVAL FLANGE, A.Y. MCDONALD, OR APPROVED EQUAL
- ⑦ 1-1/2" X 2" BADGER DISC METER (CITY PROVIDED)
- ⑧ ARMORCAST 17"x30"x12" POLYMER CONCRETE METER BOX & COVER W/DROP-IN LID (PART # A6001640TAPCX12CPA)

| | | | | |
|----------|------------|--|--|----------------|
| BY | DATE | 2" COPPER WATER SERVICE (CONTAMINATED SOILS) STANDARD DETAIL | APPROVED: DECEMBER 20, 2023 | SCALE: NONE |
| DRAWN | J.J. 02/19 | | <i>Silvia Lee Santos</i> 50674 | DWG. NO. |
| CHECKED | D.B. 10/23 | | SILVIA LEE SANTOS ENGINEERING MANAGER | STD. WD-02C |
| REVIEWED | A.P. 12/23 | | REVISION: DECEMBER 20, 2023 | APPENDIX B |

CITY OF PALO ALTO, CALIFORNIA



PLAN

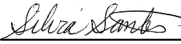


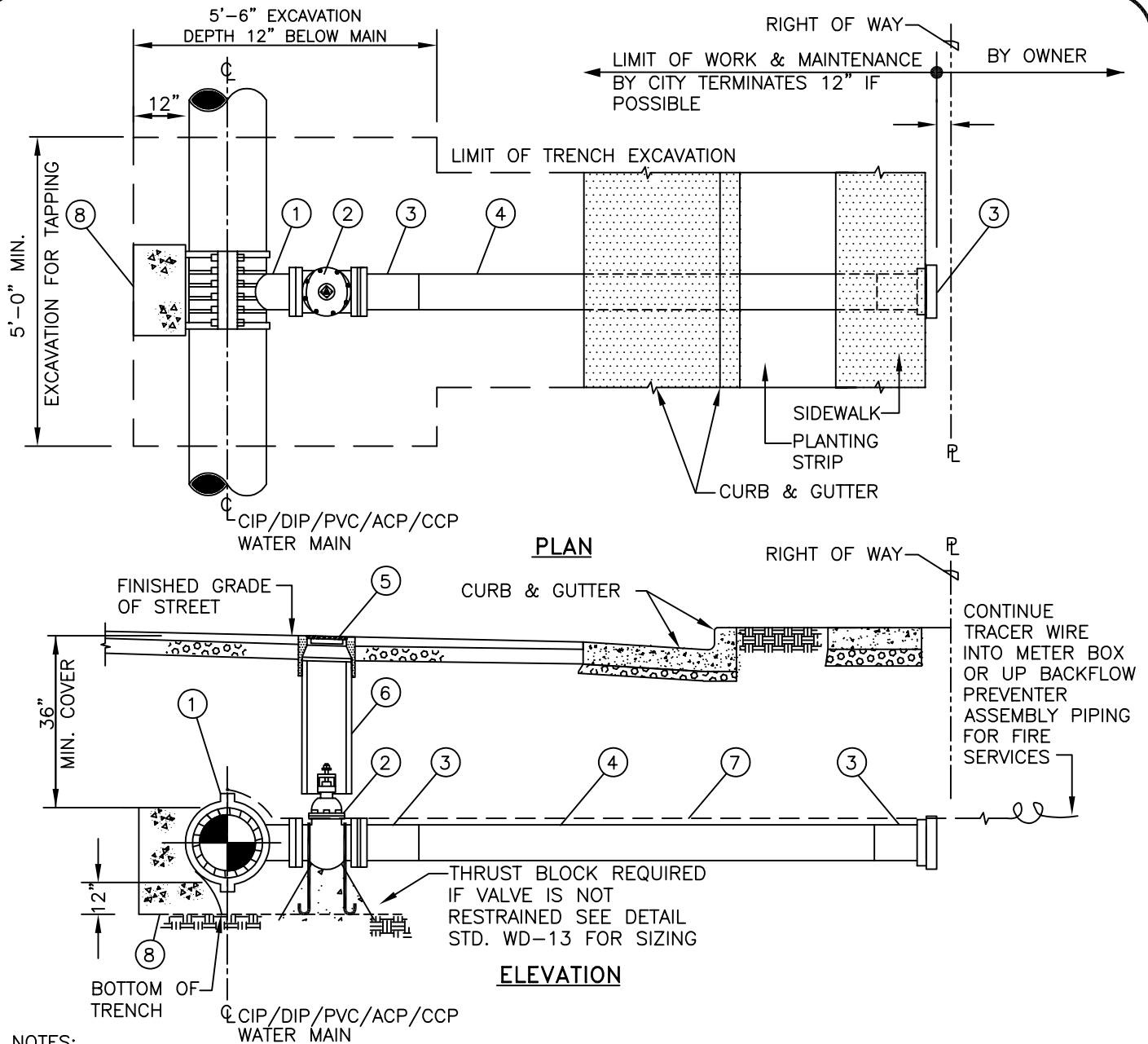
ELEVATION

NOTES:

1. CITY'S OWNERSHIP AND MAINTENANCE RESPONSIBILITY FOR SERVICE LINE TERMINATES IN THE PUBLIC RIGHT OF WAY AT THE CITY'S POINT OF CONNECTION.
2. CONTRACTOR'S INSTALLED SERVICE WITH CONTINUATION OF ON-SITE HDPE PIPE DOES NOT REQUIRE TRANSITION COUPLING #7.
3. METER, REDUCED PRESSURE PRINCIPLE ASSEMBLY REQUIRED FOR DOMESTIC AND IRRIGATION CONNECTIONS AND 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\"/>

| | | |
|---|-------|-------------------------------|
| BY | DATE | 4\"/> |
| DRAWN J.J. | 08/92 | |
| CHECKED P.L. | 05/22 | CITY OF PALO ALTO, CALIFORNIA |
| REVIEWED R.D. | 05/22 | |
| APPROVED: | | SCALE: NONE |
| MAY 16, 2022 | | DWG. NO. |
|  SILVIA LEE SANTOS ENGINEERING MANAGER | | STD. WD-03A |
| REVISION: | | APPENDIX B |
| MAY 16, 2022 | | |

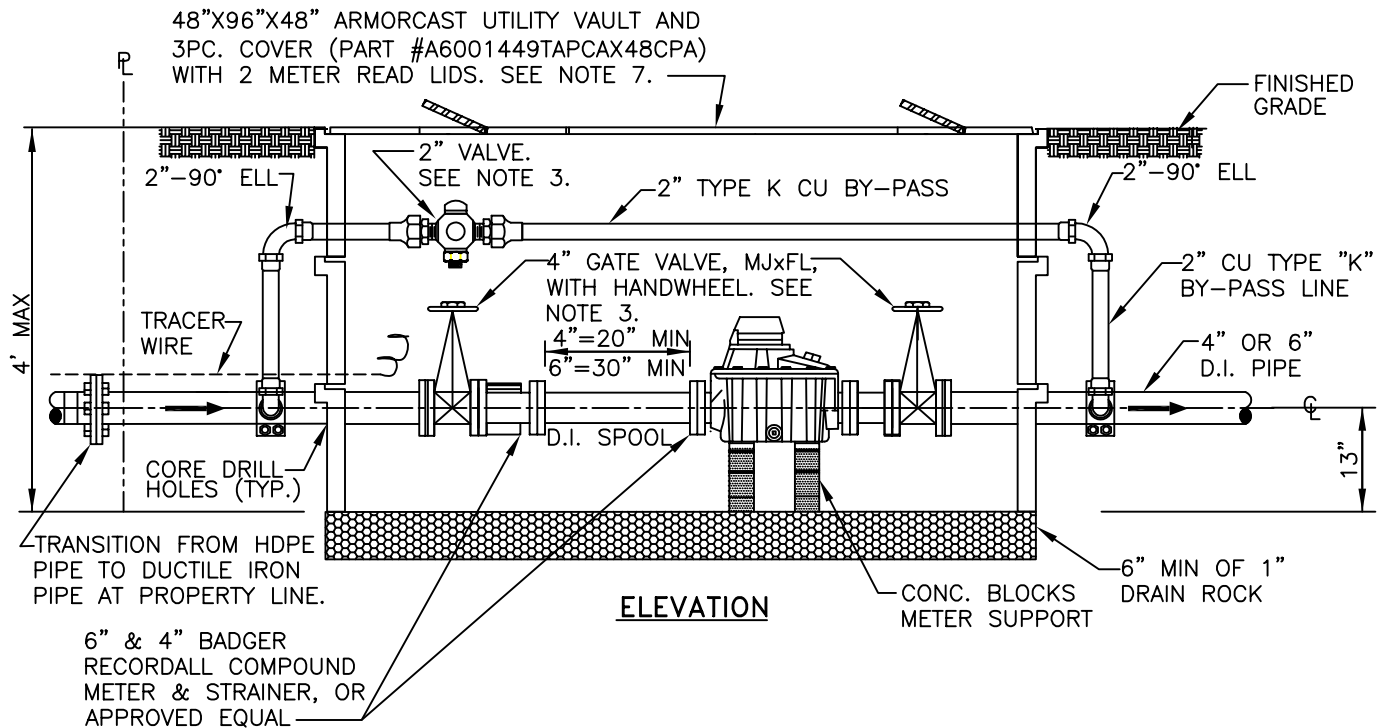
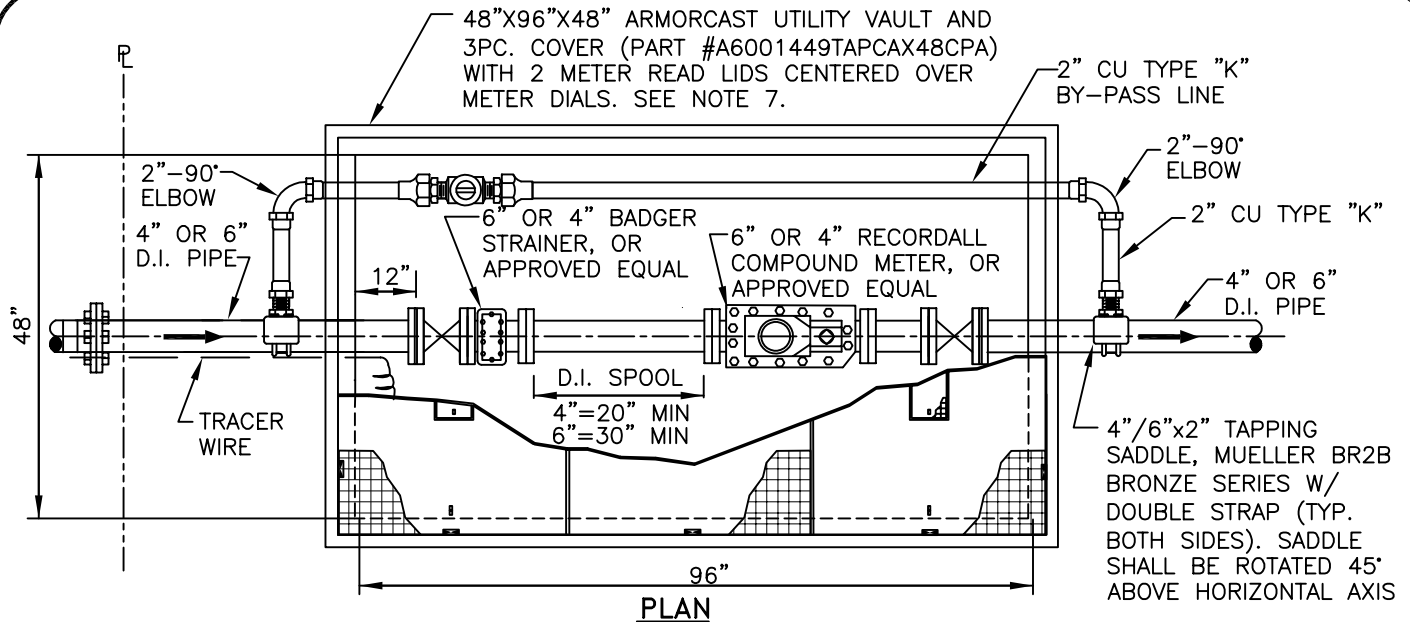


NOTES:

1. NO TAP TO BE MADE WITHIN 24" ON CIP/DIP AND 36" ON ACP/PVC MAINS FROM ANY JOINT, COUPLING, OR FITTING.
2. CITY'S OWNERSHIP AND MAINTENANCE RESPONSIBILITY FOR SERVICE LINE TERMINATES IN THE PUBLIC RIGHT OF WAY AT THE CITY'S POINT OF CONNECTION.
3. CONTRACTOR'S INSTALLED SERVICE WITH CONTINUATION OF ON-SITE HDPE PIPE DOES NOT REQUIRE TRANSITION COUPLING #7.
4. METER, REDUCED PRESSURE PRINCIPLE ASSEMBLY REQUIRED FOR DOMESTIC AND IRRIGATION CONNECTIONS AND REDUCED PRESSURE DETECTOR ASSEMBLY REQUIRED FOR FIRE SERVICE.

- ① TAPPING SLEEVE: FOR CIP/DIP/PVC/ACP USE JCM 6432, OR APPROVED EQUAL; FOR CCP MAIN USE JCM 415 175 PSI
- 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: MAY 16, 2022 | SCALE: NONE |
| DRAWN J.J. | 08/92 | | <i>Silvia Santos</i> 50674 | DWG. NO. |
| CHECKED P.L. | 05/22 | | SILVIA LEE SANTOS ENGINEERING MANAGER R.E. NO. | STD. WD-03B |
| REVIEWED R.D. | 05/22 | | REVISION: MAY 16, 2022 | APPENDIX B |

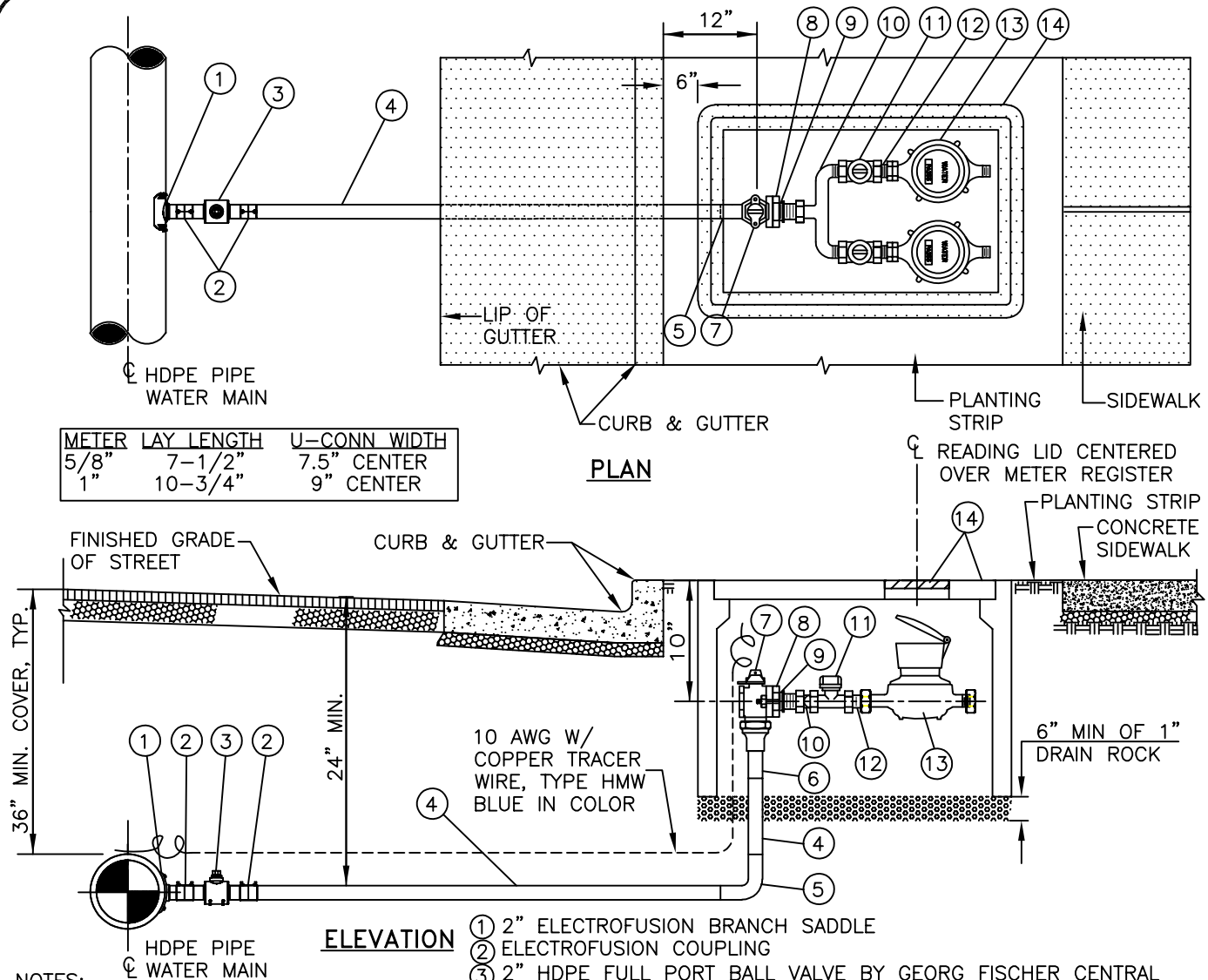


NOTES:

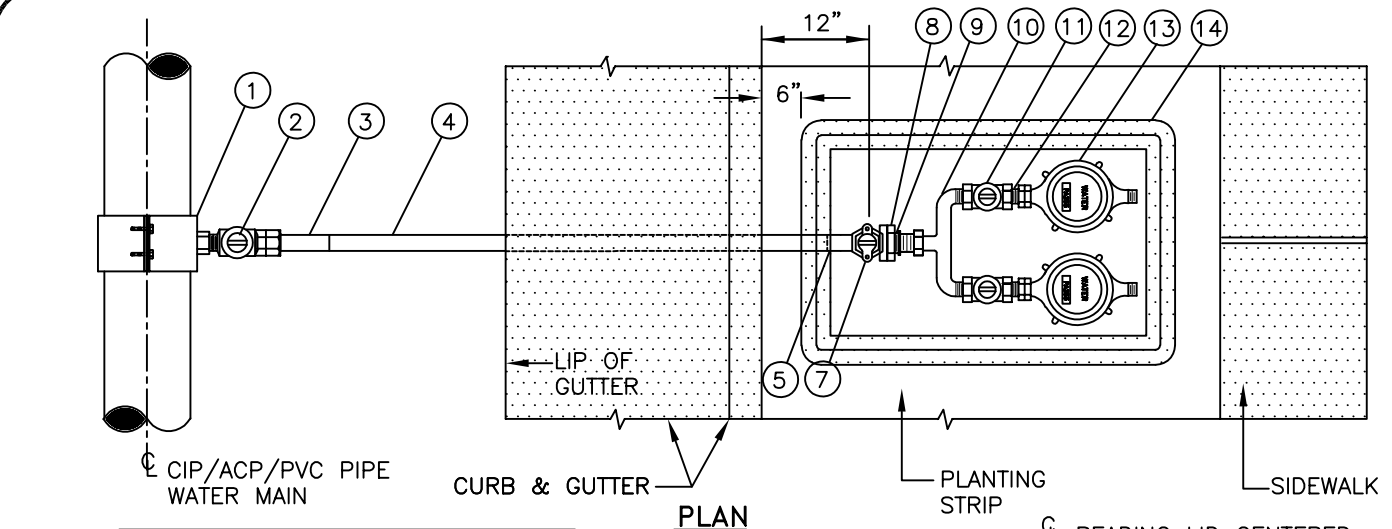
1. FOR WATER PIPE CONNECTION TO MAIN, SEE STANDARD DETAIL WD-03A.
2. BYPASS LINE SERVICE SADDLE CLAMPS FOR DIP LINE SHALL BE MUELLER BR2B BRONZE SERIES WITH DOUBLE STRAP.
3. 2" BALL STRAIGHT CURB VALVE SHALL BE MUELLER B-20287N, OR APPROVED EQUAL. 4" AND 6" GATE VALVES SHALL BE MUELLER A-2361 SERIES, OR APPROVED EQUAL.
4. WATER METERS SHALL NOT BE INSTALLED MORE THAN 4 FEET DEEP.
5. CUSTOMER TO SUPPLY, INSTALL, AND MAINTAIN VAULT TO GRADE PER CITY SPECIFICATIONS.
6. VAULT SHALL BE LOCATED ON PRIVATE PROPERTY NEXT TO THE PROPERTY LINE IN A PUBLIC UTILITY EASEMENT.
7. 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: MAY 16, 2022 | SCALE: NONE |
| DRAWN | J.J. 09/91 | | <i>Silvia Santos</i> 50674 | DWG. NO. |
| CHECKED | J.J. 05/21 | | SILVIA LEE SANTOS ENGINEERING MANAGER | STD. WD-04 |
| REVIEWED | A.P. 05/21 | | REVISION: MAY 5, 2021 | APPENDIX B |

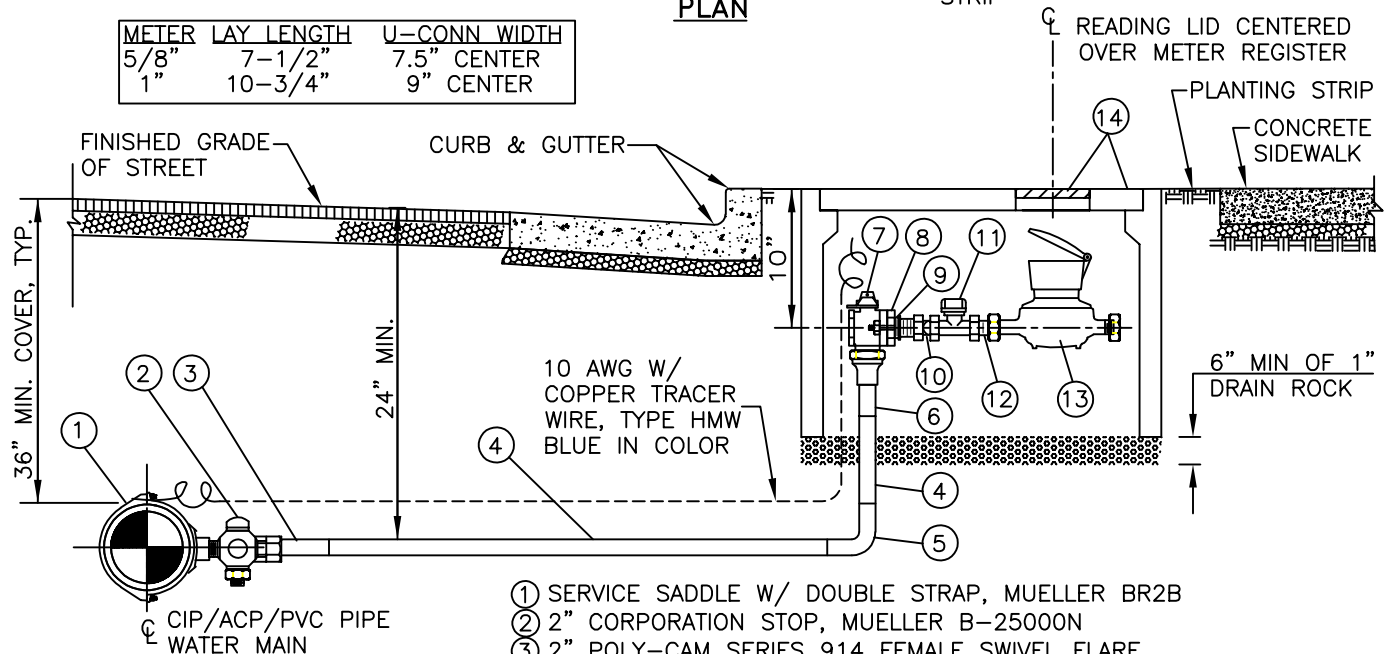
CITY OF PALO ALTO, CALIFORNIA



| | | | | |
|---------------|-------|--|--|----------------|
| BY | DATE | 2" HDPE WATER SERVICE (HDPE MAIN) WITH TWO 5/8" OR 1" METERS STANDARD DETAIL | APPROVED: MAY 16, 2022 | SCALE: NONE |
| DRAWN J.J. | 02/19 | | <i>Silvia Santos</i> 50674 | DWG. NO. |
| CHECKED P.L. | 05/22 | | SILVIA LEE SANTOS ENGINEERING MANAGER | STD. WD-05A |
| REVIEWED R.D. | 05/22 | | REVISION: MAY 16, 2022 | APPENDIX B |



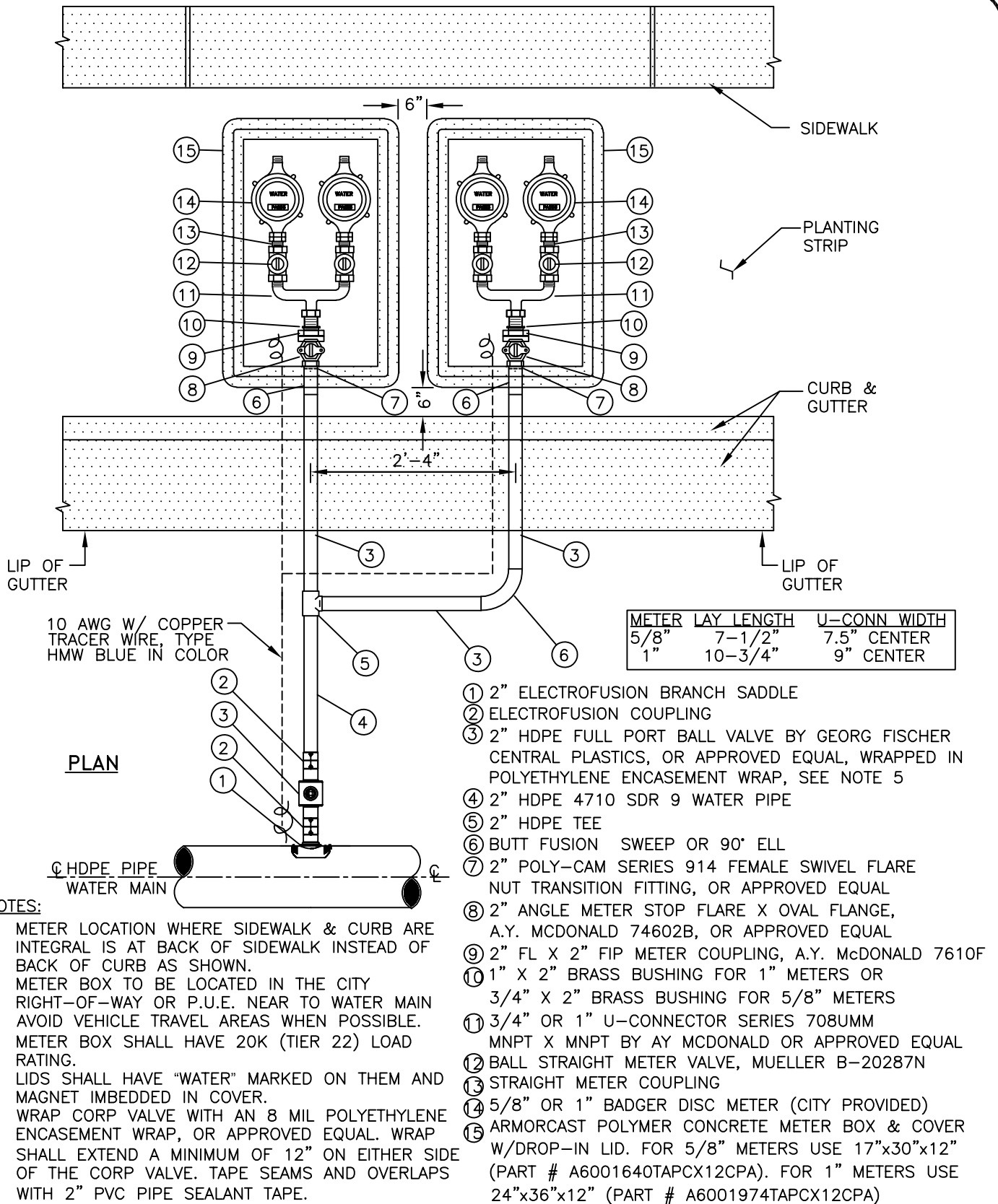
| METER | LAY LENGTH | U-CONN WIDTH |
|-------|------------|--------------|
| 5/8" | 7-1/2" | 7.5" CENTER |
| 1" | 10-3/4" | 9" CENTER |



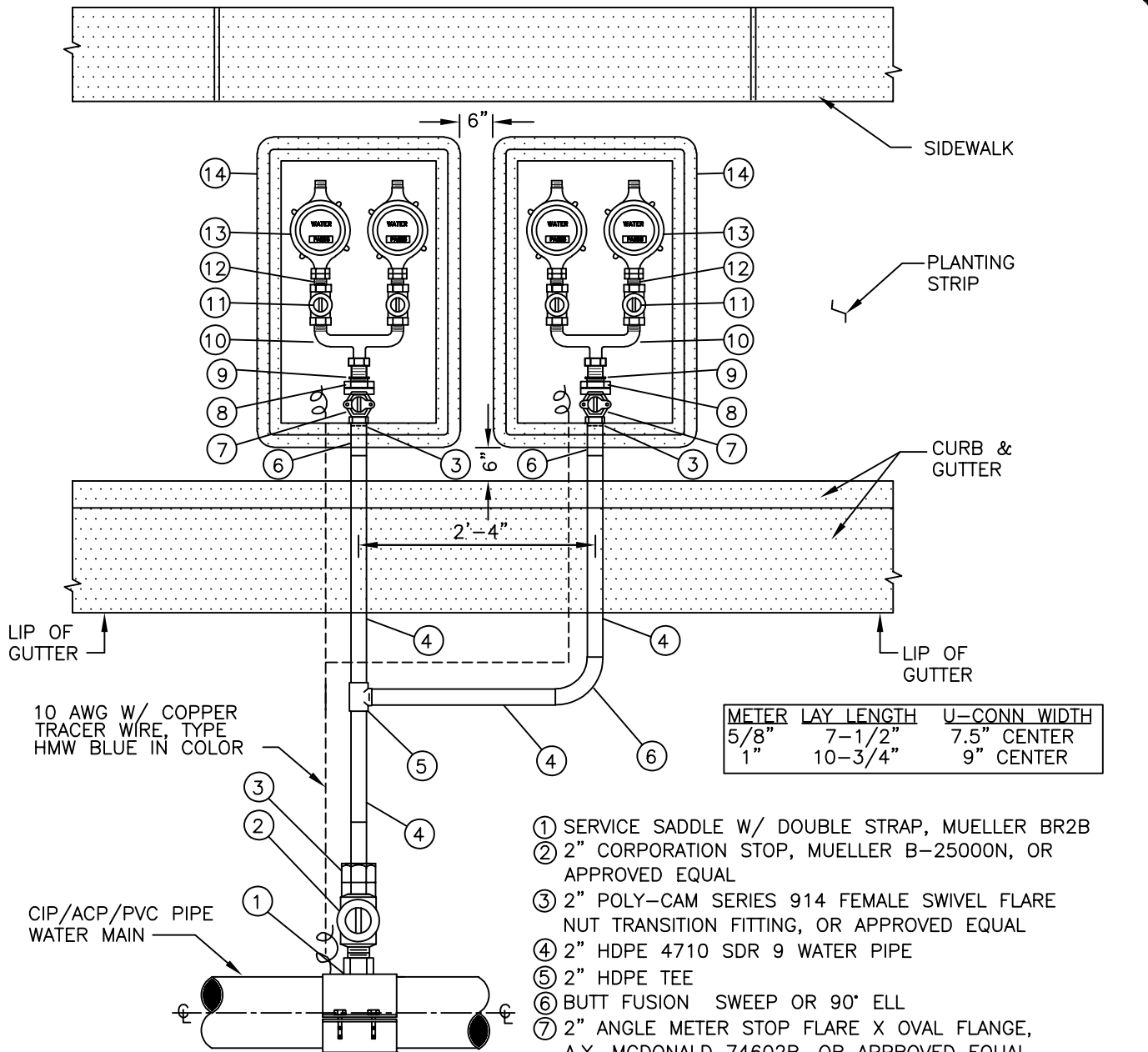
NOTES:

- 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. 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
- 2" POLY-CAM SERIES 914 FEMALE SWIVEL FLARE NUT TRANSITION FITTING, OR APPROVED EQUAL
- 2" HDPE 4710 SDR 9 WATER PIPE
- BUTT FUSION SWEEP OR 90° ELL
- 2" POLY-CAM SERIES 914 FEMALE SWIVEL FLARE NUT TRANSITION FITTING, OR APPROVED EQUAL
- 2" ANGLE METER STOP FLARE X OVAL FLANGE, A.Y. McDONALD 74602B
- 2" FL X 2" FIP METER COUPLING, A.Y. McDONALD 7610F
- 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 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" HDPE WATER SERVICE (NON-HDPE MAIN) WITH TWO 5/8" OR 1" METERS STANDARD DETAIL | APPROVED: MAY 16, 2022 | SCALE: NONE |
| DRAWN | J.J. 02/19 | | <i>Silvia Santos</i> 50674 | DWG. NO. |
| CHECKED | P.L. 05/22 | | SILVIA LEE SANTOS ENGINEERING MANAGER | STD. WD-05B |
| REVIEWED | R.D. 05/22 | | REVISION: MAY 16, 2022 | APPENDIX B |



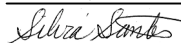
| | | | | |
|---------------|-------|--|--|----------------|
| BY | DATE | 2" WATER SERVICE MANIFOLD (HDPE MAIN) WITH TWO OR FOUR 5/8" OR 1" METERS STANDARD DETAIL | APPROVED: MAY 16, 2022 | SCALE: NONE |
| DRAWN J.J. | 02/19 | | <i>Silvia Lee Santos</i> 50674 | DWG. NO. |
| CHECKED P.L. | 05/22 | | SILVIA LEE SANTOS ENGINEERING MANAGER | STD. WD-06A |
| REVIEWED R.D. | 05/22 | | REVISION: MAY 16, 2022 | APPENDIX B |

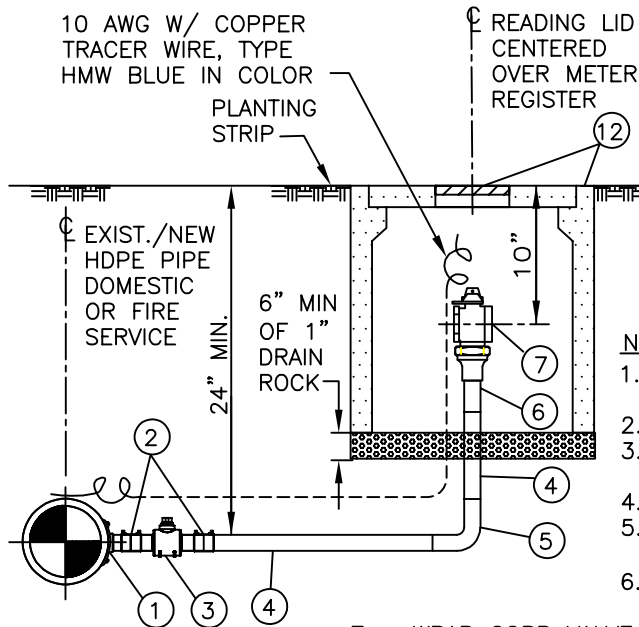
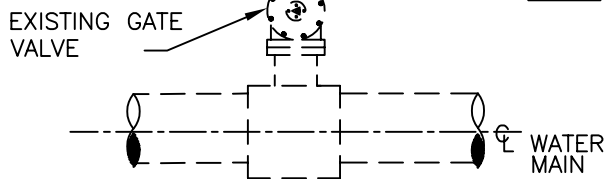
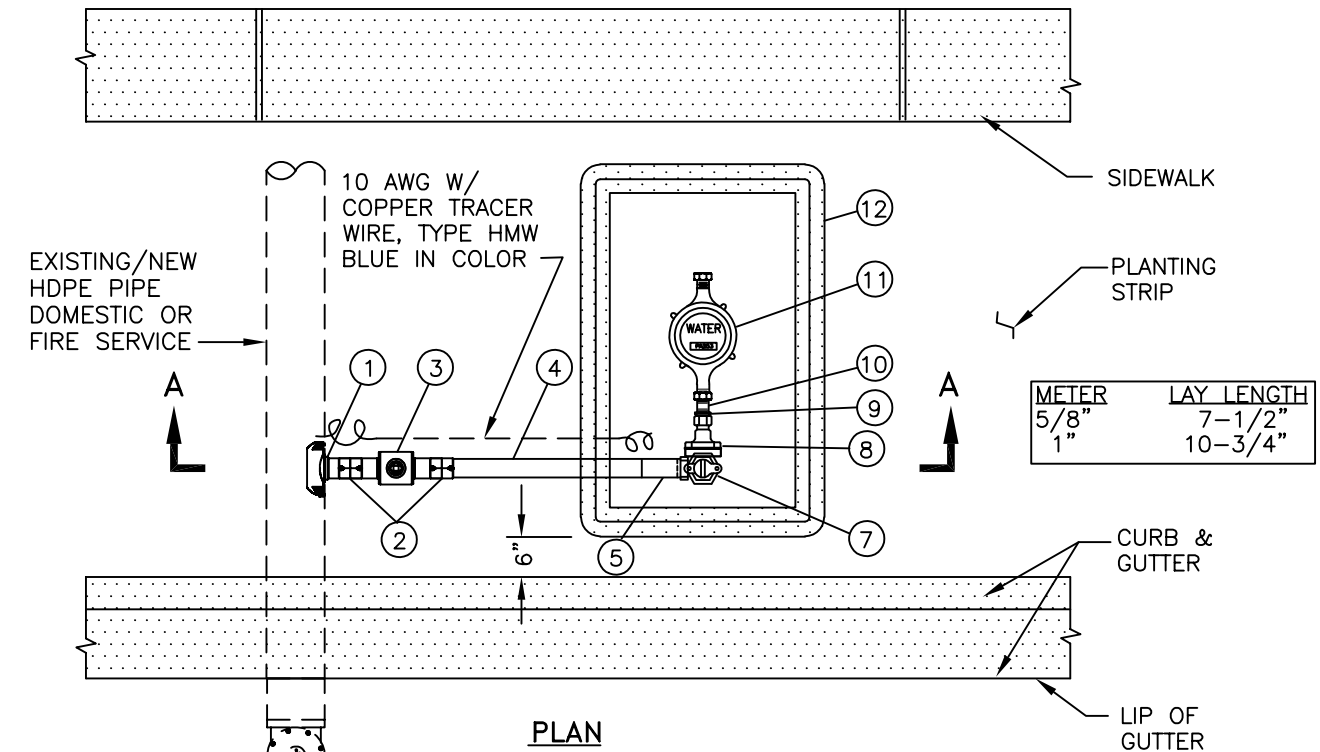


NOTES:

- 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. 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 FLARE X OVAL FLANGE, A.Y. McDONALD 74602B, OR APPROVED EQUAL
- 2" FL X 2" FIP METER COUPLING, A.Y. McDONALD 7610F
- 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: MAY 16, 2022 | SCALE: NONE |
| DRAWN J.J. | 02/19 | |  SILVIA LEE SANTOS ENGINEERING MANAGER | DWG. NO. STD. WD-06B |
| CHECKED P.L. | 05/22 | | | |
| REVIEWED R.D. | 05/22 | | REVISION: MAY 16, 2022 | APPENDIX B |
| | | CITY OF PALO ALTO, CALIFORNIA | | |

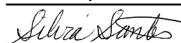


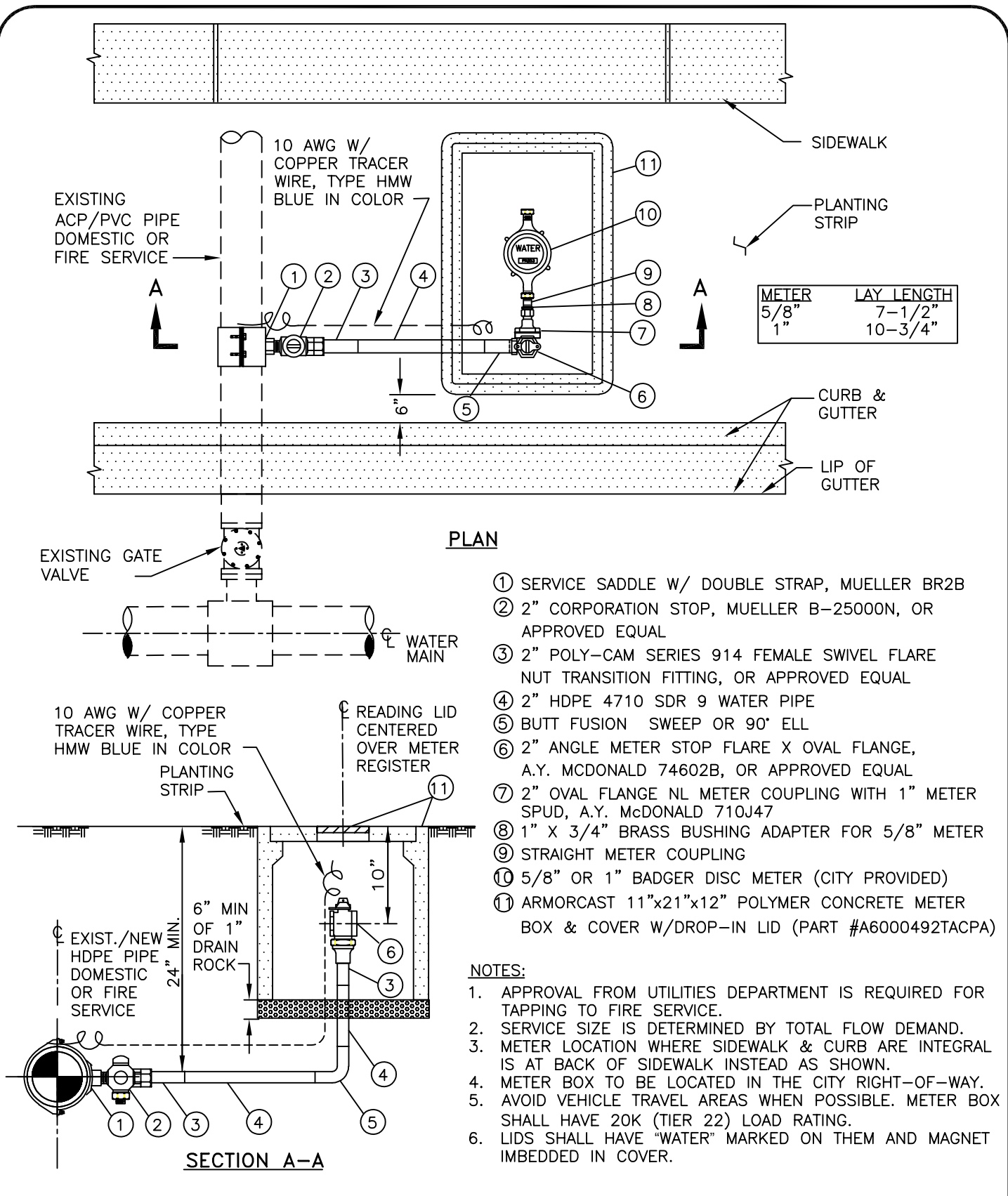
- ① 2" ELECTROFUSION BRANCH SADDLE
- ② ELECTROFUSION COUPLING
- ③ 2" HDPE FULL PORT BALL VALVE BY GEORG FISCHER CENTRAL PLASTICS, OR APPROVED EQUAL, WRAPPED IN POLYETHYLENE ENCASEMENT WRAP, SEE NOTE 7.
- ④ 2" HDPE 4710 SDR 9 WATER PIPE
- ⑤ BUTT FUSION SWEEP OR 90° ELL
- ⑥ 2" POLY-CAM SERIES 914 FEMALE SWIVEL FLARE NUT TRANSITION FITTING, OR APPROVED EQUAL
- ⑦ 2" ANGLE METER STOP FLARE X OVAL FLANGE, A.Y. McDONALD 74602B, OR APPROVED EQUAL
- ⑧ 2" OVAL FLANGE NL METER COUPLING WITH 1" METER SPUD, A.Y. McDONALD 710J47
- ⑨ 1" X 3/4" BRASS BUSHING ADAPTER 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:

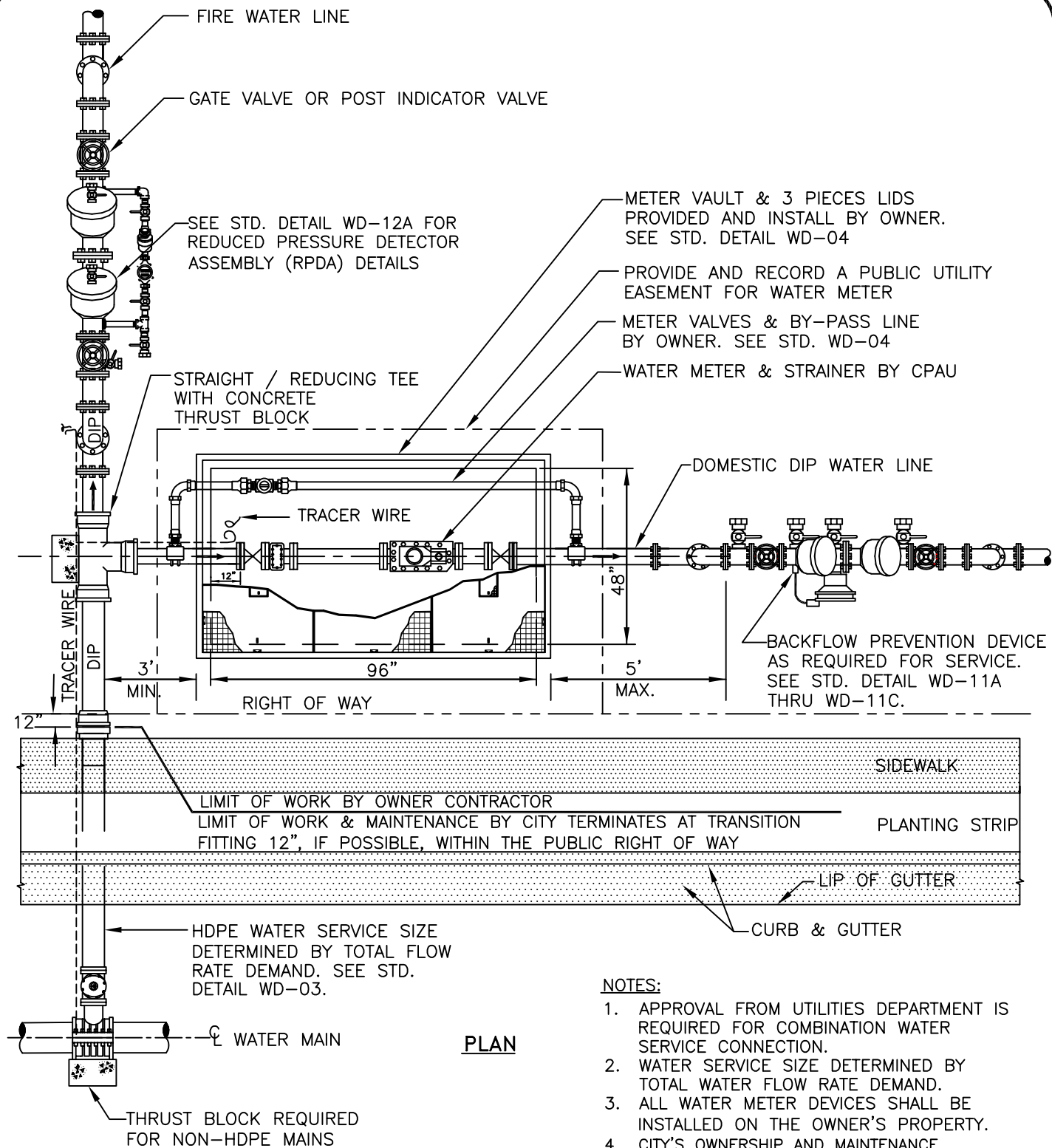
1. APPROVAL FROM UTILITIES DEPARTMENT IS REQUIRED FOR TAPPING TO FIRE SERVICE.
2. SERVICE SIZE IS DETERMINED BY TOTAL FLOW DEMAND.
3. METER LOCATION WHERE SIDEWALK & CURB ARE INTEGRAL IS AT BACK OF SIDEWALK INSTEAD AS SHOWN.
4. METER BOX TO BE LOCATED IN THE CITY RIGHT-OF-WAY.
5. AVOID VEHICLE TRAVEL AREAS WHEN POSSIBLE. METER BOX SHALL HAVE 20K (TIER 22) LOAD RATING.
6. LIDS SHALL HAVE "WATER" MARKED ON THEM AND MAGNET IMBEDDED IN COVER.
7. WRAP CORP VALVE WITH AN 8 MIL POLYETHYLENE ENCASEMENT WRAP, OR APPROVED EQUAL. WRAP SHALL EXTEND A MINIMUM OF 12" ON EITHER SIDE OF THE CORP VALVE. TAPE SEAMS AND OVERLAPS WITH 2" PVC PIPE SEALANT TAPE.

