CITY OF HEALDSBURG

APPENDICES

FOR

CONSTRUCTION OF THE

MUNICIPAL RECYCLED WATER PIPELINE PROJECT

CITY OF HEALDSBURG

CITY OF HEALDSBURG
ENGINEERING DEPARTMENT
401 Grove Street

HEALDSBURG, CALIFORNIA 95448
PHONE: (707) 431-3346

(THIS PAGE LEFT BLANK INTENTIONALLY)

APPENDICES

TABLE OF CONTENTS

(THIS PAGE LEFT BLANK INTENTIONALLY)

APPENDIX A

Caltrans - Encroachment Permit and Rider

Appendix A1
Caltrans - Encroachment Permit

STATE OF CALIFORNIA • DEPARTMENT OF TRANSPORTATION

ENCROACHMENT PERMIT

DOT TR-0120 (REV 05/2023)

FM 91 1436

Permit No.
04-23-N-US-1659

In compliance with your application of August 16, 2023

Dist/Co/Rte/PM
04/SON/101/PM 34

Reference Documents:

- ☐ Utility Notice No. ____ of ____
- ☐ Agreement No. ____ of ____
- ☐ R/W Contract No. ____ of ____
- ☐ Project code (ID): ____ CFC #: ____
- ☒ Applicant's Reference/ Utility Work Order No. NA

Permit Approval Date
January 08, 2024

Performance Bond Amount (1)	Payment Bond Amount (2)
$0	$0

Bond Company
$ N/A

Bond Number (1)	Bond Number (2)
$ N/A	$ N/A

TO:

CITY OF HEALDSBURG
C/O: Scott Greenwood
2020 Research Park Drive
Davis CA 95618
(530)756-5905

, PERMITTEE

and subject to the following, PERMISSION IS HEREBY GRANTED to:

Perform traffic control to install recycle water of 36 inch. and approximately 162 ft. length crossing under Highway 101, using Jack and Bore method, on State Highway 04-SON-101, Post Mile 34.0, in the City of Healdsburg.

A minimum of 7 days prior to the start of work under this encroachment permit, notice must be given to State Representative Reza Shirazi, 611 Payran Street, Petaluma, CA 94952, at reza.shirazi@dot.ca.gov or (510)-715-9573, weekdays between 7:00 a.m. and 3:30 p.m., excluding holidays.

THIS PERMIT IS NOT A PROPERTY RIGHT AND DOES NOT TRANSFER WITH THE PROPERTY TO A NEW OWNER.

The following attachments are also included as part of this permit (check applicable):

- ☒ YES ☐ NO General Provisions
- ☐ YES ☒ NO Utility Maintenance Provisions
- ☒ YES ☐ NO Storm Water Special Provisions
- ☒ YES ☐ NO Special Provisions
- ☐ YES ☒ NO A Cal-OSHA Permit, if required: Permit No. ____
- ☐ YES ☒ NO As-Built Plans Submittal Route Slip for Locally Advertised Projects
- ☐ YES ☒ NO Storm Water Pollution Protection Plan

In addition to fee, the permittee will be billed actual costs for:

- ☒ YES ☐ NO Review
- ☒ YES ☐ NO Inspection
- ☒ YES Field Work *(if any Caltrans effort expended)*

As-built Plans are Required

☒ YES ☐ NO

☐ YES ☒ NO The information in the environmental documentation has been reviewed and considered prior to approval of this permit.

This permit is void unless the work is completed before January 31, 2025
This permit is to be strictly construed and no other work other than specifically mentioned is hereby authorized.
No project work shall be commenced until all other necessary permits and environmental clearances have been obtained.

CC:
#1: MOHAMMAD R SHIRAZI
#2: ROLI ELSOTARI
#3: CHAD C KLEIN
#4: MOHAMMAD R SHIRAZI

APPROVED:

Dina El-Tawansy, District Director

BY

Jae-Myung Lee
Jae-Myung Lee (Jan 8, 2024 08:58 PST)

JAE-MYUNG LEE, District Permit Engineer

ADA Notice This document is available in alternative accessible formats. For more information, please contact the Forms Management Unit at (279) 234-2284, TTY 711, in writing at Forms Management Unit, 1120 N Street, MS-89, Sacramento, CA 95814, or by email at Forms.Management.Unit@dot.ca.gov.