SECTION A-A

| | | | | |
|---------------|-------|---|---|-------------------------|
| BY | DATE | 2" HDPE WATER SERVICE TAP HDPE DOMESTIC OR FIRE SERVICE STANDARD DETAIL | APPROVED: MAY 16, 2022 | SCALE: NONE |
| DRAWN J.J. | 02/19 | |  SILVIA LEE SANTOS ENGINEERING MANAGER | DWG. NO. STD. WD-07A |
| CHECKED P.L. | 05/22 | | | |
| REVIEWED R.D. | 05/22 | | REVISION: MAY 16, 2022 | APPENDIX B |
| | | CITY OF PALO ALTO, CALIFORNIA | | |



| | | | | |
|---------------|-------|--|---|-------------------------|
| BY | DATE | 2" HDPE WATER SERVICE TAP EXISTING NON-HDPE FIRE SERVICE STANDARD DETAIL | APPROVED: MAY 16, 2022 | SCALE: NONE |
| DRAWN J.J. | 02/19 | |  SILVIA LEE SANTOS ENGINEERING MANAGER | DWG. NO. STD. WD-07B |
| CHECKED P.L. | 05/22 | | | |
| REVIEWED R.D. | 05/22 | | REVISION: MAY 16, 2022 | APPENDIX B |
| | | CITY OF PALO ALTO, CALIFORNIA | | |

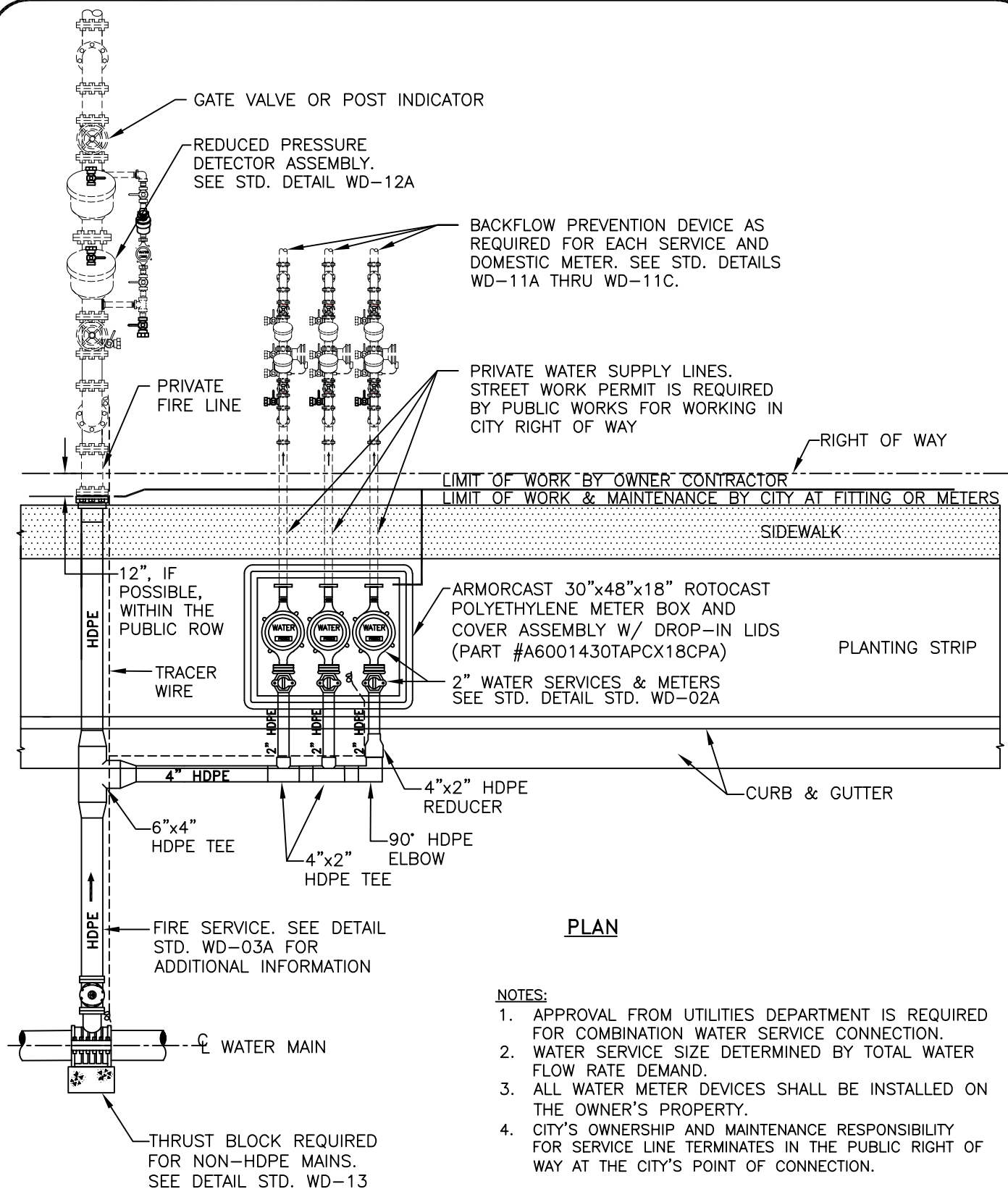


PLAN

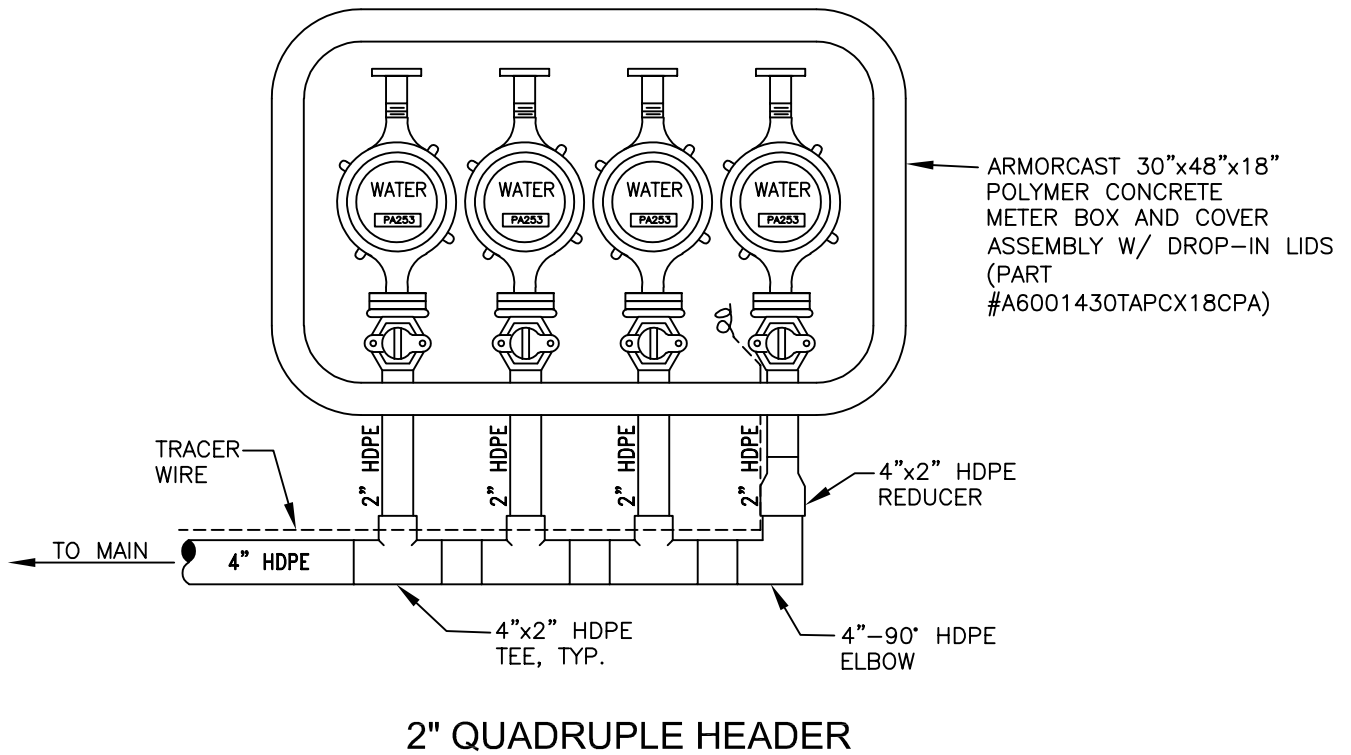
NOTES:

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 METER DEVICES SHALL BE INSTALLED ON THE OWNER'S PROPERTY.
4. CITY'S OWNERSHIP AND MAINTENANCE RESPONSIBILITY FOR SERVICE LINE TERMINATES IN THE PUBLIC RIGHT OF WAY AT THE CITY'S POINT OF CONNECTION.

| | | | | |
|---------------|-------|--|---|----------------|
| BY | DATE | COMBINATION FIRE/DOMESTIC WATER SERVICE CONNECTION STANDARD DETAIL | APPROVED: MAY 16, 2022 | SCALE: NONE |
| DRAWN J.J. | 9/92 | | <i>Silvia Lee Santos</i> | DWG. NO. |
| CHECKED J.J. | 05/21 | | SILVIA LEE SANTOS 50674 ENGINEERING MANAGER R.E. NO. | STD. WD-08 |
| REVIEWED A.P. | 05/21 | | REVISION: MAY 5, 2021 | APPENDIX B |
| | | CITY OF PALO ALTO, CALIFORNIA | | |

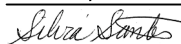


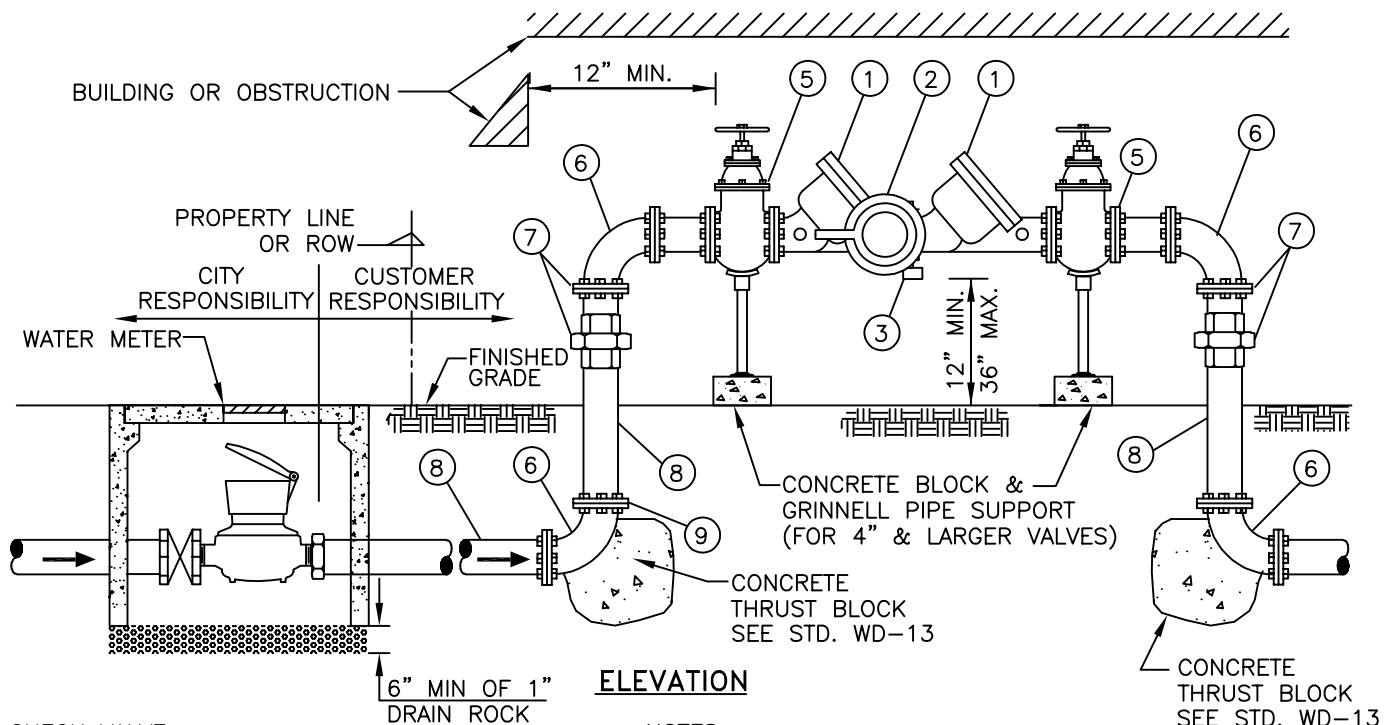
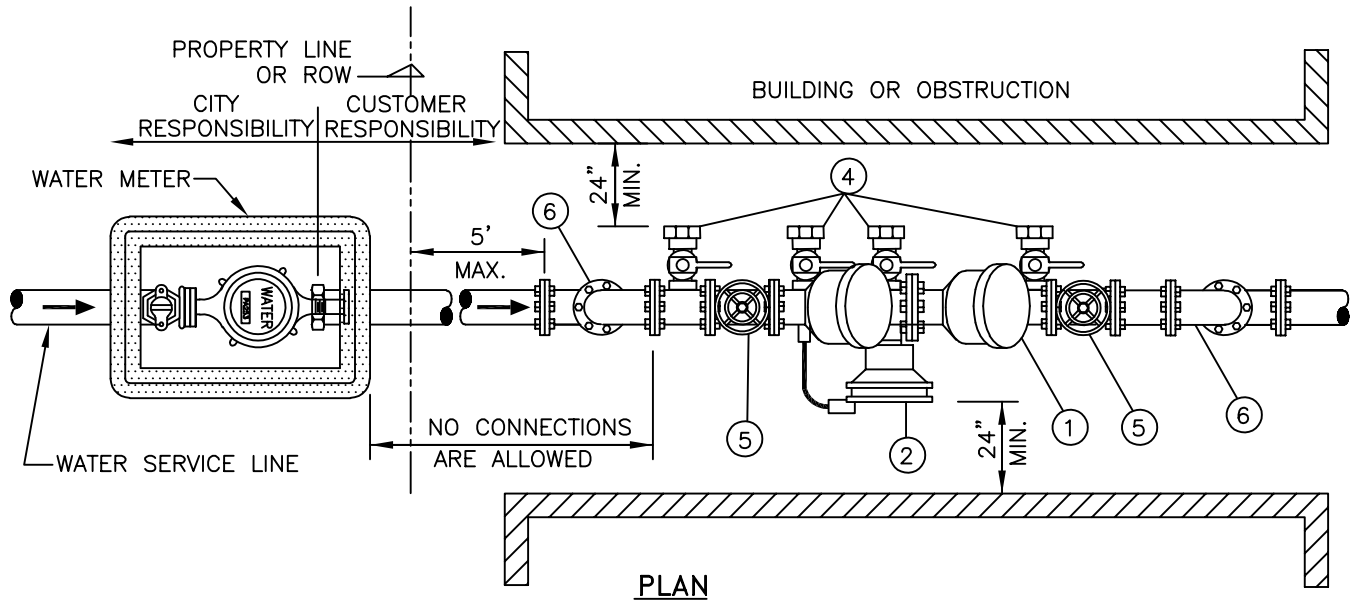
| | | | | |
|---------------|-------|---|--|----------------|
| BY | DATE | COMBINATION FIRE/DOMESTIC WATER SERVICE CONNECTION (MULTIPLE METERS) STANDARD DETAIL | APPROVED: MAY 16, 2022 | SCALE: NONE |
| DRAWN R.E. | 6/97 | | <i>Silvia Santos</i> 50674 | DWG. NO. |
| CHECKED J.J. | 05/21 | | SILVIA LEE SANTOS ENGINEERING MANAGER | STD. WD-09 |
| REVIEWED A.P. | 05/21 | | REVISION: MAY 5, 2021 | 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 22 RATING FOR ALL APPLICATIONS. METER BOXES NOT TO BE INSTALLED IN STREET.

| | | | | | |
|----------|------|-------|--|---|----------------|
| BY | | DATE | ARMORCAST METER BOX (30"x48") WITH MULTIPLE HEADERS STANDARD DETAIL | APPROVED: MAY 16, 2022 | SCALE: NONE |
| DRAWN | R.E. | 6/97 | |  SILVIA LEE SANTOS ENGINEERING MANAGER | DWG. NO. |
| CHECKED | J.J. | 02/20 | | 50674 R.E. NO. | STD. WD-10 |
| REVIEWED | R.I. | 02/20 | | REVISION: MAY 5, 2021 | APPENDIX B |

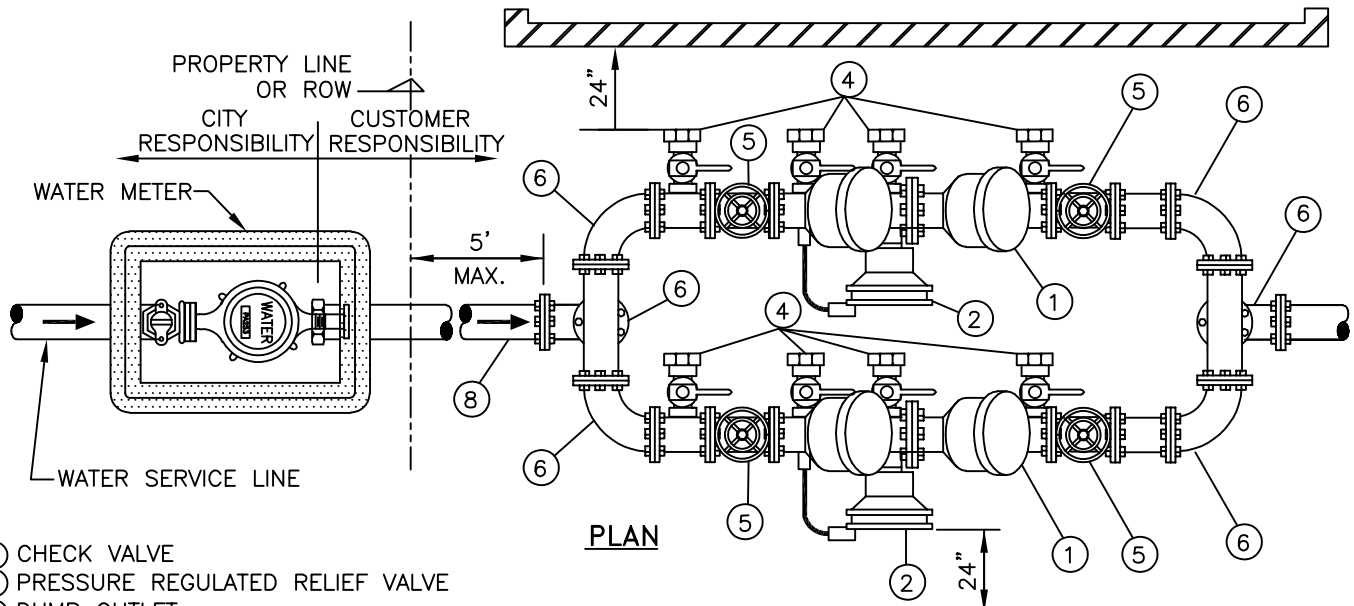


- ① CHECK VALVE
- ② PRESSURE REGULATED RELIEF VALVE
- ③ DUMP OUTLET
- ④ TEST COCK WITH CAP, 4 REQUIRED
- ⑤ GATE VALVE OR BALL VALVE
- ⑥ 90° BEND, FLANGED
- ⑦ FLANGE OR UNION
- ⑧ DUCTILE IRON OR COPPER PIPE
- ⑨ BURIED JOINTS, FLANGES & CORTEN BOLTS OR MEGALUGS SHALL BE PLASTIC WRAPPED

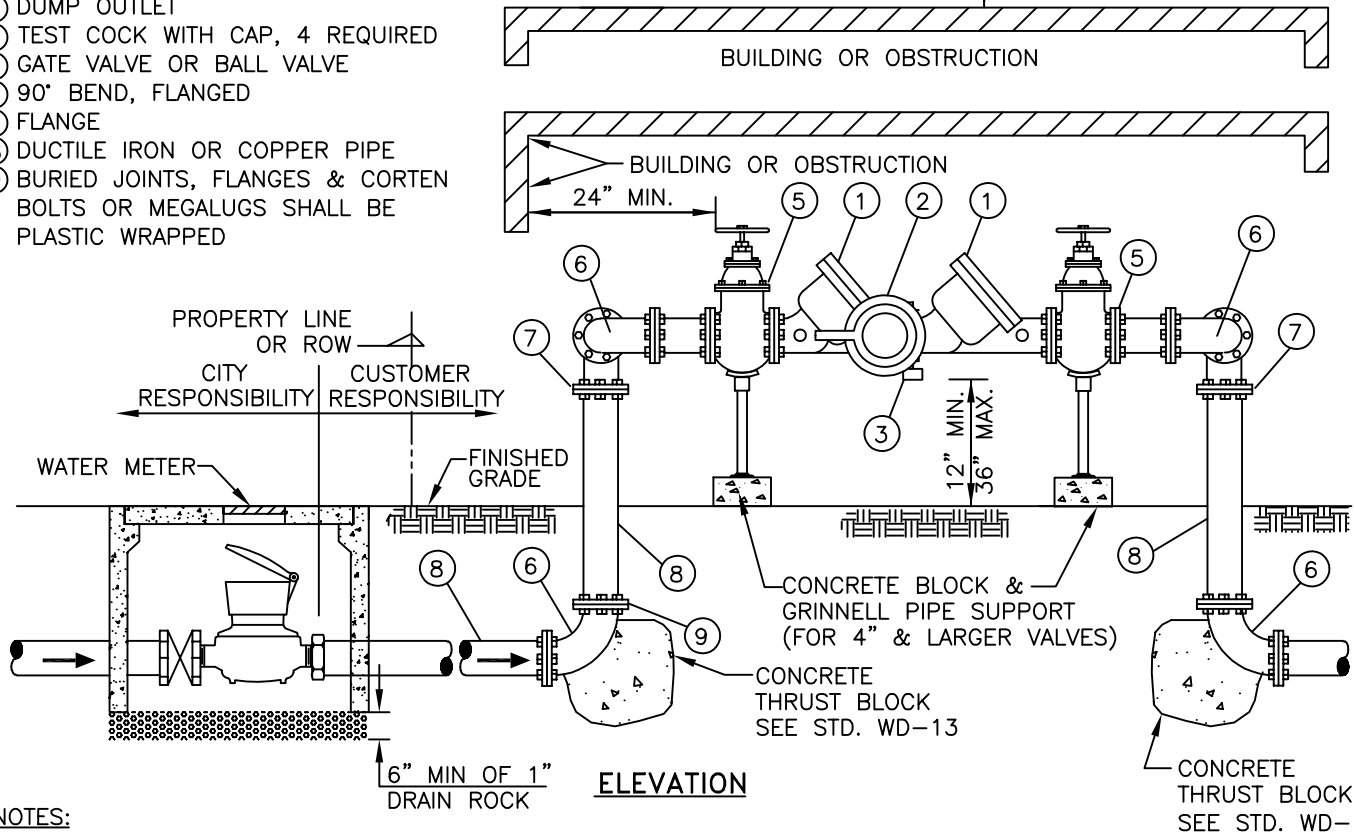
NOTES:

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: MAY 16, 2022 | 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 R.E. NO. | STD. WD-11A |
| REVIEWED R.I. | 02/20 | | REVISION: MAY 5, 2021 | APPENDIX B |
| | | CITY OF PALO ALTO, CALIFORNIA | | |



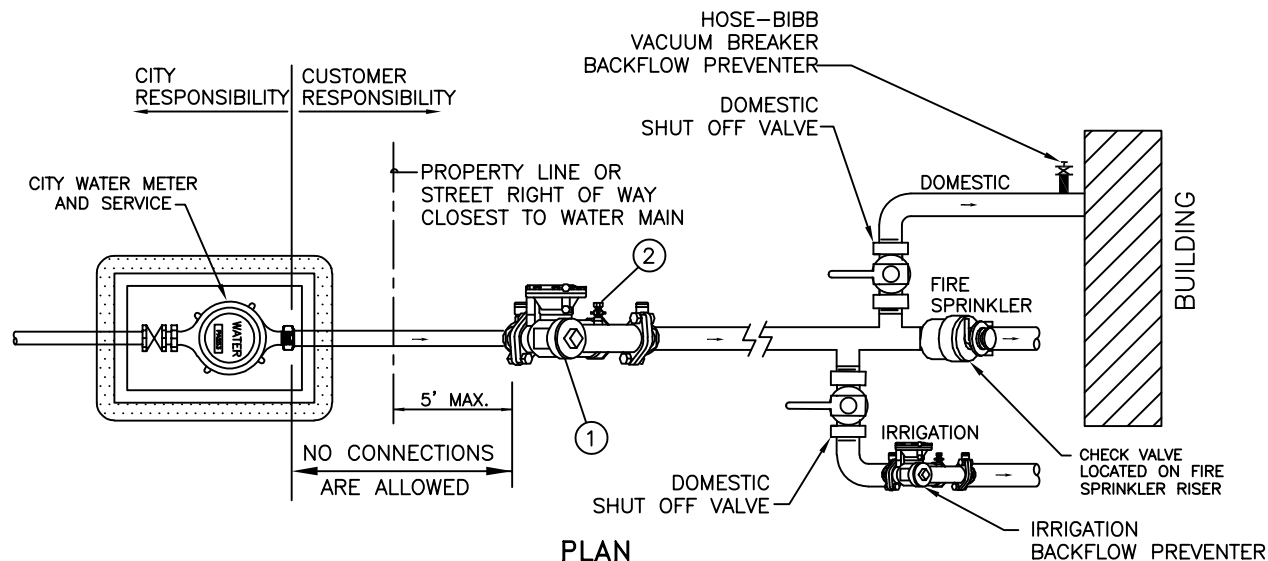
- ① CHECK VALVE
- ② PRESSURE REGULATED RELIEF VALVE
- ③ DUMP OUTLET
- ④ TEST COCK WITH CAP, 4 REQUIRED
- ⑤ GATE VALVE OR BALL VALVE
- ⑥ 90° BEND, FLANGED
- ⑦ FLANGE
- ⑧ DUCTILE IRON OR COPPER PIPE
- ⑨ BURIED JOINTS, FLANGES & CORTEN BOLTS OR MEGALUGS SHALL BE PLASTIC WRAPPED



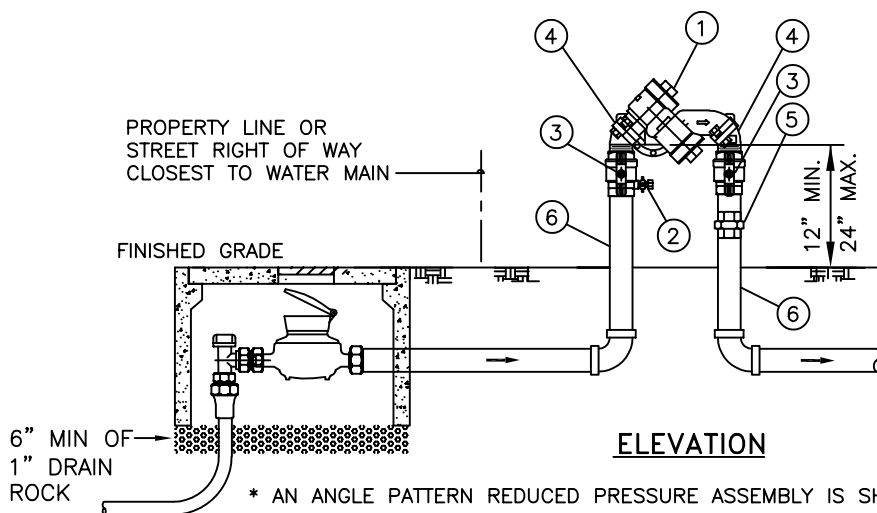
NOTES:

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 CITY OF PALO ALTO, CALIFORNIA | APPROVED: MAY 16, 2022 <i>Silvia Santos</i> SILVIA LEE SANTOS ENGINEERING MANAGER | SCALE: NONE |
| DRAWN J.J. | 02/19 | | 50674 R.E. NO. | DWG. NO. STD. WD-11B |
| CHECKED J.J. | 02/20 | | REVISION: MAY 5, 2021 | APPENDIX B |
| REVIEWED R.I. | 02/20 | | | |



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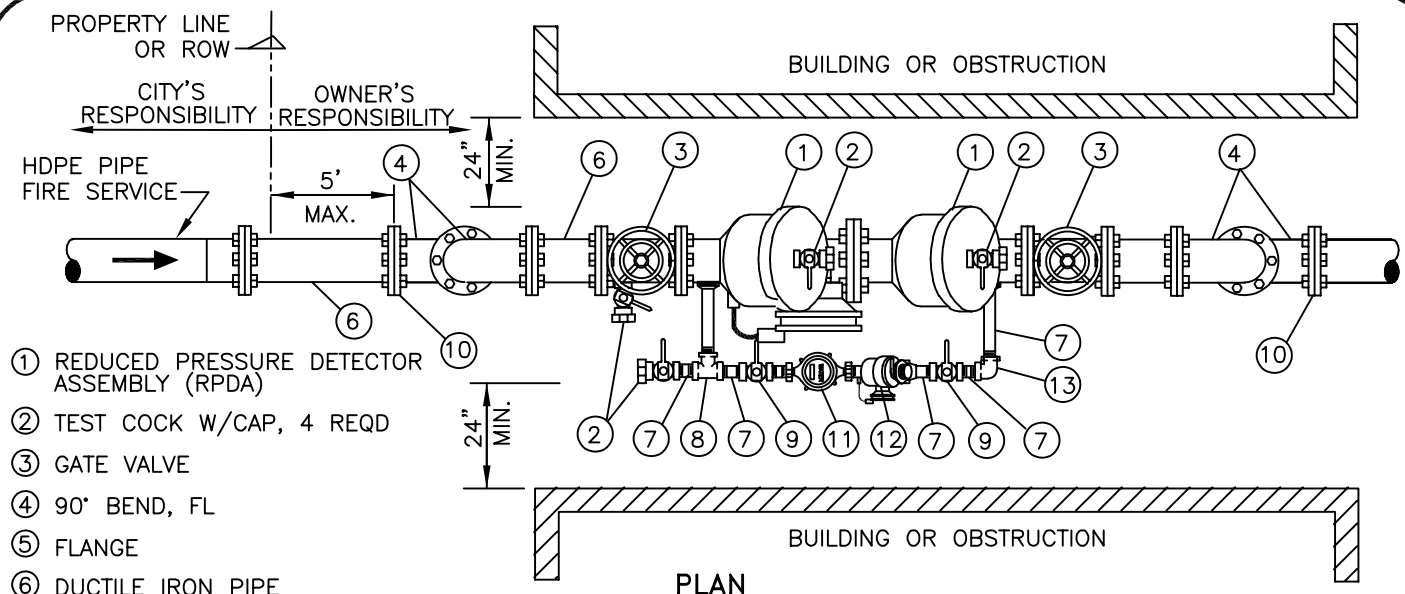
ELEVATION

- 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

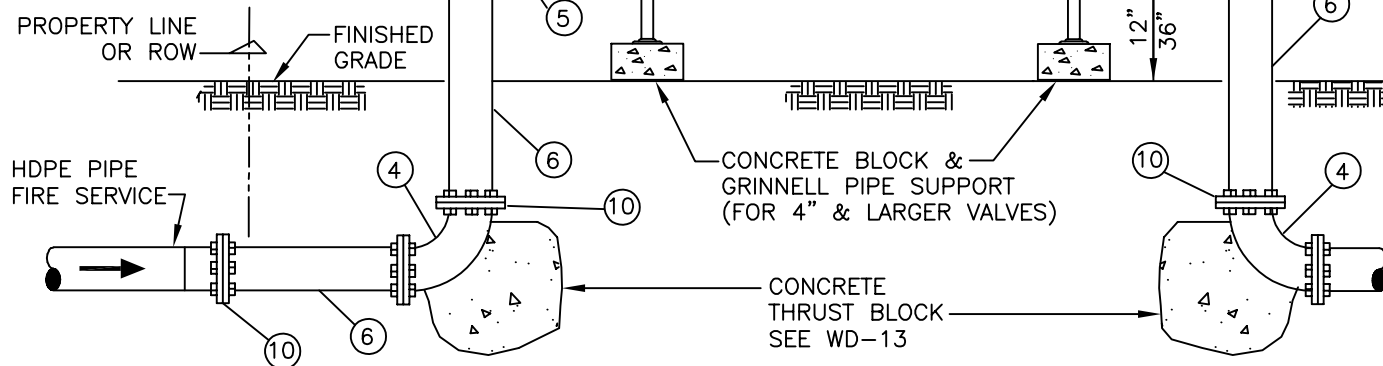
NOTES:

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: MAY 16, 2022 | SCALE: NONE |
| DRAWN J.J. | 7/16 | | <i>Silvia Lee Santos</i> | DWG. NO. |
| CHECKED J.J. | 02/20 | | SILVIA LEE SANTOS ENGINEERING MANAGER | STD. WD-11C |
| REVIEWED R.I. | 02/20 | | REVISION: MAY 5, 2021 | APPENDIX B |



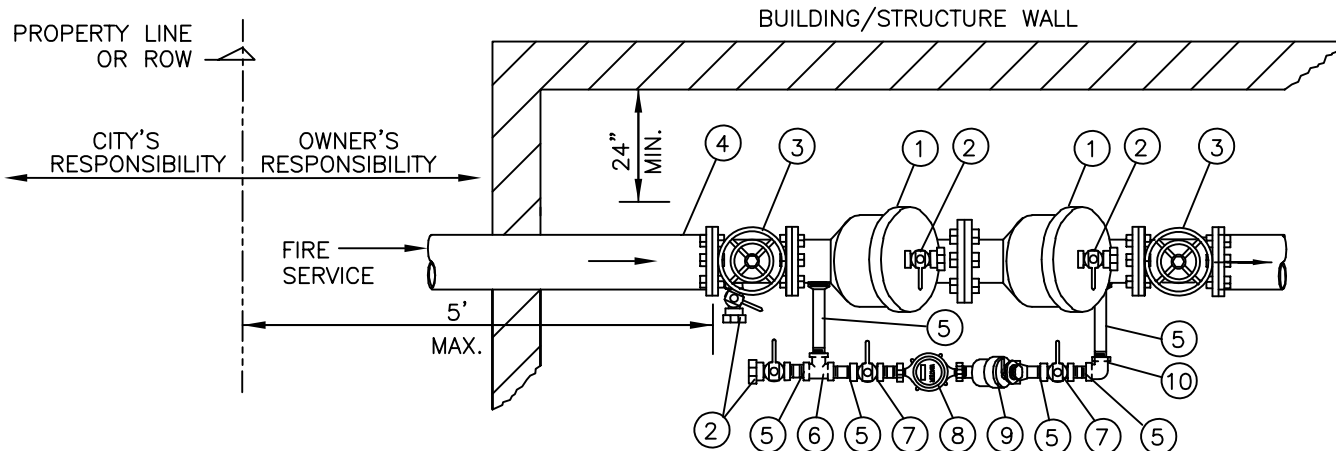
- ① REDUCED PRESSURE DETECTOR ASSEMBLY (RPDA)
- ② TEST COCK W/CAP, 4 REQD
- ③ GATE VALVE
- ④ 90° BEND, FL
- ⑤ FLANGE
- ⑥ DUCTILE IRON PIPE
- ⑦ 3/4" BRASS NIPPLE TO SUIT
- ⑧ 3/4" TEE, BRASS
- ⑨ FULL PORT BALL VALVE
- ⑩ BURIED JOINTS TO BE PLASTIC WRAPPED FLANGE & CORTEN BOLTS OR MEGALUG
- ⑪ 5/8"x3/4" DETECTOR METER & COUPLINGS. (FURNISHED BY CITY)
- ⑫ 3/4" REDUCED PRESSURE DETECTOR ASSEMBLY (RPDA)
- ⑬ 3/4" 90° ELBOW, BRASS



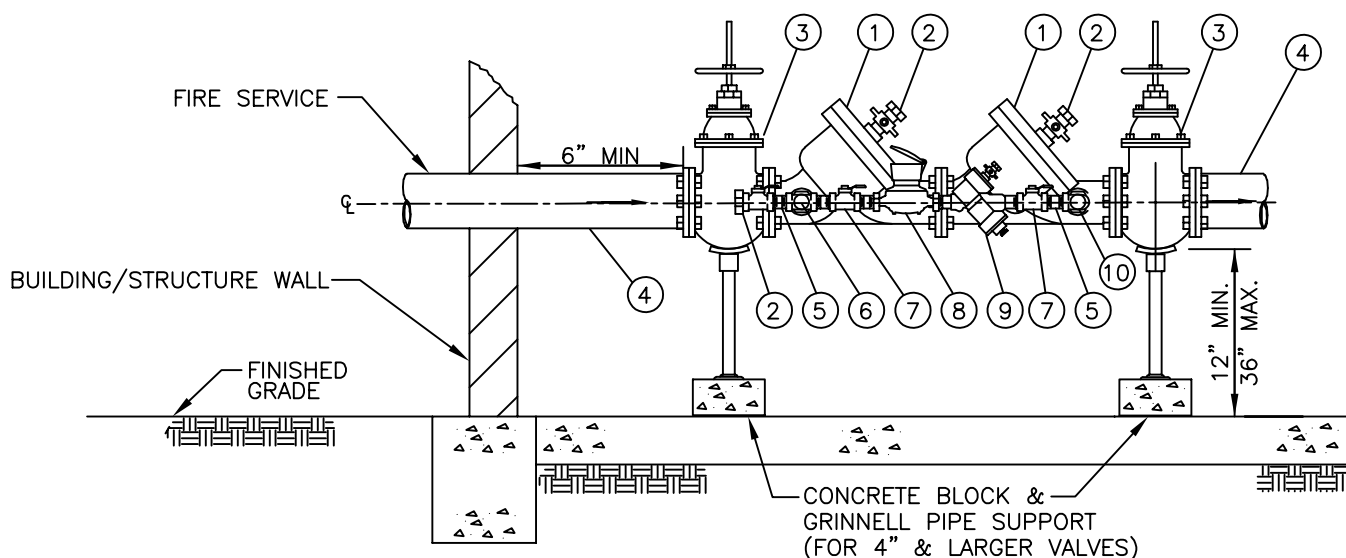
NOTES:

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 | APPROVED: MAY 16, 2022 | SCALE: NONE |
| DRAWN J.J. | 9/92 | | <i>Silvia Lee Santos</i> 50674 | DWG. NO. |
| CHECKED J.J. | 02/20 | | SILVIA LEE SANTOS ENGINEERING MANAGER | STD. WD-12A |
| REVIEWED R.I. | 02/20 | | REVISION: MAY 5, 2021 | APPENDIX B |



PLAN



ELEVATION

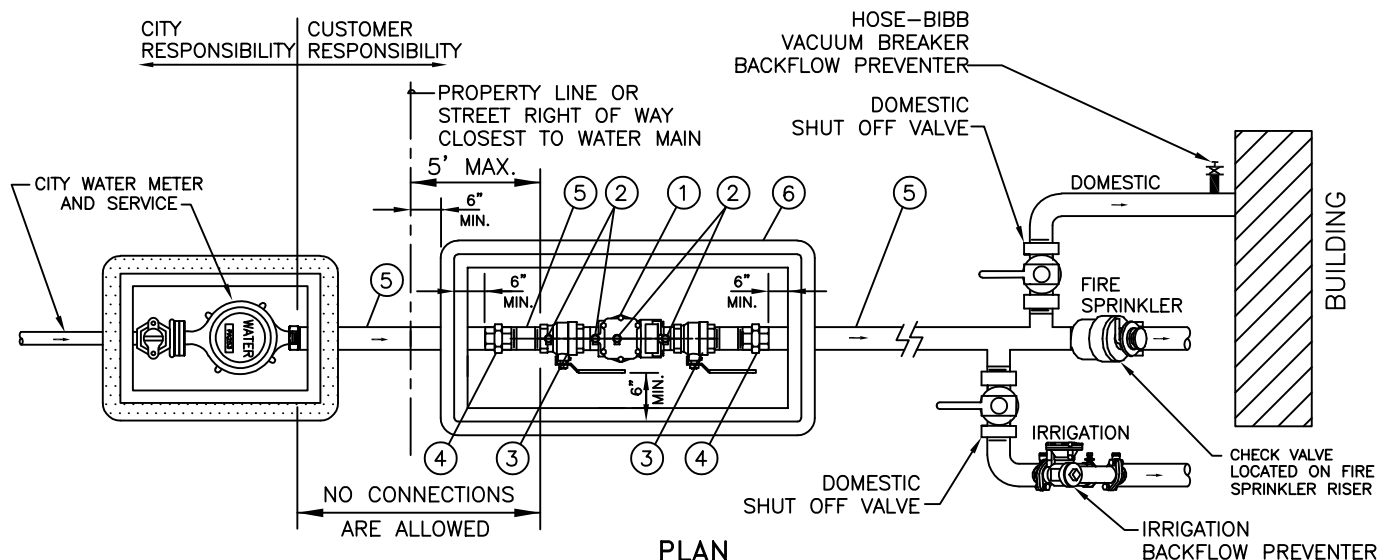
- ① REDUCED PRESSURE DETECTOR ASSEMBLY (RPDA)
- ② TEST COCK WITH CAP, 4 REQUIRED
- ③ GATE VALVE
- ④ DUCTILE IRON PIPE
- ⑤ 3/4" BRASS NIPPLE TO SUIT
- ⑥ 3/4" TEE, BRASS
- ⑦ FULL PORT BALL VALVE
- ⑧ 5/8"x3/4" DETECTOR METER & COUPLINGS. (FURNISHED BY CITY)
- ⑨ REDUCED PRESSURE DETECTOR ASSEMBLY (RPDA)
- ⑩ 3/4" 90° BEND, BRASS

NOTES:

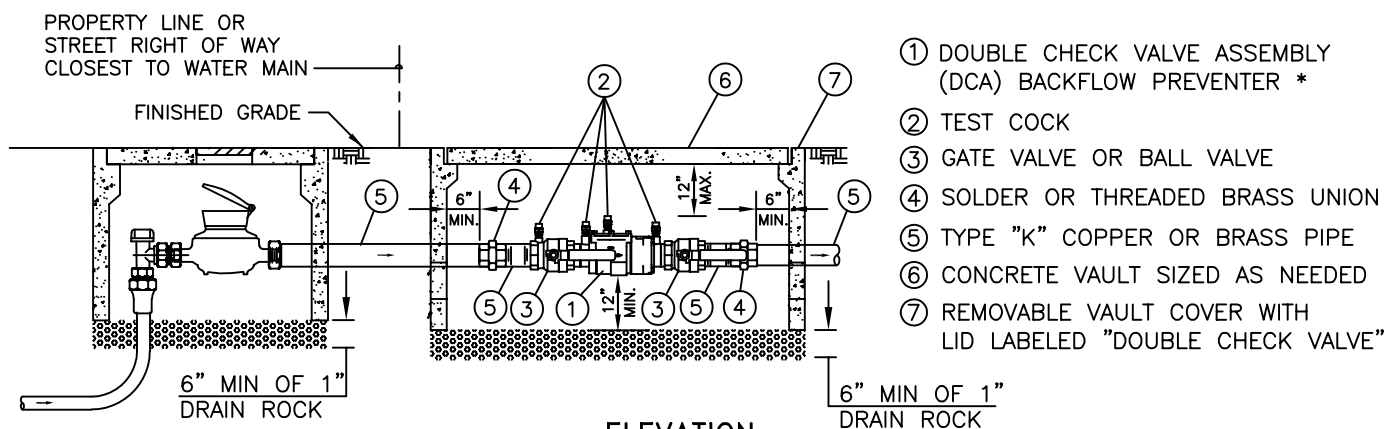
1. ALL RPDA DEVICES SHALL BE AS APPROVED BY USC FOUNDATION FOR CROSS-CONNECTION CONTROL AND HYDRAULIC RESEARCH, AND APPROVED BY WATER-GAS-WASTEWATER UTILITIES DEPARTMENT.
2. THE DEVICE SHALL BE INSTALLED ON THE OWNER'S PROPERTY, DIRECTLY BEHIND THE CITY-OWNED METER, WITHIN 5' OF THE PROPERTY LINE.
3. 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: MAY 16, 2022 | SCALE: NONE |
| DRAWN C.W. | 10/04 | | <i>Silvia Lee Santos</i> 50674 | DWG. NO. |
| CHECKED J.J. | 02/20 | | SILVIA LEE SANTOS R.E. NO. | STD. WD-12B |
| REVIEWED R.I. | 02/20 | | REVISION: MAY 5, 2021 | APPENDIX B |

CITY OF PALO ALTO, CALIFORNIA



PLAN



ELEVATION

* 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: MAY 16, 2022 | 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–12C |
| REVIEWED R.I. | 02/20 | | REVISION: MAY 5, 2021 | APPENDIX B |

THRUST BLOCK TABLE

| TYPE OF FITTING | | 90° BEND & BURIES | 45° BEND | 11 1/4' OR 22 1/2' BEND | TEE OR DEAD END | IN-LINE ANCHORING 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# |

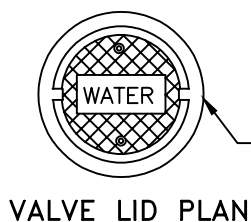
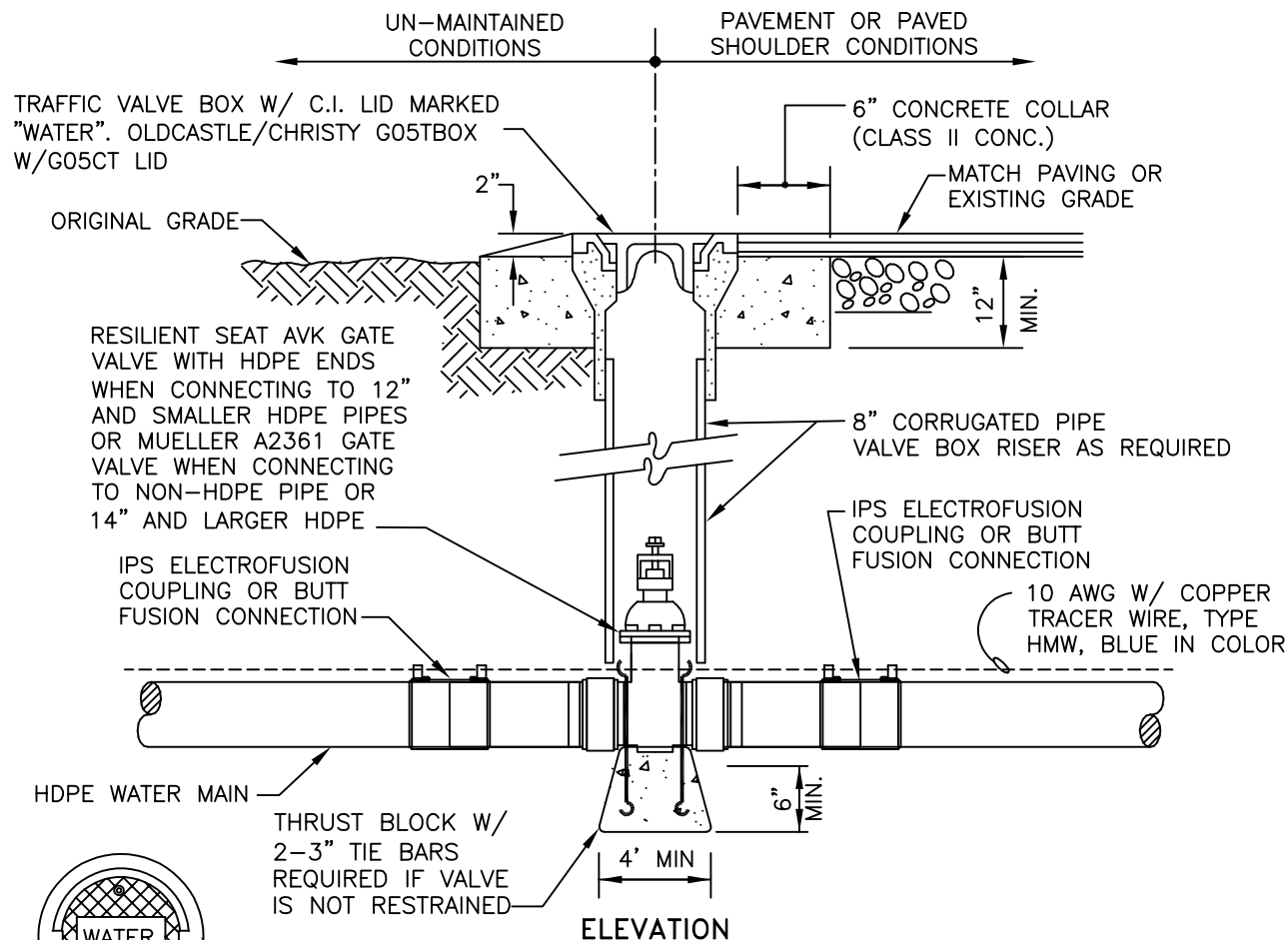
* MINIMUM TWO FLEX RESTRAINTS INSTALLED SYMMETRICALLY

** IN-LINE ANCHORING BEARING AREA IS EQUAL TO THE AREA OF DIMENSION "a" BY DIMENSION "c", AS SHOWN IN "THRUST BLOCK TABLE" IN DETAILS WD-17, WD-17A, AND WD-18.

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.
- IN-LINE ANCHORING SHALL BE INSTALLED ON HDPE PIPE CONNECTIONS TO EXISTING OR NEW UNRESTRAINED PIPES (I.E. ACP, PVC, AND DIP), OR IN-LINE ANCHORING SHALL BE INSTALLED ON VALVING WHEN IN-LINE ANCHORING IS REQUIRED TO RESTRAIN VALVES, AS SHOWN IN DETAIL WD-18.

| | | | | |
|---------------|-------|---|--|------------------------|
| BY | DATE | THRUST BLOCK TABLE STANDARD DETAIL | APPROVED: DECEMBER 20, 2023 | SCALE: NONE |
| DRAWN E.L. | 5/92 | | SILVIA LEE SANTOS ENGINEERING MANAGER | DWG. NO. STD. WD-13 |
| CHECKED P.L. | 12/23 | | 50674 R.E. NO. | |
| REVIEWED A.P. | 12/23 | CITY OF PALO ALTO, CALIFORNIA | REVISION: DECEMBER 20, 2023 | APPENDIX B |



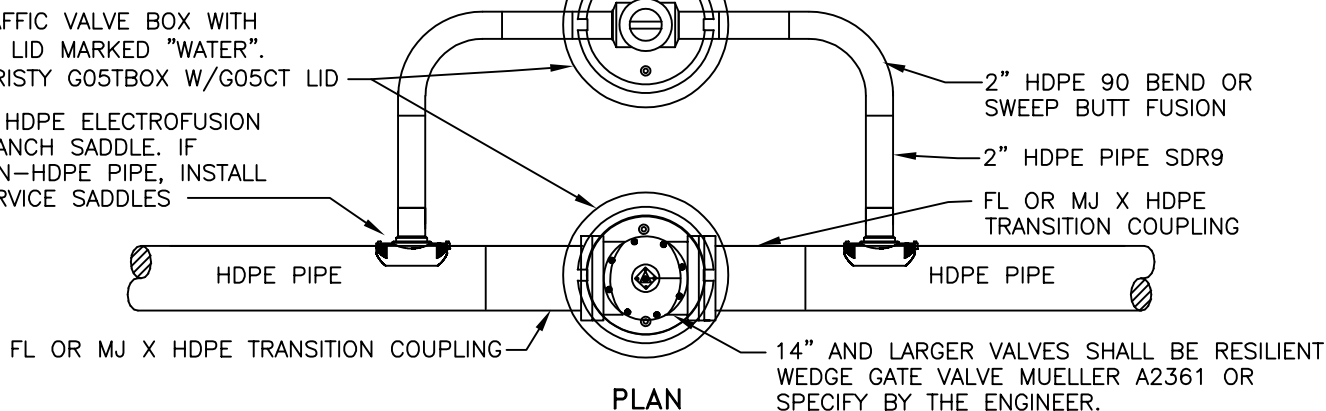
CAST IRON NON-LOCKING TYPE LID OLDCASTLE/CHRISTY G05CT

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

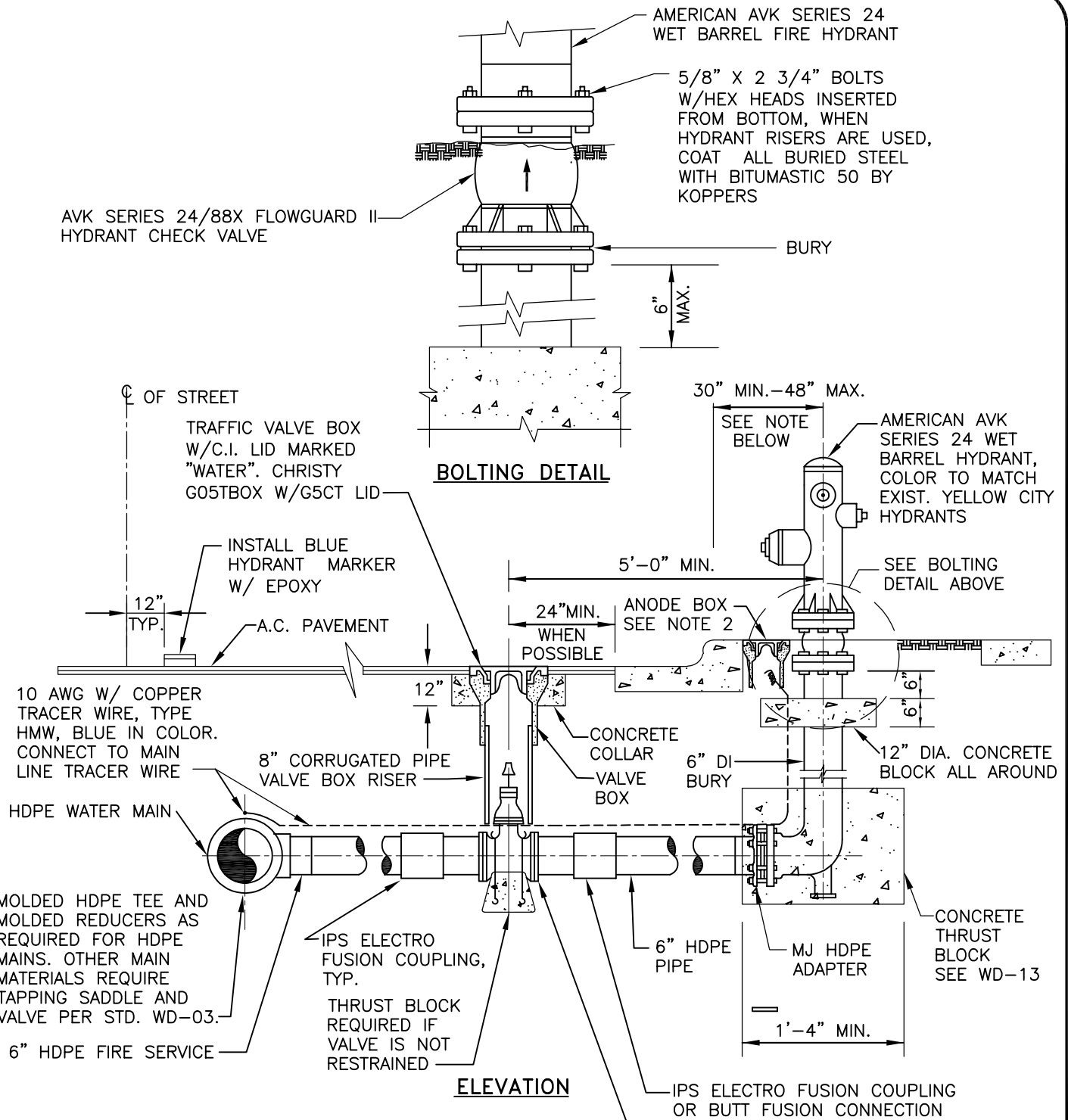


2" BYPASS FOR 14" AND LARGER VALVES *

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.

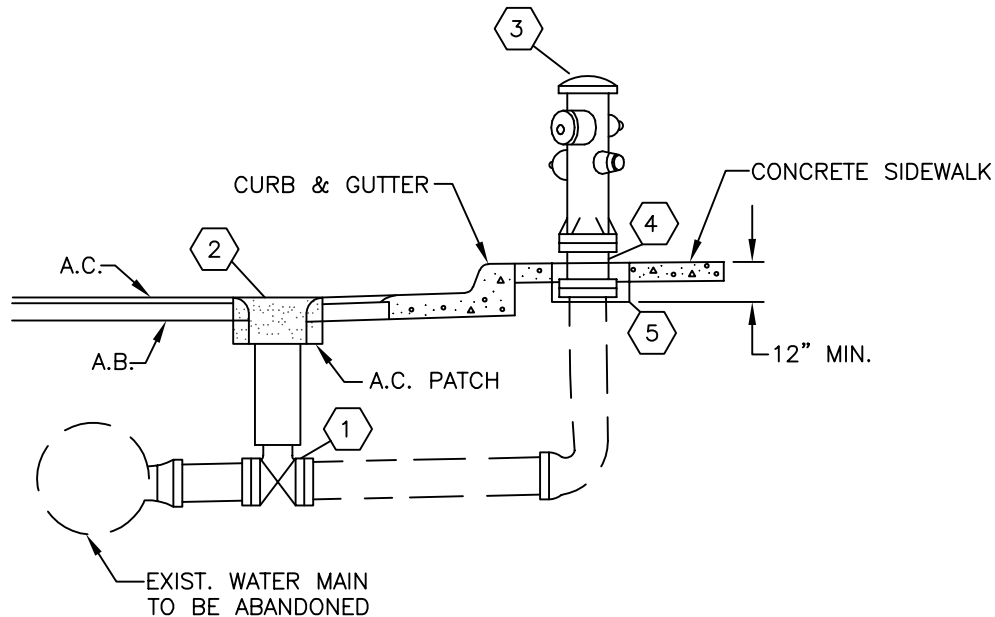
| | | | | |
|---------------|-------|--|--------------------------------|----------------|
| BY | DATE | GATE VALVE ASSEMBLY STANDARD DETAIL | APPROVED: MAY 16, 2022 | SCALE: NONE |
| DRAWN J.J. | 02/19 | | <i>Silvia Lee Santos</i> 50674 | DWG. NO. |
| CHECKED J.J. | 02/20 | | SILVIA LEE SANTOS R.E. NO. | STD. WD-14 |
| REVIEWED R.I. | 02/20 | | REVISION: MAY 5, 2021 | 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. INSTALL 5#-10# ANODE ON ALL ISOLATED TRACER WIRE SYSTEMS AS DIRECTED BY THE CITY.

| | | | | |
|-------------------------------|-------|--|----------------------------|----------------|
| BY | DATE | FIRE HYDRANT ASSEMBLY WITH HDPE PIPE STANDARD DETAIL | APPROVED: MAY 16, 2022 | SCALE: NONE |
| DRAWN A.P. | 07/09 | | <i>Silvia Santos</i> 50674 | DWG. NO. |
| CHECKED P.L. | 05/22 | | SILVIA LEE SANTOS R.E. NO. | STD. WD-15 |
| REVIEWED R.D. | 05/22 | | REVISION: MAY 16, 2022 | APPENDIX B |
| CITY OF PALO ALTO, CALIFORNIA | | | | |



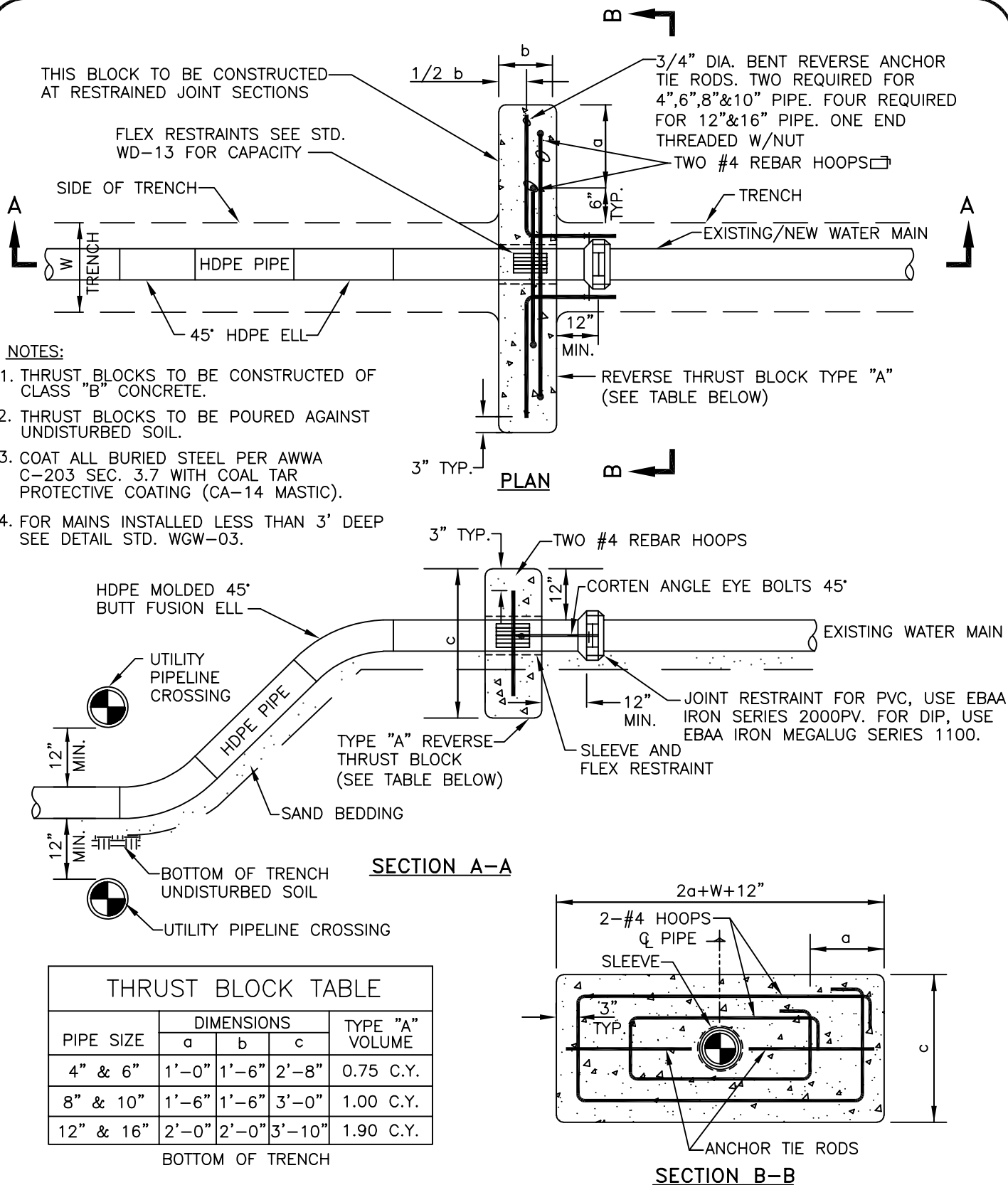
PROCEDURE FOR FIRE HYDRANT ABANDONMENT

- 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.

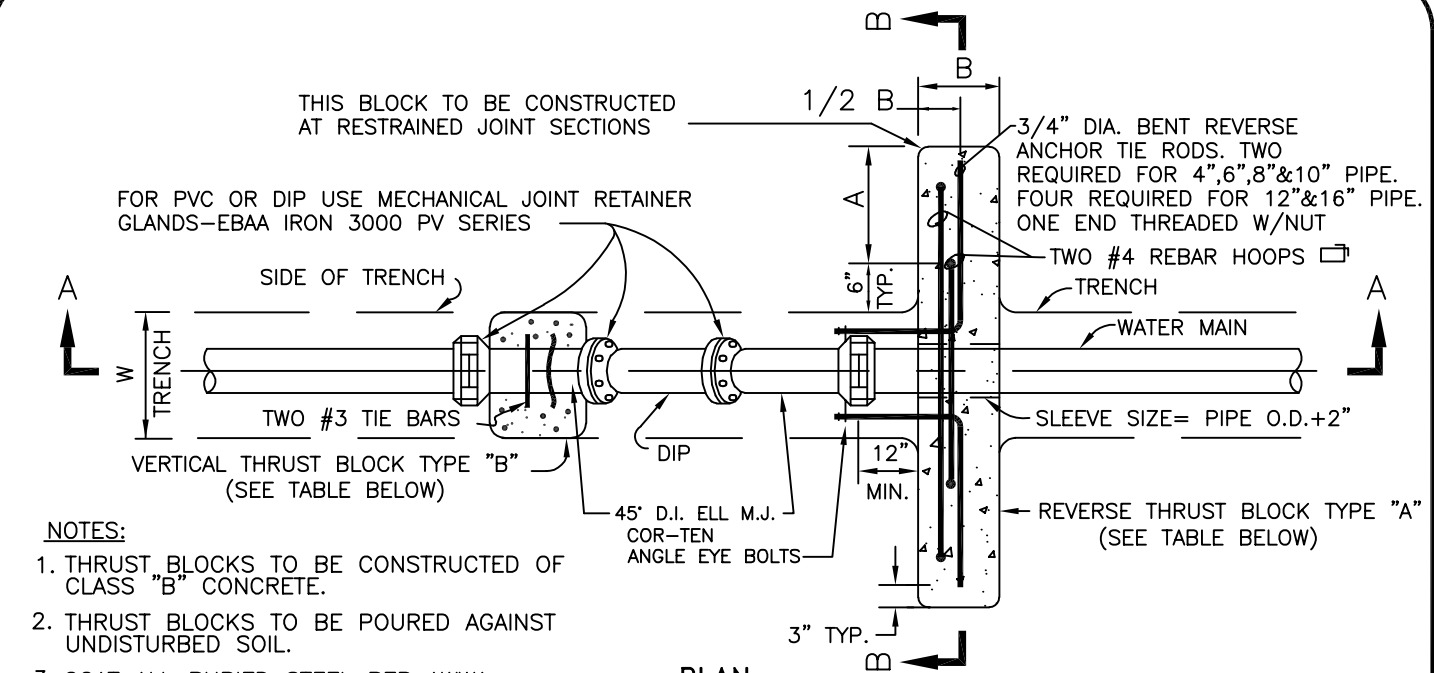
FIRE SERVICE ABANDONMENT PROCEDURE (IF NECESSARY)

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. USE FULLY-RESTRAINED MECHANICAL COUPLINGS FOR STRAIGHT PIPE CONNECTIONS TO EXISTING NON-HDPE PIPE. COUPLINGS SHALL BE APPROVED BY CITY.
5. REMOVE THE FIRE HYDRANT AND SALVAGE TO THE CITY OF PALO ALTO CORPORATION YARD WGWR 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: MAY 16, 2022 | SCALE: NONE |
| DRAWN E.L. | 05/92 | | <i>Silvia Santos</i> 50674 | DWG. NO. |
| CHECKED P.L. | 05/22 | | SILVIA LEE SANTOS R.E. NO. | STD. WD-16 |
| REVIEWED R.D. | 05/22 | | REVISION: MAY 16, 2022 | APPENDIX B |

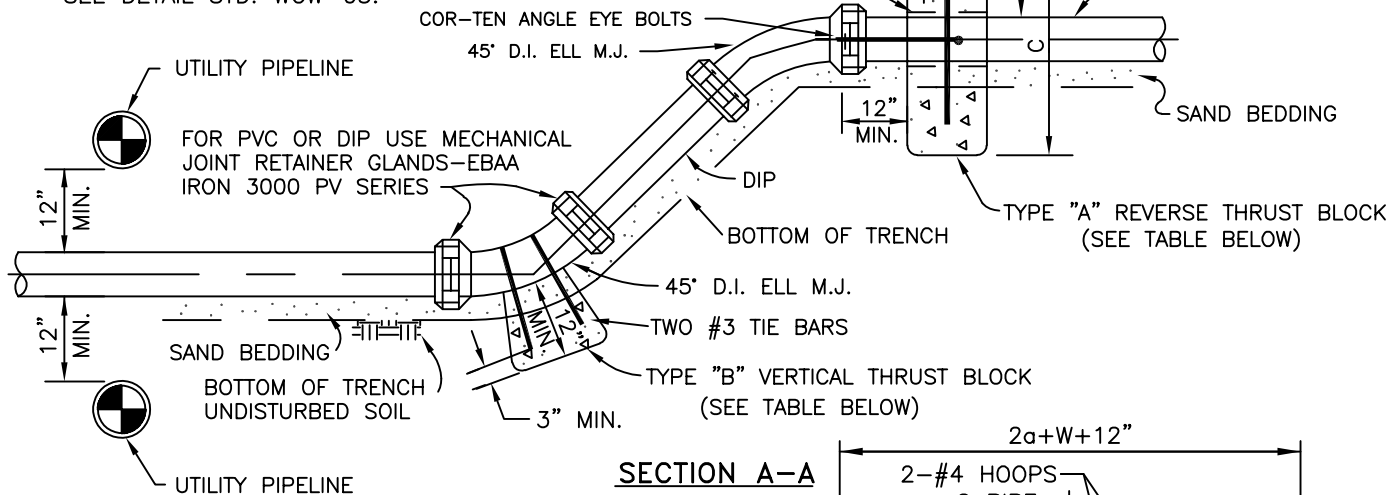


| | | | | |
|---------------|-------|--|---|----------------|
| BY | DATE | VERTICAL BENDS HDPE PIPE CONNECTING TO NON-HDPE PIPE STANDARD DETAIL CITY OF PALO ALTO, CALIFORNIA | APPROVED: MAY 16, 2022 <i>Silvia Santos</i> SILVIA LEE SANTOS ENGINEERING MANAGER | SCALE: NONE |
| DRAWN E.L. | 5/92 | | 50674 R.E. NO. | DWG. NO. |
| CHECKED J.J. | 02/20 | | | STD. WD-17 |
| REVIEWED R.I. | 02/20 | | REVISION: MAY 5, 2021 | APPENDIX B |

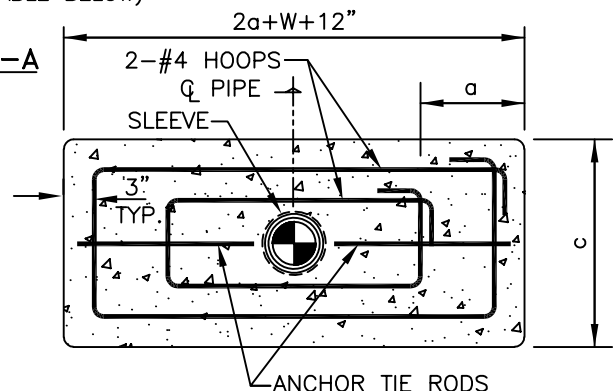


NOTES:

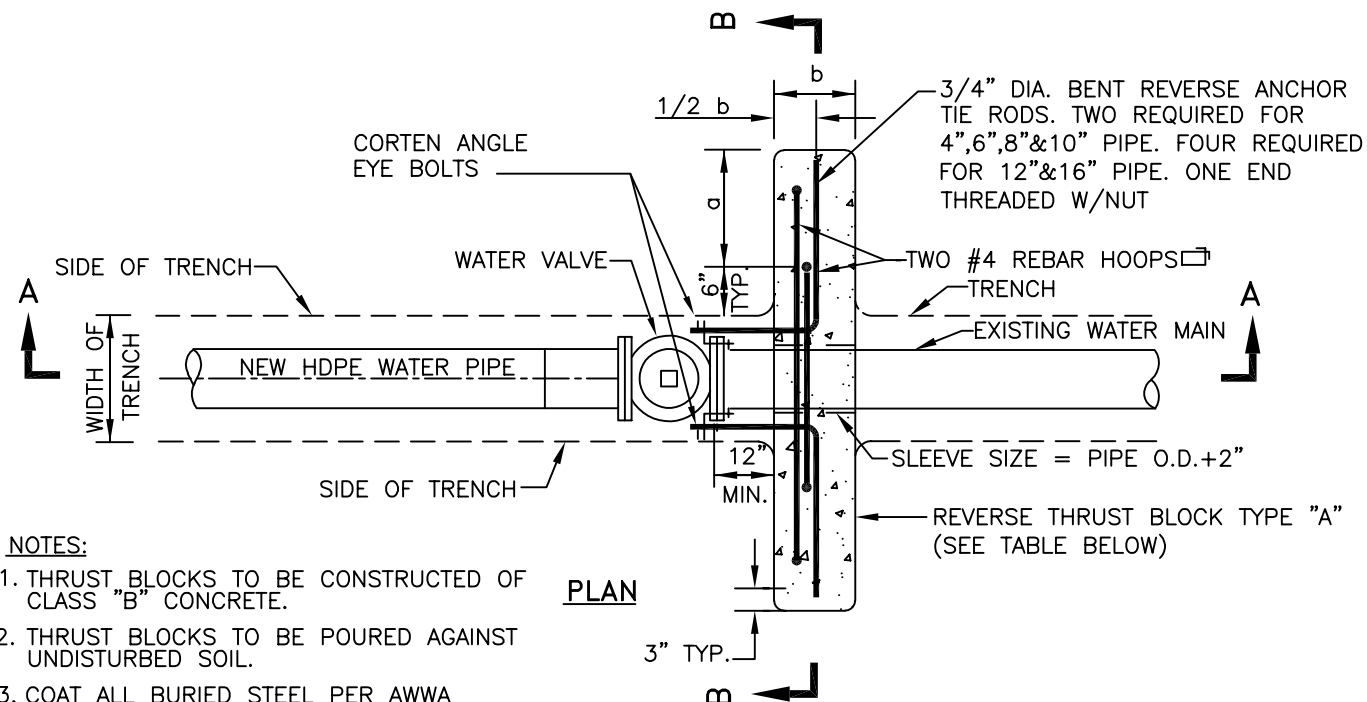
1. THRUST BLOCKS TO BE CONSTRUCTED OF CLASS "B" CONCRETE.
2. THRUST BLOCKS TO BE POURED AGAINST UNDISTURBED SOIL.
3. COAT ALL BURIED STEEL PER AWWA C-203 SEC. 3.7 WITH COAL TAR PROTECTIVE COATING (CA-14 MASTIC).
4. FOR MAINS INSTALLED LESS THAN 3' DEEP SEE DETAIL STD. WGW-03.



| 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. |

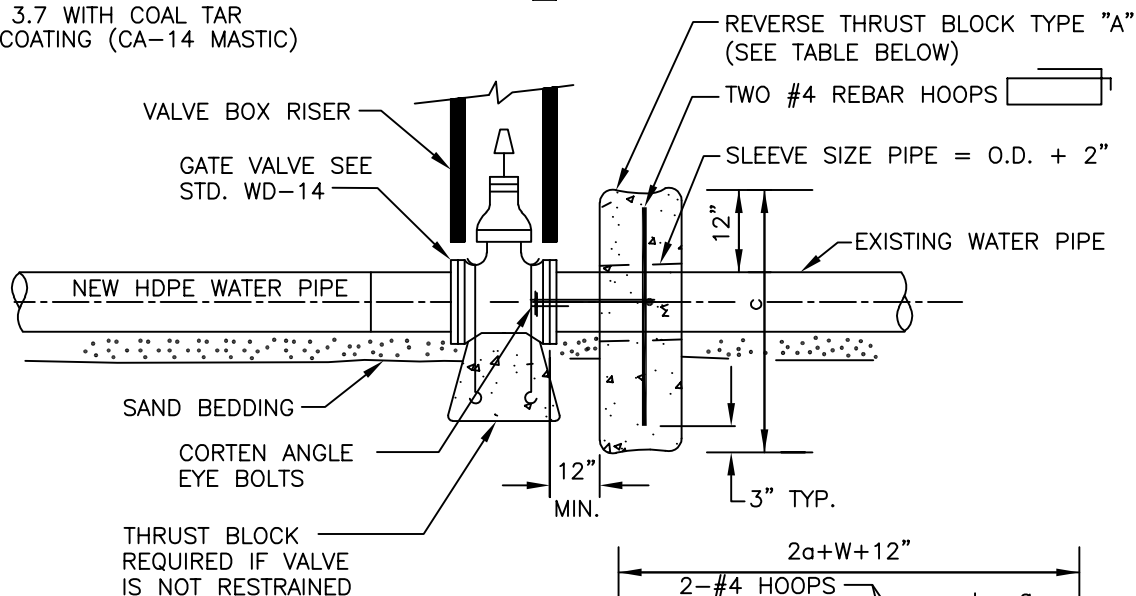


| | | | | |
|---------------|-------|---|--|----------------|
| BY | DATE | VERTICAL BENDS PVC OR DI PIPE CONNECTING TO NON-HDPE PIPE STANDARD DETAIL | APPROVED: MAY 16, 2022 | SCALE: NONE |
| DRAWN J.J. | 02/19 | | <i>Silvia Santos</i> 50674 | DWG. NO. |
| CHECKED J.J. | 02/20 | | SILVIA LEE SANTOS ENGINEERING MANAGER | STD. WD-17A |
| REVIEWED R.I. | 02/20 | CITY OF PALO ALTO, CALIFORNIA | REVISION: MAY 5, 2021 | APPENDIX B |



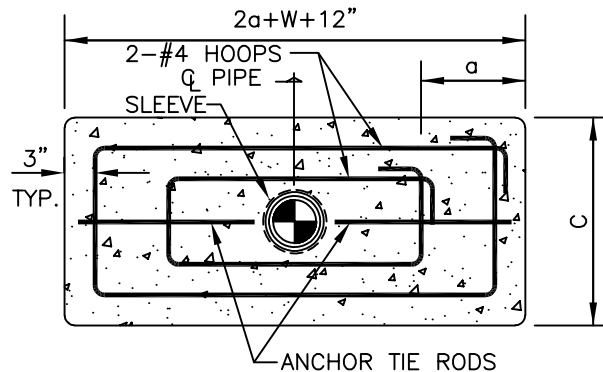
NOTES:

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)

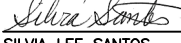


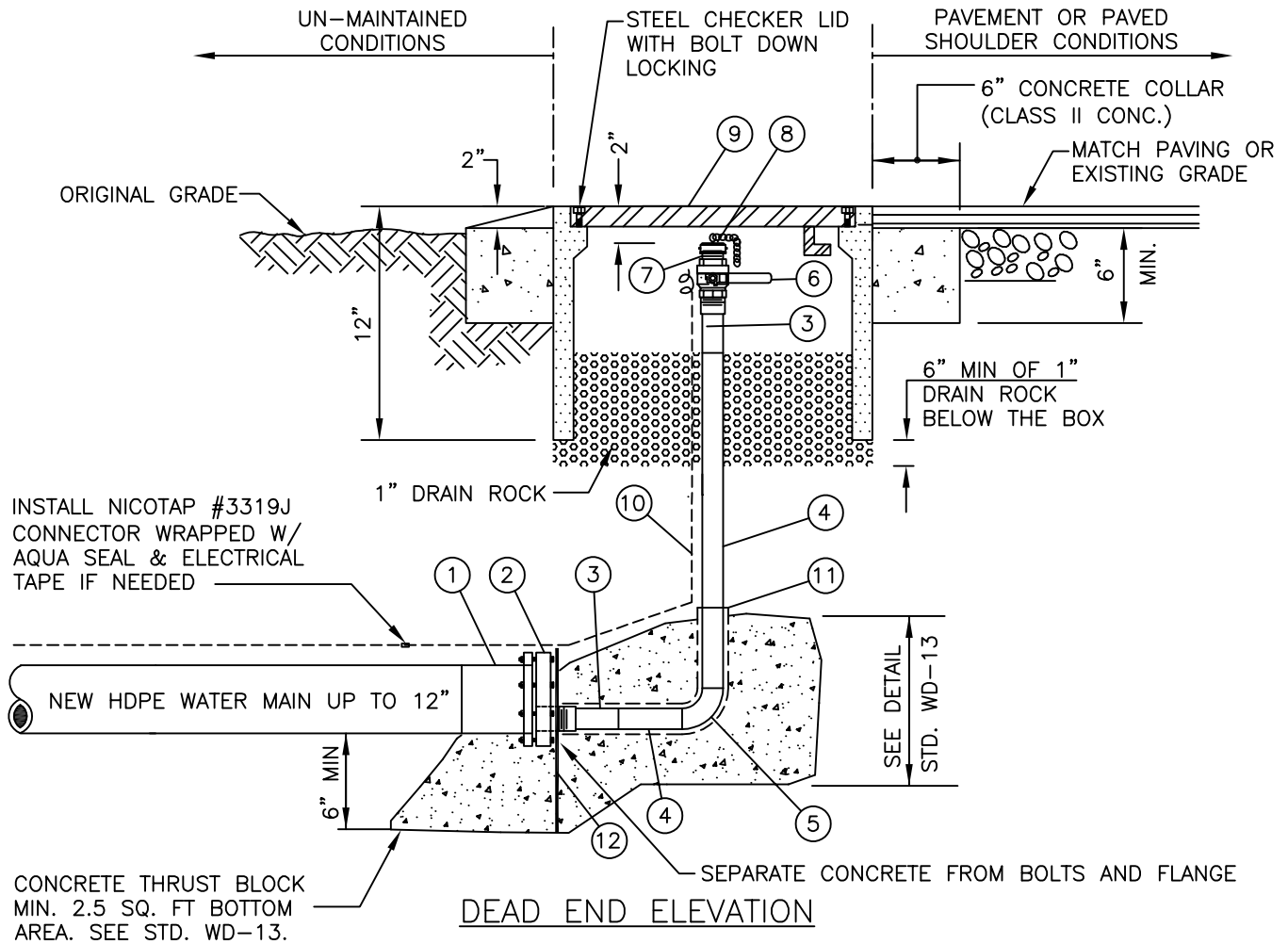
SECTION A-A

| 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. |



SECTION B-B

| | | | | |
|----------|------|--|---|----------------|
| BY | DATE | VALVE TIE-BACK DURING CONSTRUCTION STANDARD DETAIL CITY OF PALO ALTO, CALIFORNIA | APPROVED: MAY 16, 2022 | SCALE: NONE |
| DRAWN | E.L. | |  50674 R.E. NO. | DWG. NO. |
| CHECKED | J.J. | | SILVIA LEE SANTOS ENGINEERING MANAGER | STD. WD-18 |
| REVIEWED | R.I. | | REVISION: MAY 5, 2021 | APPENDIX B |

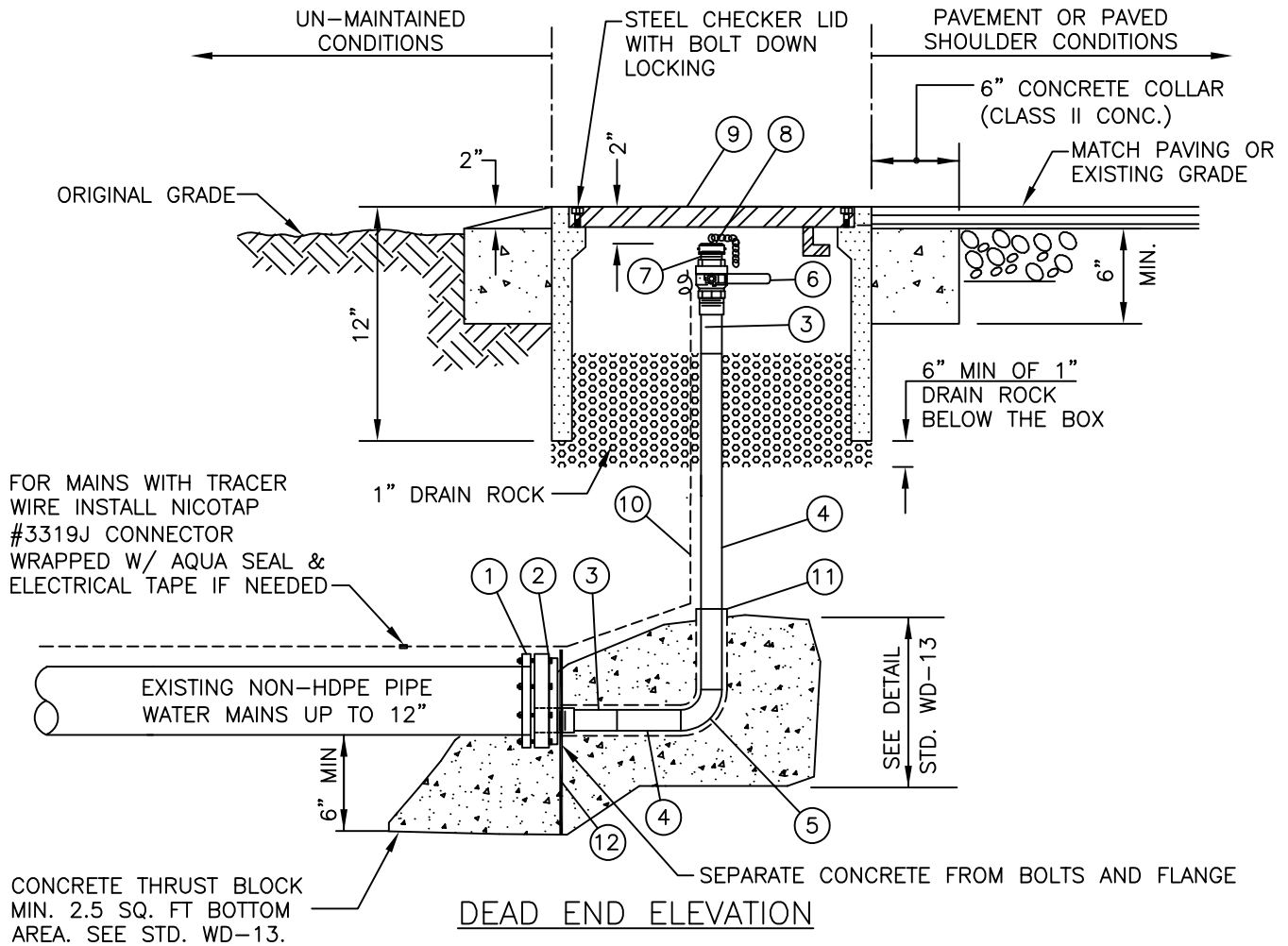


NOTES:

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 AND BACKUP RING
2. BLIND FLANGE WITH 2" NPT THREADED ECCENTRIC 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 HOSE
8. 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: MAY 16, 2022 | SCALE: NONE |
| DRAWN J.J. | 02/19 | | <i>Silvia Lee Santos</i> | DWG. NO. |
| CHECKED P.L. | 05/22 | | SILVIA LEE SANTOS ENGINEERING MANAGER | STD. WD-19 |
| REVIEWED R.D. | 05/22 | | REVISION: MAY 16, 2022 | APPENDIX B |

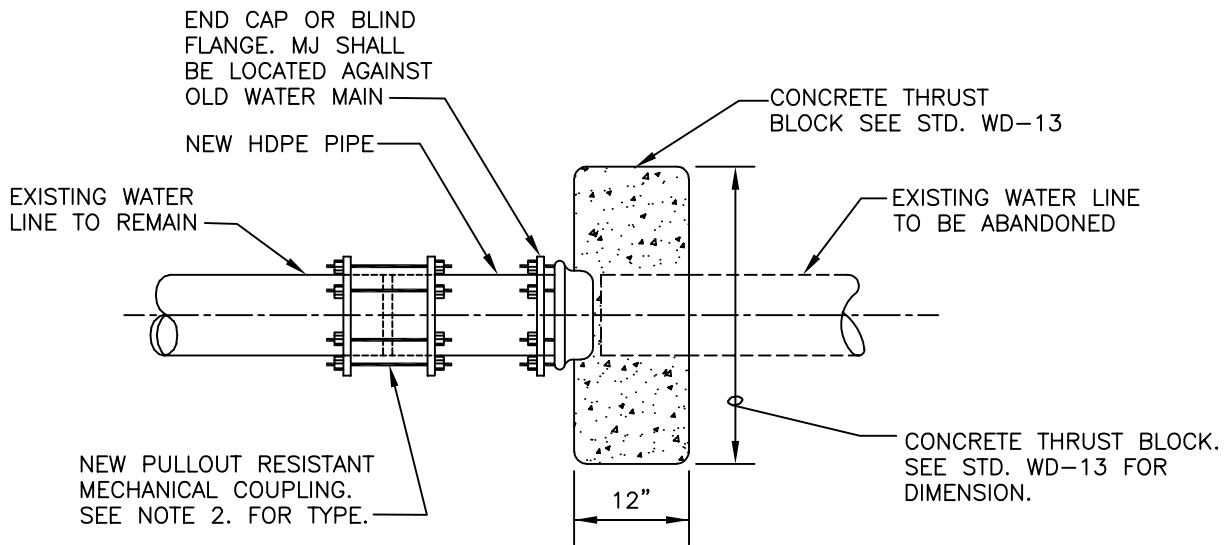


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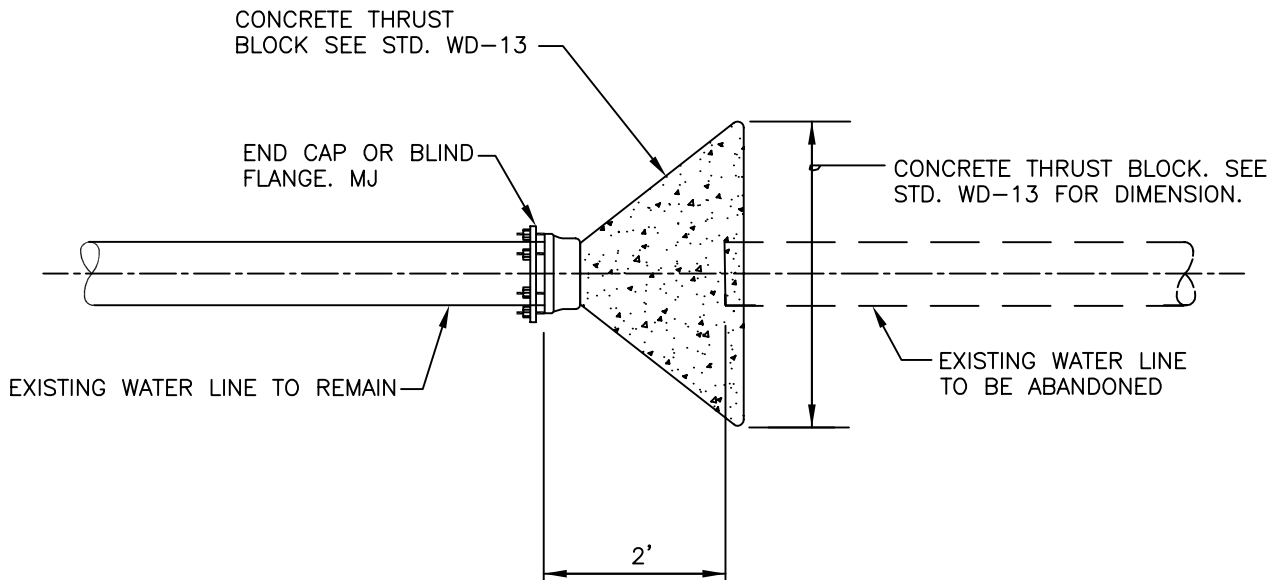
1. MINIMUM BLOW OFF PIPE DIAMETER SHALL BE 2" FOR MAINS UP TO 12". DESIGN OF BLOW OFF ASSEMBLIES FOR MAINS LARGER THAN 12" REQUIRES APPROVAL OF THE ENGINEERING MANAGER.
2. FOR INSTALLATION IN AREAS SUBJECT TO VEHICULAR TRAFFIC THE BLOW OFF BOX SHALL HAVE 20K (TIER 22) LOAD RATING AND SHALL BE ADJUSTED 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" NPT THREADED ECCENTRIC 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 HOSE
- ⑧ 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: MAY 16, 2022 | SCALE: NONE |
| DRAWN J.J. | 02/19 | | <i>Silvia Lee Santos</i> 50674 | DWG. NO. |
| CHECKED P.L. | 05/22 | | SILVIA LEE SANTOS R.E. NO. | STD. WD-19A |
| REVIEWED R.D. | 05/22 | | ENGINEERING MANAGER | |
| | | CITY OF PALO ALTO, CALIFORNIA | REVISION: MAY 16, 2022 | APPENDIX B |



OPTION NO. 1



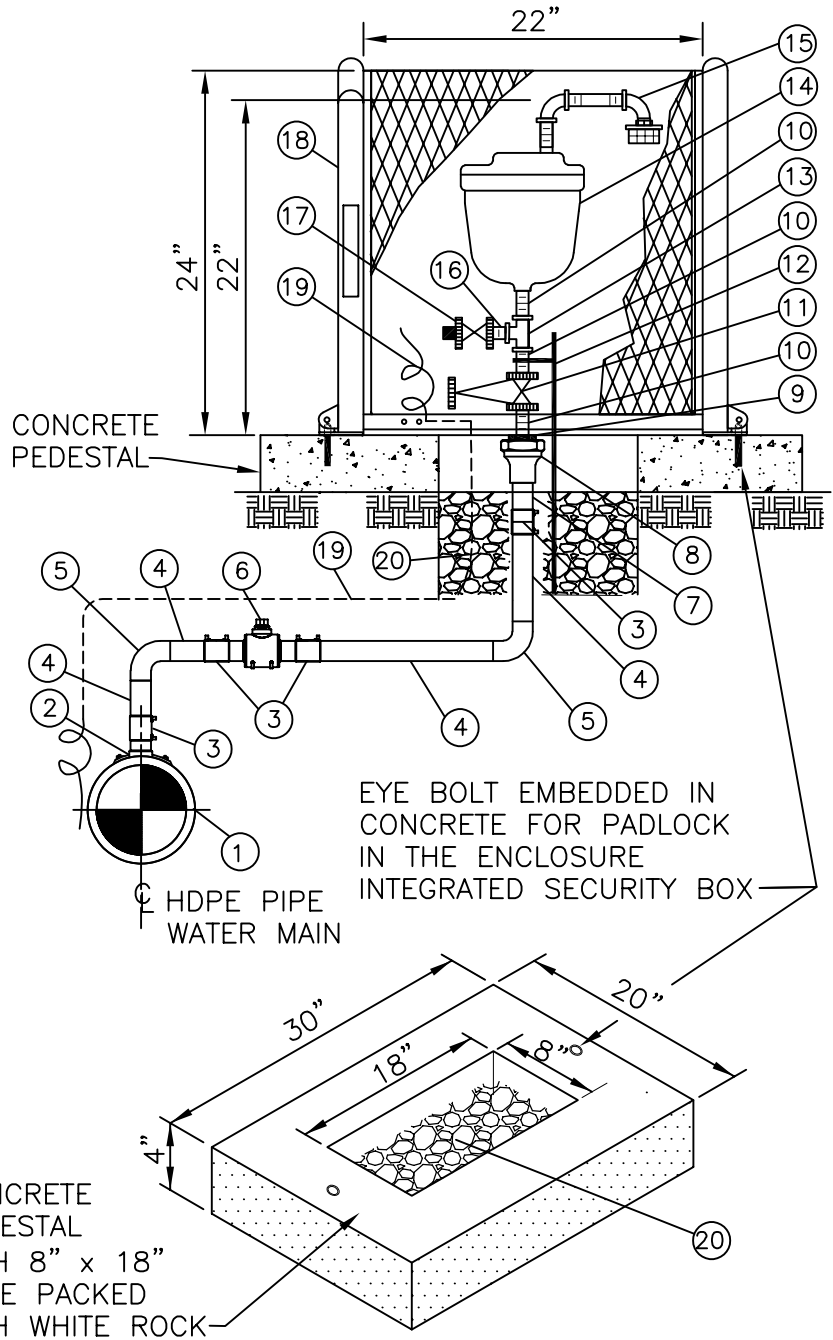
OPTION NO. 2

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: MAY 16, 2022 | SCALE: NONE |
| DRAWN E.L. | 5/92 | | <i>Silvia Lee Santos</i> 50674 | DWG. NO. |
| CHECKED J.J. | 02/20 | | SILVIA LEE SANTOS R.E. NO. | STD. WD-20 |
| REVIEWED R.I. | 02/20 | | ENGINEERING MANAGER | |
| | | CITY OF PALO ALTO, CALIFORNIA | REVISION: MAY 5, 2021 | APPENDIX B |