Email: sgreenwood@westyost.com
Phone: 530-756-5905

Notwithstanding General Provision 35, lane closures and other activities that may cause a traffic impact requires the permittee to apply for and obtain a closure ID prior to the start of work. Requests must be submitted using the attached "Encroachment Permit Work Scheduling Request Form".

In addition to the 2023 Standard Specifications and Standard Plans (available at https://dot.ca.gov/programs/design/ccs-standard-plans-and-standard-specifications), the attached "Encroachment Permit General Provisions" (TR-0045), "Storm Water Special Provisions for Minimal or No Impact (SWSP)" (TR-0400), "Hazardous Materials and Hazardous Waste Management Special Provisions" (TR-0408), "Encroachment Permit Survey Grid" (TR-0151), "Encroachment Permit Settlement Rod Detail" (TR-0152), "Encroachment Permit Underground Utility Provisions" (TR-0163), Steel Plate Bridging Utility" (TR-0157), and Trench Detail (available at http://dot.ca.gov/programs/traffic-operations/ep/ep-manual/), all work permitted herein must comply with the following provisions:

Caltrans is not a member of and does not respond to 'call USA'. The permittee is responsible for locating underground facilities. Any damages done to Caltrans facilities during construction must be repaired or replaced in kind at permittee's expense.

A pre-job meeting with the State Representative is required at least 7 days prior to the start of any work under this encroachment permit. Failure to do so may result in permit revocation with no prejudice.

The permittee must provide the stage construction plans, traffic handling plans, work schedule, and a list of all sub-contractors to the State Representative at the time of the pre-job meeting.

Certain details of work authorized herein are shown on the plans and specifications submitted by the permittee, and attached to this encroachment permit.

All the permittee's personnel must wear appropriate and approved personal protective equipment per Chapter 12 of Caltrans "Safety Manual", including hard hats and bright-colored safety vests, shirts or jackets with retro-reflective material, while on the State right-of-way.

Permittee must give the State Representative at least 7 days advance notice for lane closure requests.

Permittee must stop work and notify the State Representative immediately upon encountering field safety or environmental issues.

Permittee must coordinate all scheduled construction activities with other construction activities which may be in progress in the same general area.

Request for rider permit must be made minimum two weeks prior to start of the construction.

Additional inspection hours will be charged at the current State hourly rate.

Signs, lights, flags or other protective devices must not obscure the visibility of, nor conflict in intent, meaning, and function of either existing signs, lights and traffic control devices, or any construction area signs.

On freeways and expressways, permittee's vehicles and equipment not involved in the permitted activities must be legally located outside the State highway right-of-way.

On conventional highways, permittee's vehicles and equipment not involved in the permitted activities must be legally located off the traveled way and not interfere with free traffic and pedestrian flow.

Email: sgreenwood@westyost.com
Phone: 530-756-5905

This permit does not authorize work on freeways, expressways, or other activities not specifically provided for in this permit. Permittee's vehicles and equipment not involved in the permitted activities must be legally located outside the State highway right-of-way.

No vehicle or equipment must be stored overnight within the State highway right-of-way. All vehicles and equipment must be removed immediately at the completion of the day's work. Refueling of vehicle or equipment within the State highway right-of-way is strictly prohibited.

Traffic control must comply with the 2023 Caltrans Standard Plans T9 through T22 (available at https://dot.ca.gov/programs/design/ccs-standard-plans-and-standard-specifications), and the California MUTCD, Part 6, "Temporary Traffic Control" (available at http://www.dot.ca.gov/programs/safety-programs/camutcd).

All traffic control devices must be installed, maintained, and removed by a qualified traffic control contractor.

Construction activities must not inconvenience the public or abutting property owners. Maintain access to driveways, houses, and buildings.

The State Representative and CHP reserve the right to require reopening the highway at any time as necessary. All cost must be borne by the permittee.

Traffic control using flagging, must comply with the California MUTCD, Part 6E, "Flagger Control" (available at https://dot.ca.gov/programs/traffic-operations/camutcd/), and Cal/OSHA Construction Safety Orders, Section 1599, "Flaggers", (available at https://www.dir.ca.gov/title8/1599.html).