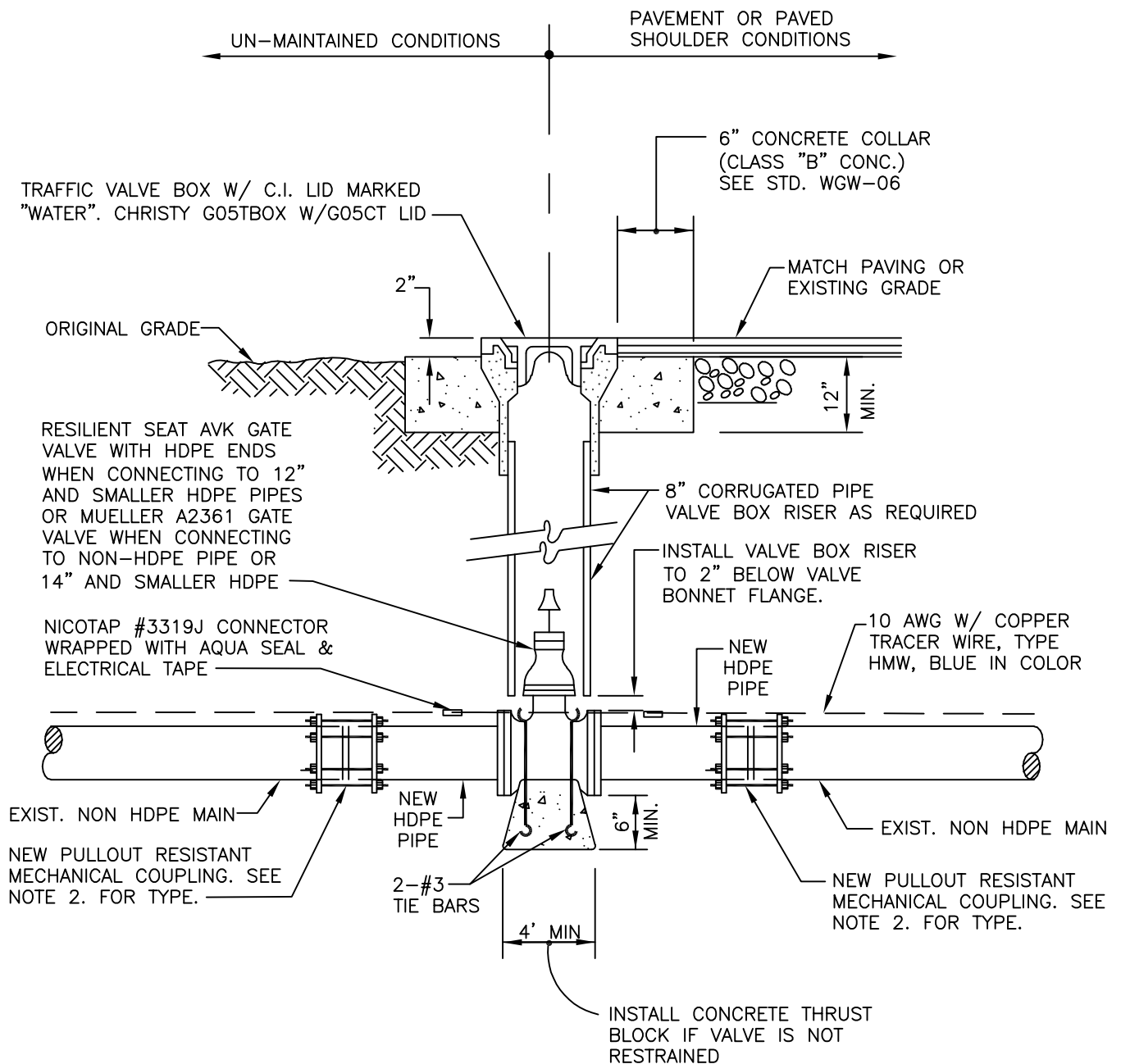
- ① HDPE WATER MAIN
- ② EF BRANCH SADDLE
- ③ EF COUPLING
- ④ 2" HDPE WATER PIPE SDR 9
- ⑤ 2" HDPE 90° ELL
- ⑥ 2" HDPE BALL VALVE
- ⑦ POLY-CAM SERIES 914 TRANSITION
- ⑧ MUELLER BRASS STRAIGHT FLARE CONNECTOR
- ⑨ 2" X 1" BRASS REDUCER
- ⑩ 1" BRASS PIPE SHORT NIPPLE
- ⑪ MUELLER H-10914 1" NRS BRONZE GATE VALVE (IP THREADS)
- ⑫ STAINLESS STEEL SUPPORT
- ⑬ 1" X 3/4" BRASS TEE
- ⑭ APCO OR CRISPIN 1" AIR RELEASE VALVE, OR APPROVED EQUAL.
- ⑮ 1" BRASS VENT PIPE, ELBOWS, NIPPLE WITH CU FINE SCREEN
- ⑯ 3/4" BRASS PIPE CLOSE NIPPLE
- ⑰ 3/4" TEST DRAIN VALVE AND PLUG. BRONZE GATE VALVE.
- ⑱ 10"Wx24"Hx22"L (INSIDE DIMENSIONS) VENTED ENCLOSURE, STANDARD GUARDSHACK ENCLOSURE BPDI-GATED OR APPROVED EQUAL
- ⑲ 10 AWG W/ COPPER TRACER WIRE, TYPE HMW BLUE IN COLOR
- ⑳ STONE #57 WHITE ROCK



NOTES:

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. WGW-05B.
5. MAINTAIN A MINIMUM 2% POSITIVE SLOPE TO AIR RELEASE VALVE.

| | | | | |
|---------------|-------|--------------------------------------|--|------------------------|
| BY | DATE | AIR RELEASE VALVE STANDARD DETAIL | APPROVED: DECEMBER 20, 2023 | SCALE: NONE |
| DRAWN J.J. | 02/20 | | <i>Silvia Lee Santos</i> 50674 SILVIA LEE SANTOS R.E. NO. | DWG. NO. STD. WD-21 |
| CHECKED P.L. | 12/23 | | REVISION: DECEMBER 20, 2023 | APPENDIX B |
| REVIEWED A.P. | 12/23 | CITY OF PALO ALTO, CALIFORNIA | | |



NOTES:

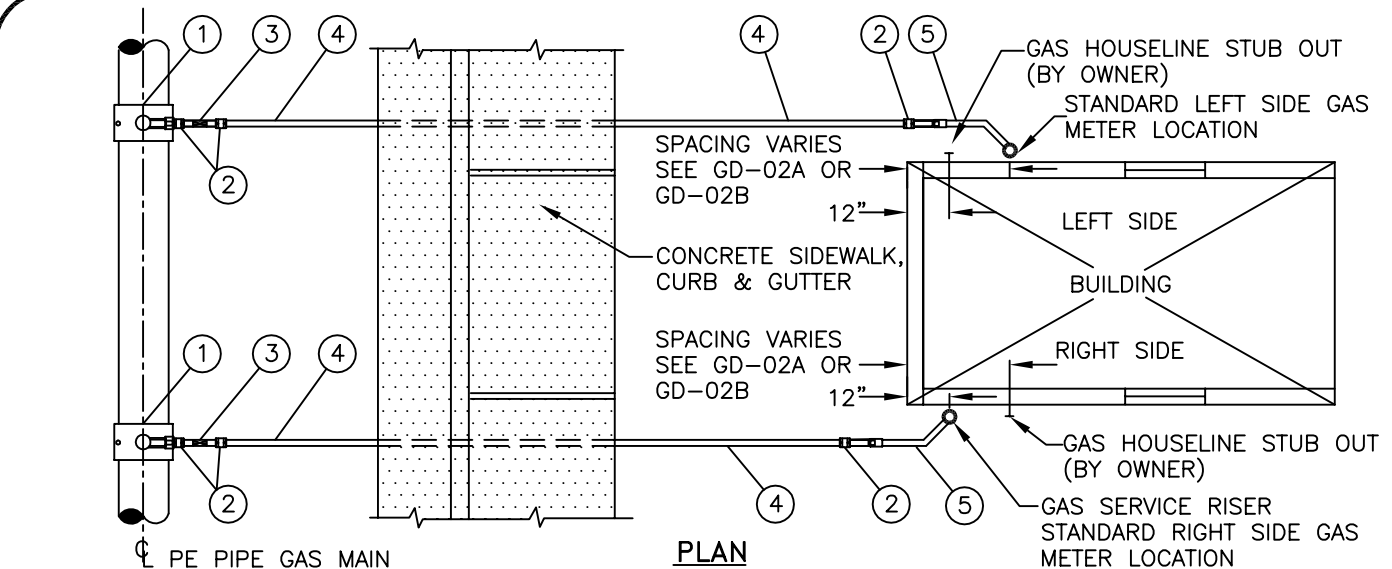
1. COUPLINGS SHALL BE ASSEMBLED AND INSTALLED ACCORDING TO THE STANDARDS RECOMMENDED BY THE MANUFACTURER.
2. MECHANICAL COUPLINGS FOR JOINING HDPE TO ACP AND PVC MAIN, USE SMITH & BLAIR QUANTUM COUPLING. FOR JOINING HDPE TO CIP OR DIP MAIN, USE KRAUSZ HYMAX GRIP OR SMITH & BLAIR QUANTUM COUPLING. FOR JOINING HDPE TO HDPE MAIN, USE ELECTROFUSION COUPLINGS.
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: MAY 16, 2022 | SCALE: NONE |
| DRAWN B.C. | 08/04 | | <i>Silvia Lee Santos</i> | DWG. NO. |
| CHECKED J.J. | 02/20 | | SILVIA LEE SANTOS ENGINEERING MANAGER | STD. WD-22 |
| REVIEWED R.I. | 02/20 | | REVISION: MAY 5, 2021 | APPENDIX B |

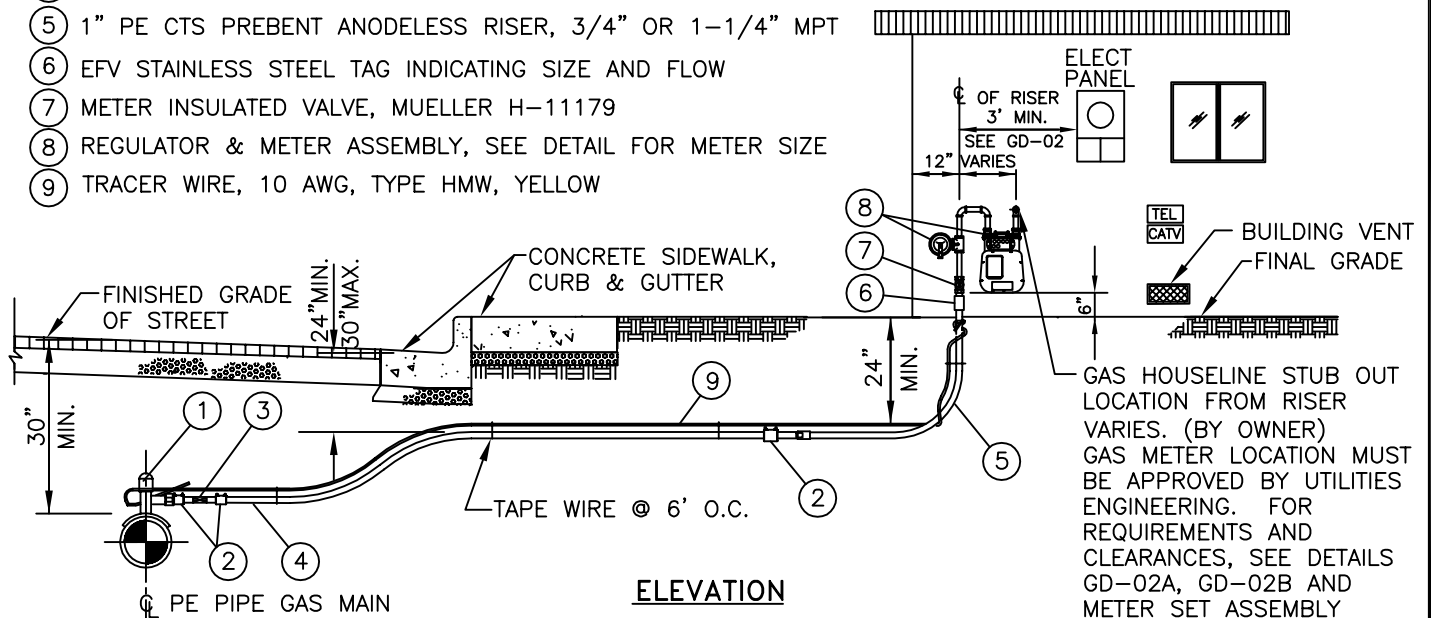
**Table of Contents
Appendix C
Gas Standard Details**

| <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 (List of Materials) |
| GD-04C | Residential Manifold Meter Set Assembly w/ Bypass 1,000 SCFH |
| GD-04D | Residential Manifold Meter Set Assembly w/ Bypass 1,000 SCFH (List of Materials) |
| 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 (List of Materials) |
| 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 (List of Materials) |
| 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 (List of Materials) |
| 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 (List of Materials) |
| GD-08C | Residential/Commercial Manifold Meter Set Assembly 5,000 to 15,000 SCFH (Est. Pressure Loss) |
| 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 |
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| GD-22 | Multiple Curb Gas Meters 250-630 SCFH |
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| 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 Curb Gas Rotary Meter 800-2,000 SCFH Utility Box (Curb Location) |
| GD-24B | Commercial Rotary Meter Set Assembly 800-1,100 Utility Box (Curb Location) |
| GD-24C | 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 Curb Gas Rotary Meter 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-26D | Commercial/Industrial Rotary Meter Set Assembly 2,000-3,000 SCFH Utility Box (Curb) |
| GD-27A | Commercial/Industrial Curb Gas Rotary Meter 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-27D | 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 |



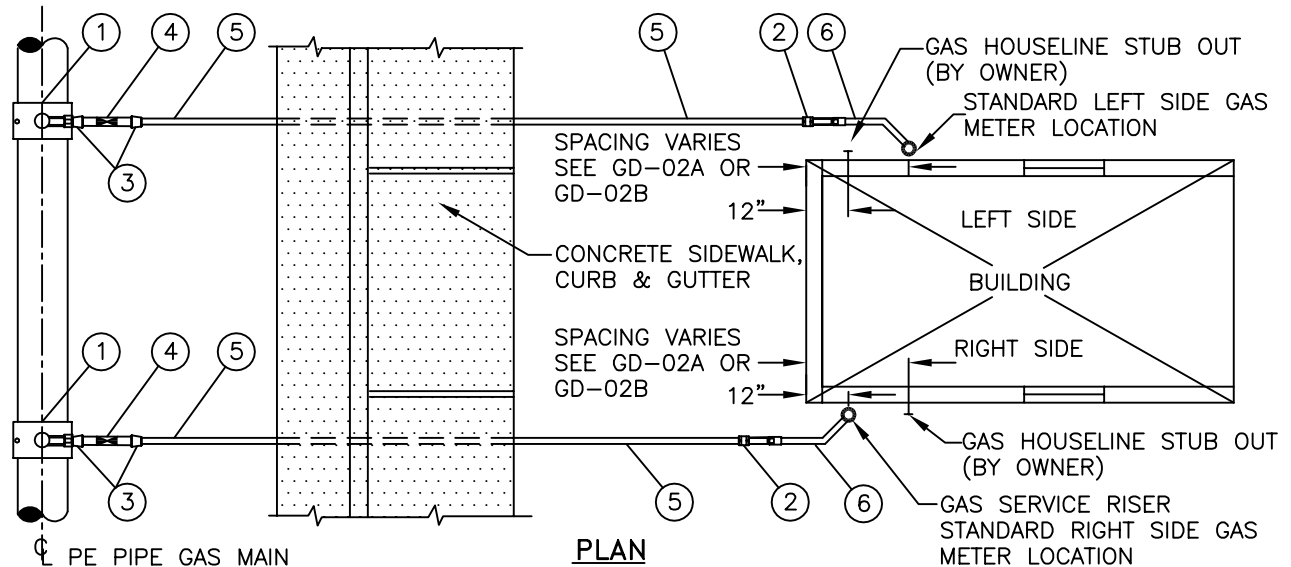
- ① ELECTROFUSION TAPPING TEE, MAIN SIZE X 1" CTS
- ② 1" ELECTROFUSION COUPLING
- ③ 1" CTS EFV, UMAC MODEL 41, SERIES 1,800 OR 2,600
- ④ 1" PE PIPE GAS SERVICE
- ⑤ 1" PE CTS PREBENT ANODELESS RISER, 3/4" OR 1-1/4" MPT
- ⑥ EFV STAINLESS STEEL TAG INDICATING SIZE AND FLOW
- ⑦ METER INSULATED VALVE, MUELLER H-11179
- ⑧ REGULATOR & METER ASSEMBLY, SEE DETAIL FOR METER SIZE
- ⑨ TRACER WIRE, 10 AWG, TYPE HMW, YELLOW



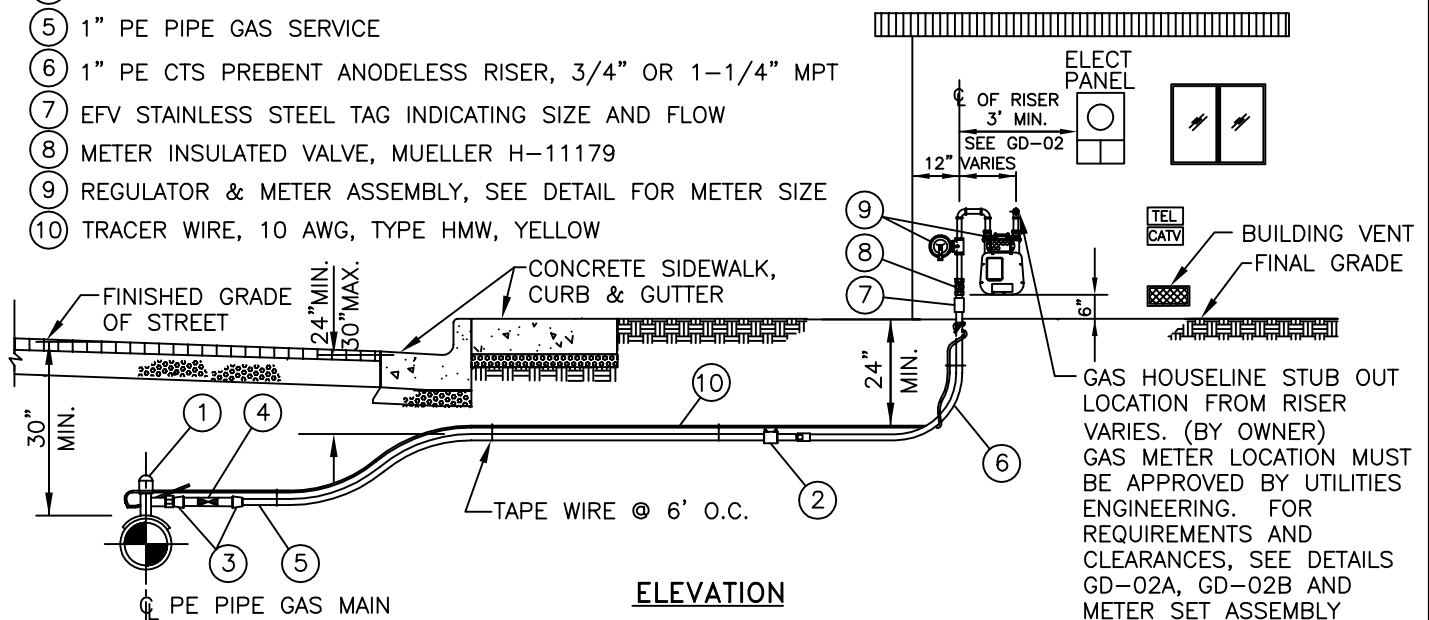
NOTES:

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: MAY 20, 2022 | SCALE: NONE |
| DRAWN | J.J. 02/92 | | <i>Silvia Lee Santos</i> 50674 SILVIA LEE SANTOS R.E. NO. | DWG. NO. |
| CHECKED | E.D. 05/22 | | ENGINEERING MANAGER | STD. GD-01A |
| REVIEWED | S.S. 05/22 | | REVISION: MAY 20, 2022 | APPENDIX C |
| | | CITY OF PALO ALTO, CALIFORNIA | | |



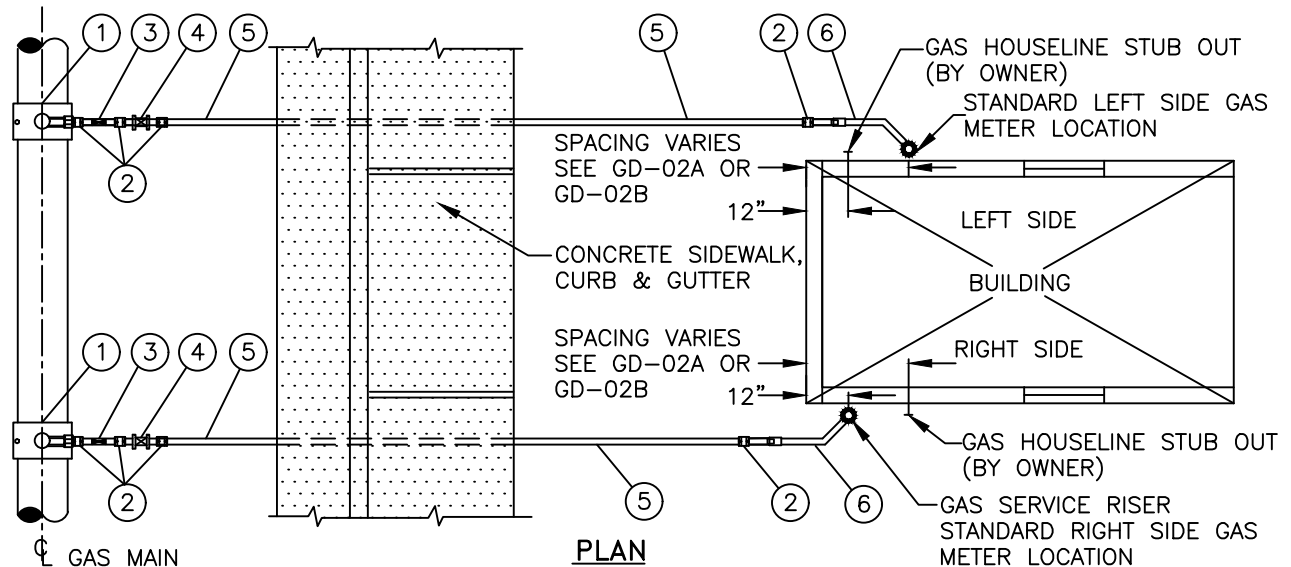
- ① ELECTROFUSION TAPPING TEE, MAIN SIZE X 1" CTS
- ② 1" ELECTROFUSION COUPLING
- ③ 1" CTS X 1-1/4" IPS TRANSITION COUPLING, STORES NO. 49351
- ④ 1-1/4" IPS EFV, UMAC MODEL 41, SERIES 5,500
- ⑤ 1" PE PIPE GAS SERVICE
- ⑥ 1" PE CTS PREBENT ANODELESS RISER, 3/4" OR 1-1/4" MPT
- ⑦ EFV STAINLESS STEEL TAG 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



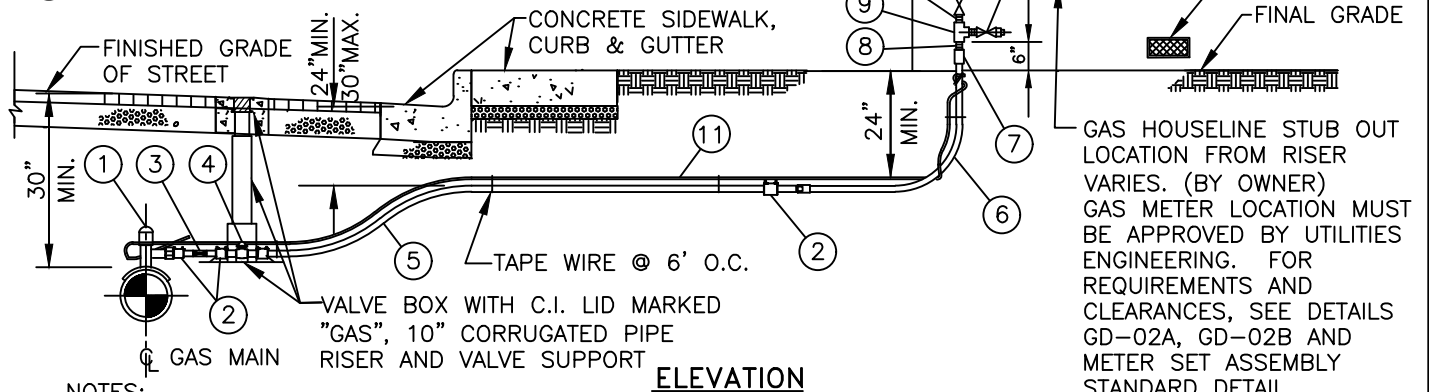
NOTES:

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: | SCALE: |
| DRAWN J.J. | 02/20 | | MAY 20, 2022 | NONE |
| CHECKED E.D. | 05/22 | | <i>Silvia Lee Santos</i> 50674 SILVIA LEE SANTOS R.E. NO. ENGINEERING MANAGER | DWG. NO. STD. GD-01B |
| REVIEWED S.S. | 05/22 | | REVISION: MAY 20, 2022 | APPENDIX C |
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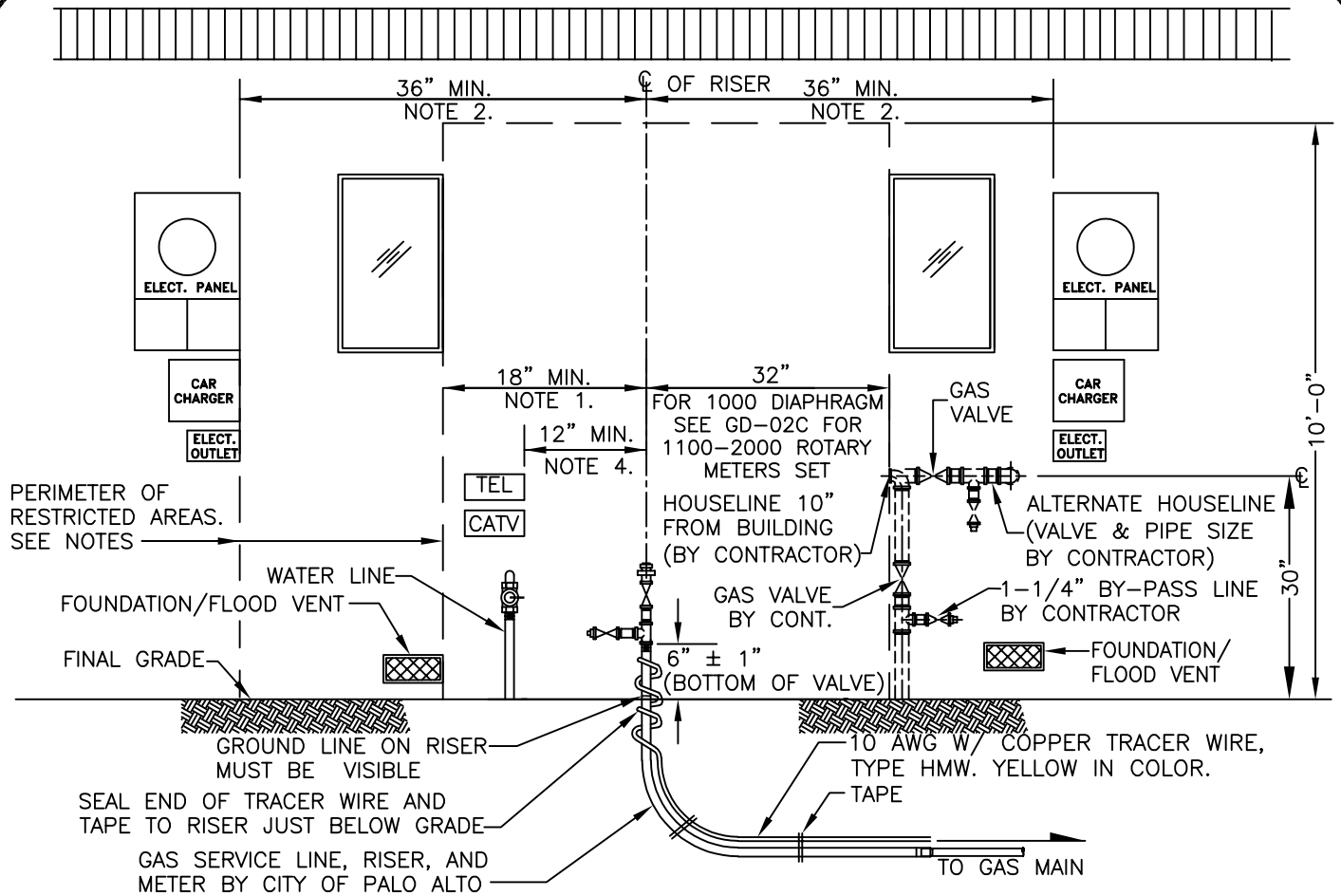
- ① ELECTROFUSION PE TAPPING TEE, MAIN SIZE X 2" IPS
- ② 2" ELECTROFUSION COUPLING
- ③ 2" IPS EFV, UMAC, MODEL 41, SERIES 5,500 OR 10,000
- ④ 2" POLY-GAS BALL VALVE, POLYVALVE FLOWSERVE CORP.
- ⑤ 2" IPS PE SDR 11 PIPE GAS SERVICE
- ⑥ 2" IPS X 2" IPS PREBENT ANODELESS RISER
- ⑦ EFV STAINLESS STEEL TAG 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.
5. 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.
6. 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: MAY 20, 2022 | SCALE: NONE |
| DRAWN J.J. | 02/92 | | <i>Silvia Lee Santos</i> 50674 | DWG. NO. |
| CHECKED J.J. | 02/20 | | SILVIA LEE SANTOS ENGINEERING MANAGER | STD. GD-01C |
| REVIEWED A.P. | 05/21 | | REVISION: MAY 5, 2021 | APPENDIX C |
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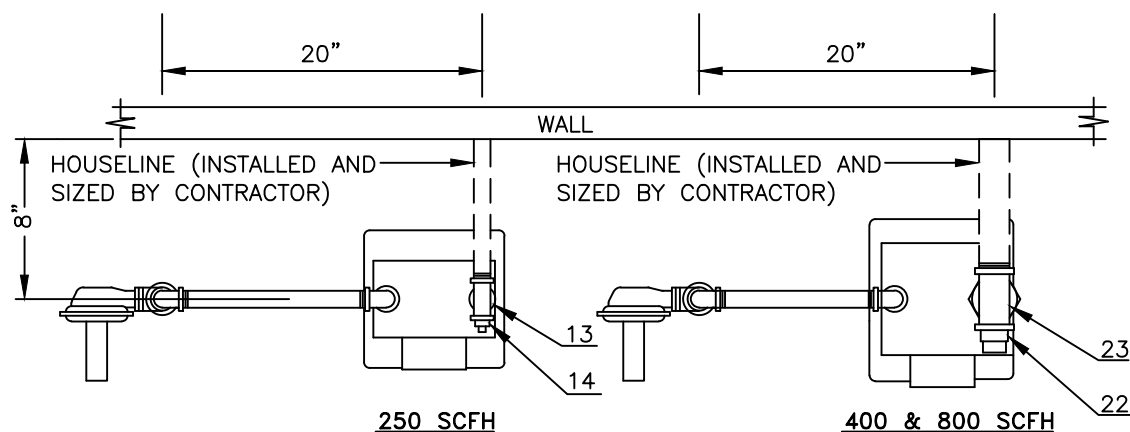


NOTES:

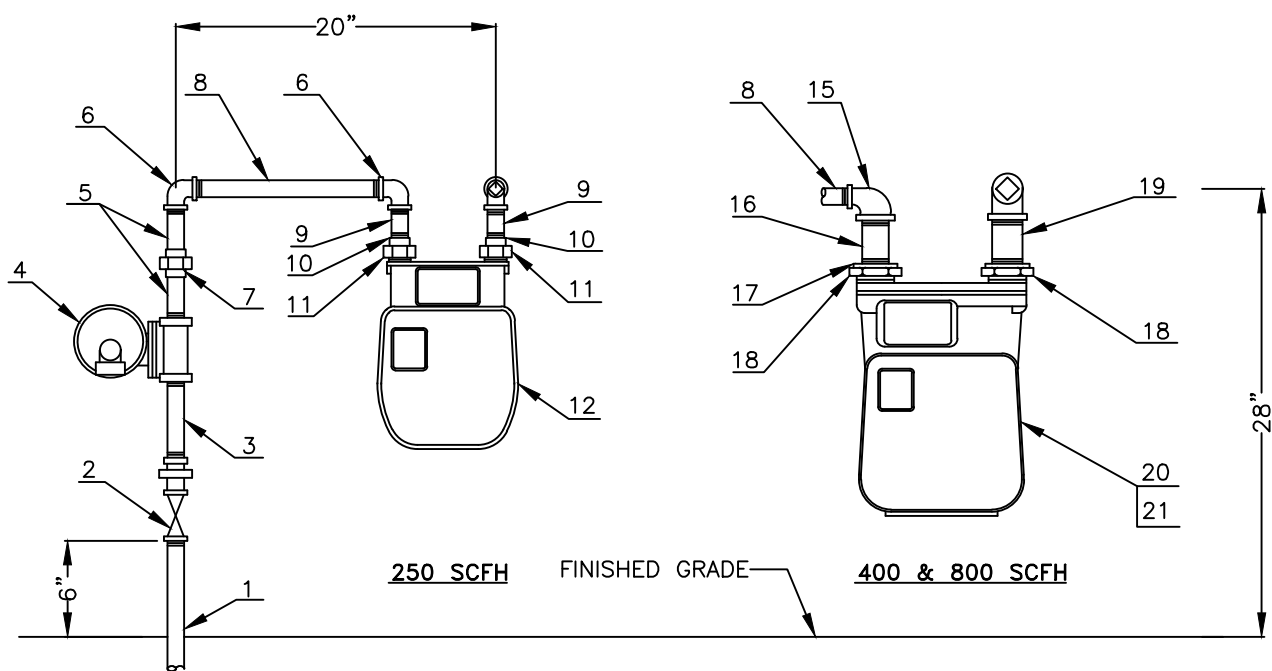
LEFT BUILDING ELEVATION

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. ELECTRIC GROUNDING OR BONDING WIRES ARE NOT PERMITTED TO CPA GAS SERVICES AND METERS. GAS PIPING SHALL NOT BE USED AS A GROUNDING CONDUCTOR OR ELECTRODE. (CPC 1211.3)
4. 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.
5. MAINTAIN 3 FEET CLEAR AND LEVEL WORKING SPACE IN FRONT OF THE GAS METER.
6. 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.
7. 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, WGW-05B.
8. 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 CITY OF PALO ALTO, CALIFORNIA | APPROVED: DECEMBER 21, 2023 | SCALE: NONE |
| DRAWN | J.J. 02/92 | | <i>Silvia Lee Santos</i> 50674 SILVIA LEE SANTOS R.E. NO. | DWG. NO. STD. GD-02B |
| CHECKED | J.J. 02/20 | | ENGINEERING MANAGER | |
| REVIEWED | A.P. 12/23 | | REVISION: DECEMBER 21, 2023 | APPENDIX A |



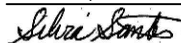
PLAN



ELEVATION

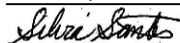
NOTES:

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.

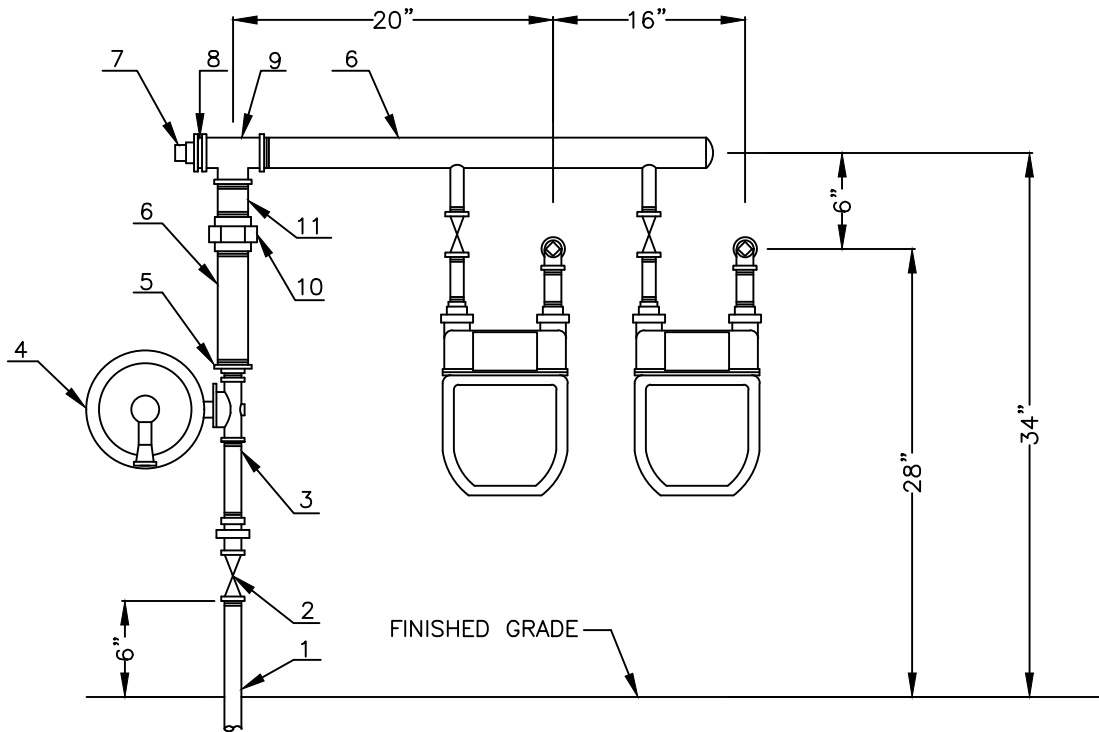
| | | | | | |
|----------|------|-------|--|--|-------------------------|
| BY | | DATE | RESIDENTIAL METER SET ASSEMBLY 250-800 SCFH STANDARD DETAIL | APPROVED: MAY 20, 2022  SILVIA LEE SANTOS ENGINEERING MANAGER | SCALE: 1"=1'-0" |
| DRAWN | A.P. | 12/15 | | | |
| CHECKED | A.P. | 12/15 | | 50674 R.E. NO. | DWG. NO. STD. GD-03A |
| REVIEWED | A.P. | 05/21 | | REVISION: MAY 5, 2021 | 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: MAY 20, 2022 | SCALE: NONE |
| DRAWN A.P. | 12/15 | |  50674 SILVIA LEE SANTOS ENGINEERING MANAGER | DWG. NO. |
| CHECKED A.P. | 12/15 | | | STD. GD-03B |
| REVIEWED A.P. | 05/21 | CITY OF PALO ALTO, CALIFORNIA | REVISION: MAY 5, 2021 | APPENDIX C |

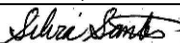
METER SET ASSEMBLY WITHOUT BYPASS



ELEVATION

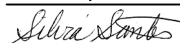
NOTES:

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.

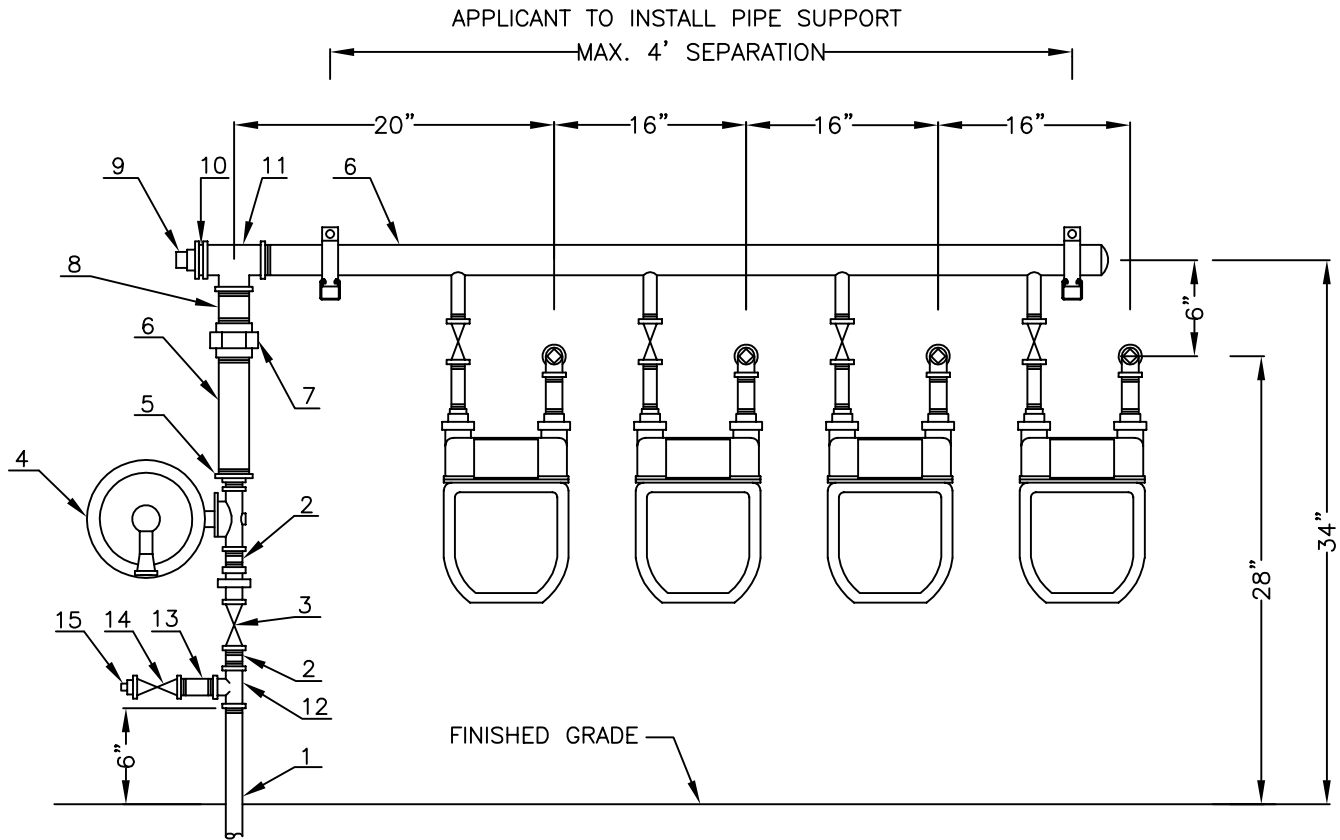
| | | | | |
|----------|------------|--|--|-------------------------|
| BY | | RESIDENTIAL MANIFOLD METER SET ASSEMBLY W/O BYPASS 500 SCFH DELIVERY PRESSURE 7" W.C. STANDARD DETAIL | APPROVED: MAY 20, 2022  SILVIA LEE SANTOS ENGINEERING MANAGER | SCALE: 1"=1'-0" |
| DRAWN | A.P. 12/15 | | | |
| CHECKED | A.P. 12/15 | | 50674 R.E. NO. | DWG. NO. STD. GD-04A |
| REVIEWED | A.P. 05/21 | CITY OF PALO ALTO, CALIFORNIA | REVISION: MAY 5, 2021 | 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" 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: MAY 20, 2022  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-04B |
| REVIEWED | A.P. | 05/21 | | APPENDIX C |
| CITY OF PALO ALTO, CALIFORNIA | | | REVISION: MAY 5, 2021 | |

METER SET ASSEMBLY WITH BYPASS



ELEVATION

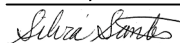
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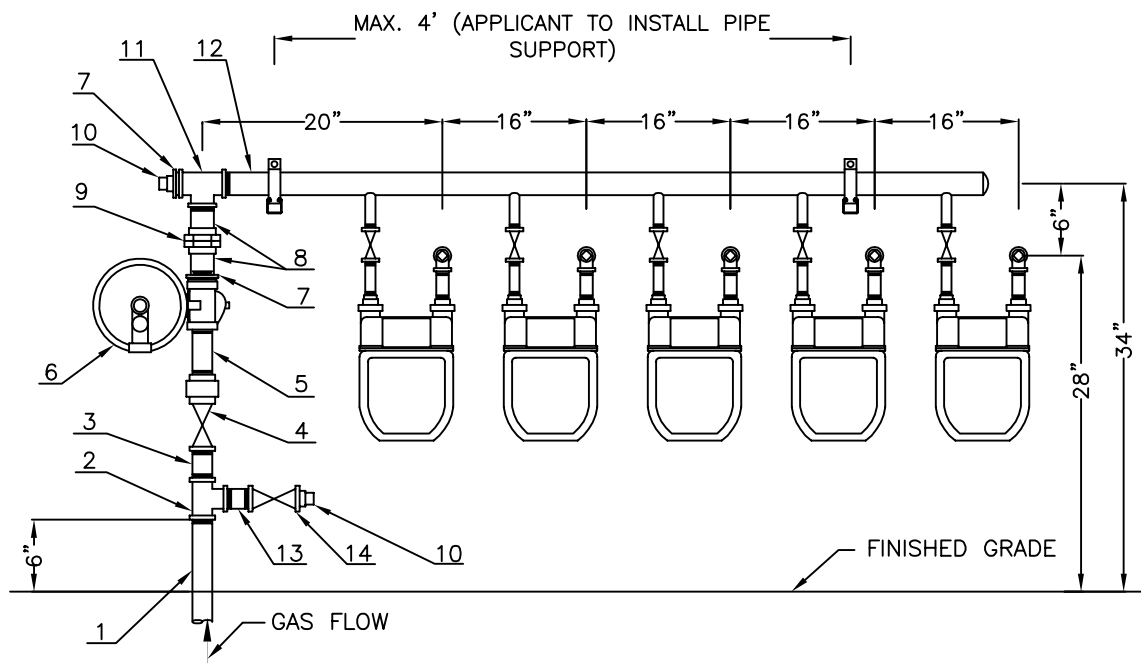
1. SEPARATIONS BETWEEN THE RISER AND HOUSE LINE STUB-OUTS SHOWN FOR MANIFOLD WITH MULTIPLE CLASS 250 SCFH METERS.
2. FOR PLACEMENT REQUIREMENTS REFER TO THE WATER, GAS, AND WASTEWATER UTILITY STANDARD DETAILS.
3. UPON COMPLETION OF METER ASSEMBLY, LEAK TEST ALL CONNECTIONS.
4. BYPASS AND REGULATOR ORIENTATION 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: MAY 20, 2022 | SCALE: 1"=1'-0" |
| DRAWN A.P. | 12/15 | | <i>Silvia Lee Santos</i> 50674 | DWG. NO. |
| CHECKED A.P. | 12/15 | | SILVIA LEE SANTOS R.E. NO. | STD. GD-04C |
| REVIEWED A.P. | 05/21 | | REVISION: MAY 5, 2021 | 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" 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 DRAWN CHECKED REVIEWED | DATE | RESIDENTIAL MANIFOLD METER SET ASSEMBLY W/ BYPASS 1,000 SCFH DELIVERY PRESSURE 7" W.C. STANDARD DETAIL CITY OF PALO ALTO, CALIFORNIA | APPROVED: MAY 20, 2022  SILVIA LEE SANTOS ENGINEERING MANAGER | SCALE: NONE |
| | 12/15 | | 50674 R.E. NO. | DWG. NO. STD. GD-04D |
| | 05/21 | | REVISION: MAY 5, 2021 | APPENDIX C |



ELEVATION

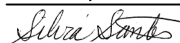
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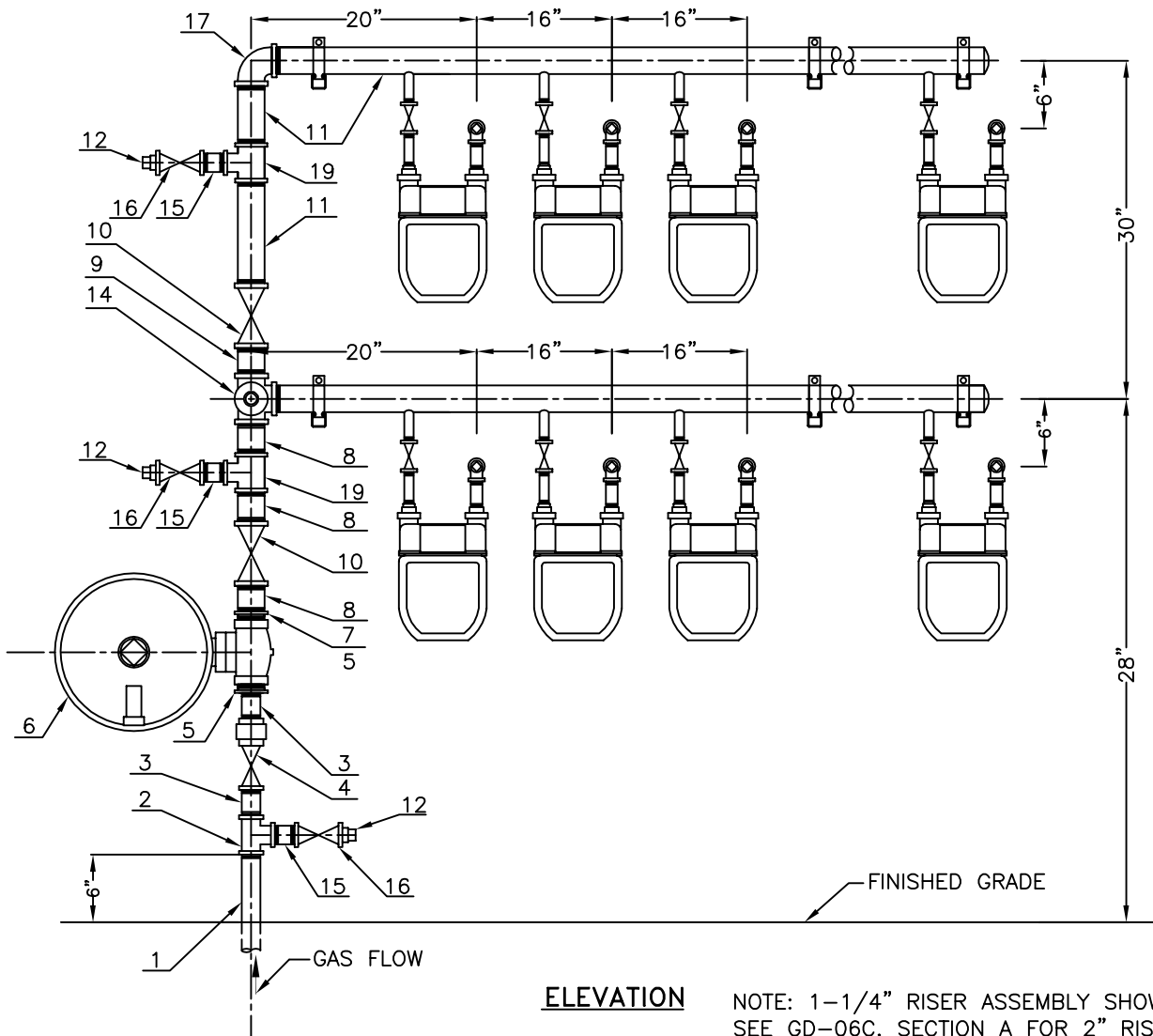
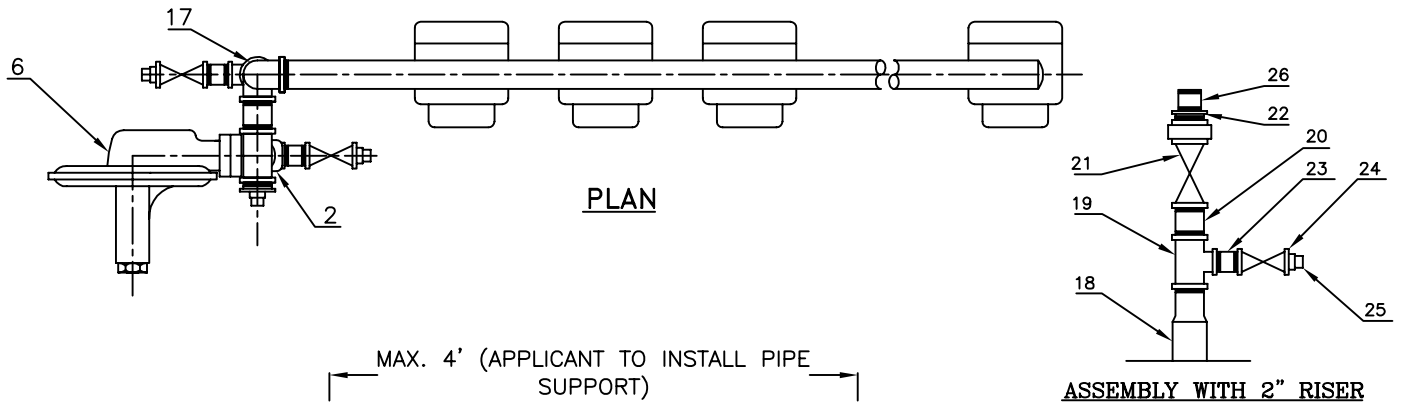
1. SEPARATIONS BETWEEN THE RISER AND HOUSE LINE STUB-OUTS SHOWN FOR MANIFOLD WITH MULTIPLE CLASS 250 SCFH METERS.
2. FOR PLACEMENT REQUIREMENTS REFER THE WATER, GAS, AND WASTEWATER UTILITY STANDARD DETAILS.
3. UPON COMPLETION OF METER ASSEMBLY, LEAK TEST ALL CONNECTIONS.
4. BYPASS AND REGULATOR ORIENTATION IS FIELD ADJUSTABLE.
5. IT IS ASSUMED THE STANDARD DELIVERY PRESSURE OF 7" W.C. AND THE SYSTEM INLET PRESSURE IS MIN. 8 PSIG.

| | | | | |
|----------|------------|--|---|----------------------|
| BY | | RESIDENTIAL/COMMERCIAL MANIFOLD METER SET ASSEMBLY UP TO 1,250 SCFH DELIVERY PRESSURE 7" W.C. STANDARD DETAIL | APPROVED: MAY 20, 2022 <i>Silvia Lee Santos</i> 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-05A |
| REVIEWED | A.P. 05/21 | CITY OF PALO ALTO, CALIFORNIA | REVISION: MAY 5, 2021 | 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: MAY 20, 2022 | SCALE: NONE |
| DRAWN A.P. | 12/15 | |  50674 | DWG. NO. |
| CHECKED A.P. | 12/15 | | SILVIA LEE SANTOS ENGINEERING MANAGER | STD. GD-05B |
| REVIEWED A.P. | 05/21 | | REVISION: MAY 5, 2021 | APPENDIX C |



NOTE: 1-1/4" RISER ASSEMBLY SHOWN.
SEE GD-06C, SECTION A FOR 2" RISER
ASSEMBLY.

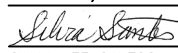
| | | | | |
|----------|------------|--|---|-----------------------------|
| BY | | RESIDENTIAL/COMMERCIAL MANIFOLD METER SET ASSEMBLY 1,500-3,000 SCFH DELIVERY PRESSURE 7" W.C. STANDARD DETAIL | APPROVED: MAY 20, 2022 SILVIA LEE SANTOS ENGINEERING MANAGER | SCALE: 3/4"=1'-0" |
| DRAWN | A.P. 12/15 | | | |
| CHECKED | A.P. 12/15 | | 50674 R.E. NO. | DWG. NO. STD. GD-06A |
| REVIEWED | A.P. 05/21 | CITY OF PALO ALTO, CALIFORNIA | REVISION: MAY 5, 2021 | APPENDIX C |

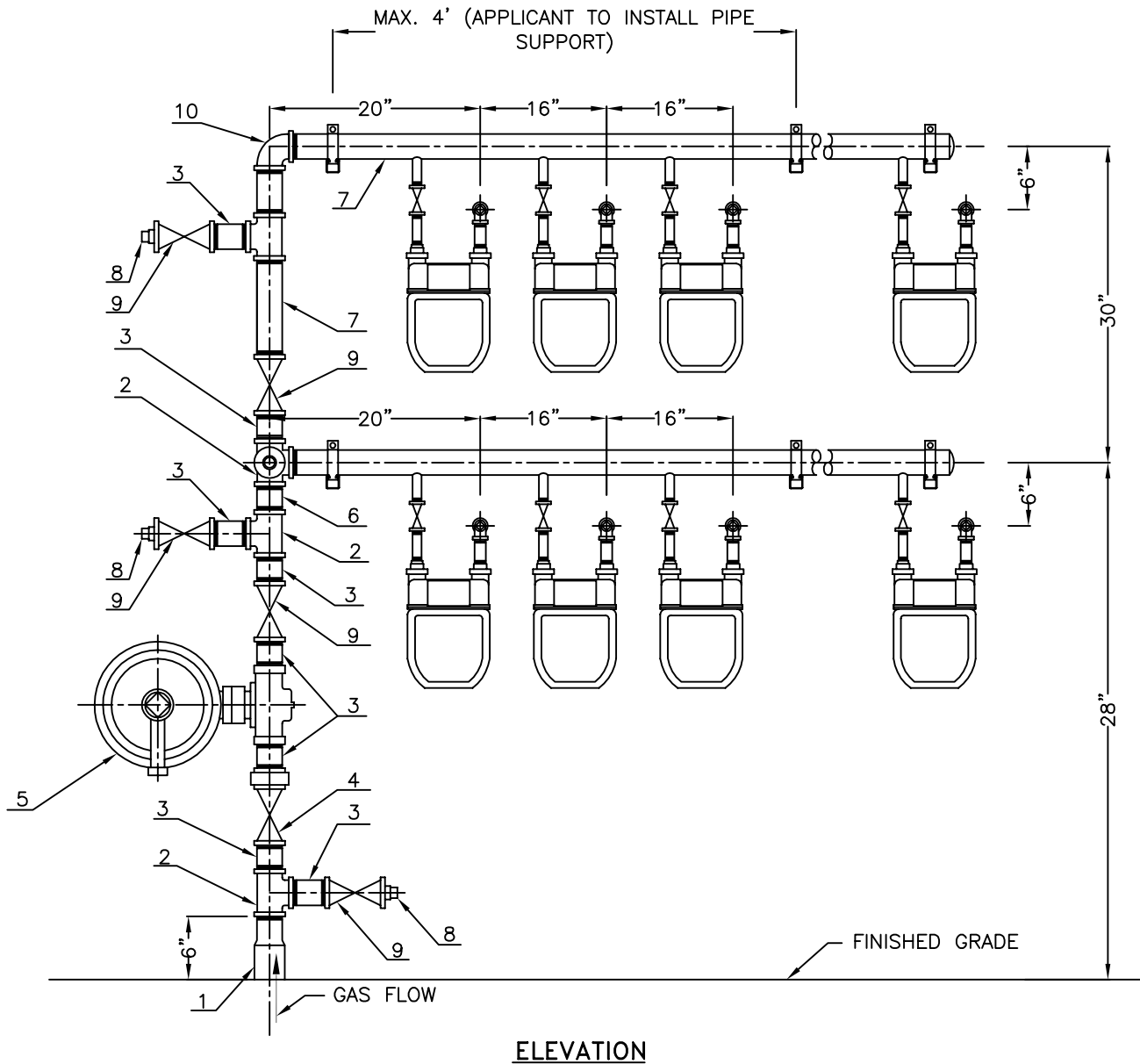
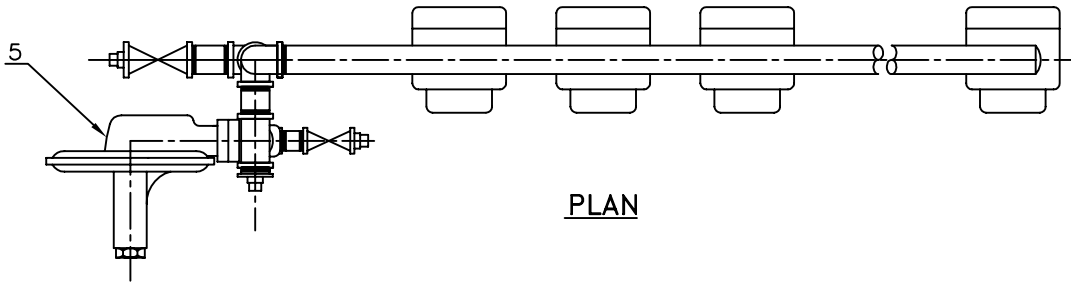
LIST OF MATERIALS

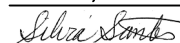
| NO. | DESCRIPTION | STOCK NO. | UNIT | QUANTITY |
|-----|--|-----------|------|----------|
| 1 | 1-1/4" IPS X 1" CTS SERVICE RISER, PREBENT | 43050 | EA. | 1 |
| 2 | 1-1/4" TEE, BLK | 41802 | EA. | 1 |
| 3 | 1-1/4" x 2-1/2" NIPPLE, BLK | 41432 | EA. | 2 |
| 4 | 1-1/4" H-11179 MUELLER METER VALVE | 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: MAY 20, 2022 | SCALE: NONE | |
| DRAWN | A.P. | 12/15 | |  SILVIA LEE SANTOS ENGINEERING MANAGER | 50674 R.E. NO. | DWG. NO. |
| CHECKED | A.P. | 12/15 | | | | STD. GD-06B |
| REVIEWED | A.P. | 05/21 | | CITY OF PALO ALTO, CALIFORNIA | REVISION: MAY 5, 2021 | APPENDIX C |



| BY | | DATE | RESIDENTIAL/COMMERCIAL MANIFOLD METER SET ASSEMBLY 3,000-5,000 SCFH DELIVERY PRESSURE 7" W.C. STANDARD DETAIL | APPROVED: MAY 20, 2022 | SCALE: 3/4"=1'-0" |
|----------|------|-------|---|--|--------------------------|
| DRAWN | A.P. | 11/15 | |  50674 SILVIA LEE SANTOS ENGINEERING MANAGER R.E. NO. | DWG. NO. |
| CHECKED | A.P. | 11/15 | | | STD. GD-07A |
| REVIEWED | A.P. | 05/21 | | CITY OF PALO ALTO, CALIFORNIA | REVISION: MAY 5, 2021 |

LIST OF MATERIALS

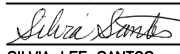
| NO. | DESCRIPTION | STOCK NO. | UNIT | QUANTITY |
|-----|--|-----------|------|----------|
| 1 | 2" IPS x 2" IPS ANODELESS SERVICE RISER, PREBENT | 43057 | EA. | 1 |
| 2 | 2" TEE, BLK | 41804 | EA. | 4 |
| 3 | 2" x 2-1/2" NIPPLE, BLK | 41451 | EA. | 5 |
| 4 | 2" H-11179 MUELLER METER VALVE WITH INSULATED OUTLET | 43005 | EA. | 1 |
| 5 | 2" NPT ITRON B38R REGULATOR WITH 2-1/2" FULL CAPACITY INTERNAL RELIEF WITH 5/8" (O 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 |

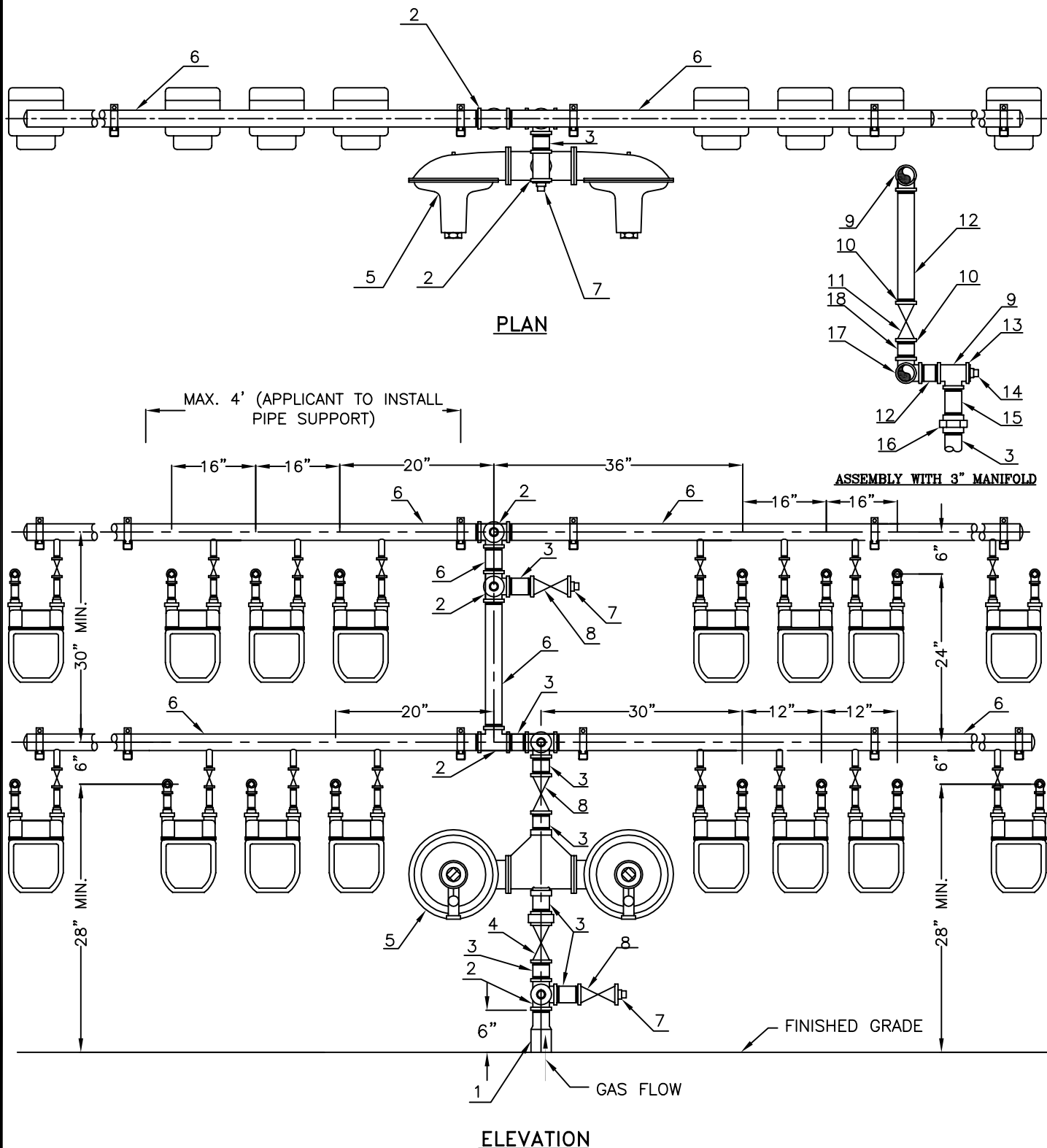
ESTIMATED PRESSURE LOSS IN INDIVIDUAL MANIFOLD RUN

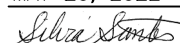
| SET PRESSURE INCH W.C. | FLOW SCFH | MANIFOLD SIZE | PRESSURE BEFORE FIRST LEVEL MANIFOLD INCH W.C. | PRESSURE BEFORE SECOND LEVEL MANIFOLD INCH W.C. | PRESSURE AT THE END OF MANIFOLD INCH W.C. | SET PRESSURE TO OBTAIN 7" W.C. AT THE END OF MANIFOLD |
|------------------------------|--------------|------------------|---|--|---|---|
| 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: MAY 20, 2022 | 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. | 05/21 | CITY OF PALO ALTO, CALIFORNIA | REVISION: MAY 5, 2021 | APPENDIX C |



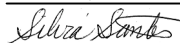
| | | | | | | | |
|----------|------|-------|--|---|--|--------------------------|------------|
| BY | | DATE | RESIDENTIAL/COMMERCIAL MANIFOLD METER SET ASSEMBLY 5,000–15,000 SCFH DELIVERY PRESSURE 7" W.C. STANDARD DETAIL | APPROVED: MAY 20, 2022 | | SCALE: 3/5"=1'–0" | |
| DRAWN | A.P. | 9/15 | |  50674 | | DWG. NO. | |
| CHECKED | A.P. | 9/15 | | SILVIA LEE SANTOS ENGINEERING MANAGER | | R.E. NO. STD. GD–08A | |
| REVIEWED | A.P. | 05/21 | | CITY OF PALO ALTO, CALIFORNIA | | REVISION: MAY 5, 2021 | |
| | | | | | | | APPENDIX C |

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 | 43319 | EA. | 16 |
| | NUTS, 5/8" HEX NCT | 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 |

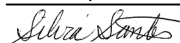
| | | | | |
|---------------|-------|---|---|-------------------|
| BY | DATE | RESIDENTIAL/COMMERCIAL MANIFOLD METER SET ASSEMBLY 5,000-15,000 SCFH DELIVERY PRESSURE 7" W.C. STANDARD DETAIL | APPROVED: MAY 20, 2022 | SCALE: NONE |
| DRAWN A.P. | 9/15 | |  SILVIA LEE SANTOS ENGINEERING MANAGER | 50674 R.E. NO. |
| CHECKED A.P. | 9/15 | | | |
| REVIEWED A.P. | 05/21 | CITY OF PALO ALTO, CALIFORNIA | REVISION: MAY 5, 2021 | 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 |

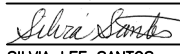
NOTES:

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: MAY 20, 2022 | 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-08C |
| REVIEWED A.P. | 05/21 | CITY OF PALO ALTO, CALIFORNIA | REVISION: MAY 5, 2021 | 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 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 |

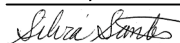
| | | | | |
|---------------|-------|---|--|----------------|
| BY | DATE | RESIDENTIAL/COMMERCIAL/INDUSTRIAL ROTARY METER SET ASSEMBLY 800-2,000 SCFH DELIVERY PRESSURE 7" W.C., 14" W.C., 1 PSIG, 2 PSIG STANDARD DETAIL | APPROVED: MAY 20, 2022  SILVIA LEE SANTOS ENGINEERING MANAGER | SCALE: NONE |
| DRAWN A.P. | 9/15 | | 50674 R.E. NO. | DWG. NO. |
| CHECKED A.P. | 9/15 | | | STD. GD-09B |
| REVIEWED A.P. | 05/21 | CITY OF PALO ALTO, CALIFORNIA | REVISION: MAY 5, 2021 | APPENDIX C |

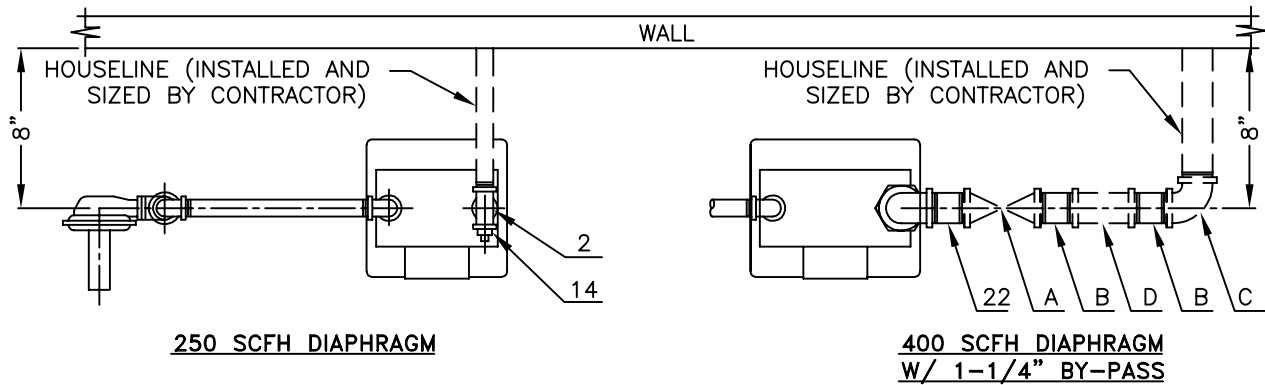
LIST OF MATERIALS

| 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 |

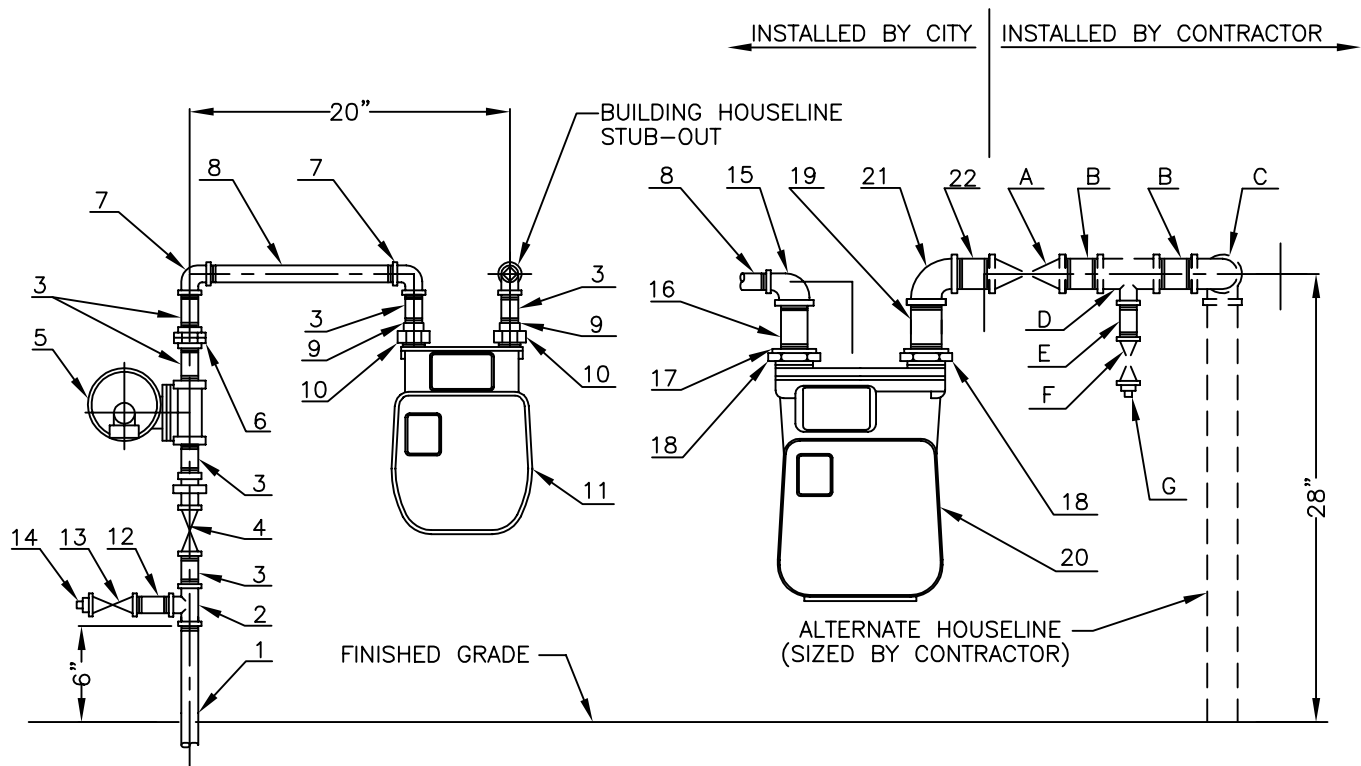
ESTIMATED PRESSURE LOSS IN DOWNSTREAM OF REGULATOR CITY PIPING

| 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 | APPROVED: MAY 20, 2022 | SCALE: NONE |
| DRAWN A.P. | 9/15 | 800-2,000 SCFH |  | DWG. NO. |
| CHECKED A.P. | 9/15 | DELIVERY PRESSURE 7" W.C., 14" W.C., 1 PSIG, 2 PSIG | SILVIA LEE SANTOS ENGINEERING MANAGER | STD. GD-09C |
| REVIEWED A.P. | 05/21 | CITY OF PALO ALTO, CALIFORNIA | REVISION: MAY 5, 2021 | 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: MAY 20, 2022 <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. | 05/21 | | REVISION: MAY 5, 2021 | APPENDIX C |

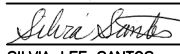
CITY OF PALO ALTO, CALIFORNIA

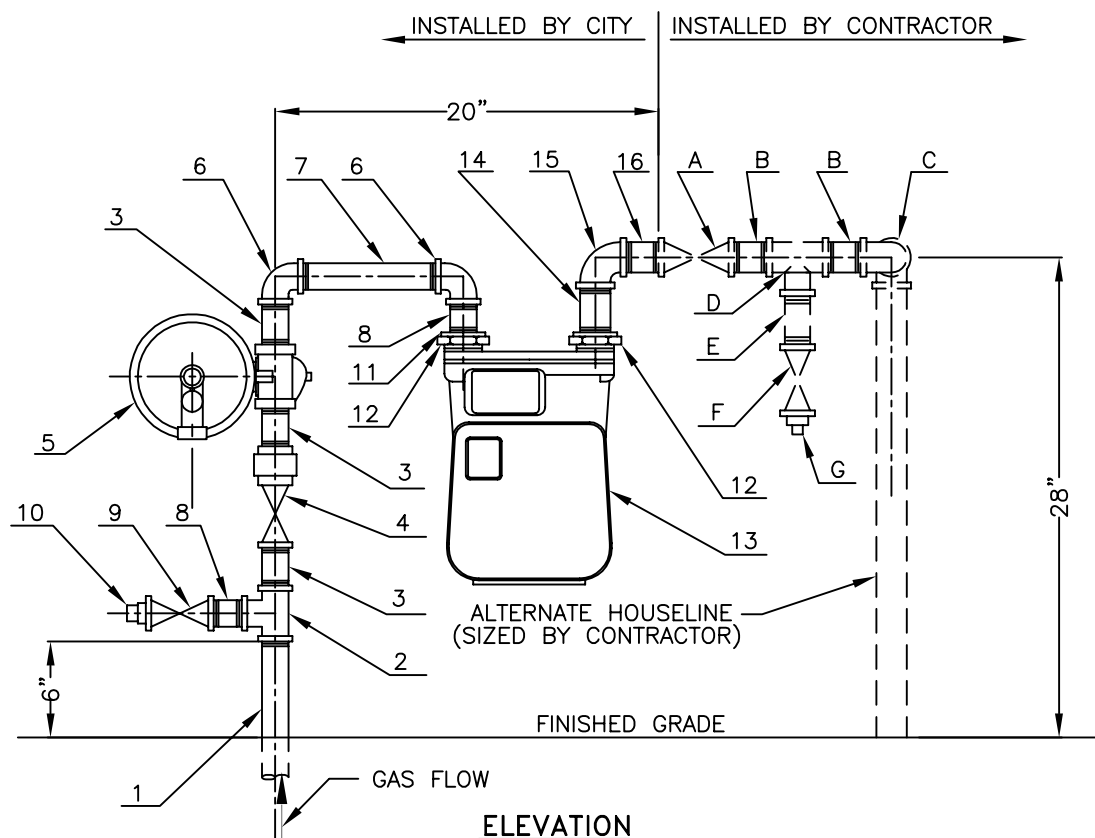
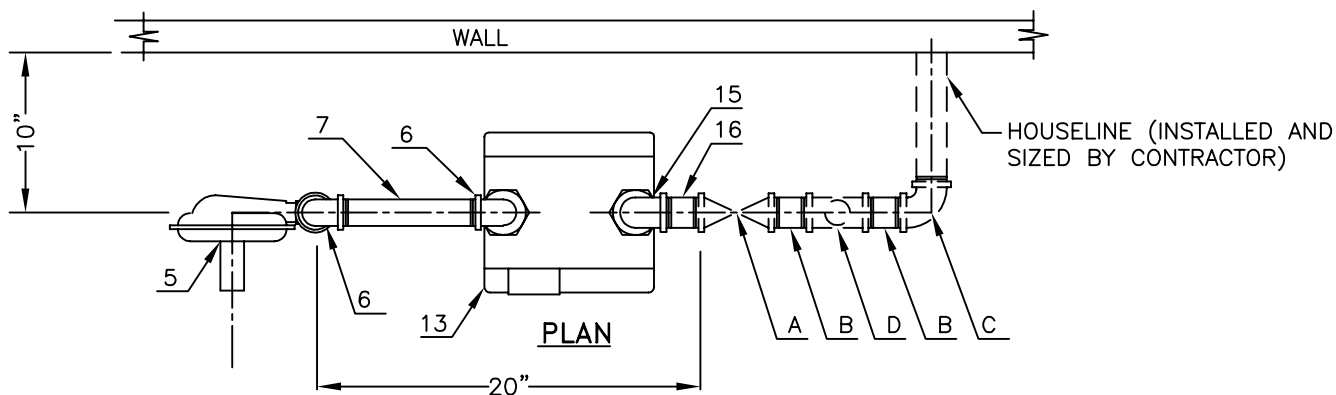
LIST OF MATERIALS

| 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

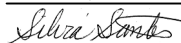
| NO. | DESCRIPTION | QUANTITY |
|-----|--|----------|
| A | 1-1/2" METER VALVE (NATURAL GAS APPROVED) | 1 |
| B | 1-1/2" NIPPLE (LENGTH AS REQUIRED) | 2 |
| C | 1-1/2" 90° ELBOW | 1 |
| D | 1-1/2" x 1-1/2" x 3/4" TEE | 1 |
| E | 3/4" NIPPLE (LENGTH AS REQUIRED) | 1 |
| F | 3/4" METER VALVE (NATURAL 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: MAY 20, 2022  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. | 05/21 | CITY OF PALO ALTO, CALIFORNIA | REVISION: MAY 5, 2021 | 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: MAY 20, 2022  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-11A |
| REVIEWED | A.P. | 05/21 | | REVISION: MAY 5, 2021 | APPENDIX C |

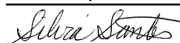
CITY OF PALO ALTO, CALIFORNIA

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: MAY 20, 2022  | 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. | 05/21 | CITY OF PALO ALTO, CALIFORNIA | REVISION: MAY 5, 2021 | APPENDIX C |



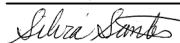
| | | | | |
|---------------|-------|--|--|-------------------------|
| BY | DATE | COMMERCIAL METER SET ASSEMBLY 1,000 SCFH DELIVERY PRESSURE 7" W.C. STANDARD DETAIL | APPROVED: MAY 20, 2022 | SCALE: 1"=1'-0" |
| DRAWN A.P. | 1/16 | |  50674 SILVIA LEE SANTOS ENGINEERING MANAGER R.E. NO. | DWG. NO. STD. GD-12A |
| CHECKED A.P. | 1/16 | | | |
| REVIEWED A.P. | 05/21 | CITY OF PALO ALTO, CALIFORNIA | REVISION: MAY 5, 2021 | APPENDIX C |

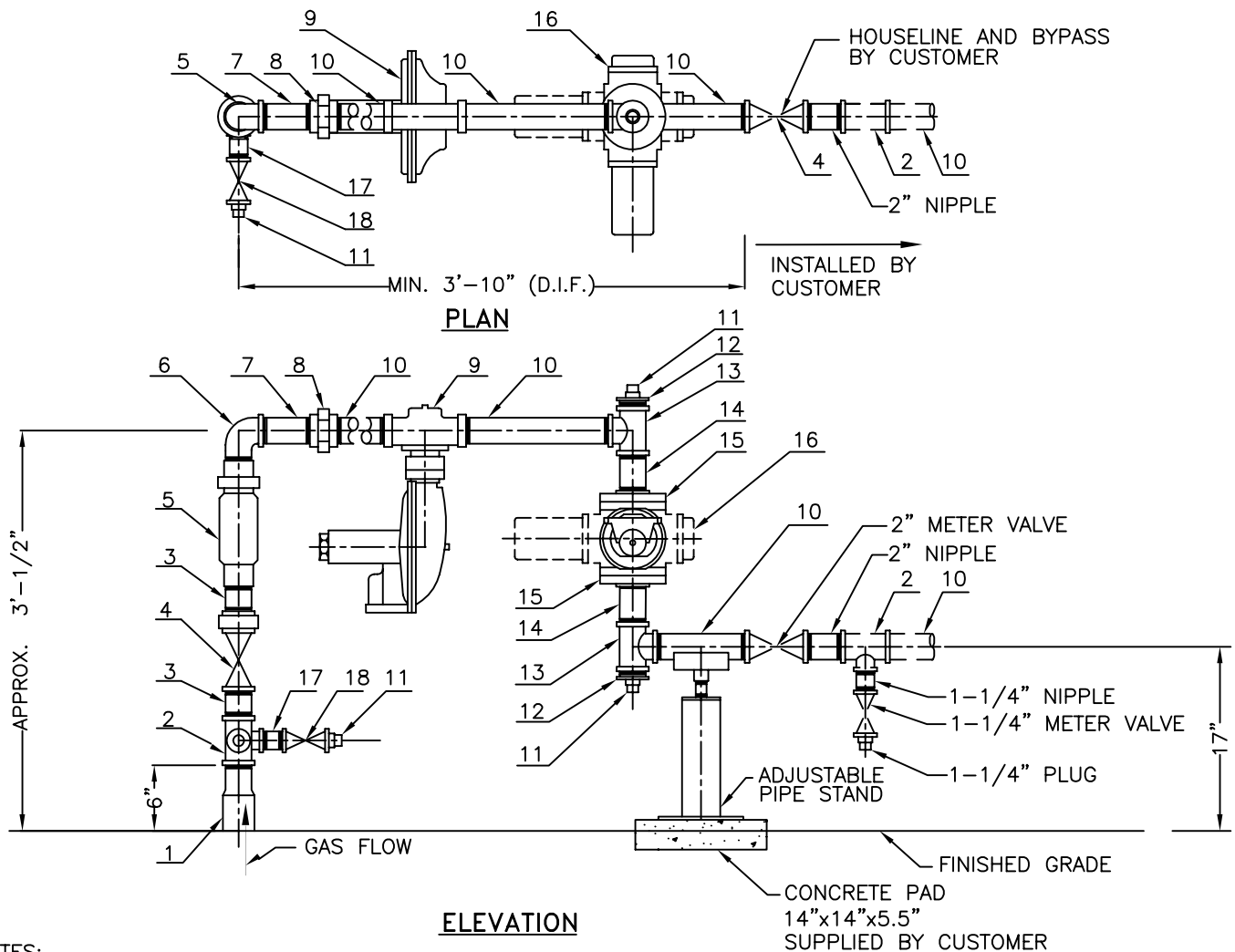
LIST OF MATERIALS

| 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: MAY 20, 2022 | SCALE: NONE |
| DRAWN A.P. | 1/16 | |  50674 | DWG. NO. |
| CHECKED A.P. | 1/16 | | SILVIA LEE SANTOS ENGINEERING MANAGER | STD. GD-12B |
| REVIEWED A.P. | 05/21 | CITY OF PALO ALTO, CALIFORNIA | REVISION: MAY 5, 2021 | 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

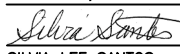
| | | | | |
|---------------|-------|---|----------------------------|----------------------|
| BY | DATE | COMMERCIAL/INDUSTRIAL ROTARY METER SET ASSEMBLY 2,000-3,000 SCFH DELIVERY PRESSURE 7" W.C., 14" W.C., 1 PSIG, 2 PSIG STANDARD DETAIL | APPROVED: MAY 20, 2022 | SCALE: 3/4"=1'-0" |
| DRAWN A.P. | 9/15 | | <i>Silvia Santos</i> 50674 | DWG. NO. |
| CHECKED A.P. | 9/15 | | SILVIA LEE SANTOS R.E. NO. | STD. GD-13A |
| REVIEWED A.P. | 05/21 | | REVISION: MAY 5, 2021 | APPENDIX C |

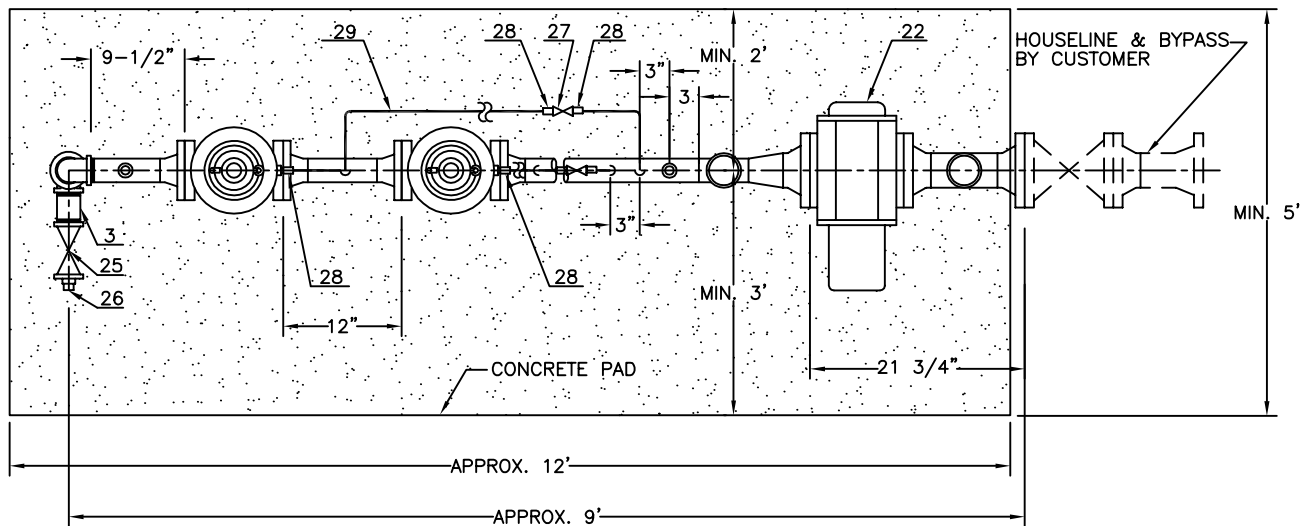
LIST OF MATERIALS

| 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 |

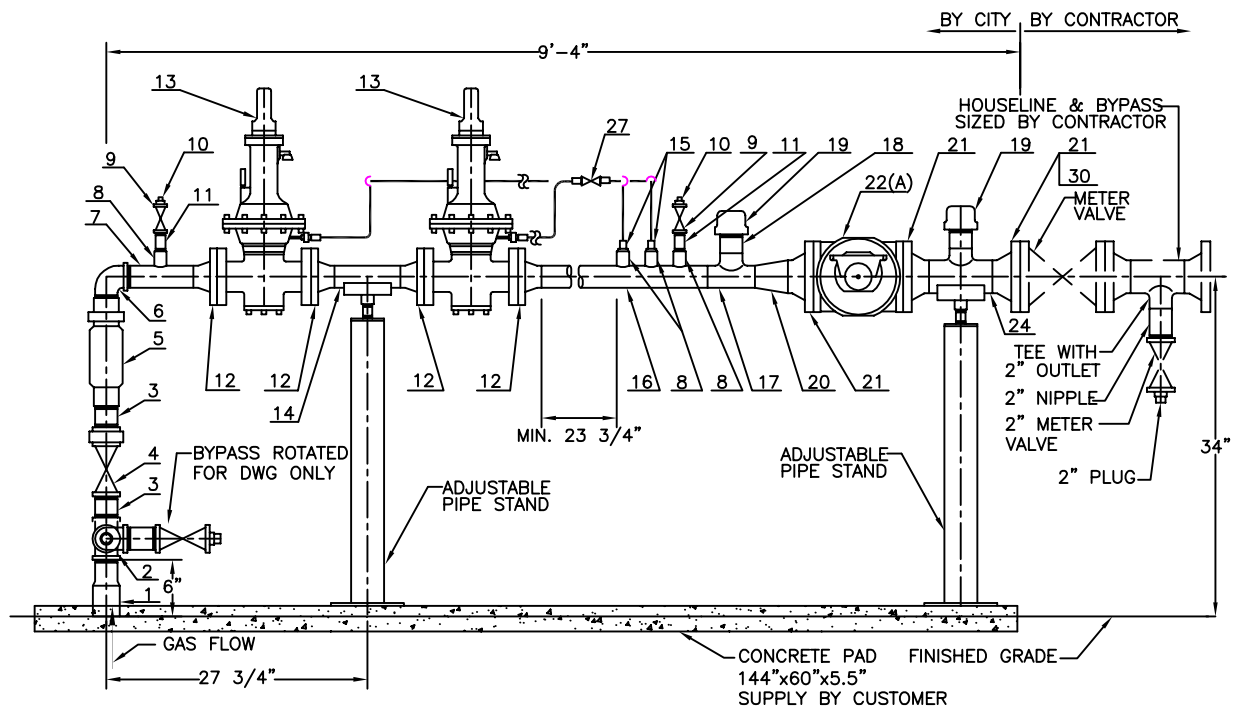
ESTIMATED PRESSURE LOSS IN DOWNSTREAM OF REGULATOR CITY PIPING

| 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: MAY 20, 2022  SILVIA LEE SANTOS ENGINEERING MANAGER | SCALE: NONE |
| DRAWN A.P. | 9/15 | | 50674 R.E. NO. | DWG. NO. STD. GD-13B |
| CHECKED A.P. | 9/15 | | | |
| REVIEWED A.P. | 05/21 | CITY OF PALO ALTO, CALIFORNIA | REVISION: MAY 5, 2021 | APPENDIX C |

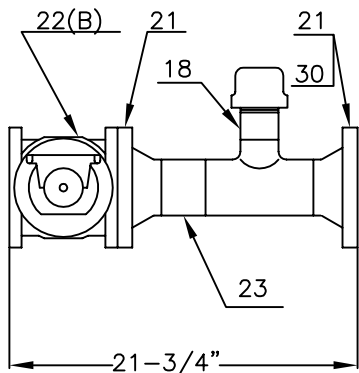


PLAN

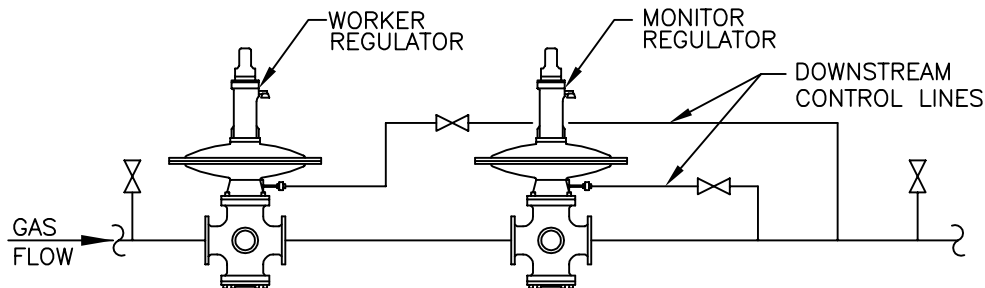


ELEVATION

| | | | | |
|----------|------------|---|--|-------------|
| BY | DATE | COMMERCIAL/INDUSTRIAL ROTARY METER SET ASSEMBLY 5,000 & 7,000 SCFH DELIVERY PRESSURE 3 PSIG & 5 PSIG STANDARD DETAIL | APPROVED: | SCALE: |
| | | | MAY 20, 2022 | 3/4"=1'-0" |
| DRAWN | A.P. 6/15 | | <i>Silvia Santos</i> | DWG. NO. |
| CHECKED | A.P. 05/21 | | SILVIA LEE SANTOS ENGINEERING MANAGER | STD. GD-14A |
| REVIEWED | A.P. 05/21 | CITY OF PALO ALTO, CALIFORNIA | REVISION: MAY 5, 2021 | APPENDIX C |



**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.

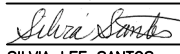
**ESTIMATED PRESSURE LOSS IN
DOWNSTREAM OF REGULATOR CITY PIPING**

| 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 |

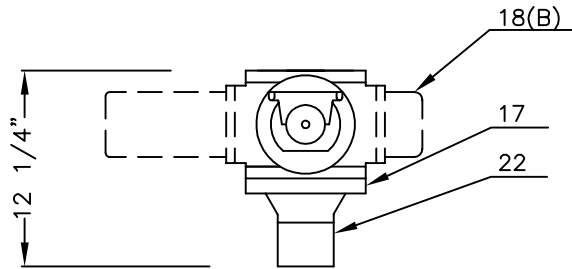
| | | | | |
|---------------|-------|---|----------------------------|-----------------------|
| BY | DATE | COMMERCIAL/INDUSTRIAL ROTARY METER SET ASSEMBLY 5,000 & 7,000 SCFH DELIVERY PRESSURE 3 PSIG & 5 PSIG STANDARD DETAIL | APPROVED: MAY 20, 2022 | SCALE: NONE |
| DRAWN A.P. | 6/15 | | <i>Silvia Santos</i> 50674 | DWG. NO. |
| CHECKED A.P. | 6/15 | | SILVIA LEE SANTOS R.E. NO. | STD. GD-14B |
| REVIEWED A.P. | 05/21 | | REVISION: MAY 5, 2021 | 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: MAY 20, 2022  SILVIA LEE SANTOS ENGINEERING MANAGER | SCALE: NONE |
| DRAWN A.P. | 6/15 | | 50674 R.E. NO. | DWG. NO. |
| CHECKED A.P. | 6/15 | | | STD. GD-14C |
| REVIEWED A.P. | 05/21 | CITY OF PALO ALTO, CALIFORNIA | REVISION: MAY 5, 2021 | APPENDIX C |

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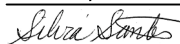
5000 SCFH METER INSTALLATION

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 |

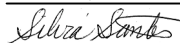
NOTES:

- FOR PLACEMENT REQUIREMENTS REFER TO STD. GD-01B AND STD. GD-02B.
- UPON COMPLETION OF METER ASSEMBLY, LEAK TEST ALL CONNECTIONS.
- IT IS ASSUMED THAT INLET PRESSURE DOWNSTREAM OF THE FILTER IS MIN. 10 PSIG.
- ITRON B38R (44321) AND B838R (44349) SHARE SAME ORIFICES AND SPRINGS.
- 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.
- 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.
- 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: MAY 20, 2022 | SCALE: NONE |
| DRAWN A.P. | 9/15 | |  50674 SILVIA LEE SANTOS ENGINEERING MANAGER R.E. NO. | DWG. NO. STD. GD-15B |
| CHECKED A.P. | 9/15 | | | |
| REVIEWED A.P. | 05/21 | CITY OF PALO ALTO, CALIFORNIA | REVISION: MAY 5, 2021 | 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. | 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: MAY 20, 2022  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. | 05/21 | CITY OF PALO ALTO, CALIFORNIA | REVISION: MAY 5, 2021 | APPENDIX C |



LIST OF MATERIALS

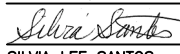
| NO. | DESCRIPTION | STOCK NO. | UNIT | QUANTITY |
|-----|--|-------------|------|----------|
| 1 | 2" IPS x 2" IPS ANODELESS SERVICE RISER PREBENT | 43057 | EA. | 1 |
| 2 | 2" TEE, BLK | 41804 | EA. | 1 |
| 3 | 2" x 2-1/2" NIPPLE, BLK | 41451 | EA. | 4 |
| 4 | 2" H-11179 MUELLER METER VALVE WITH INSULATED 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: MAY 20, 2022  SILVIA LEE SANTOS ENGINEERING MANAGER | SCALE: NONE |
| DRAWN A.P. | 9/15 | | 50674 R.E. NO. | DWG. NO. STD. GD-16B |
| CHECKED A.P. | 9/15 | | | |
| REVIEWED A.P. | 05/21 | CITY OF PALO ALTO, CALIFORNIA | REVISION: MAY 5, 2021 | 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.