When the work area encroaches upon a sidewalk, walkway, or crosswalk area, special consideration must be given to pedestrian safety. Protective barricades, fencing, handrails and bridges, together with warning and guidance devices and signs must be utilized so that the passageway for pedestrians, especially blind and other physically handicapped, is safe and well defined and shown on the approved plan.

Temporary pedestrian facilities must comply with the Caltrans Temporary Pedestrian Facilities Handbook (available at https://dot.ca.gov/-/media/dot-media/programs/construction/documents/contract-administration/temporary-pedestrian-facilities-handbook-a11y.pdf and the California MUTCD Part 6, Chapter 6D – "Pedestrian and Worker Safety" (available at http://www.dot.ca.gov/programs/safety-programs/camutcd).

Notwithstanding General Provision 13, temporary pedestrian access routes must comply with the 2023 Caltrans Standard Plans T30 through T34 (available at https://dot.ca.gov/programs/design/ccs-standard-plans-and-standard-specifications).

Temporary pedestrian walkways and canopies must comply with the requirements of the applicable local agency or the latest edition of the International Building Code whichever contains the higher standards.

Streets and highways in the San Francisco Bay Area contain a significant number of existing underground utilities. This includes traffic signal conduits that are installed 9 inches or less in depth. The permittee is responsible for necessary site investigations for identification of the location and depth of existing underground facilities prior to excavation (e.g., pothole or hand-dig) to avoid damage or disruption in services.

All pavement must be saw cut prior to removal, or removed by grinding.

Obliterated pavement markings must be replaced in kind.

Email: sgreenwood@westyost.com
Phone: 530-756-5905

All signs and markings must comply with the California MUTCD (available at http://www.dot.ca.gov/programs/safety-programs/camutcd).

Where Asphalt Concrete (AC) has been placed, temporary painted traffic striping and pavement markings must be installed within 24 hours. Where shown on the plans, after 30 days curing time, thermoplastic materials must be applied in accordance with the 2023 Caltrans Standard Specifications, Section 84, "Markings" (available at https://dot.ca.gov/programs/design/ccs-standard-plans-and-standard-specifications).

Trench excavation must comply with the 2023 Caltrans Standard Specifications, Section 19-3, "Structure Excavation and Backfill" (available at https://dot.ca.gov/programs/design/ccs-standard-plans-and-standard-specifications).

Trench backfill must comply with the attached trench detail and the 2023 Caltrans Standard Specifications, Section 19.3.02E, "Slurry Cement Backfill", and 19-3.02G, "Controlled Low-Strength Material".

Asphalt Concrete (AC) to be removed must be saw cut to the full depth along both sides of the trench. Portland Cement Concrete (PCC) to be removed must be saw cut to a minimum depth of 4 inches along both sides of the trench.

Where the edge of trench is within 2 feet of curb, gutter, or pavement edge, Asphalt Concrete (AC) pavement between the trench and curb, gutter, or pavement edge must be removed and replaced.

No excavation must be left open overnight. Temporary backfilling of excavations in finished surfaces must be capped with a minimum 3 inches Asphalt Concrete (AC).

Changes to the provisions herein require an Encroachment Permit Rider, except for minor changes authorized by the State Representative.

Time extension requests must be made a minimum 2 weeks prior to permit expiration.

The State Representative or CHP may stop work not being performed in compliance with this permit.

Neither materials nor waste must be stockpiled within the State highway right-of-way.

All mud, dirt, and gravel tracked onto the roadway must be immediately removed.

Upon completion of work authorized by this encroachment permit, the permittee must provide the State Representative with three sets of As-Built plans, in accordance with General Provision 22.