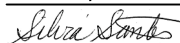
| | | | | |
|---------------|-------|---|---|----------------|
| BY | DATE | COMMERCIAL/INDUSTRIAL ROTARY METER SET ASSEMBLY 11,000/16,000 SCFH DELIVERY PRESSURE 7" W.C., 14" W.C., 1, 2, 3 & 5 PSIG STANDARD DETAIL | APPROVED: MAY 20, 2022 | SCALE: NONE |
| DRAWN A.P. | 5/15 | | <i>Silvia Santos</i> 50674 | DWG. NO. |
| CHECKED A.P. | 5/15 | | SILVIA LEE SANTOS ENGINEERING MANAGER R.E. NO. | STD. GD-17B |
| REVIEWED A.P. | 05/21 | CITY OF PALO ALTO, CALIFORNIA | REVISION: MAY 5, 2021 | APPENDIX C |

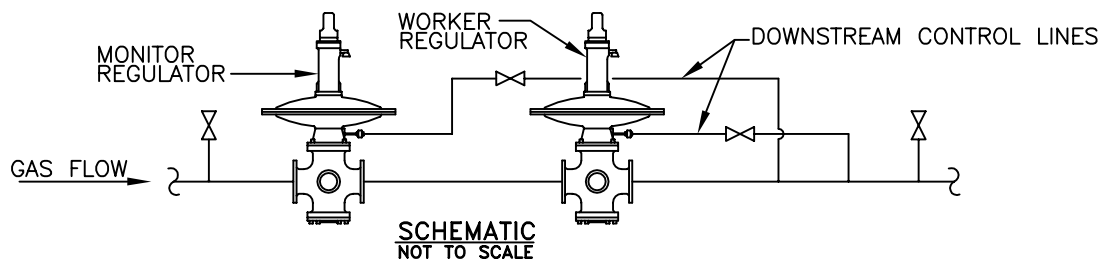
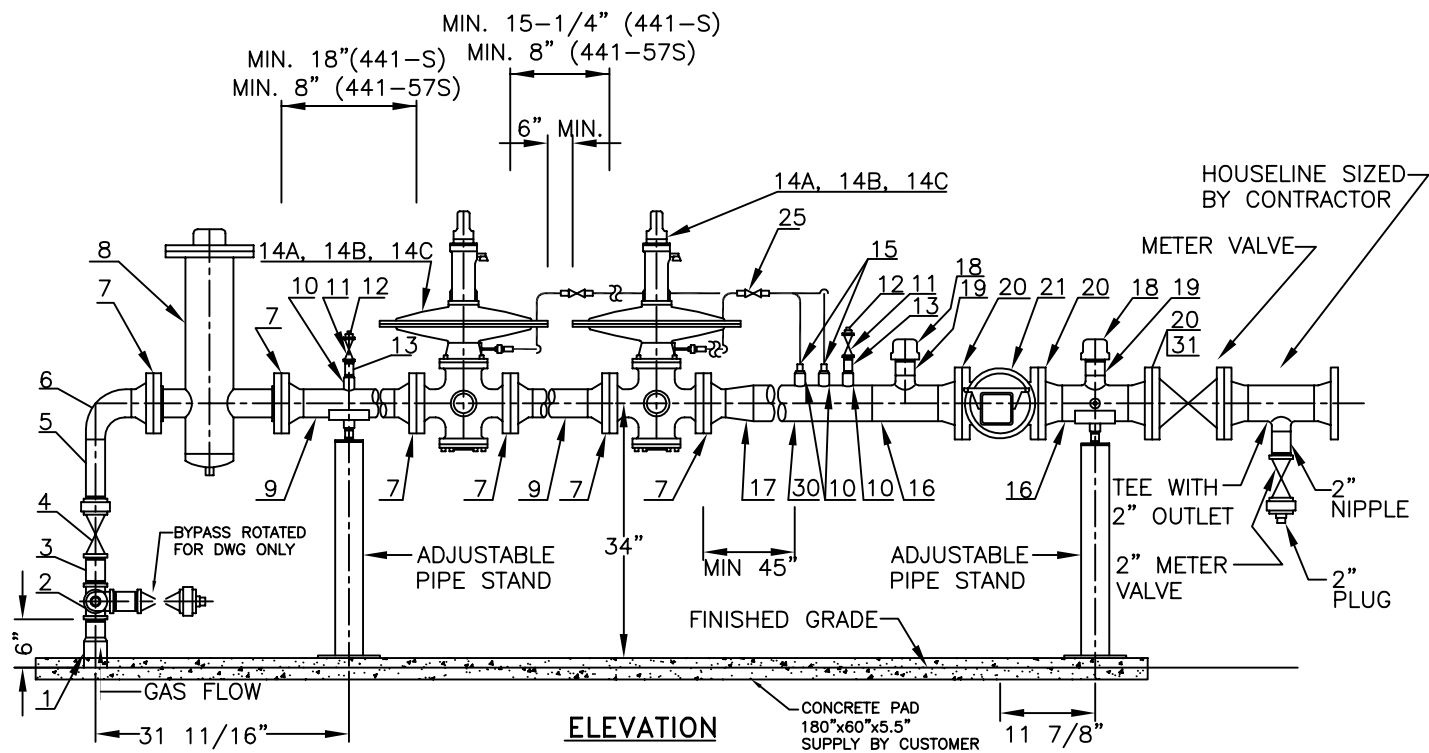
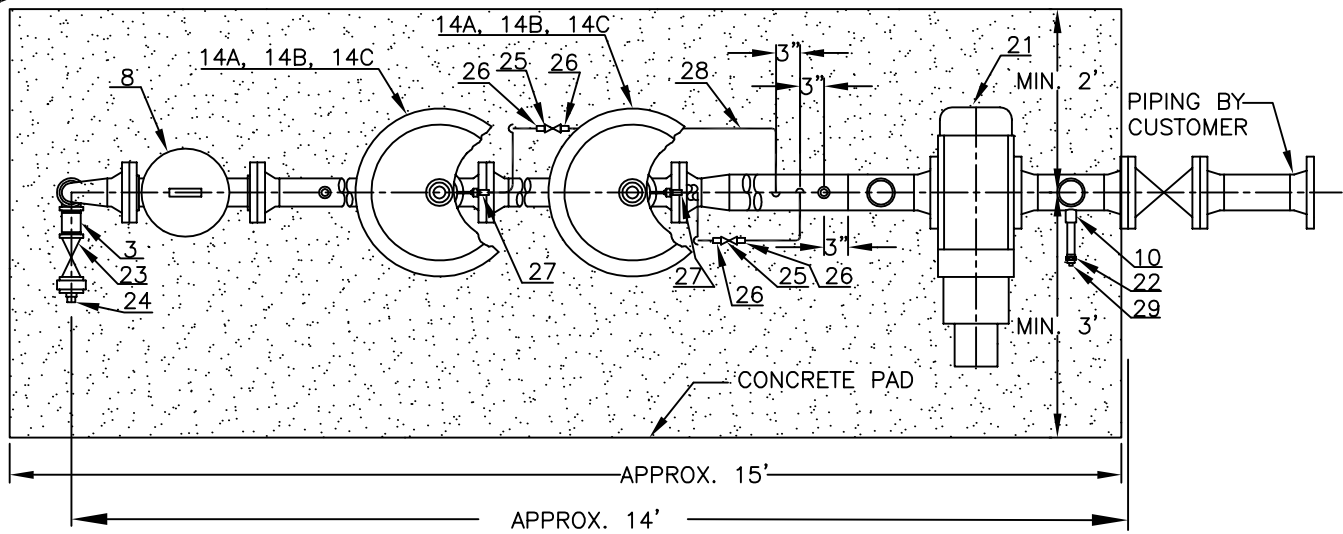
LIST OF MATERIALS

| 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 |

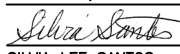
| | | | | |
|---------------|-------|---|--|-------------------------|
| BY | DATE | COMMERCIAL/INDUSTRIAL ROTARY METER SET ASSEMBLY 11,000/16,000 SCFH DELIVERY PRESSURE 7" W.C., 14" W.C., 1, 2, 3 & 5 PSIG STANDARD DETAIL | APPROVED: MAY 20, 2022  SILVIA LEE SANTOS ENGINEERING MANAGER | SCALE: NONE |
| DRAWN A.P. | 5/15 | | 50674 R.E. NO. | DWG. NO. STD. GD-17C |
| CHECKED A.P. | 5/15 | | | |
| REVIEWED A.P. | 05/21 | CITY OF PALO ALTO, CALIFORNIA | REVISION: MAY 5, 2021 | APPENDIX C |



| | | | | |
|----------|------------|---|---|-------------------------|
| BY | DATE | INDUSTRIAL ROTARY METER SET ASSEMBLY 23,000 SCFH DELIVERY PRESSURE 14" W.C., 1, 2, 3, & 5 PSIG STANDARD DETAIL | APPROVED: MAY 20, 2022 SILVIA LEE SANTOS ENGINEERING MANAGER | SCALE: 1/2"=1'-0" |
| | | | | |
| | | | | |
| | | | | |
| DRAWN | A.P. 5/15 | CITY OF PALO ALTO, CALIFORNIA | REVISION: MAY 5, 2021 | DWG. NO. STD. GD-18A |
| CHECKED | A.P. 5/15 | | | APPENDIX C |
| REVIEWED | A.P. 05/21 | | | |

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 | DATE | INDUSTRIAL ROTARY METER SET ASSEMBLY 23,000 SCFH DELIVERY PRESSURE 14" W.C., 1, 2, 3, & 5 PSIG STANDARD DETAIL | APPROVED: MAY 20, 2022  SILVIA LEE SANTOS ENGINEERING MANAGER | SCALE: NONE |
| | | | | |
| | | | | |
| DRAWN | A.P. | 5/15 | 50674 R.E. NO. | DWG. NO. |
| CHECKED | A.P. | 5/15 | | STD. GD-18B |
| REVIEWED | A.P. | 05/21 | REVISION: MAY 5, 2021 | APPENDIX C |
| | | CITY OF PALO ALTO, CALIFORNIA | | |

LIST OF MATERIALS

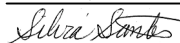
| NO. | DESCRIPTION | STOCK NO. | UNIT | QUANTITY |
|-----|--|-----------|------|----------|
| 21 | 4" FF FLANGE 175 MAOP 23000 SCFH ROTARY GAS WITH A DIGITAL NON-COMPENSATED INDEX AND INTERNAL PULSER | 44152 | EA. | 1 |
| 22 | 3/4" MALE x 1/2" FEMALE THERMOWELL 4" LONG, THREADED TYPE, 304 STAINLESS 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 |

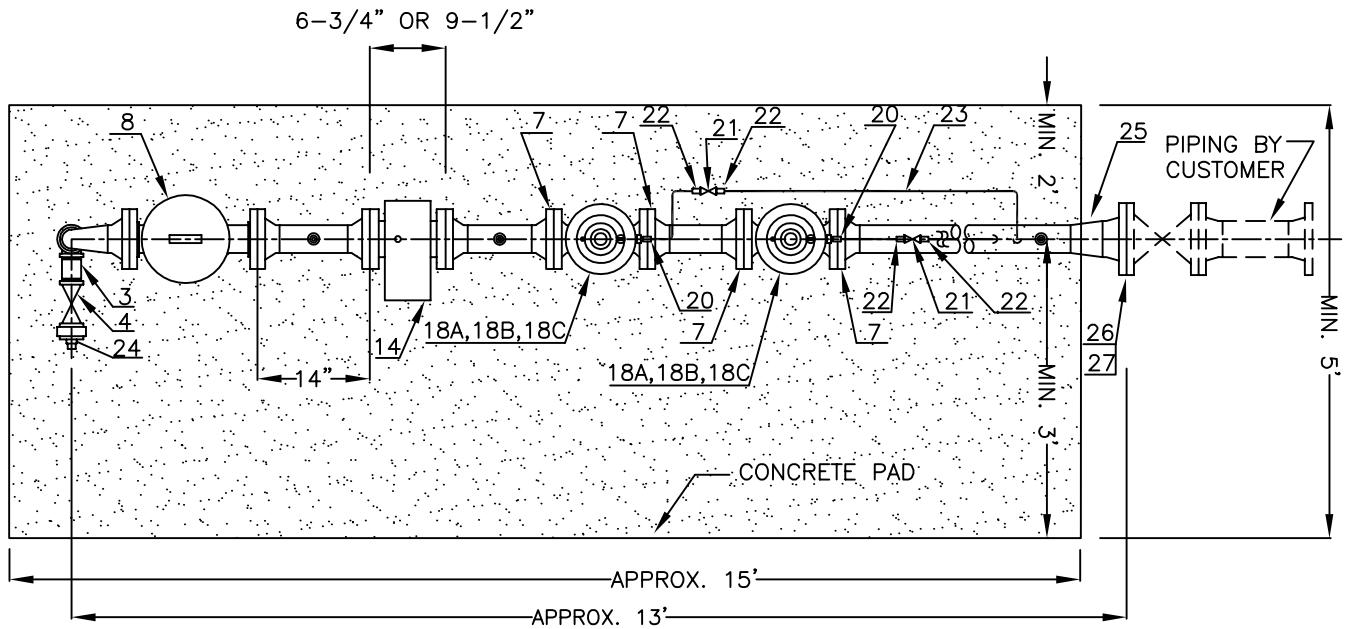
ESTIMATED PRESSURE LOSS IN DOWNSTREAM OF REGULATOR CITY PIPING

| 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 |

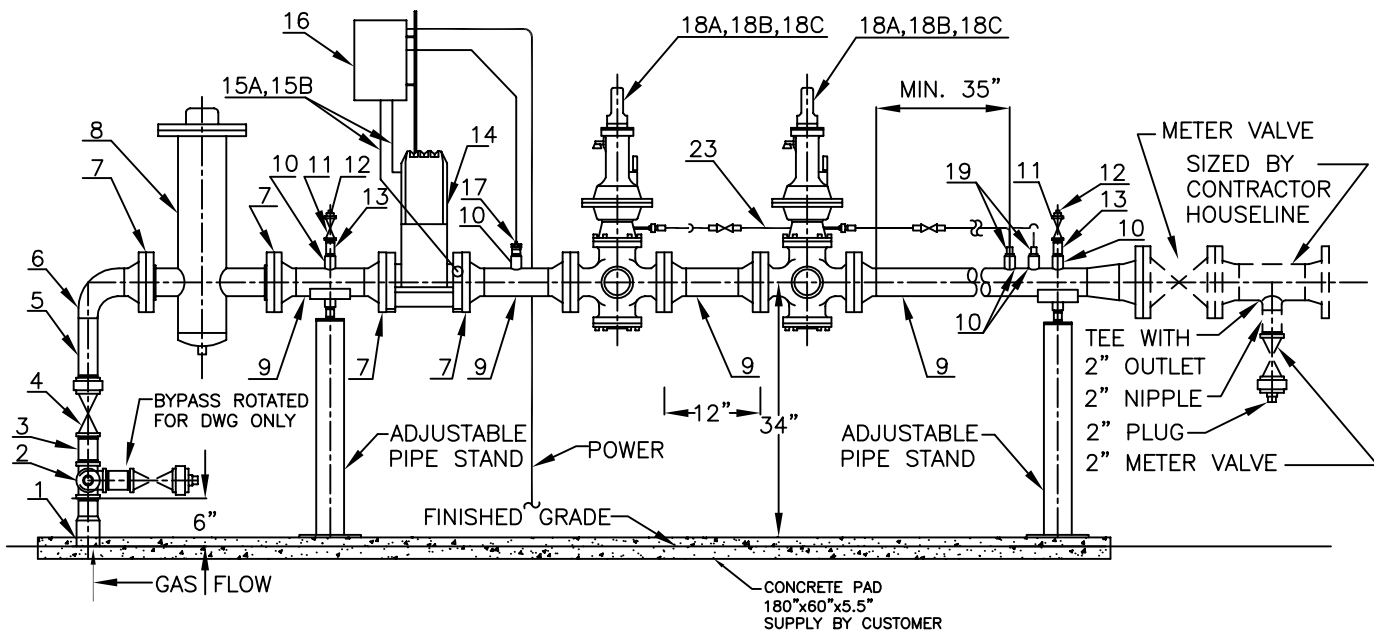
NOTES:

- 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.

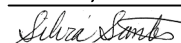
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|---------------|-------|---|---|-------------------------|
| BY | DATE | INDUSTRIAL ROTARY METER SET ASSEMBLY 23,000 SCFH DELIVERY PRESSURE 14" W.C., 1, 2, 3, & 5 PSIG STANDARD DETAIL | APPROVED: MAY 20, 2022 | SCALE: NONE |
| DRAWN A.P. | 5/15 | |  SILVIA LEE SANTOS ENGINEERING MANAGER | DWG. NO. STD. GD-18C |
| CHECKED A.P. | 5/15 | | 50674 R.E. NO. | |
| REVIEWED A.P. | 05/21 | CITY OF PALO ALTO, CALIFORNIA | REVISION: MAY 5, 2021 | APPENDIX C |



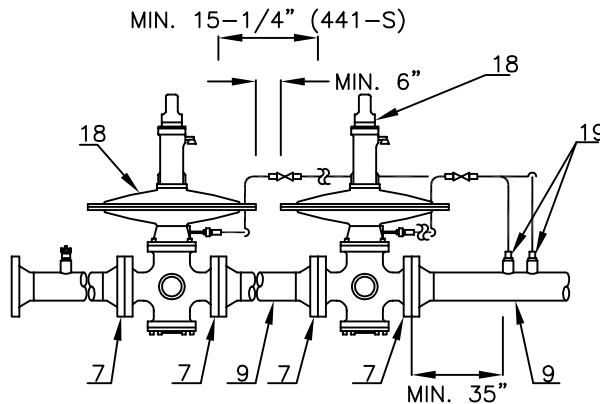
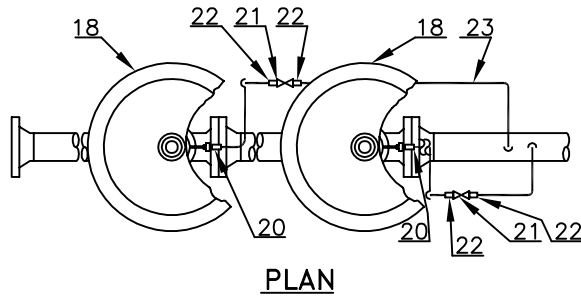
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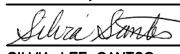
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|----------|------|-------|--|--|--|--------------------------|--|
| BY | | DATE | INDUSTRIAL ULTRASONIC METER SET ASSEMBLY 16,000–25,000 SCFH DELIVERY PRESSURE 14" W.C., 1, 3, 5, 7 & 10 PSIG STANDARD DETAIL | APPROVED: MAY 20, 2022 | | SCALE: 1/2"=1'-0" | |
| DRAWN | A.P. | 7/16 | |  50674 SILVIA LEE SANTOS ENGINEERING MANAGER R.E. NO. | | DWG. NO. STD. GD-19A | |
| CHECKED | A.P. | 7/16 | | | | | |
| REVIEWED | A.P. | 05/21 | | CITY OF PALO ALTO, CALIFORNIA | | REVISION: MAY 5, 2021 | |

LOW PRESSURE REGULATORS



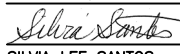
NOTES

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: MAY 20, 2022  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. | 05/21 | | REVISION: MAY 5, 2021 | 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. | 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 |

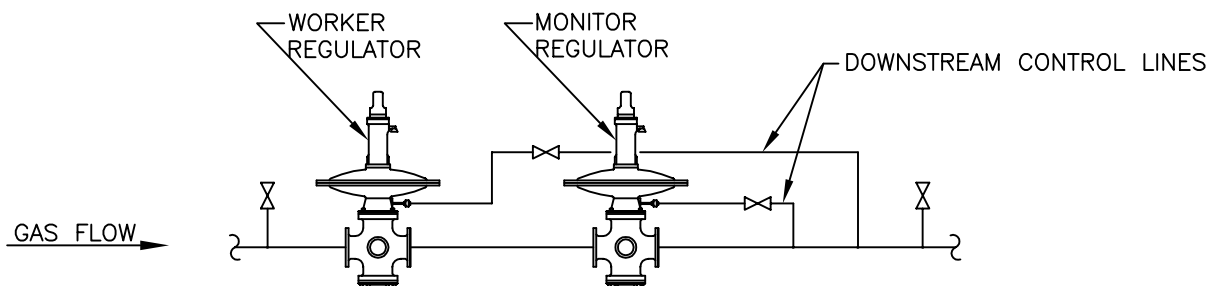
| | | | | |
|---------------|-------|---|---|-------------|
| BY | DATE | INDUSTRIAL ULTRASONIC METER SET ASSEMBLY 16,000-25,000 SCFH DELIVERY PRESSURE 14" W.C., 1, 3, 5, 7 & 10 PSIG STANDARD DETAIL | APPROVED: | SCALE: |
| DRAWN A.P. | 7/16 | | MAY 20, 2022 | NONE |
| CHECKED A.P. | 7/16 | |  SILVIA LEE SANTOS ENGINEERING MANAGER | DWG. NO. |
| REVIEWED A.P. | 05/21 | | 50674 R.E. NO. | STD. GD-19C |
| | | CITY OF PALO ALTO, CALIFORNIA | REVISION: MAY 5, 2021 | APPENDIX C |

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 |

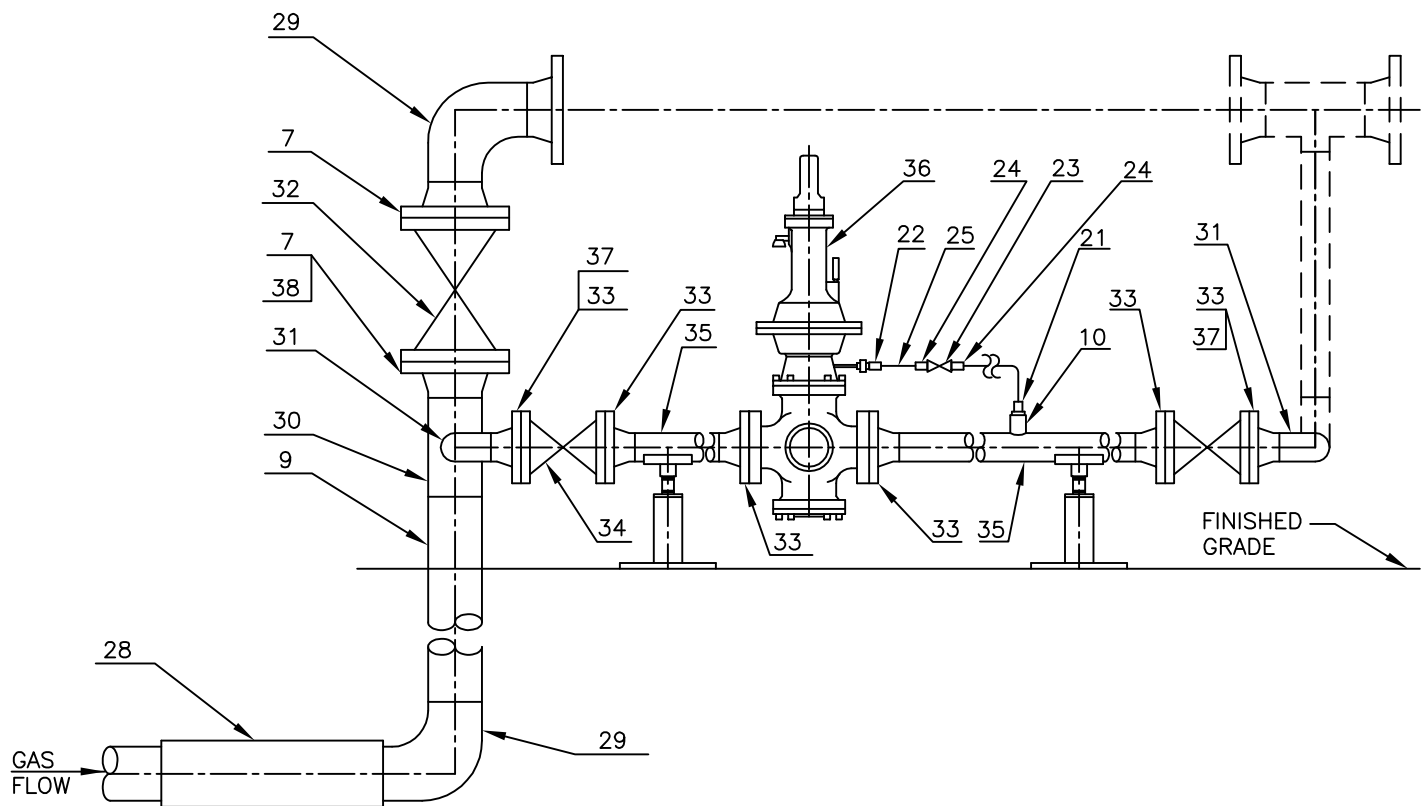
ESTIMATED PRESSURE LOSS IN DOWNSTREAM OF REGULATOR CITY PIPING

| 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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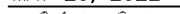
| | | | | |
|---------------|-------|---|---|----------------|
| BY | DATE | INDUSTRIAL ULTRASONIC METER SET ASSEMBLY 16,000-25,000 SCFH DELIVERY PRESSURE 14" W.C., 1, 3, 5, 7 & 10 PSIG STANDARD DETAIL | APPROVED: MAY 20, 2022 | SCALE: NONE |
| DRAWN A.P. | 7/16 | | 50674 SILVIA LEE SANTOS ENGINEERING MANAGER R.E. NO. | DWG. NO. |
| CHECKED A.P. | 7/16 | | | STD. GD-19D |
| REVIEWED A.P. | 05/21 | CITY OF PALO ALTO, CALIFORNIA | REVISION: MAY 5, 2021 | APPENDIX C |



PERMANENT BY-PASS DESIGN 4" RISER PIPE

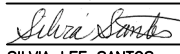
NOTES:

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: MAY 20, 2022 | SCALE: 3/4"=1'-0" |
|----------|------|-------|---|---|--------------------------|
| DRAWN | A.P. | 1/16 | |  50674 | DWG. NO. STD. GD-20B |
| CHECKED | A.P. | 1/16 | | SILVIA LEE SANTOS ENGINEERING MANAGER | |
| REVIEWED | A.P. | 05/21 | | CITY OF PALO ALTO, CALIFORNIA | REVISION: MAY 5, 2021 |

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 |

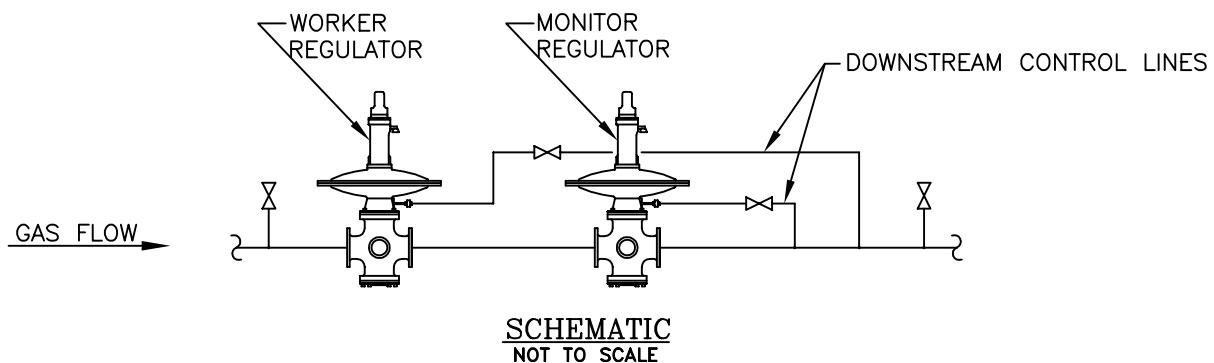
| | | | | |
|---------------|-------|--|--|-------------------------|
| BY | DATE | INDUSTRIAL ULTRASONIC METER SET ASSEMBLY 23,000-45,000 SCFH DELIVERY PRESSURE 3, 5, 7 & 10 PSIG STANDARD DETAIL | APPROVED: MAY 20, 2022  SILVIA LEE SANTOS ENGINEERING MANAGER | SCALE: NONE |
| DRAWN A.P. | 1/16 | | 50674 R.E. NO. | DWG. NO. STD. GD-20C |
| CHECKED A.P. | 1/16 | | | |
| REVIEWED A.P. | 05/21 | CITY OF PALO ALTO, CALIFORNIA | REVISION: MAY 5, 2021 | 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

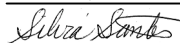
| FLOW SCFH | SET PRESSURE | PRESSURE AT CUSTOMER PIPING | SET PRESSURE TO COMPENSATE FOR CITY PIPING HEADLOSS |
|-----------|--------------|-----------------------------|---|
| 25000 | 3 PSIG | 2.947 PSIG | 3.053 PSIG |
| | 5 PSIG | 4.952 PSIG | 5.047 PSIG |
| | 10 PSIG | 9.962 PSIG | 10.038 PSIG |
| 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 |

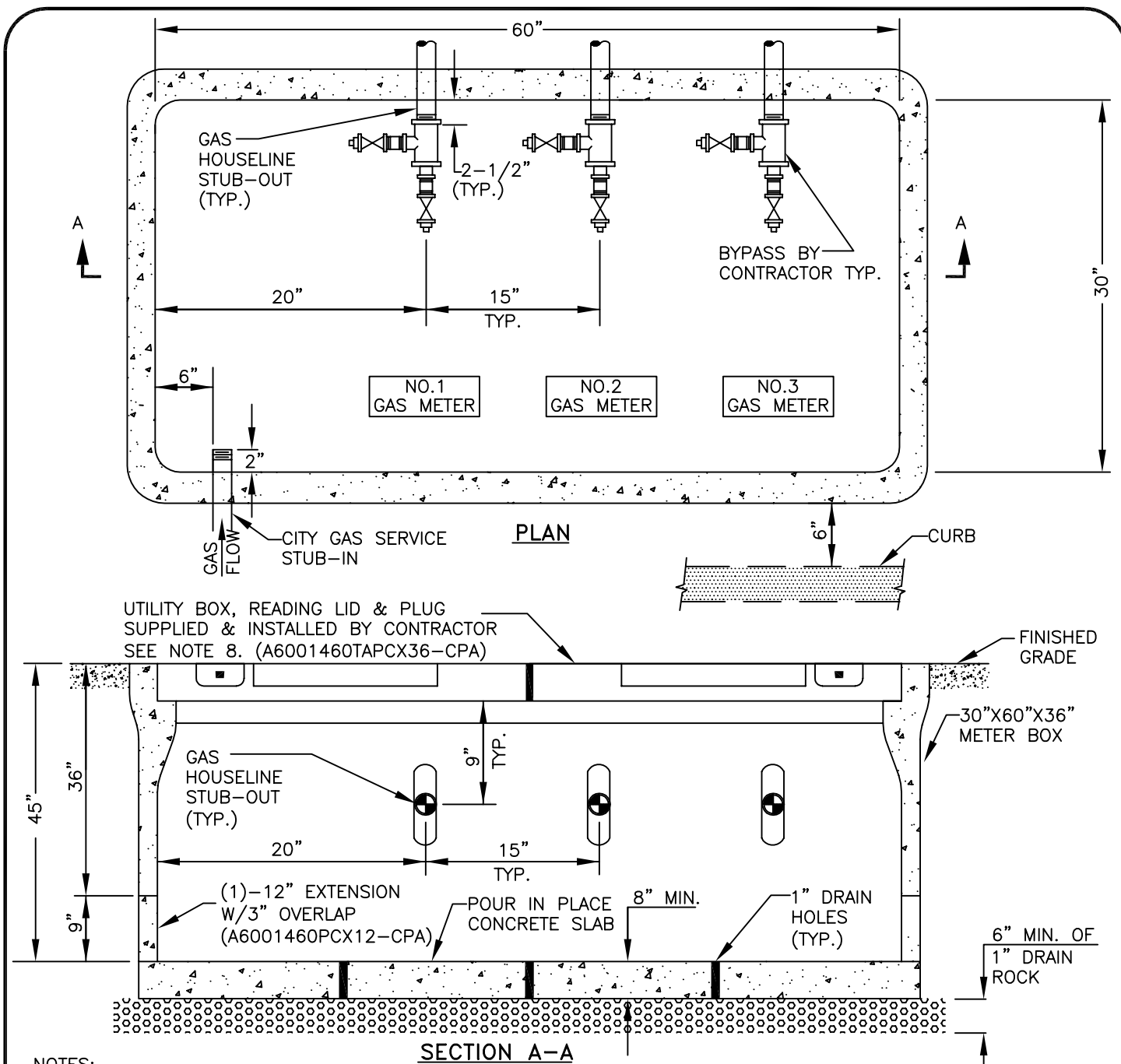


| | | | | |
|---------------|-------|--|--|-------------------------|
| BY | DATE | INDUSTRIAL ULTRASONIC METER SET ASSEMBLY 23,000-45,000 SCFH DELIVERY PRESSURE 3, 5, 7 & 10 PSIG STANDARD DETAIL | APPROVED: MAY 20, 2022 | SCALE: NONE |
| DRAWN A.P. | 1/16 | | SILVIA LEE SANTOS ENGINEERING MANAGER | DWG. NO. STD. GD-20D |
| CHECKED A.P. | 1/16 | | 50674 R.E. NO. | |
| REVIEWED A.P. | 05/21 | CITY OF PALO ALTO, CALIFORNIA | REVISION: MAY 5, 2021 | APPENDIX C |

LIST OF MATERIAL
4" RISER PIPE WITH PERMANENT BY-PASS ADDITIONAL FITTINGS

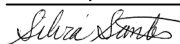
| NO. | DESCRIPTION | STOCK NO. | UNIT | QUANTITY |
|-----|---|-----------|------|----------|
| 7 | 4" 150 ANSI WELD NECK FLANGE, FLAT FACE A105 | 43332 | EA. | 2 |
| | 4" IPS 1/16" THICK, FULL FACE GASKET FOR 150 ANSI FLAT FACE FLANGE | 43352 | EA. | 1 |
| | STUD BOLT 5/8" x 3-1/2" WITH HEX CAP | 43319 | 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: MAY 20, 2022  | 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. | 05/21 | CITY OF PALO ALTO, CALIFORNIA | REVISION: MAY 5, 2021 | APPENDIX C |

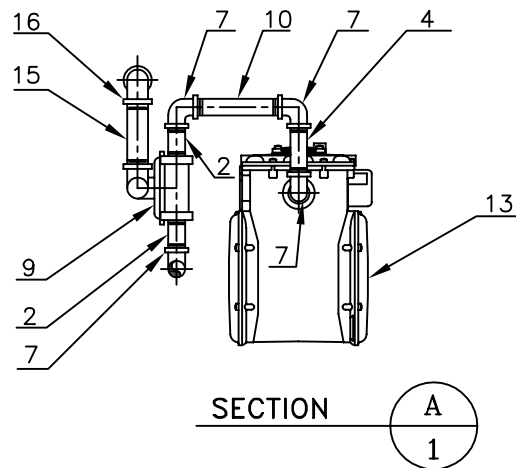
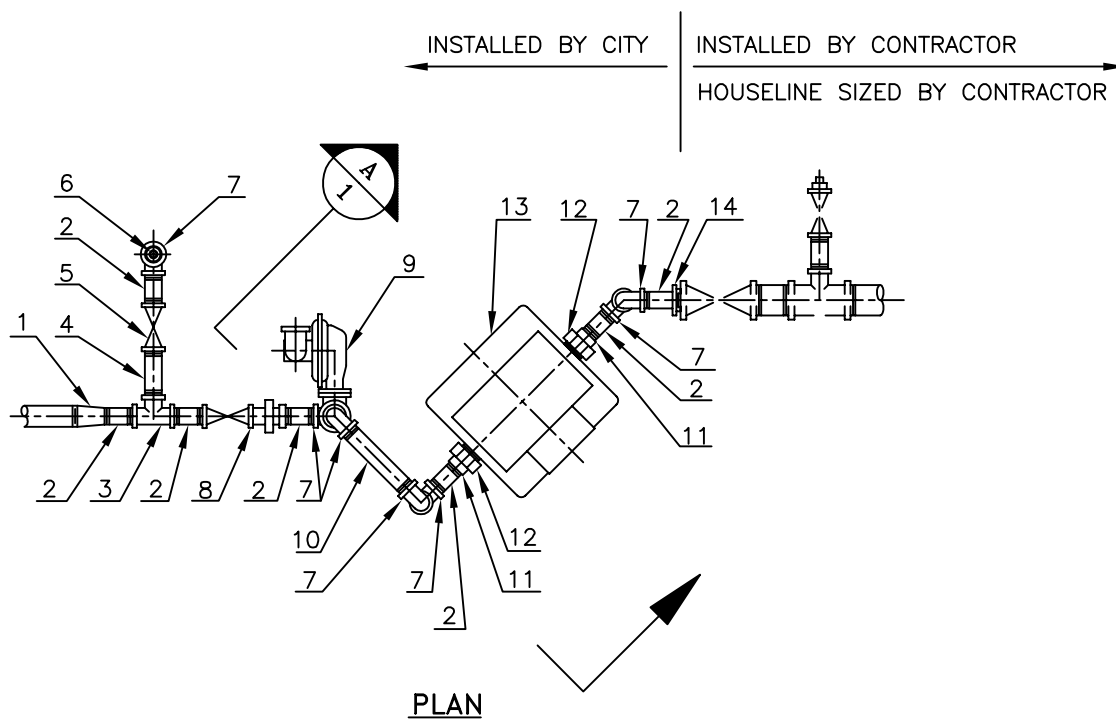


NOTES:

1. CURB METER BOX, INSTALLATION AND LOCATION SHALL BE APPROVED BY THE UTILITIES DEPARTMENT. CONTRACTOR SHALL FURNISH AND INSTALL METER BOX, LID, HOUSELINE & BY-PASS.
2. CURB METER BOXES MUST NOT BE LOCATED IN CONTINUOUS VEHICULAR TRAFFIC AREAS.
3. CURB METER BOXES SHALL NOT BE INSTALLED IN AREAS PRONE TO FLOODING (RAINFALL, SURFACE WATER FLOW, IRRIGATION, ETC.)
4. 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.
5. METER BOX AND LIDS SHALL BE H-20 RATING FOR SW & PLANTING STRIP APPLICATIONS.
6. 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 PLUG (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: | SCALE: |
| DRAWN | A.P. 8/96 | | MAY 20, 2022 | NONE |
| CHECKED | A.P. 2/20 | |  SILVIA LEE SANTOS ENGINEERING MANAGER | DWG. NO. |
| REVIEWED | A.P. 05/21 | CITY OF PALO ALTO, CALIFORNIA | REVISION: | STD. GD-22 |
| | | | MAY 5, 2021 | APPENDIX C |

250 SCFH METER ASSEMBLY (UTILITY BOX)



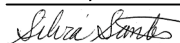
NOTES:

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.

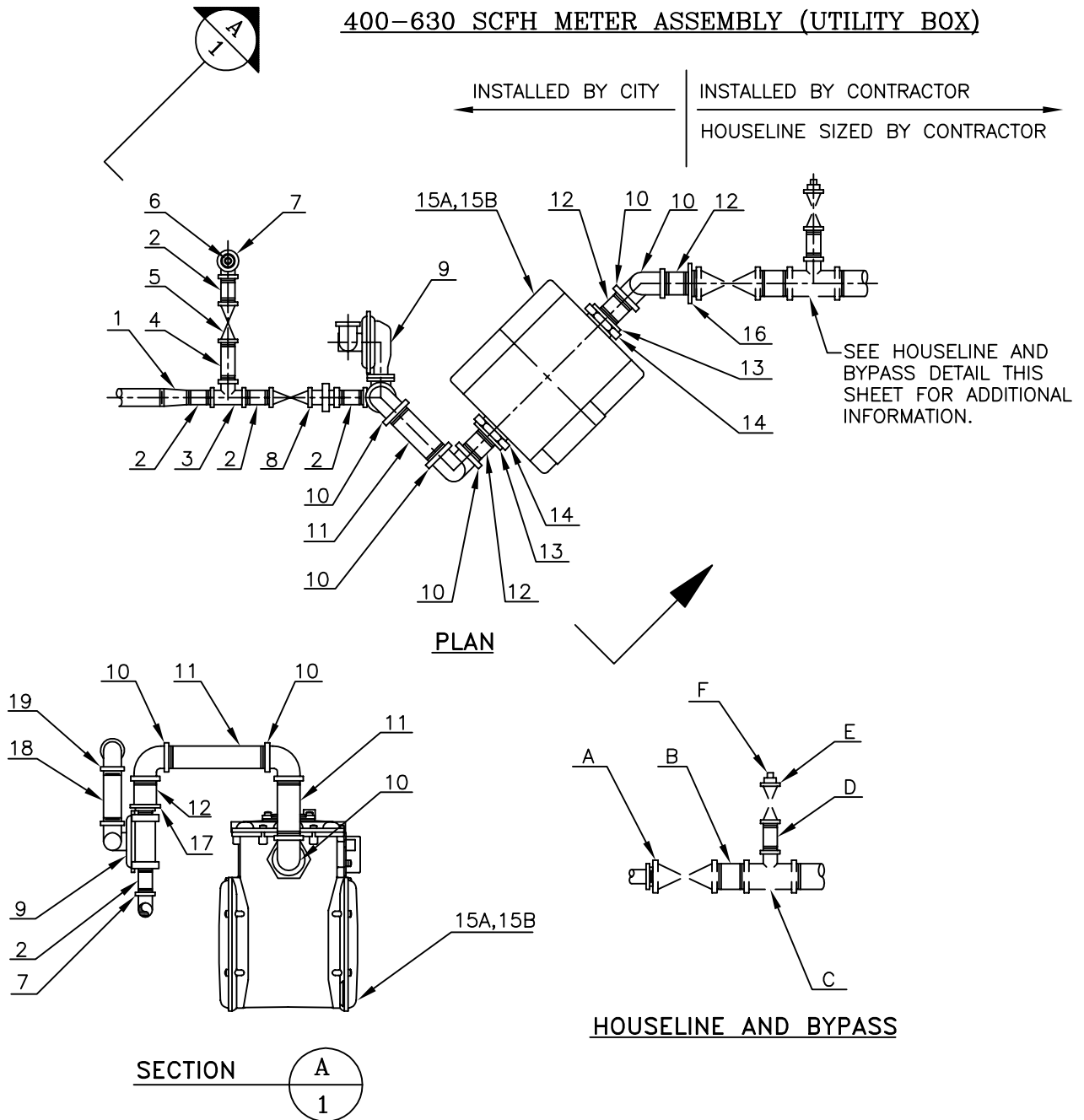
| | | | | |
|----------|------|--|---|-------------------------|
| BY | | UTILITY BOX (CURB LOCATION) METER SET ASSEMBLY 250 SCFH STANDARD DETAIL | APPROVED: MAY 20, 2022 <i>Silvia Santos</i> SILVIA LEE SANTOS ENGINEERING MANAGER | SCALE: 1"=1'-0" |
| DRAWN | A.P. | | | |
| CHECKED | A.P. | | 50674 R.E. NO. | DWG. NO. STD. GD-23A |
| REVIEWED | A.P. | | REVISION: MAY 5, 2021 | 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: MAY 20, 2022 | SCALE: NONE |
| DRAWN A.P. | 2/16 | |  50674 | DWG. NO. |
| CHECKED A.P. | 2/16 | | SILVIA LEE SANTOS ENGINEERING MANAGER | STD. GD-23B |
| REVIEWED A.P. | 05/21 | CITY OF PALO ALTO, CALIFORNIA | REVISION: MAY 5, 2021 | APPENDIX C |

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.

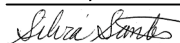
| BY | | DATE | UTILITY BOX (CURB LOCATION) METER SET ASSEMBLY 400-630 SCFH STANDARD DETAIL CITY OF PALO ALTO, CALIFORNIA | APPROVED: MAY 20, 2022 <i>Silvia Lee Santos</i> SILVIA LEE SANTOS ENGINEERING MANAGER | SCALE: 1"=1'-0" |
|----------|------|-------|---|---|--------------------|
| DRAWN | A.P. | 2/16 | | 50674 R.E. NO. | DWG. NO. |
| CHECKED | A.P. | 2/16 | | | STD. GD-23C |
| REVIEWED | A.P. | 05/21 | | REVISION: MAY 5, 2021 | APPENDIX C |

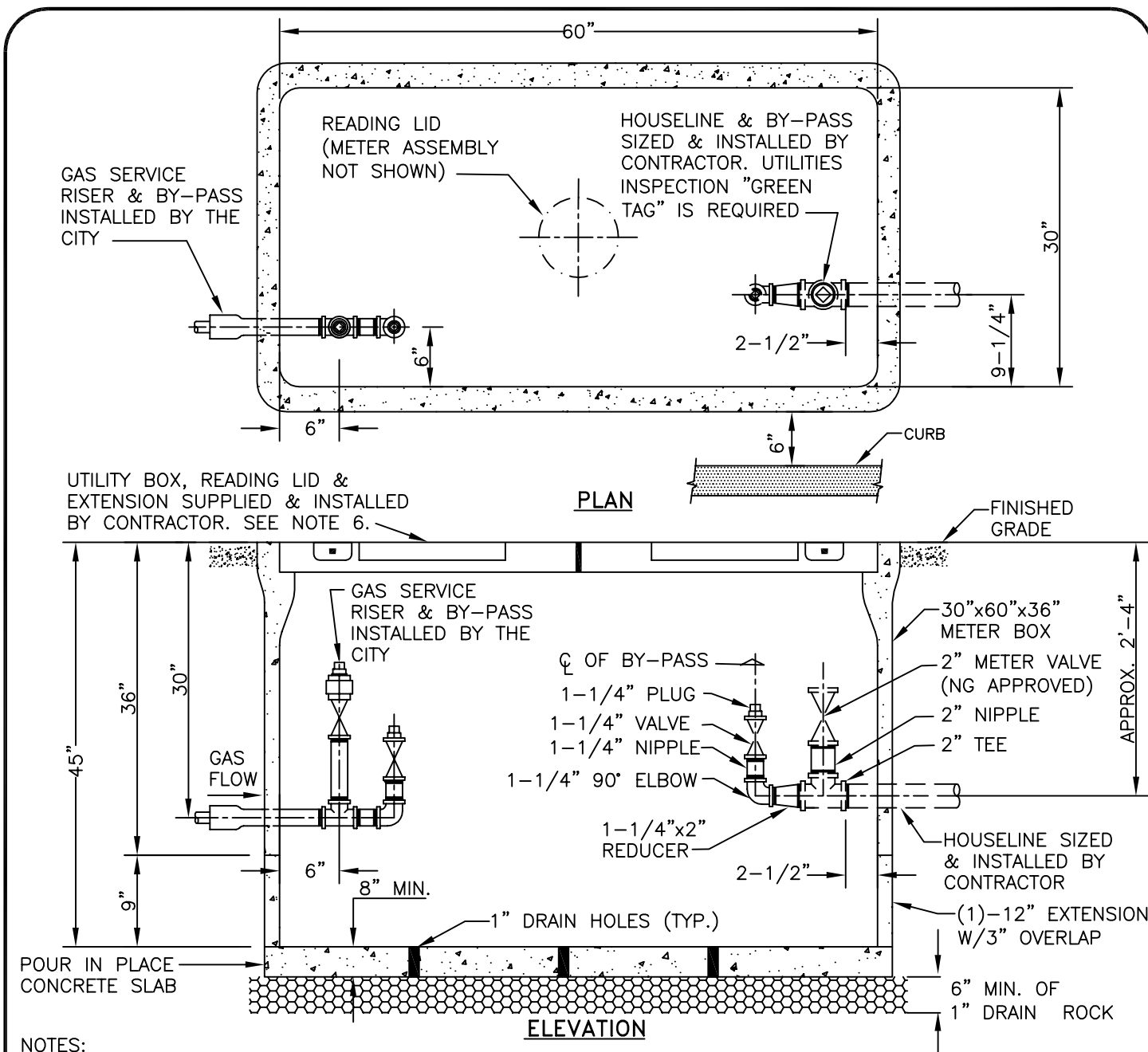
LIST OF MATERIALS
400-630 SCFH METER ASSEMBLY (UTILITY BOX)

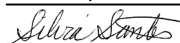
| NO. | DESCRIPTION | STOCK NO. | QUANTITY |
|-----|--|-----------|----------|
| 1 | 3/4" x 1" REDUCER, BLK | 41700 | 1 |
| 2 | 3/4" x 2 NIPPLE, BLK | 41401 | 5 |
| 3 | 3/4" TEE, BLK | 41800 | 1 |
| 4 | 3/4" x 3 NIPPLE, BLK | 41403 | 1 |
| 5 | 3/4" H-11175 MUELLER METER VALVE, NON-INSULATED | 43000 | 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 |

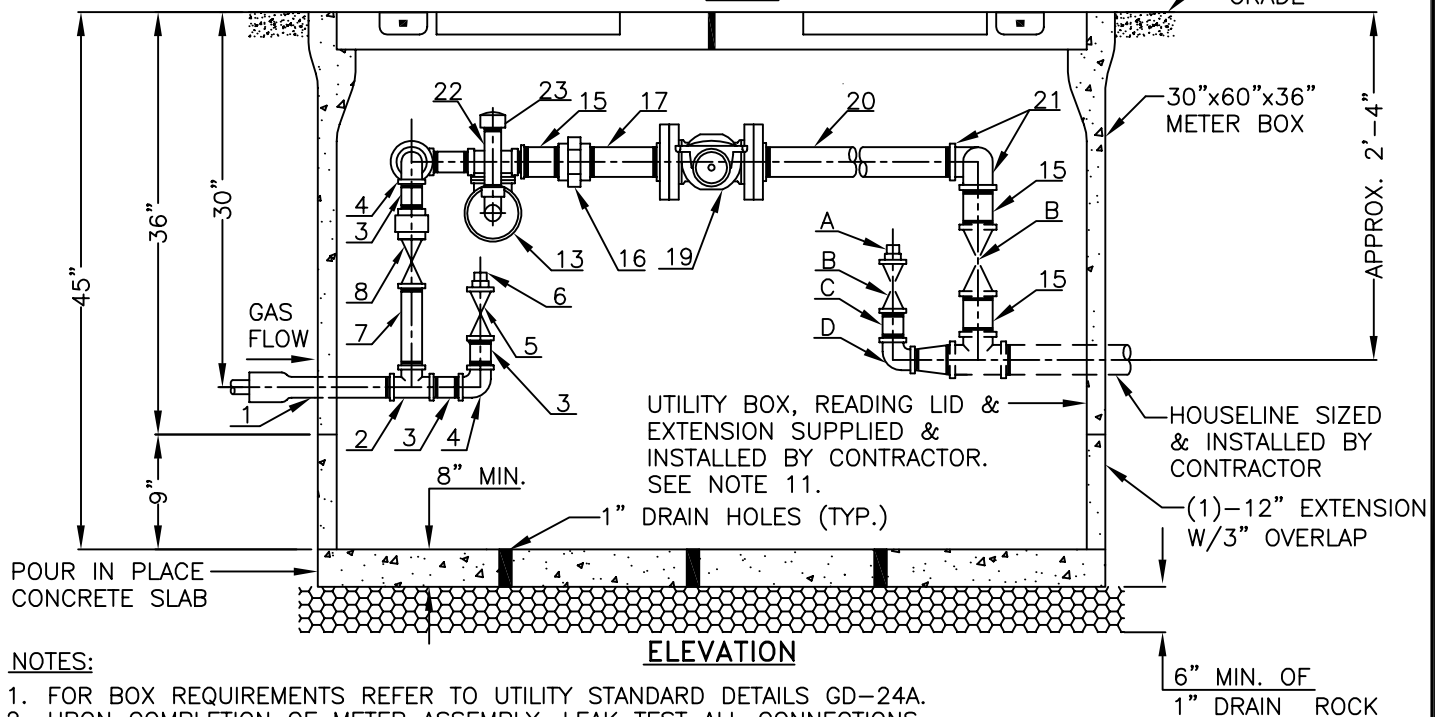
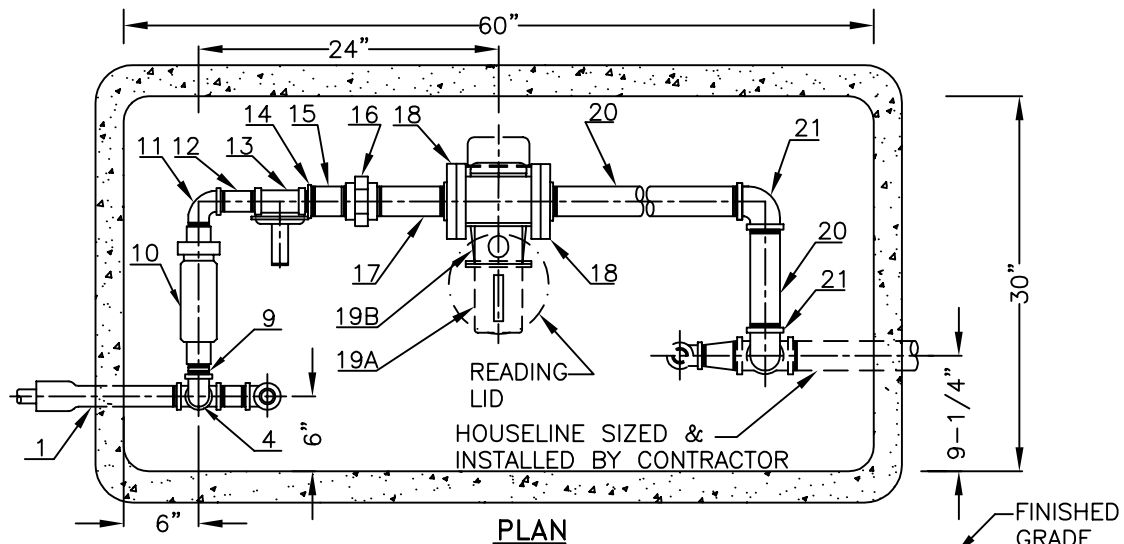
MATERIALS SUPPLIED AND INSTALLED BY CONTRACTOR

| 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: MAY 20, 2022  SILVIA LEE SANTOS ENGINEERING MANAGER | SCALE: NONE |
| | | | | |
| | | | 50674 R.E. NO. | DWG. NO. STD. GD-23D |
| DRAWN | A.P. 2/16 | CITY OF PALO ALTO, CALIFORNIA | REVISION: MAY 5, 2021 | APPENDIX C |
| CHECKED | A.P. 2/16 | | | |
| REVIEWED | A.P. 05/21 | | | |

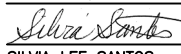


| | | | | | |
|-------------------------------|------|-------|--|--|--------------------|
| BY | | DATE | COMMERCIAL CURB GAS ROTARY METER 800-1,100 SCFH UTILITY BOX (CURB LOCATION) STANDARD DETAIL | APPROVED: MAY 20, 2022  SILVIA LEE SANTOS ENGINEERING MANAGER | SCALE: 1"=1'-0" |
| DRAWN | J.J. | 05/21 | | | DWG. NO. |
| CHECKED | J.J. | 05/21 | | 50674 R.E. NO. | STD. GD-24A |
| REVIEWED | A.P. | 05/21 | | REVISION: MAY 5, 2021 | APPENDIX C |
| CITY OF PALO ALTO, CALIFORNIA | | | | | |



NOTES:

1. FOR BOX REQUIREMENTS REFER TO UTILITY STANDARD DETAILS GD-24A.
2. UPON COMPLETION OF METER ASSEMBLY, LEAK TEST ALL CONNECTIONS.
3. AN ACTUAL SET CONFIGURATION MAY REQUIRE FIELD ADJUSTMENT. BOX DIMENSIONS ARE SHOWN.
4. 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.
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 THE SYSTEM INLET PRESSURE IS MIN. 10 PSIG OR LARGER ORIFICE SHALL BE USED (NOT STOCKED).
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 800-1,100 SCFH UTILITY BOX (CURB LOCATION) STANDARD DETAIL | APPROVED: MAY 20, 2022 | SCALE: 1"=1'-0" |
| DRAWN A.P. | 8/96 | |  50674 SILVIA LEE SANTOS ENGINEERING MANAGER R.E. NO. | DWG. NO. STD. GD-24B |
| CHECKED A.P. | 8/96 | | REVISION: MAY 5, 2021 | APPENDIX C |

CITY OF PALO ALTO, CALIFORNIA

LIST OF MATERIALS

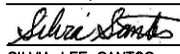
| NO. | DESCRIPTION | STOCK NO. | UNIT | QUANTITY |
|-----|--|-----------|------|----------|
| 1 | 1-1/4" TRANSITION FITTING, THREADED END | 45598 | EA. | 1 |
| 2 | 1-1/4" TEE, BLK | 41802 | EA. | 1 |
| 3 | 1-1/4" x 2-1/2" NIPPLE, BLK | 41432 | EA. | 3 |
| 4 | 1-1/4" 90° ELBOW, BLK | 41312 | EA. | 2 |
| 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" NPT B31R REGULATOR WITH 1" VENT AND 1/4" ORIFICE FOR DELIVERY OF 1000/1100 SCFH WITH GREY SPRING FOR 7" W.C. OUTLET PRESSURE 3/16" ORIFICE FOR 800 SCFH | 44302 | EA. | 1 |
| 14 | 2" x 1-1/4" BUSHING, BLK | 43064 | 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 | 43312 | EA. | 8 |
| 20 | 2" PIPE, THREADED BOTH ENDS | 44123 | EA. | 1 |
| 21 | 2" x 90° ELBOW, BLK | 44121 | EA. | 1 |
| 22 | 1" x 9" NIPPLE, BLK | 41516 | L.F. | D.I.F. |
| 23 | 1" FEMALE TYPE 975 VERTICAL VENT | 41314 | EA. | 2 |
| | | 41470 | EA. | 1 |
| | | 44311 | EA. | 1 |

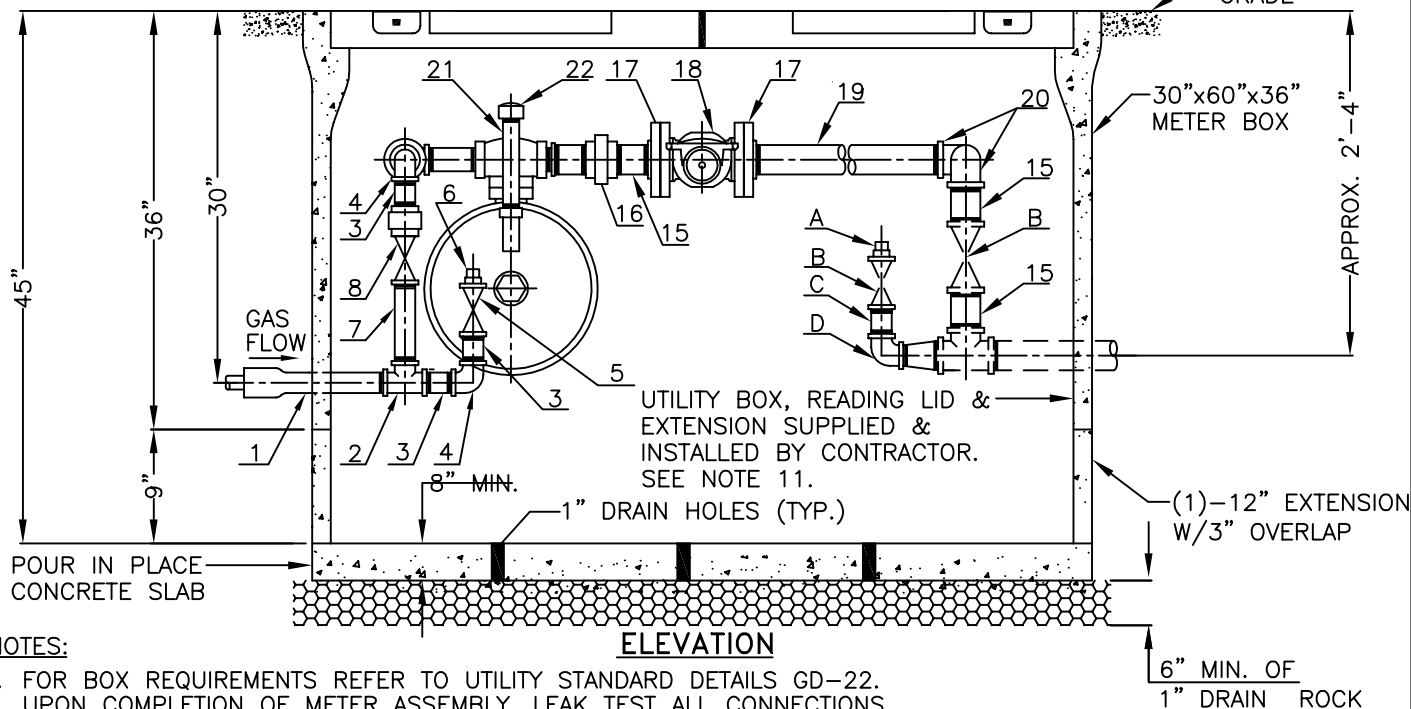
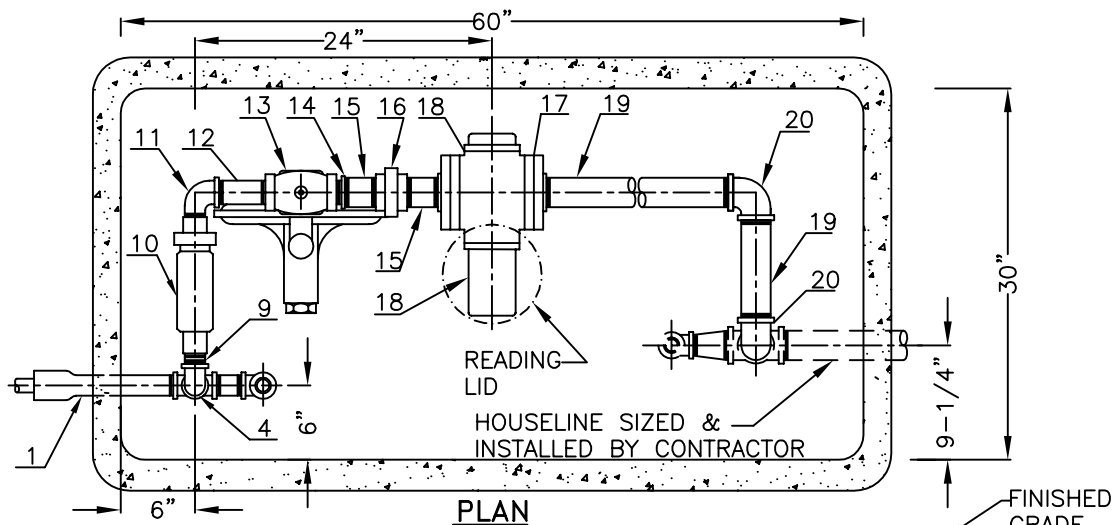
ESTIMATED PRESSURE LOSS IN DOWNSTREAM OF REGULATOR CITY PIPING

| 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

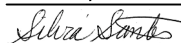
| NO. | DESCRIPTION | QUANTITY |
|-----|-----------------------------------|----------|
| A | 2" PLUG | 1 |
| B | 2" METER VALVE (NATURAL GAS APP.) | 1 |
| C | 2" NIPPLE (LENGTH AS REQUIRED) | 1 |
| D | 2" 90° ELBOW | 1 |

| | | | | |
|---------------|-------|--|--|----------------|
| BY | DATE | COMMERCIAL ROTARY METER SET ASSEMBLY 800-1,100 SCFH UTILITY BOX (CURB LOCATION) STANDARD DETAIL | APPROVED: MAY 20, 2022  SILVIA LEE SANTOS ENGINEERING MANAGER | SCALE: NONE |
| DRAWN A.P. | 8/96 | | 50674 R.E. NO. | DWG. NO. |
| CHECKED A.P. | 05/22 | | | STD. GD-24C |
| REVIEWED A.P. | 05/22 | CITY OF PALO ALTO, CALIFORNIA | REVISION: MAY 20, 2022 | APPENDIX C |



NOTES:

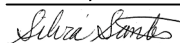
1. FOR BOX REQUIREMENTS REFER TO UTILITY STANDARD DETAILS GD-22.
2. UPON COMPLETION OF METER ASSEMBLY, LEAK TEST ALL CONNECTIONS.
3. AN ACTUAL SET CONFIGURATION MAY REQUIRE FIELD ADJUSTMENT. BOX DIMENSIONS ARE SHOWN.
4. STOCK ITEM 044324 1-1/2" 243-12-2 REGULATOR IS STOCKED WITH 3/8" ORIFICE AND 10"-18" 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: MAY 20, 2022 | SCALE: 1"=1'-0" |
| DRAWN A.P. | 8/96 | |  50674 SILVIA LEE SANTOS ENGINEERING MANAGER R.E. NO. | DWG. NO. STD. GD-25A |
| CHECKED A.P. | 8/96 | | REVISION: MAY 5, 2021 | APPENDIX C |

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 |

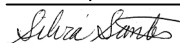
| | | | | |
|-------------------------------|------|--|--|-------------------------|
| BY | DATE | COMMERCIAL ROTARY METER SET ASSEMBLY 1,500-2,000 SCFH UTILITY BOX (CURB LOCATION) STANDARD DETAIL | APPROVED: MAY 20, 2022  SILVIA LEE SANTOS ENGINEERING MANAGER | SCALE: NONE |
| | | | | |
| | | | | |
| DRAWN | A.P. | 8/96 | 50674 R.E. NO. | DWG. NO. STD. GD-25B |
| CHECKED | A.P. | 8/96 | | |
| REVIEWED | A.P. | 05/21 | | |
| CITY OF PALO ALTO, CALIFORNIA | | | REVISION: MAY 5, 2021 | 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 |

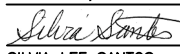
ESTIMATED PRESSURE LOSS IN DOWNSTREAM OF REGULATOR CITY PIPING

| 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: MAY 20, 2022 | 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. | 05/21 | CITY OF PALO ALTO, CALIFORNIA | REVISION: MAY 5, 2021 | APPENDIX C |

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 |

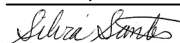
| | | | | |
|---------------|-------|---|---|----------------|
| BY | DATE | COMMERCIAL/INDUSTRIAL ROTARY METER SET ASSEMBLY 2,000-3,000 SCFH UTILITY BOX (CURB LOCATION) STANDARD DETAIL | APPROVED: MAY 20, 2022 | SCALE: NONE |
| DRAWN A.P. | 8/96 | |  SILVIA LEE SANTOS ENGINEERING MANAGER | DWG. NO. |
| CHECKED A.P. | 8/96 | | 50674 R.E. NO. | STD. GD-26C |
| REVIEWED A.P. | 05/21 | CITY OF PALO ALTO, CALIFORNIA | REVISION: MAY 5, 2021 | APPENDIX C |

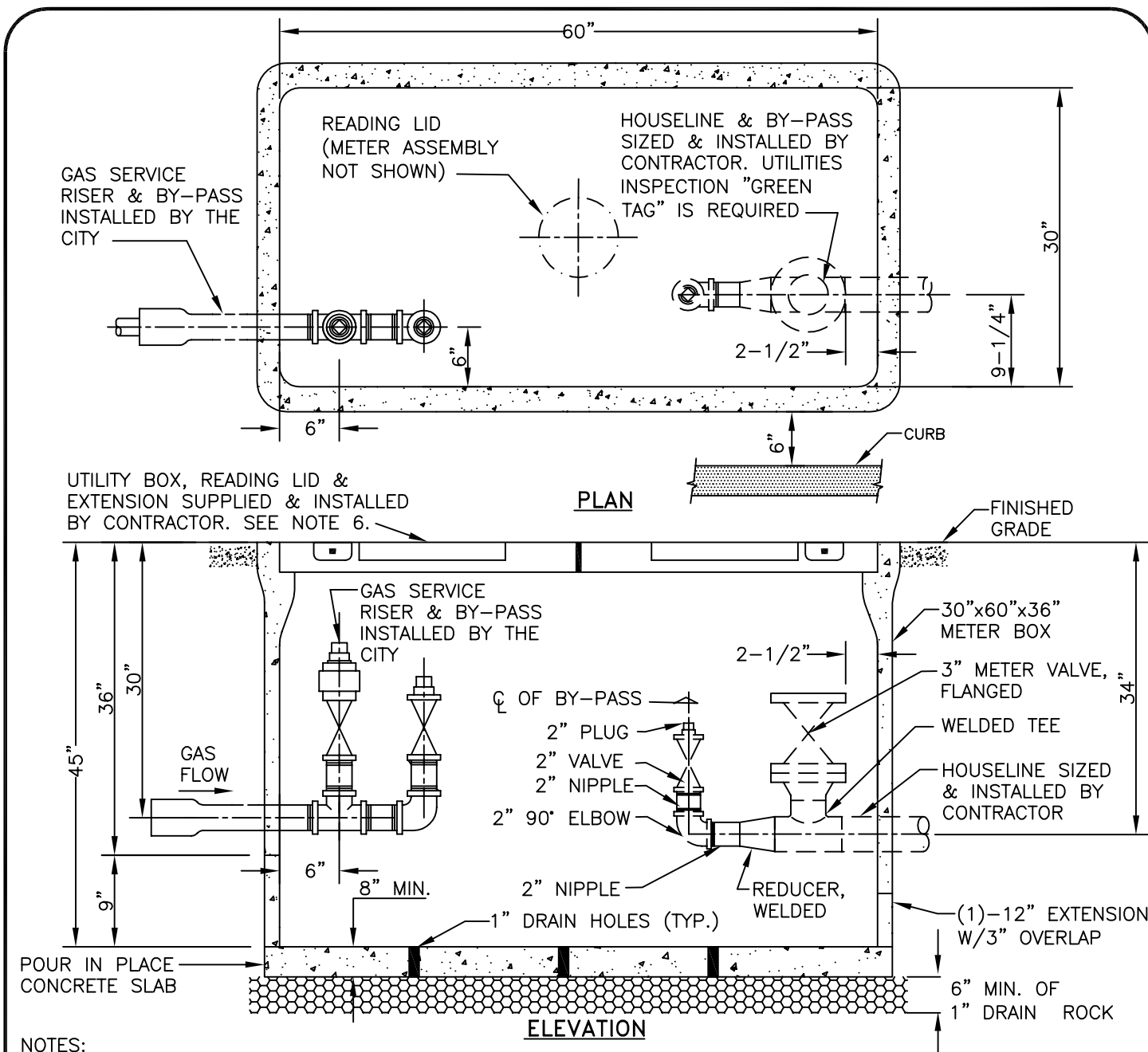
MATERIALS SUPPLIED AND INSTALLED BY CONTRACTOR

| 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

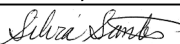
| FLOW SCFH | SET PRESSURE | PRESSURE AT THE CUSTOMER PIPING | SET PRESSURE TO COMPENSATE FOR CITY PIPING HEADLOSS |
|--------------|-----------------|---------------------------------------|---|
| 2000 | 7" W.C. | 5.988" W.C. | 8.012" W.C. |
| | 14" W.C. | 12.890" W.C. | 15.110" W.C. |
| | 1 PSIG | 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: MAY 20, 2022 | SCALE: NONE |
| DRAWN A.P. | 8/96 | |  50674 | DWG. NO. |
| CHECKED A.P. | 8/96 | | SILVIA LEE SANTOS ENGINEERING MANAGER | STD. GD-26D |
| REVIEWED A.P. | 05/21 | CITY OF PALO ALTO, CALIFORNIA | REVISION: MAY 5, 2021 | APPENDIX C |

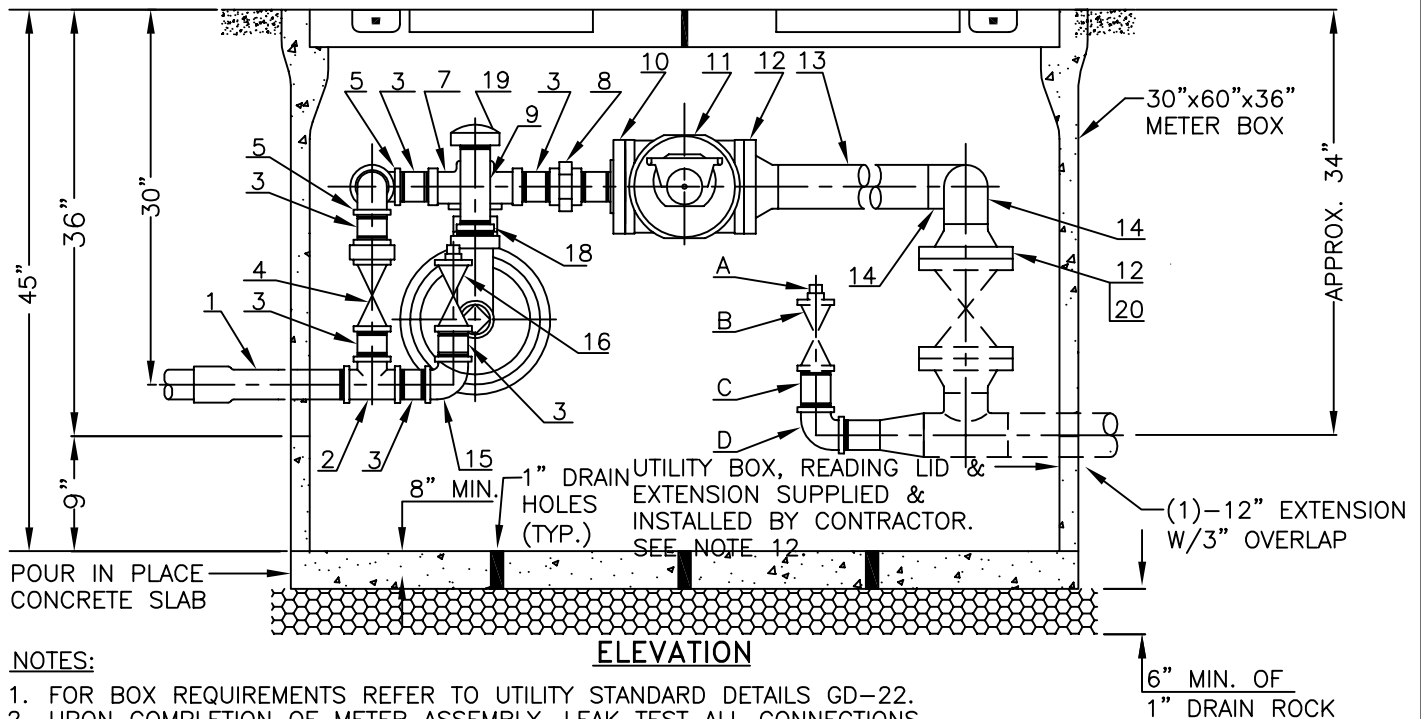
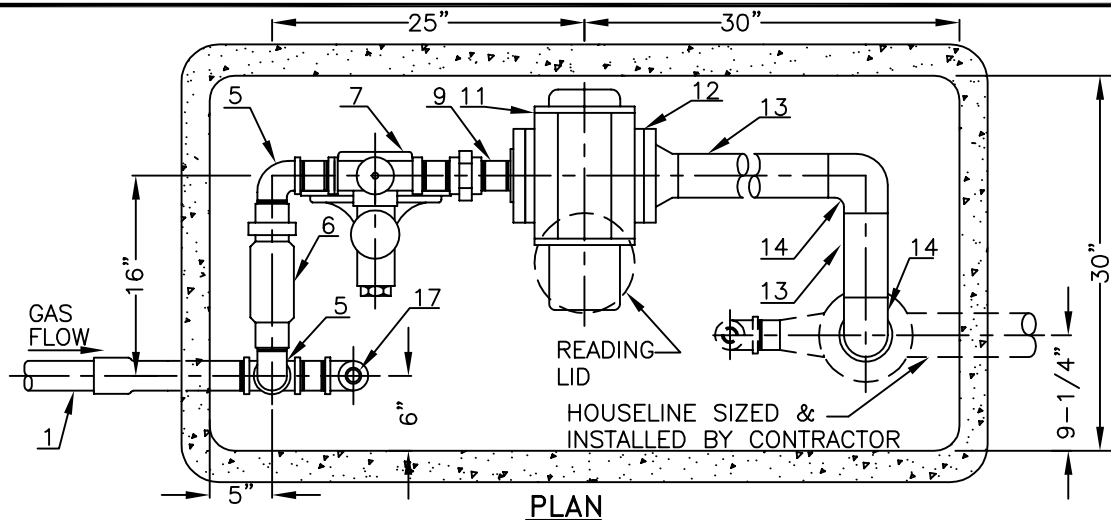


NOTES:

1. CURB METER BOX, INSTALLATION AND LOCATION SHALL BE APPROVED BY THE UTILITIES DEPARTMENT. CONTRACTOR SHALL FURNISH AND INSTALL METER BOX, LID, HOUSELINE & BY-PASS.
2. CURB METER BOXES MUST NOT BE LOCATED IN CONTINUOUS VEHICULAR TRAFFIC AREAS.
3. CURB METER BOXES SHALL NOT BE INSTALLED IN AREAS PRONE TO FLOODING (RAINFALL, SURFACE WATER FLOW, IRRIGATION, ETC.)
4. 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.
5. METER BOX AND LIDS SHALL BE H-20 RATING FOR SW & PLANTING STRIP APPLICATIONS.
6. 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 | <p align="center">COMMERCIAL CURB GAS ROTARY METER 5,000-7,000 SCFH UTILITY BOX (CURB LOCATION) STANDARD DETAIL</p> | APPROVED: MAY 20, 2022 | SCALE: 1"=1'-0" |
| DRAWN | J.J. 05/21 | |  50674 SILVIA LEE SANTOS ENGINEERING MANAGER | DWG. NO. STD. GD-27A |
| CHECKED | J.J. 05/21 | | REVISION: MAY 5, 2021 | APPENDIX C |

CITY OF PALO ALTO, CALIFORNIA



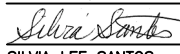
NOTES:

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: MAY 20, 2022 | SCALE: 1"=1'-0" |
| DRAWN A.P. | 8/96 | | <i>Silvia Santos</i> 50674 | DWG. NO. |
| CHECKED A.P. | 8/96 | | SILVIA LEE SANTOS R.E. NO. | STD. GD-27B |
| REVIEWED A.P. | 05/21 | | REVISION: MAY 5, 2021 | 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: MAY 20, 2022 | 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-27C |
| REVIEWED A.P. | 05/21 | CITY OF PALO ALTO, CALIFORNIA | REVISION: MAY 5, 2021 | APPENDIX C |

LIST OF MATERIALS

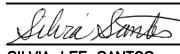
| NO. | DESCRIPTION | STOCK NO. | UNIT | QUANTITY |
|-----|---|-----------|------|----------|
| 13 | 3" PIPE, PLAIN END | 41518 | L.F. | D.I.F. |
| 14 | 3" 90° ELBOW SCH. 40, BUTT-WELD ENDS, SHORT RADIUS | 41368 | EA. | 2 |
| 15 | 2" 90 DEG. ELBOW, BLK | 41314 | EA. | 1 |
| 16 | 2" H-11175 MUELLER METER 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 |

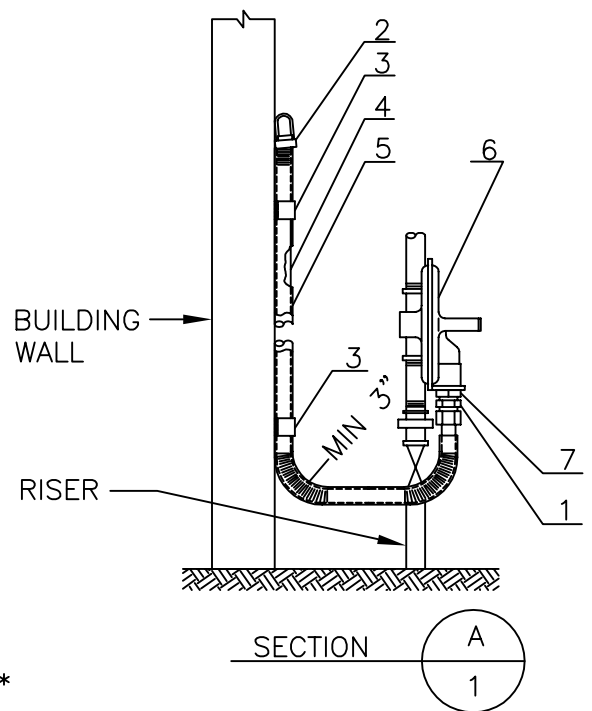
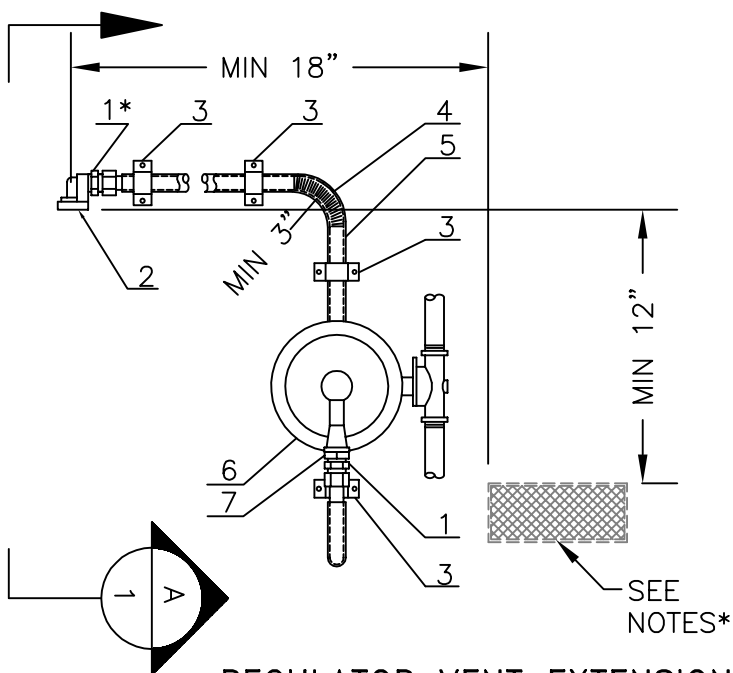
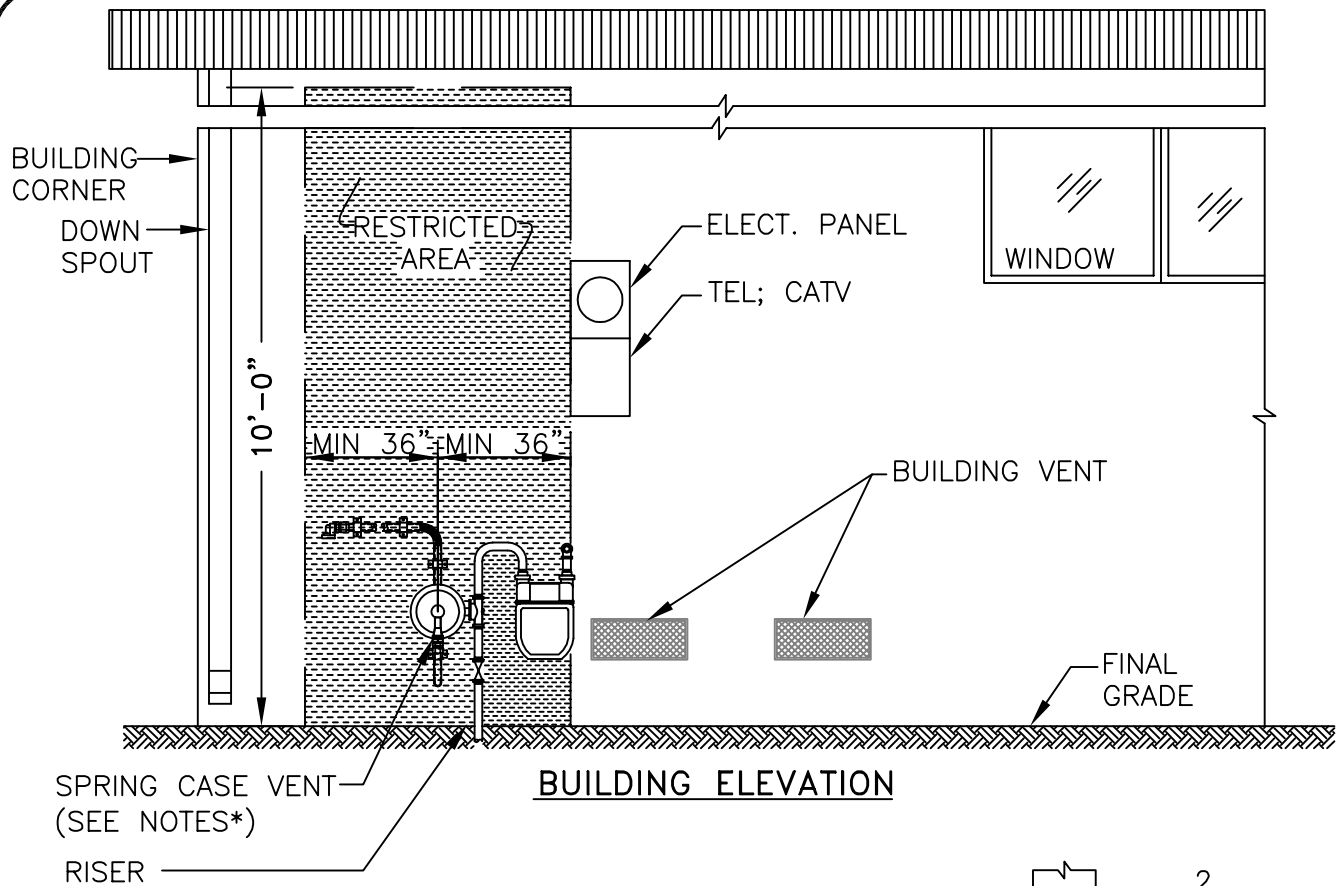
MATERIALS SUPPLIED AND INSTALLED BY CONTRACTOR

| 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 | DATE | COMMERCIAL/INDUSTRIAL ROTARY METER SET ASSEMBLY 5,000-7,000 SCFH UTILITY BOX (CURB LOCATION) STANDARD DETAIL | APPROVED: MAY 20, 2022 | 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-27D |
| REVIEWED A.P. | 05/21 | CITY OF PALO ALTO, CALIFORNIA | REVISION: MAY 5, 2021 | APPENDIX C |



REGULATOR VENT EXTENSION DETAIL - ELEVATION

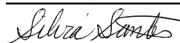
| | | | | |
|---------------|-------|--|---|-------------------------|
| BY | DATE | GAS SERVICE REGULATOR VENT EXTENSION ASSEMBLY STANDARD DETAIL CITY OF PALO ALTO, CALIFORNIA | APPROVED: MAY 20, 2022 <i>Silvia Lee Santos</i> SILVIA LEE SANTOS ENGINEERING MANAGER | SCALE: NONE |
| DRAWN A.P. | 4/97 | | 50674 R.E. NO. | DWG. NO. STD. GD-28A |
| CHECKED A.P. | 4/97 | | REVISION: MAY 5, 2021 | APPENDIX C |
| REVIEWED A.P. | 05/21 | | | |

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 |

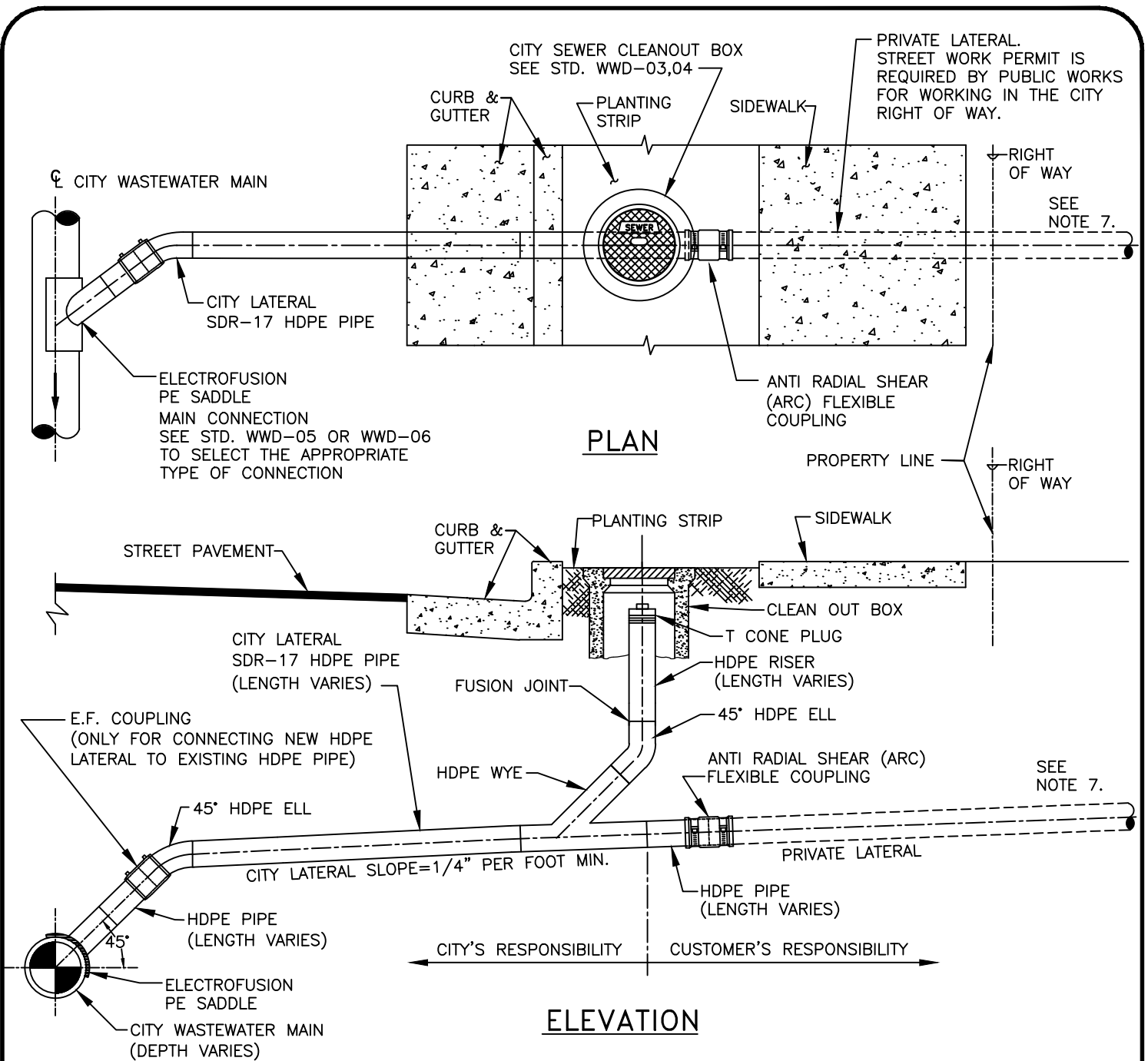
NOTES:

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. ELECTRIC GROUNDING OR BONDING WIRES ARE NOT PERMITTED TO CPA GAS SERVICES AND METERS. GAS PIPING SHALL NOT BE USED AS A GROUNDING CONDUCTOR OR ELECTRODE. (CPC 1211.3)
3. FOR GAS METER INSTALLATION REQUIREMENTS, REFER TO THE STD. GD-01A, GD-01B, 02A, AND 02B STANDARD DETAILS.
4. RECOMMENDED SPACING OF SUPPORT CLAMPS IS 12".

| | | | | |
|---------------|-------|--|---|----------------|
| BY | DATE | GAS SERVICE REGULATOR VENT EXTENSION ASSEMBLY STANDARD DETAIL | APPROVED: MAY 20, 2022 | 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. | 05/21 | CITY OF PALO ALTO, CALIFORNIA | REVISION: MAY 5, 2021 | APPENDIX C |

**Table of Contents
Appendix D
Wastewater Standard Details**

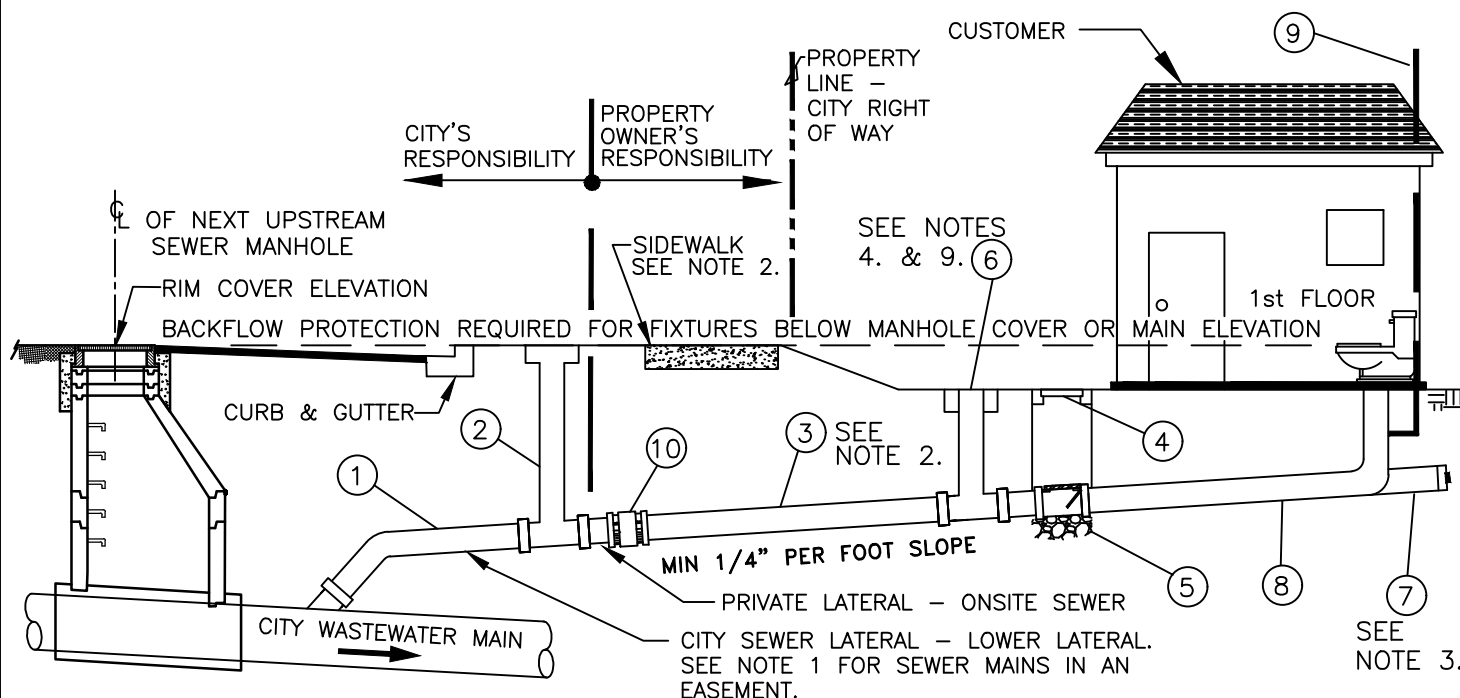
| <u>Detail No.</u> | <u>Title</u> |
|--------------------------|---|
| WWD-01A | Sanitary Sewer Lateral |
| WWD-01B | Sanitary Sewer Lateral with Backwater Valve Protection Type 1 |
| WWD-01C | Sanitary Sewer Lateral with Backwater Valve Protection Type 2 |
| WWD-02A | Sanitary Sewer Cleanout Type 1 |
| 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 - 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 TO HDPE CONNECTIONS SHALL BE BY THERMAL BUTT-FUSION OR ELECTROFUSION COUPLING.
4. VCP/PVC WYE, STRAPPED FLEX. SADDLE, TAP-TITE/INSERTA-TEE, 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, ANTI RADIAL SHEAR (ARC) 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: MAY 20, 2022 | SCALE: NONE |
| DRAWN AL/EMM | 3/21 | | <i>Silvia Lee Santos</i> SILVIA LEE SANTOS ENGINEERING MANAGER | DWG. NO. STD. WWD-01A |
| CHECKED J.J. | 2/20 | CITY OF PALO ALTO, CALIFORNIA | REVISION: MAY 5, 2021 | APPENDIX D |
| REVIEWED RA | 5/21 | | | |



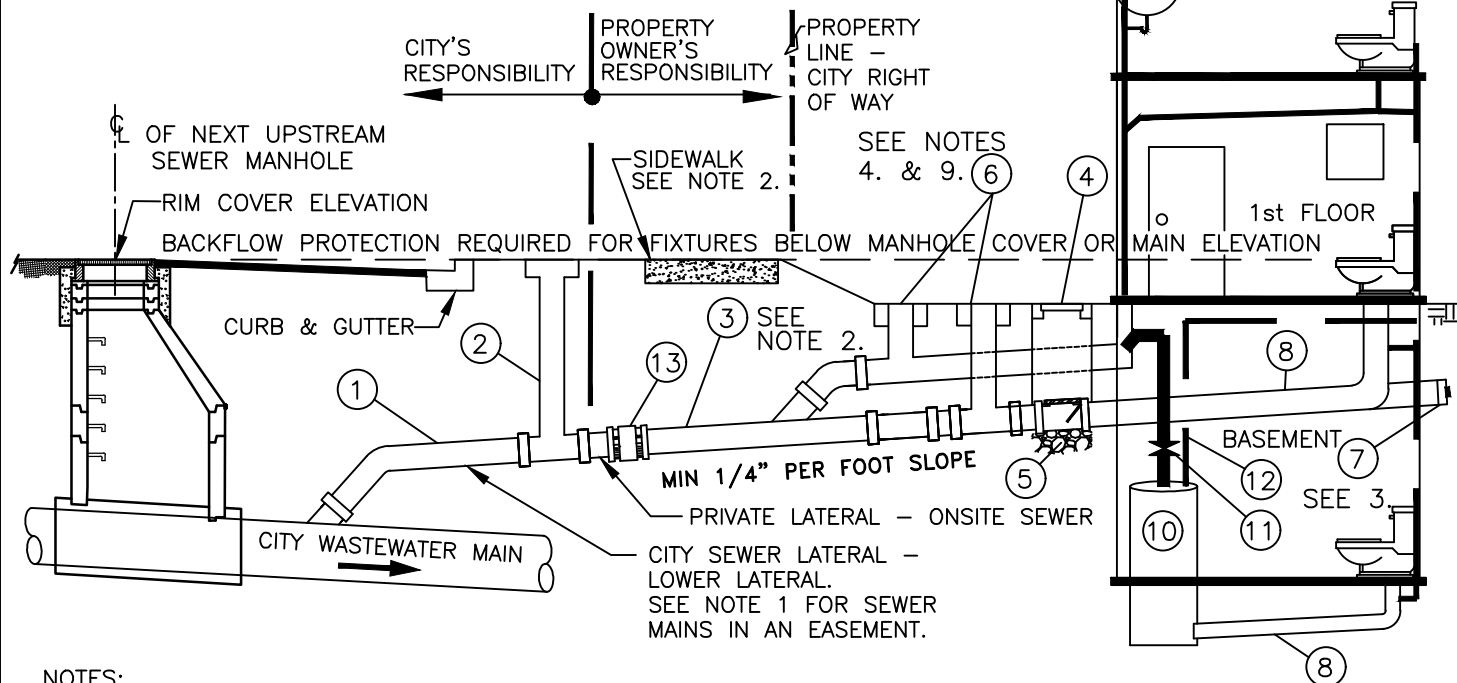
- | | |
|---|---|
| ① CITY SEWER LATERAL – LOWER LATERAL | ⑥ BUILDING SEWER CLEANOUT – SEE GENERAL NOTE 3. |
| ② CITY SEWER CLEANOUT. SEE NOTE 2. | ⑦ BUILDING SEWER END OF LINE CLEANOUT |
| ③ UPPER SEWER LATERAL – BUILDING SEWER LINE | ⑧ BUILDING SEWER DRAIN PIPE |
| ④ BACK WATER VALVE, SEE NOTES BELOW | ⑨ BUILDING SEWER VENT PIPE |
| ⑤ DRAIN ROCK | ⑩ ANTI RADIAL SHEAR (ARC) FLEXIBLE 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: MAY 20, 2022 | SCALE: NONE |
| DRAWN JJ/EMM | 5/21 | | <i>Silvia Lee Santos</i> | DWG. NO. STD. WWD-01B |
| CHECKED JJ/RA | 5/21 | | SILVIA LEE SANTOS ENGINEERING MANAGER | |
| REVIEWED JJ/RA | 5/21 | | 50674 R.E. NO. | |
| | | CITY OF PALO ALTO, CALIFORNIA | REVISION: MAY 5, 2021 | APPENDIX D |

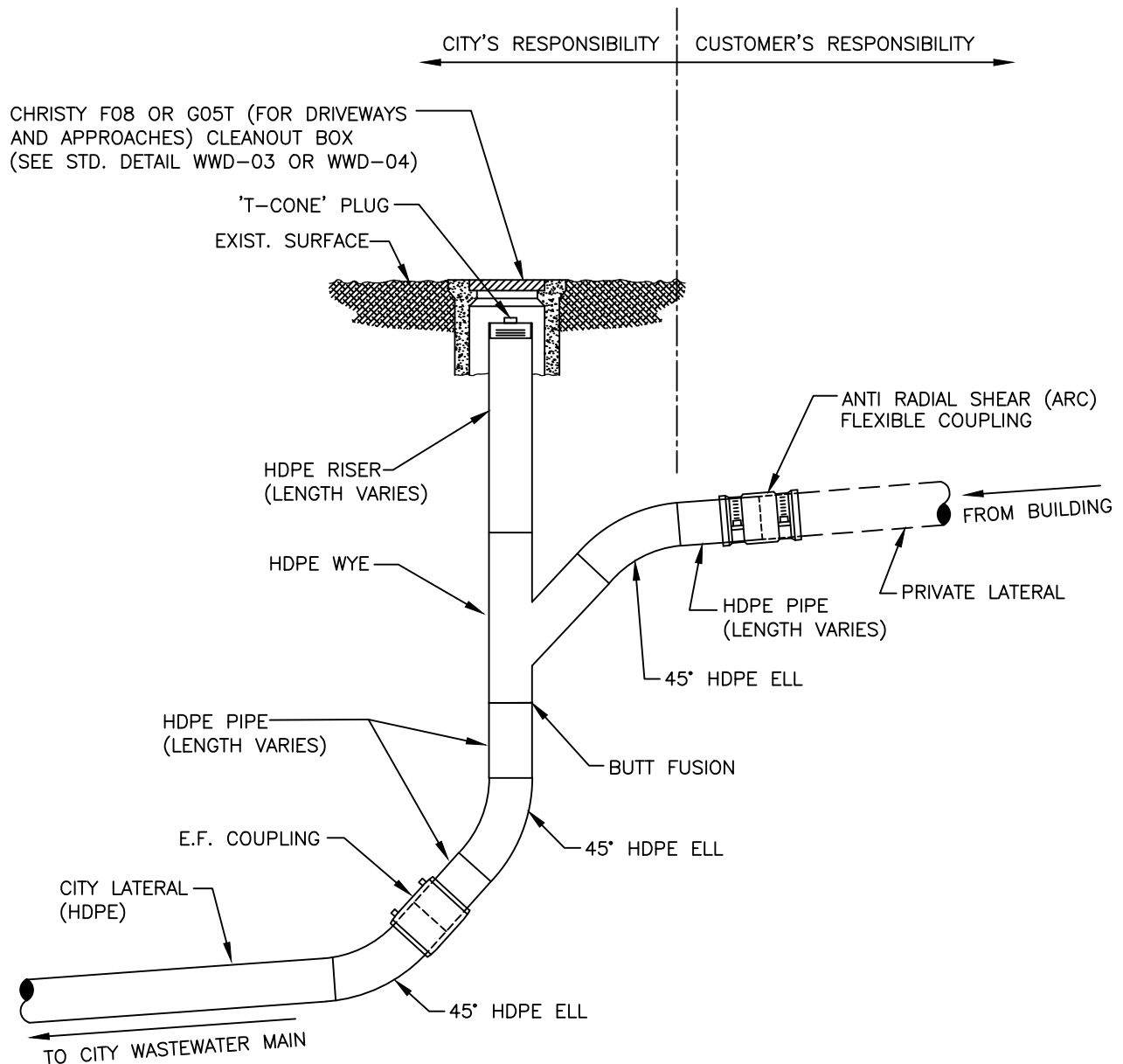
- ① CITY SEWER LATERAL – LOWER LATERAL
- ② CITY SEWER CLEANOUT
- ③ UPPER SEWER LATERAL – BUILDING SEWER LINE
- ④ BACK WATER VALVE, SEE NOTES BELOW
- ⑤ DRAIN ROCK
- ⑥ BUILDING SEWER CLEANOUT – SEE 4.
- ⑦ SEWER END OF LINE CLEANOUT
- ⑧ BUILDING SEWER DRAIN PIPE
- ⑨ BUILDING SEWER VENT PIPE
- ⑩ SEWER EJECTOR PUMPS (30 G.P.M MAX. DISCHARGE)
- ⑪ EJECTOR DISCHARGE LINE, GATE &
- ⑫ CHECK OR BACKWATER VALVES EJECTOR PUMP VENT PIPE
- ⑬ ANTI RADIAL SHEAR FLEXIBLE 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".