Upon completion of work authorized by this encroachment permit, permittee must provide the State Representative with "Notice of Completion" (TR-0128) (available at http://forms.dot.ca.gov/v2Forms/servlet/FormRenderer?frmid=TR0128)

Email: sgreenwood@westyost.com
Phone: 530-756-5905

Conditional Requirement(s):

Work must not start until the documents listed below have been submitted to, reviewed by, and approved by Caltrans. This permit is conditionally issued without the documents listed below, at the request of the Permittee. The Permittee acknowledges and will ensure that the following documents will be submitted to Caltrans for review and approval prior to scheduling authorized work/activities:

- The permittee must submit a completed and signed "Encroachment Permit Applicant: Contractor(s) Authorization Form" (Form TR-0429) (available at https://dot.ca.gov/-/media/dot-media/programs/traffic-operations/documents/encroachment-permits/tr-0429-a11y.pdf) with information of all the Permittee's contractors, and their sub-contractors who will be performing work authorized under the conditions of this encroachment permit. Permittee must also have all contractors complete their portion of the form and submit the final signed forms to the State Representative and District Permit Engineer at or prior to the preconstruction meeting. The form must be completed by hand.

Non-compliance with this provision may result in Caltrans taking actions including but not limited to canceling this permit without further notice, requiring bonds, and/or not providing such conditional approvals for the Permittee on future projects.

Additional Enclosure(s):

1. Notice of Completion (TR-0128)
2. Work Authorization Instruction and Request Form
3. Contractor(s) Authorization Form (TR-0429)
4. Plan Set Documents

ENCROACHMENT PERMIT GENERAL PROVISIONS

TR-0045 (REV. 12/2022)

1. **AUTHORITY:** The California Department of Transportation ("Department") has authority to issue encroachment permits under Division 1, Chapter 3, Article 1, Sections 660 through 734 of the Streets and Highways Code.
2. **REVOCATION:** Encroachment permits are revocable on five (5) business days' notice unless otherwise stated on the permit or otherwise provided by law, and except as provided by law for public corporations, franchise holders, and utilities. Notwithstanding the foregoing, in an emergency situation as determined by the Department, an encroachment permit may be revoked immediately. These General Provisions and any applicable Special Provisions are subject to modification or abrogation by the Department at any time. Permittees' joint use agreements, franchise rights, reserved rights or any other agreements for operating purposes in State of California ("State") highway right-of-way may be exceptions to this revocation.
3. **DENIAL FOR NONPAYMENT OF FEES:** Failure to pay encroachment permit fees when due may result in rejection of future applications, denial of encroachment permits, and revocation of the encroachment permit if already issued.
4. **PERMITTEE AUTHORIZATION FOR OTHERS TO PERFORM WORK:** This encroachment permit allows only the Permittee and/or Permittee's authorized contractor or agent to work within or encroach upon the State highway right-of-way, and the Permittee may not assign or transfer this encroachment permit. Any attempt to assign or transfer this encroachment permit shall be null and void. Permittee shall provide to the Department a list of Permittee's authorized contractors/agents, in the form and at the time specified by the Department but if no time is specified then no later than the pre-construction meeting. Permittee shall keep the list current and shall provide updates to the Department immediately upon any change to the list of authorized contractors/agents, including but not limited the addition, removal, or substitution of an authorized contractor/agent, or a new address or contact information for an existing authorized contractor/agent. Permittee is responsible for the acts and/or omissions of any person or entity acting on behalf of the Permittee, even if such person or entity is not included on Permittee's list of authorized contractors and/or agents.
5. **ACCEPTANCE OF PROVISIONS:** Permittee, and the Permittee's authorized contractors and/or agents, understand and agree to accept and comply with these General Provisions, the Special Provisions, any and all terms and/or conditions contained in or incorporated into the encroachment permit, and all attachments to the encroachment permit (collectively "the Permit Conditions"), for any encroachment, work, and/or activity to be performed under this encroachment permit and/or under color of authority of this encroachment permit. Permittee understands and agrees the Permit Conditions are applicable to and enforceable against Permittee as long as the encroachment remains in, under, or over any part of the State highway right-of-way. The Permittee's authorized contractors and/or agents, are also bound by the Permit Conditions. Non-compliance with the Permit Conditions by the Permittee's authorized contractor and/or agent will be deemed non-compliance by the Permittee.
6. **BEGINNING OF WORK:** When traffic is not impacted (see General Provision Number 35), the Permittee must notify the Department's representative two (2) business days before starting permitted work. Permittee must notify the Department's representative if the work is to be interrupted for a period of five (5) business days or more, unless otherwise agreed upon. All work must be performed on weekdays during regular work hours, excluding holidays, unless otherwise specified in this encroachment permit.
7. **STANDARDS OF CONSTRUCTION:** All work performed within State highway right-of-way must conform to all applicable Departmental construction standards including but not limited to: Standard Specifications, Standard Plans, Project Development Procedures Manual, Highway Design Manual and Special Provisions.