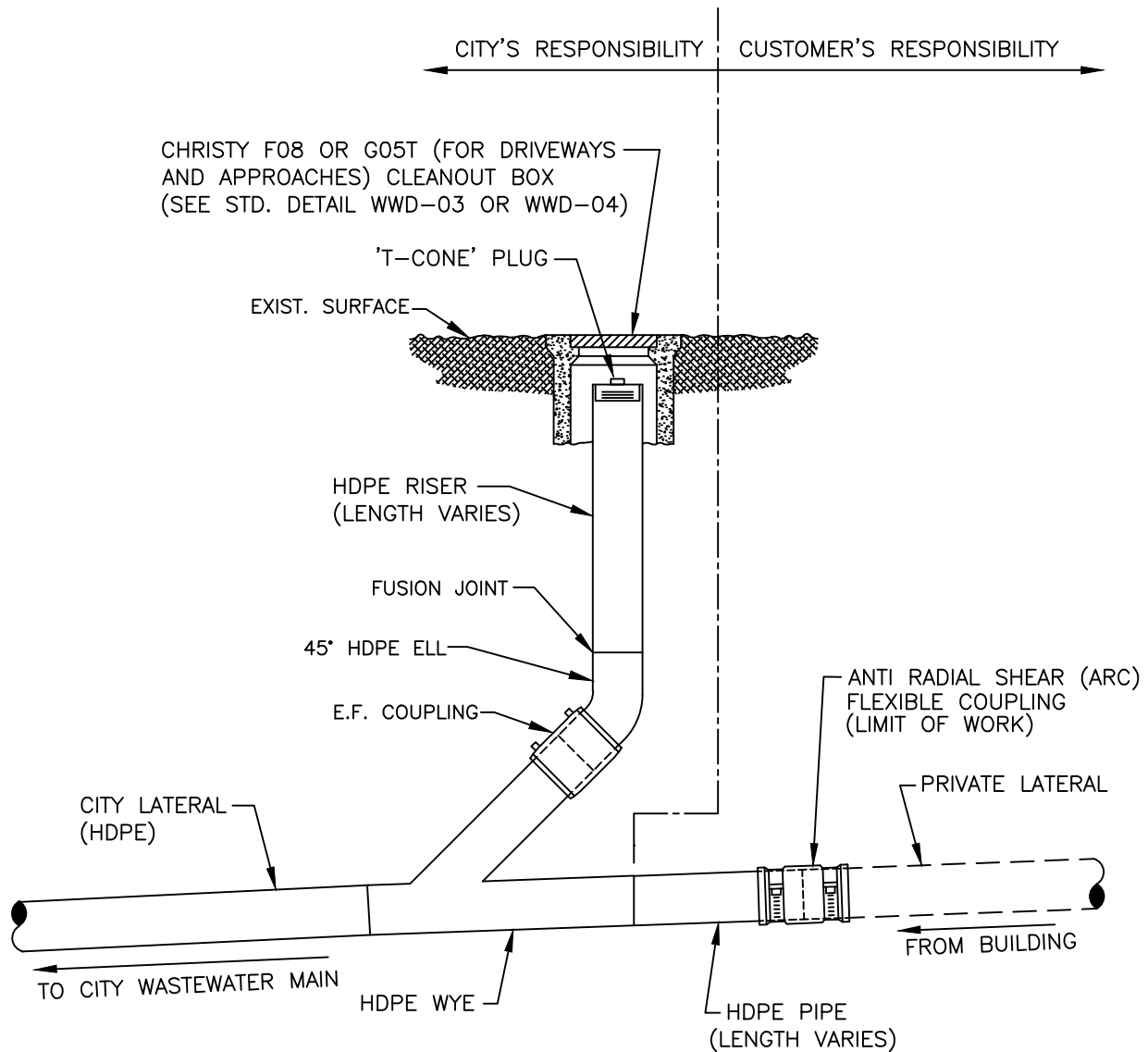
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|----------------|-------|--|--|----------------|
| BY | DATE | SANITARY SEWER LATERAL WITH BACKWATER VALVE PROTECTION STANDARD DETAIL | APPROVED: MAY 20, 2022 | SCALE: NONE |
| DRAWN JJ/EMM | 03/21 | | <i>Silvia Lee Santos</i> | DWG. NO. |
| CHECKED JJ/RA | 5/21 | | SILVIA LEE SANTOS ENGINEERING MANAGER | STD. WWD-01C |
| REVIEWED JJ/RA | 5/21 | | REVISION: MAY 5, 2021 | APPENDIX D |



NOTES:


- SEE WWD-01A FOR STANDARD SEWER CLEANOUT LOCATION.
- ALL HDPE TO HDPE CONNECTIONS SHALL BE BY THERMAL BUTT-FUSION OR ELECTROFUSION COUPLING.
- CLEANOUT BOX SHALL BE SET FLUSH TO FINISHED GRADE.
- AN ELASTOMERIC SEALANT SHALL BE APPLIED TO THE FLEXIBLE, SHIELDED, ANTI RADIAL SHEAR FLEXIBLE COUPLING.

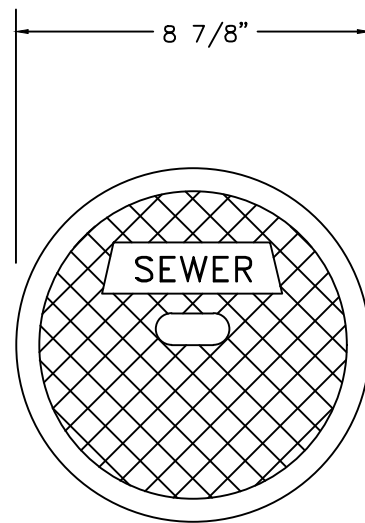
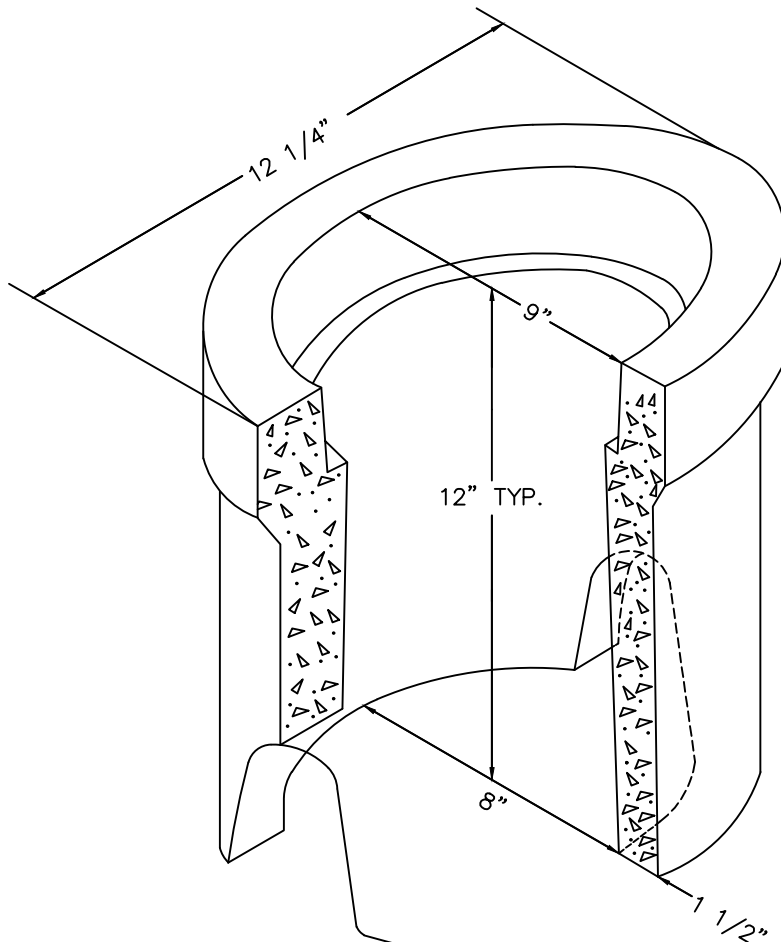
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|----------------|------|---|--|----------------|
| BY | DATE | SANITARY SEWER CLEANOUT TYPE I STANDARD DETAIL CITY OF PALO ALTO, CALIFORNIA | APPROVED: MAY 20, 2022 | SCALE: NONE |
| DRAWN EMM | 3/21 | | <i>Silvia Lee Santos</i> | DWG. NO. |
| CHECKED ET/EMM | 5/21 | | SILVIA LEE SANTOS ENGINEERING MANAGER | STD. WWD-02A |
| REVIEWED JJ/RA | 5/21 | | REVISION: MAY 5, 2021 | 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, ANTI RADIAL SHEAR COUPLING.

| | | | | |
|-------------|------|--|---|----------------|
| BY | DATE | SANITARY SEWER CLEANOUT TYPE 2 STANDARD DETAIL CITY OF PALO ALTO, CALIFORNIA | APPROVED: MAY 20, 2022 | SCALE: NONE |
| DRAWN EMM | 3/21 | |  50674 SILVIA LEE SANTOS R.E. NO. ENGINEERING MANAGER | DWG. NO. |
| CHECKED RA | 3/21 | | REVISION: MAY 5, 2021 | STD. WWD-02B |
| REVIEWED RA | 3/21 | | | APPENDIX D |



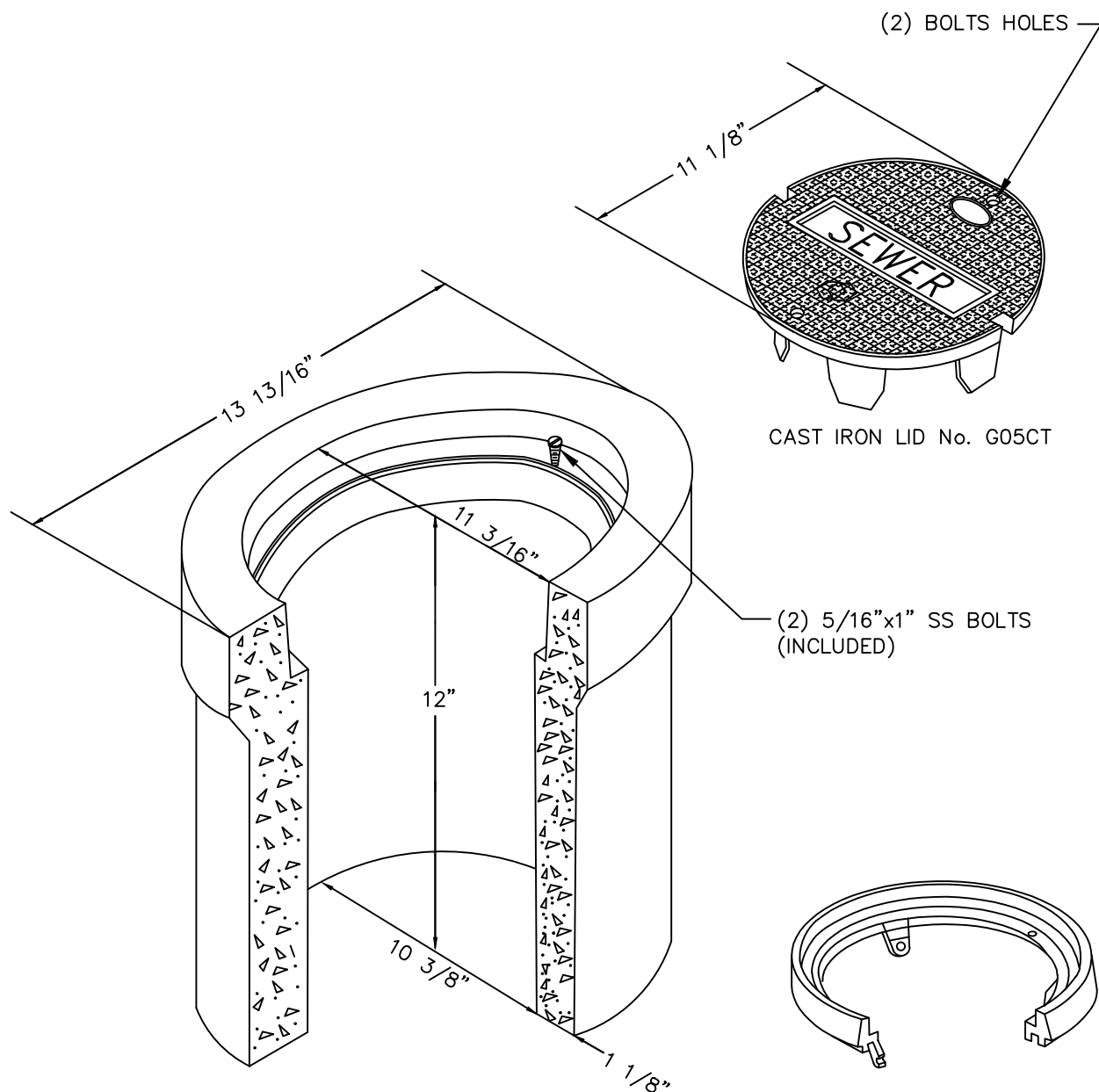
CAST IRON LID No. F08C

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: MAY 20, 2022 <i>Silvia Lee Santos</i> SILVIA LEE SANTOS ENGINEERING MANAGER | SCALE: NONE |
|---------------|------|--|---|----------------|
| DRAWN JJ/EMM | 4/21 | | 50674 R.E. NO. | DWG. NO. |
| CHECKED R.A. | 4/21 | CITY OF PALO ALTO, CALIFORNIA | REVISION: MAY 5, 2021 | STD. WWD-03 |
| REVIEWED R.A. | 4/21 | | | APPENDIX D |

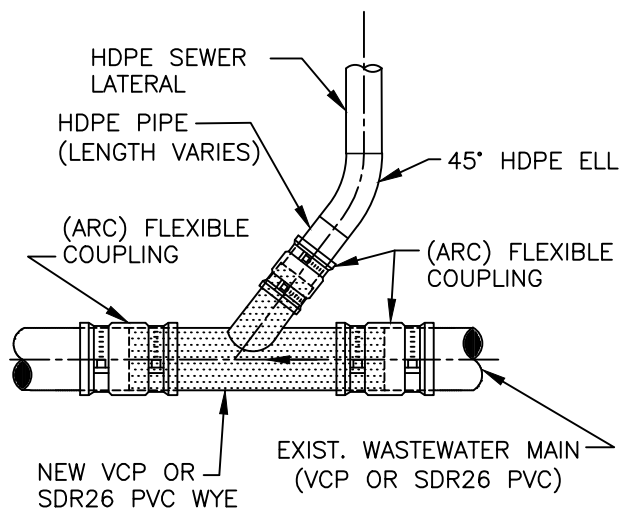


NOTE:

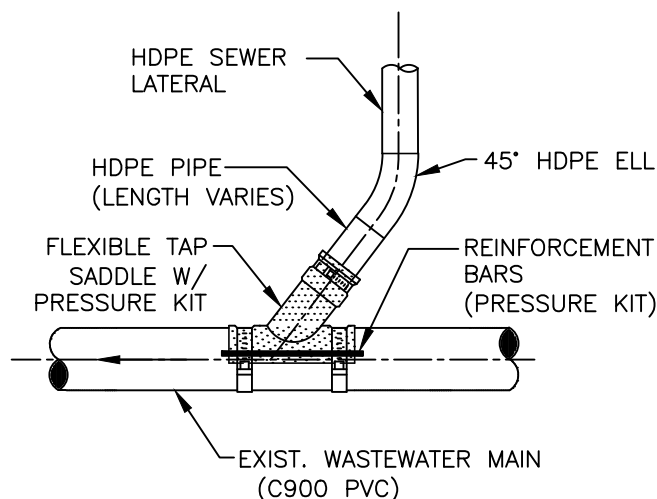
CLEANOUT BOX SHALL BE MARKED ON THE LID WITH THE LETTERS "SEWER"

| BY | DATE | SANITARY SEWER CLEANOUT BOX TYPE 2 (TRAFFIC AREAS) STANDARD DETAIL | APPROVED: MAY 20, 2022 | SCALE: NONE |
|---------------|------|--|--|-------------------------|
| DRAWN JJ/EMM | 4/21 | | <i>Silvia Lee Santos</i> SILVIA LEE SANTOS ENGINEERING MANAGER | DWG. NO. STD. WWD-04 |
| CHECKED R.A. | 4/21 | CITY OF PALO ALTO, CALIFORNIA | REVISION: MAY 5, 2021 | APPENDIX D |
| REVIEWED R.A. | 4/21 | | | |

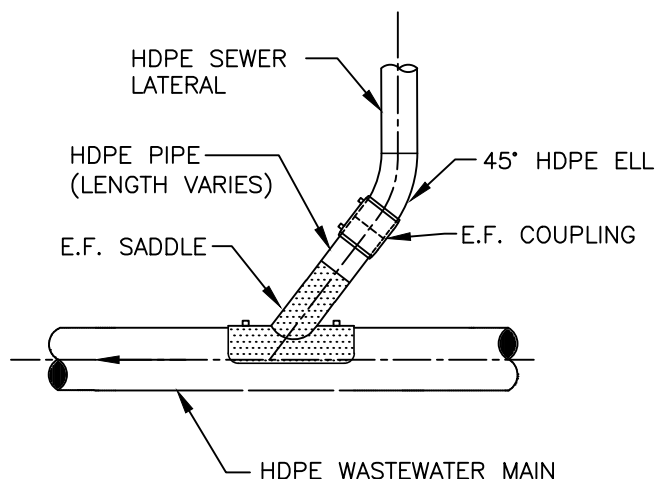
A HDPE LATERAL to VCP or SDR26 PVC MAIN



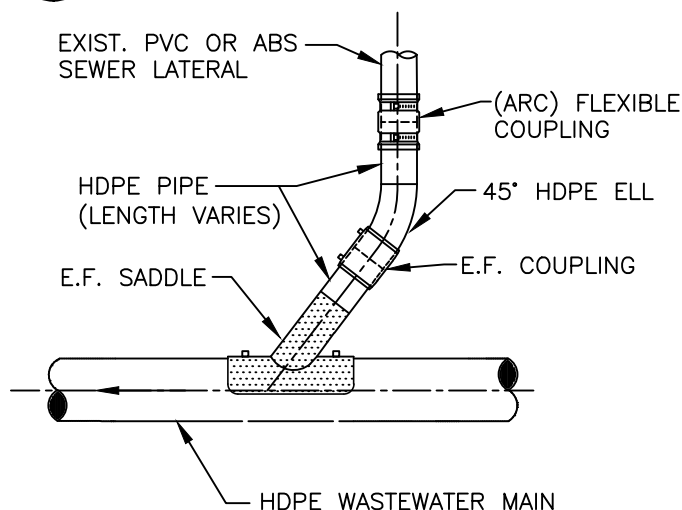
B HDPE LATERAL to PVC C900 MAIN



C HDPE LATERAL to HDPE MAIN



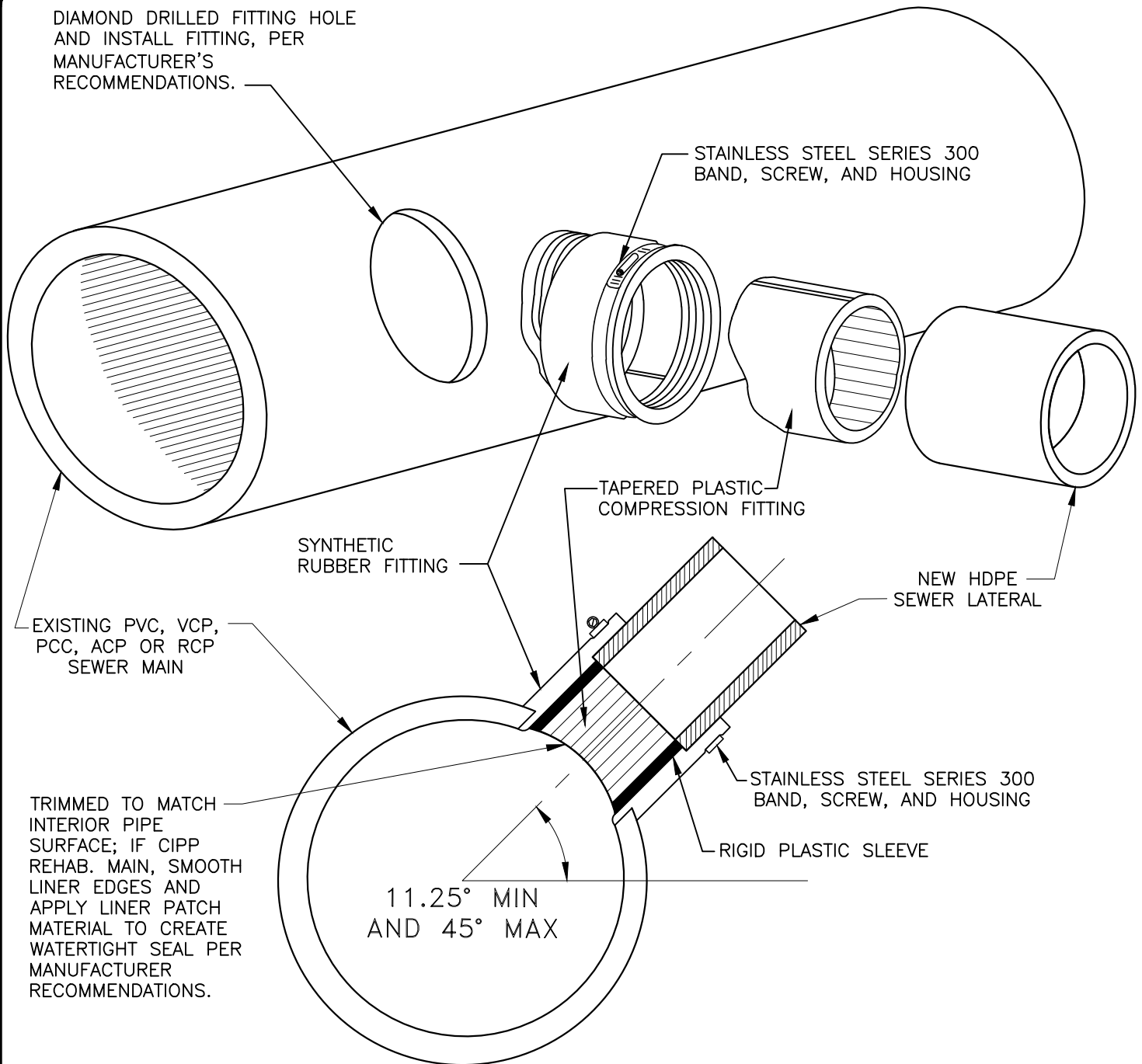
D PVC/ABS LATERAL to HDPE MAIN



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 ANTI RADIAL SHEAR (ARC) 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.

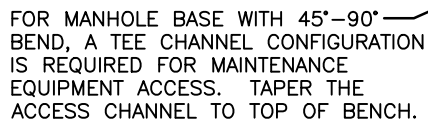
| | | | | |
|-------------|------|--|--|----------------|
| BY | DATE | SANITARY SEWER LATERAL – MAIN CONNECTIONS STANDARD DETAIL CITY OF PALO ALTO, CALIFORNIA | APPROVED: MAY 20, 2022 | SCALE: NONE |
| DRAWN EMM | 3/21 | | <i>Silvia Lee Santos</i> 50674 | DWG. NO. |
| CHECKED RA | 3/21 | | SILVIA LEE SANTOS ENGINEERING MANAGER | STD. WWD-05 |
| REVIEWED RA | 3/21 | | REVISION: MAY 5, 2021 | APPENDIX D |



NOTES:

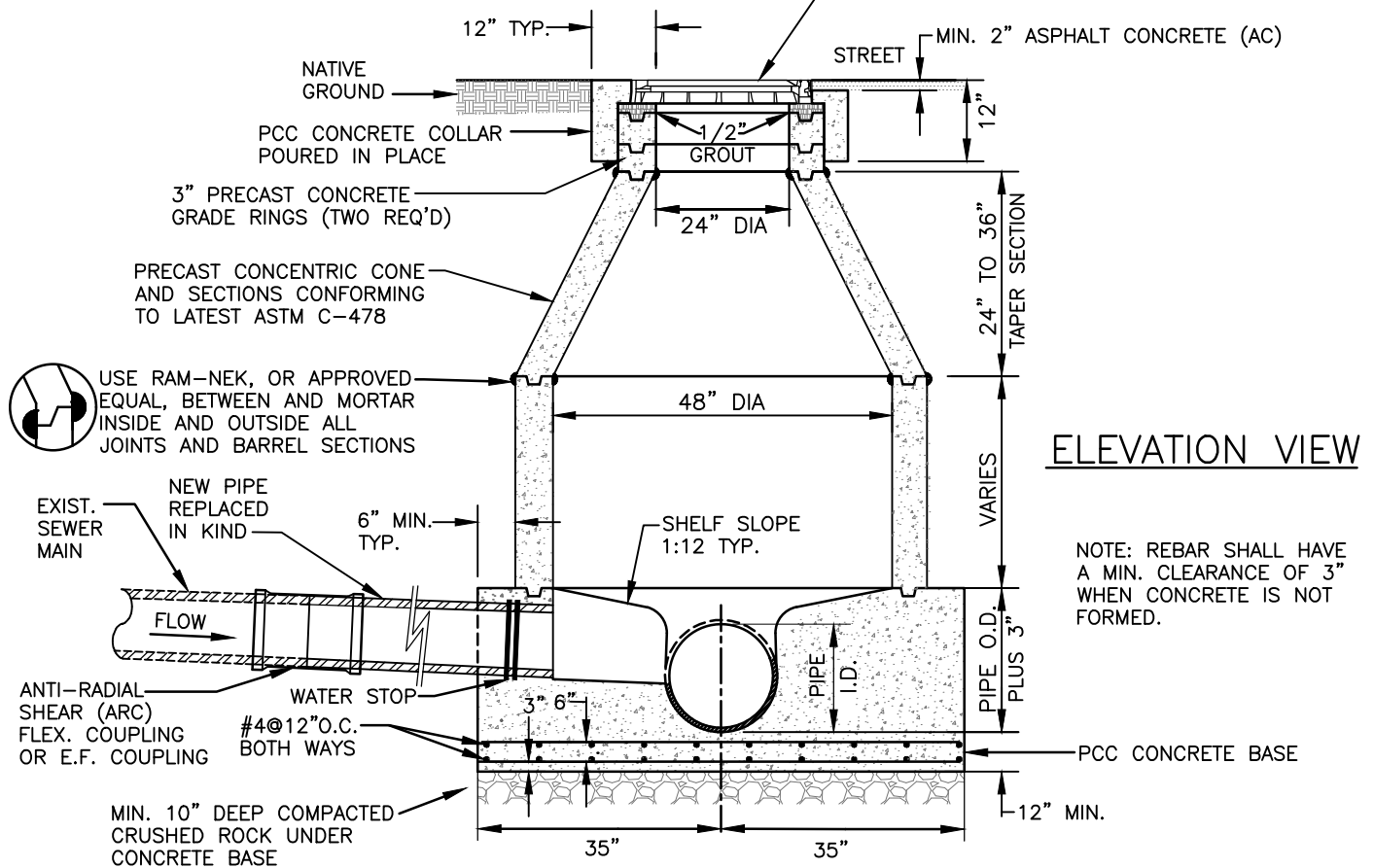
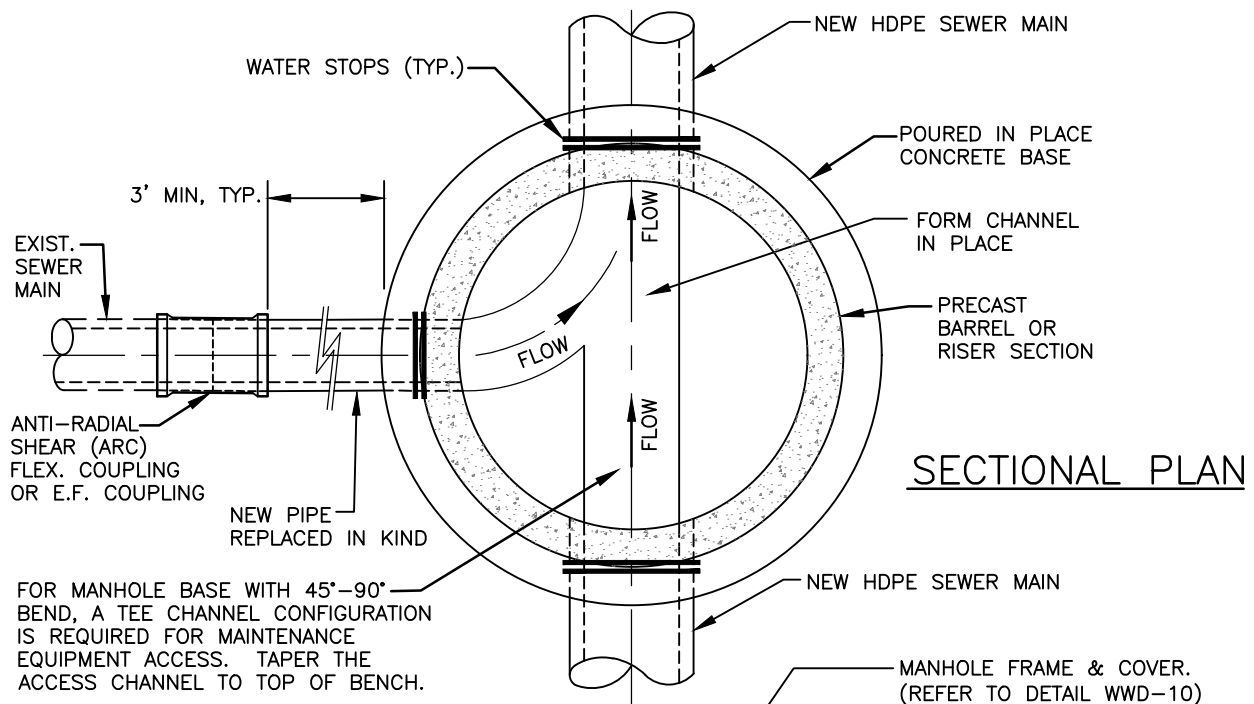
1. "TAP-TITE" (OR APPROVED EQUAL) CAN ONLY BE USED WITH THE PRIOR APPROVAL OF THE ENGINEER.
2. AN ELASTOMERIC SEALANT SHALL BE APPLIED BETWEEN THE SEWER MAIN AND THE FLEXIBLE SADDLE TO ENSURE AN AIR TIGHT CONNECTION.
3. COUPON SHALL BE REMOVED AND GIVEN TO THE CITY INSPECTOR.
4. 10-INCH MIN. MAIN SIZE FOR TAP-TITE CONNECTIONS.

| | | | | |
|----------------|------|---|--|-------------------------|
| BY | DATE | SANITARY SEWER LATERAL CONNECTION W/ TAP-TITE STANDARD DETAIL | APPROVED: MAY 20, 2022 | SCALE: NONE |
| DRAWN EMM | 5/21 | | <i>Silvia Lee Santos</i> SILVIA LEE SANTOS ENGINEERING MANAGER | DWG. NO. STD. WWD-06 |
| CHECKED EMM | 5/21 | CITY OF PALO ALTO, CALIFORNIA | 50674 R.E. NO. | |
| REVIEWED JJ/RA | 5/21 | | REVISION: MAY 5, 2021 | APPENDIX D |

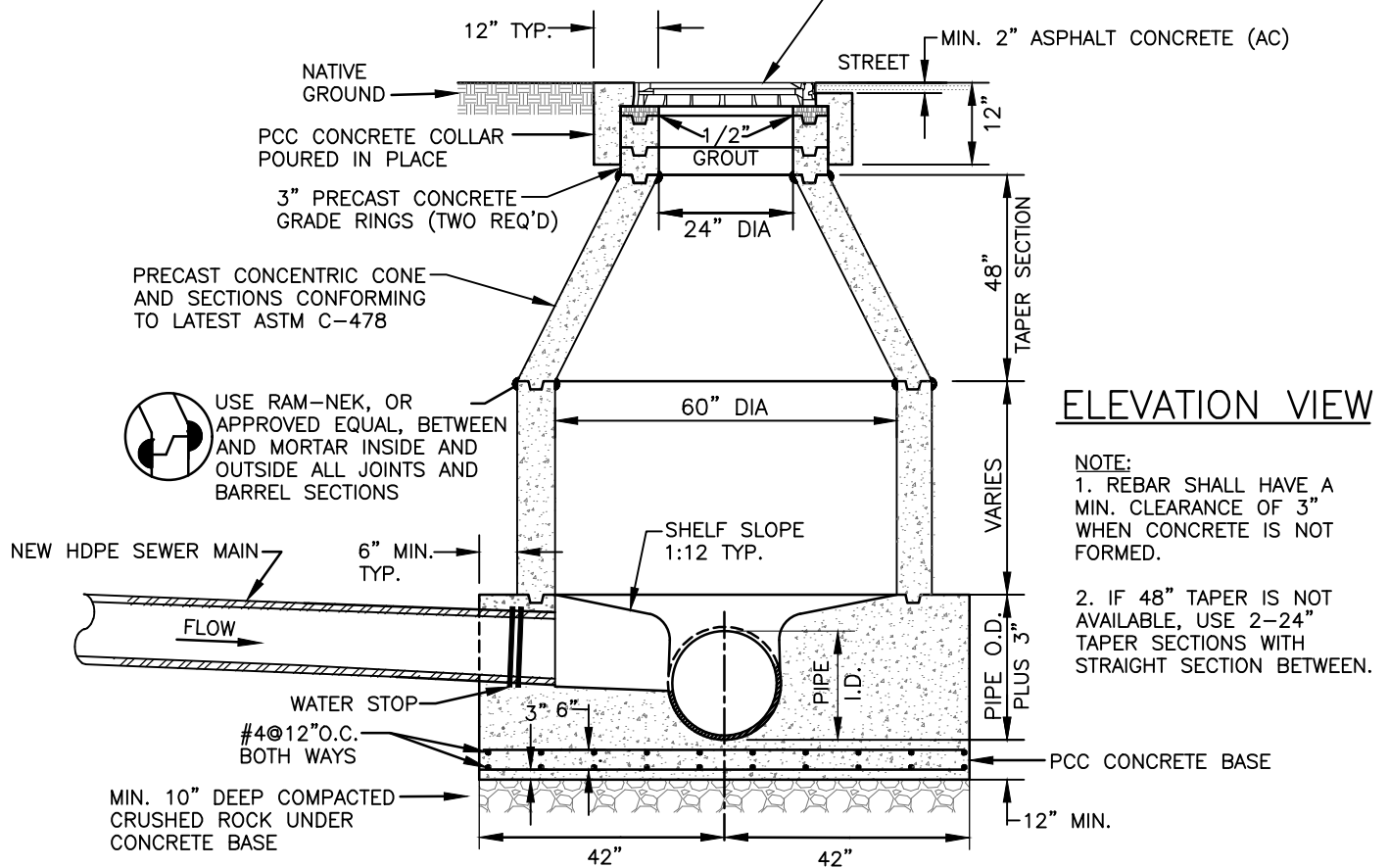
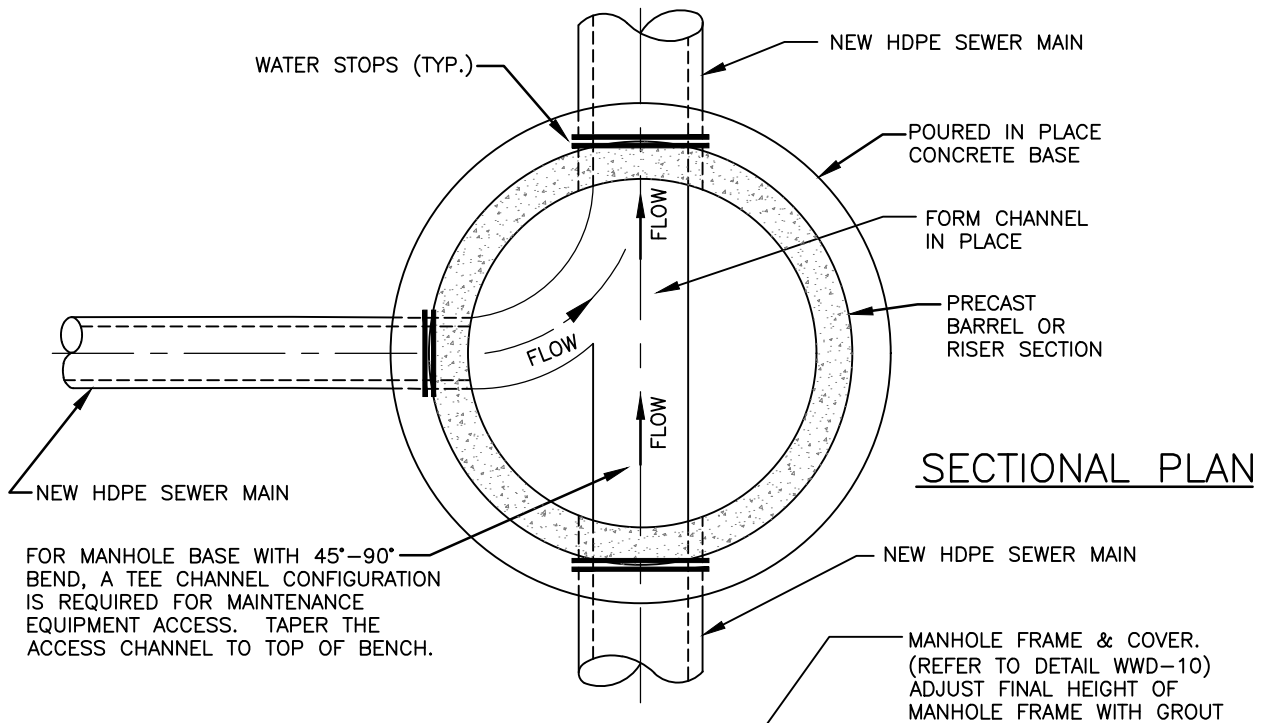


NOTE: REBAR SHALL HAVE
A MIN. CLEARANCE OF 3"
WHEN CONCRETE IS NOT
FORMED.

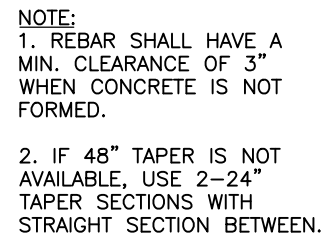
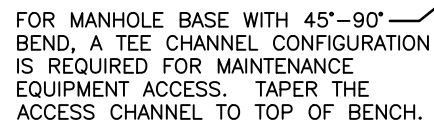
334

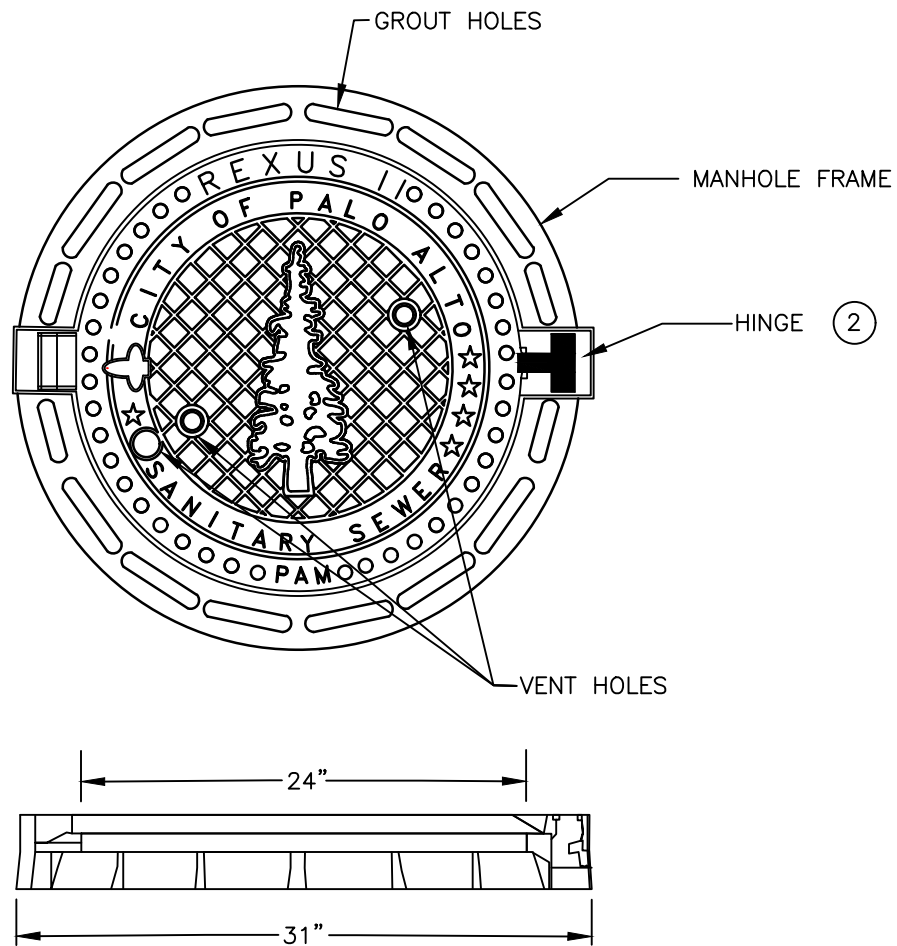


| | | | | |
|----------|------------|---|---|--------------|
| BY | DATE | SANITARY SEWER MANHOLE (FOR EXIST. PIPES 36" AND LESS) STANDARD DETAIL | APPROVED: | SCALE: |
| | | | MAY 20, 2022 | NONE |
| DRAWN | EMM 11/18 | | <i>Silvia Lee Santos</i> | DWG. NO. |
| CHECKED | EMM 5/21 | | SILVIA LEE SANTOS 50674 ENGINEERING MANAGER R.E. NO. | STD. WWD-07B |
| REVIEWED | JJ/RA 5/21 | CITY OF PALO ALTO, CALIFORNIA | REVISION: | APPENDIX D |
| | | | MAY 5, 2021 | |



| | | | | |
|----------------|-------|---|--------------------------------|--------------|
| BY | DATE | SANITARY SEWER MANHOLE (FOR NEW PIPES LARGER THAN 36") STANDARD DETAIL CITY OF PALO ALTO, CALIFORNIA | APPROVED: | SCALE: |
| | | | MAY 20, 2022 | NONE |
| DRAWN EMM | 11/18 | | <i>Silvia Lee Santos</i> 50674 | DWG. NO. |
| CHECKED EMM | 5/21 | | SILVIA LEE SANTOS R.E. NO. | STD. WWD-08A |
| REVIEWED JJ/RA | 5/21 | | REVISION: | APPENDIX D |
| | | | MAY 5, 2021 | |





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); OR APPROVED EQUAL.
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: MAY 20, 2022 | SCALE: NONE |
| DRAWN EMM | 11/18 | | <i>Silvia Lee Santos</i> | DWG. NO. STD. WWD-10 |
| CHECKED EMM | 5/21 | | SILVIA LEE SANTOS ENGINEERING MANAGER | |
| REVIEWED JJ/RA | 5/21 | | 50674 R.E. NO. | |
| CITY OF PALO ALTO, CALIFORNIA | | | REVISION: MAY 5, 2021 | APPENDIX D |