   Other than as expressly provided by these General Provisions, the Special Provisions, the Standard Specifications, Standard Plans, and other applicable Departmental standards, nothing in these General Provisions is intended to give any third party any legal or equitable right, remedy, or claim with respect to the encroachment permit and/or to these General Provisions or any provision herein. These General Provisions are for the sole and exclusive benefit of the Permittee and the Department.

   Where reference is made in such standards to "Contractor" and "Engineer," these are amended to be read as "Permittee" and "Department's representative," respectively, for purposes of this encroachment permit.
8. **PLAN CHANGES:** Deviations from plans, specifications, and/or the Permit Conditions as defined in General Provision Number 5 are not allowed without prior approval from the Department's representative and the Federal Highway Administration ("FHWA") representative if applicable.
9. **RIGHT OF ENTRY, INSPECTION AND APPROVAL:** All work is subject to monitoring and inspection. The United States, the State, the Department, and the Directors, officers, employees, agents, and/or contractors of the State and/or of the Department, and other state, and federal agencies, and the FHWA, through their agents or representatives, must have full access to highway

facilities/encroachment area, at any and all times for the purpose of inspection, maintenance, activities needed for construction/reconstruction, and operation of the State highway right-of-way.

Upon completion of work, Permittee must request a final inspection for acceptance and approval by the Department. The local public agency Permittee must not give final construction approval to its contractor until final acceptance and approval by the Department is obtained.

10. **PERMIT AT WORKSITE:** Permittee and Permittee's authorized contractors/agents must keep the permit package and current list of authorized contractors/agents, or copies thereof, at the work site at all times and must show such documents upon request to any Department representative or law enforcement officer. If the permit package or current list of authorized contractors/agents, or copies thereof, are not kept and made available at the work site at all times, then all work must be suspended.
11. **CONFLICTING ENCROACHMENTS:** Permittee must yield start of work to ongoing, prior authorized work adjacent to or within the limits of the Permittee's project site. When existing encroachments conflict with Permittee's work, the Permittee must bear all cost for rearrangements (e.g., relocation, alteration, removal, etc.).
12. **PERMITS, APPROVALS, AND CONCURRENCES FROM OTHER AGENCIES AND/OR ENTITIES:** This encroachment permit is invalidated if the Permittee has not obtained all permits, approvals, and concurrences necessary and required by law, including but not limited to those from the California Public Utilities Commission ("CPUC"), California Occupational Safety and Health Administration ("Cal-OSHA"), local and state and federal environmental agencies, the California Coastal Commission, and any other public agency and/or entity having jurisdiction. Permittee is responsible for providing notice of the encroachment to, and obtaining concurrence from, any person or entity (whether public or private) affected by the scope of work described in the encroachment permit, regardless of whether such notice or concurrence is required by law; the Department is not responsible to provide such notice or obtain such concurrence. Permittee warrants all such permits, approvals, and concurrences have been obtained before beginning work under this encroachment permit. The Department may, at the Department's discretion, require the Permittee to demonstrate that Permittee has obtained all such permits, approvals, and concurrences, and Permittee shall demonstrate this at the time and in the manner specified by the Department.
13. **PEDESTRIAN AND BICYCLIST SAFETY:** A safe continuous passageway must be maintained through the work area at existing pedestrian or bicycle facilities. At no time must pedestrians be diverted onto a portion of the street used for vehicular traffic. At locations where safe alternate passageways cannot be provided, appropriate signs and barricades must be installed at the limits of construction and in advance of the limits of construction at the nearest crosswalk or intersection to detour pedestrians to facilities across the street. Attention is directed to Section 7-1.04 "Public Safety," and to Section 12-4.04 "Temporary Pedestrian Access Routes," and to Section 16-2.02 "Temporary Pedestrian Facility," of the Department's Standard Specifications, and to California Vehicle Code section 21760, subdivision (c).
14. **PUBLIC TRAFFIC CONTROL:** The Permittee must provide traffic control protection, warning signs, lights, safety devices, etc., and take all other measures necessary for the traveling public's safety as required by law and/or the Department. While providing traffic control, the needs of all road users, including but not limited to motorists, bicyclists and pedestrians, including persons with disabilities in accordance with the Americans with Disabilities Act, must be an essential part of the work activity.

    Lane, Bike Lane, Sidewalk, Crosswalk, and/or shoulder closures must comply with the Department's Standard Specifications and Standard Plans for Temporary Traffic Control Systems & Temporary Pedestrian Access Routes, and with the applicable Special Provisions. Where issues are not addressed in the Standard Specifications, Standard Plans, and/or Special Provisions, the California Manual on Uniform Traffic Control Devices (Part 6, Temporary Traffic Control) must be followed.
15. **MINIMUM INTERFERENCE WITH TRAFFIC:** Permittee must plan and conduct work so as to create the least possible inconvenience to the traveling public (motorized vehicles, unmotorized vehicles such as bicycles, pedestrians, person(s) with disabilities, etc.), such that traffic is not unreasonably delayed.
16. **STORAGE OF EQUIPMENT AND MATERIALS:** The storage of equipment or materials is not allowed within State highway right-of-way, unless specified within the Special Provisions of this encroachment permit. If encroachment permit Special Provisions allow for the storage of equipment or materials within the State highway right-of-way, the equipment and material storage must also comply with Section 7-1.04, Public Safety, of the Department's Standard Specifications.
17. **CARE OF DRAINAGE:** Permittee must provide alternate drainage for any work interfering with an existing drainage facility in compliance with the Department's Standard Specifications, Standard Plans, and/or as directed by the Department's representative.
18. **RESTORATION AND REPAIRS IN STATE HIGHWAY RIGHT-OF-WAY:** Permittee is responsible for restoration and repair of State highway right-of-way resulting from permitted work (Streets and Highways Code, section 670 et seq.).
19. **STATE HIGHWAY RIGHT-OF-WAY CLEAN UP:** Upon completion of work, Permittee must remove and dispose of all scraps, refuse, brush, timber, materials, etc. off the State highway right-of-way. The aesthetics of the highway must be as it was before work started or better.
20. **COST OF WORK:** Unless stated otherwise in the encroachment permit or a separate written agreement with the Department, the Permittee must bear all costs

incurred for work within the State highway right-of-way and waives all claims for indemnification or contribution from the United States, the State, the Department, and from the Directors, officers, and employees of the State and/or the Department. Removal of Permittee's personal property and improvements shall be at no cost to the United States, the State, and the Department.

21. **ACTUAL COST BILLING:** When specified in the permit, the Department will bill the Permittee actual costs at the currently set Standard Hourly Rate for encroachment permits.
22. **AS-BUILT PLANS:** When required, Permittee must submit one (1) set of folded as-built plans within thirty (30) calendar days after completion and acceptance of work in compliance with requirements listed as follows:
    a) Upon completion of the work provided herein, the Permittee must submit a paper set of As-Built plans to the Department's representative.
    b) All changes in the work will be shown on the plans, as issued with the permit, including changes approved by Encroachment Permit Rider.
    c) The plans are to be prominently stamped or otherwise noted "AS-BUILT" by the Permittee's representative who was responsible for overseeing the work. Any original plan that was approved with a Department stamp, or by signature of the Department's representative, must be used for producing the As-Built plans.
    d) If construction plans include signing or striping, the dates of signing or striping removal, relocation, or installation must be shown on the As-Built plans when required as a condition of the encroachment permit. When the construction plans show signing and striping for staged construction on separate sheets, the sheet for each stage must show the removal, relocation, and installation dates of the appropriate staged striping and signing.
    e) As-Built plans must contain the Encroachment Permit Number, County, Route, and Post Mile on each sheet.
    f) The As-Built Plans must not include a disclaimer statement of any kind that differs from the obligations and protections provided by sections 6735 through 6735.6 of the California Business and Professions Code. Such statements constitute non-compliance with Encroachment Permit requirements and may result in the Department retaining Performance Bonds or deposits until proper plans are submitted. Failure to comply may also result in denial of future encroachment permits or a provision requiring a public agency to supply additional bonding.
23. **PERMITS FOR RECORD PURPOSES ONLY:** When work in the State highway right-of-way is within an area under a Joint Use Agreement (JUA) or a Consent to Common Use Agreement (CCUA), a fee exempt encroachment permit is issued to the Permittee for the purpose of providing a notice and record of work. The Permittee's prior rights must be preserved without the intention of creating new or different rights or obligations. "Notice and Record Purposes Only" must be stamped across the face of the encroachment permit.
24. **BONDING:** The Permittee must file bond(s), in advance, in the amount(s) set by the Department and using forms acceptable to the Department. The bonds must name the Department as obligee. Failure to maintain bond(s) in full force and effect will result in the Department stopping all work under this encroachment permit and possibly revoking other encroachment permit(s). Bonds are not required of public corporations or privately-owned utilities unless Permittee failed to comply with the provisions and/or conditions of a prior encroachment permit. The surety company is responsible for any latent defects as provided in California Code of Civil Procedure section 337.15. A local public agency Permittee also must comply with the following requirements:
    a) In recognition that project construction work done on State property will not be directly funded and paid by State, for the purpose of protecting stop notice claimants and the interests of State relative to successful project completion, the local public agency Permittee agrees to require the construction contractor to furnish both a payment and performance bond in the local public agency's name with both bonds complying with the requirements set forth in Section 3-1.05 Contract Bonds of the Department's Standard Specifications before performing any project construction work.
    b) The local public agency Permittee must defend, indemnify, and hold harmless the United States, the State and the Department, and the Directors, officers, and employees of the State and/or Department, from all project construction related claims by contractors, subcontractors, and suppliers, and from all stop notice and/or mechanic's lien claimants. The local public agency also agrees to remedy, in a timely manner and to the Department's satisfaction, any latent defects occurring as a result of the project construction work.
25. **FUTURE MOVING OF INSTALLATIONS:** Permittee understands and agrees to relocate a permitted installation upon notice by the Department. Unless under prior property right or agreement, the Permittee must comply with said notice at the Permittee's sole expense.
26. **ENVIRONMENTAL:**
    a) ARCHAEOLOGICAL/HISTORICAL: If any archaeological or historical resources are identified or encountered in the work vicinity, the Permittee must immediately stop work, notify the Department's representative, retain a qualified archaeologist who must evaluate the site at Permittee's sole expense, and make recommendations to the Department's representative regarding the continuance of work.
    b) HAZARDOUS MATERIALS: If any hazardous waste or materials (such as underground storage tanks, asbestos pipes, contaminated soil, etc.) are identified or encountered in the work vicinity, the Permittee must immediately stop work, notify the Department's representative, retain a qualified hazardous

waste/material specialist who must evaluate the site at the Permittee's sole expense, and make recommendations to the Department's representative regarding the continuance of work.

Attention is directed to potential aerially deposited lead (ADL) presence in unpaved areas along highways. It is the Permittee's responsibility to take all appropriate measures to protect workers in conformance with California Code of Regulations Title 8, Section 1532.1, "Lead," and with Cal-OSHA Construction Safety Orders, and to ensure roadway soil management is in compliance with Department of Toxic Substances Control (DTSC) requirements.

c) BIOLOGICAL: If any regional, state, or federally listed biological resource is identified or encountered in the work vicinity, the Permittee must immediately stop work, notify the Department's representative, retain a qualified biologist who must evaluate the site at Permittee's sole expense, and make recommendations to the Department's representative regarding the continuance of work.

27. **PREVAILING WAGES:** Work performed by or under an encroachment permit may require Permittee's contractors and subcontractors to pay appropriate prevailing wages as set by the California Department of Industrial Relations. Inquiries or requests for interpretations relative to enforcement of prevailing wage requirements must be directed to the California Department of Industrial Relations.
28. **LIABILITY, DEFENSE, AND INDEMNITY:** The Permittee agrees to indemnify and save harmless the United States, the State, the Department, and the Directors, officers, employees, agents and/or contractors of the State and/or of the Department, including but not limited to the Director of Transportation and the Deputy Directors, from any and all claims, demands, damages, costs, liability, suits, or actions of every name, kind, and description, including but not limited to those brought for or on account of property damage, invasion of privacy, violation or deprivation of a right under a state or federal law, environmental damage or penalty, or injury to or death of any person including but not limited to members of the public, the Permittee, persons employed by the Permittee, and/or persons acting on behalf of the Permittee, arising out of or in connection with: (a) the issuance and/or use of this encroachment permit; and/or (b) the encroachment, work, and/or activity conducted pursuant to this encroachment permit, or under color of authority of this encroachment permit but not in full compliance with the Permit Conditions as defined in General Provision Number 5 ("Unauthorized Work or Activity"); and/or (c) the installation, placement, design, existence, operation, and/or maintenance of the encroachment, work, and/or activity; and/or (d) the failure by the Permittee, or by anyone acting for or on behalf of the Permittee, to perform the Permittee's obligations under any part of the Permit Conditions as defined in General Provision Number 5, in respect to maintenance or any other obligation; and/or (e) any change to the Department's property or adjacent property, including but not limited to the features or conditions of either of them, made by the Permittee or anyone acting on behalf of the Permittee; and/or (f) a defect or obstruction related to or caused by the encroachment, work, and/or activity whether conducted in compliance with the Permit Conditions as defined in General Provision Number 5 or constituting Unauthorized Work or Activity, or from any cause whatsoever. The duty of the Permittee to indemnify and save harmless includes the duties to defend as set forth in Section 2778 of the Civil Code.

It is the intent of the Department and the Permittee that except as prohibited by law, the Permittee will defend, indemnify, and hold harmless as set forth in this General Provision Number 28 regardless of the existence or degree of fault or negligence, whether active or passive, primary or secondary, on the part of: the United States, the State; the Department; the Directors, officers, employees, agents and/or contractors of the State and/or of the Department, including but not limited to the Director of Transportation and the Deputy Directors; the Permittee; persons employed by the Permittee; and/or persons acting on behalf of the Permittee.

The Permittee waives any and all rights to any type of expressed or implied indemnity from or against the United States, the State, the Department, and the Directors, officers, employees, agents, and/or contractors of the State and/or of the Department, including but not limited to the Director of Transportation and the Deputy Directors.

The Permittee understands and agrees to comply with the obligations of Titles II and III of the Americans with Disabilities Act in the conduct of the encroachment, work, and/or activity whether conducted pursuant to this encroachment permit or constituting Unauthorized Work or Activity, and further agrees to defend, indemnify, and save harmless the United States, the State, the Department, and the Directors, officers, employees, agents, and/or contractors of the State and/or of the Department, including but not limited to the Director of Transportation and the Deputy Directors, from any and all claims, demands, damages, costs, penalties, liability, suits, or actions of every name, kind, and description arising out of or by virtue of the Americans with Disabilities Act.

The Permittee understands and agrees the Directors, officers, employees, agents, and/or contractors of the State and/or of the Department, including but not limited to the Director of Transportation and the Deputy Directors, are not personally responsible for any liability arising from or by virtue of this encroachment permit.

For the purpose of this General Provision Number 28 and all paragraphs herein, "contractors of the State and/or of the Department" includes contractors, and their subcontractors, under contract to the State and/or the Department.

This General Provision Number 28 and all paragraphs herein take effect immediately upon issuance of this encroachment permit, and apply before, during, and after the encroachment, work, and/or activity

contemplated under this encroachment permit, whether such work is in compliance with the Permit Conditions as defined in General Provision Number 5 or constitutes Unauthorized Work or Activity, except as otherwise provided by California law. The Permittee's obligations to defend, indemnify, and save harmless under this General Provision Number 28 take effect immediately upon issuance of this encroachment permit and have no expiration date, including but not limited to situations in which this encroachment permit expires or is revoked, the work or activity performed under this encroachment permit is accepted or not accepted by the Department, the encroachment, work, and/or activity is conducted in compliance with the Permit Conditions as defined in General Provision Number 5 or constitutes Unauthorized Work or Activity, and/or no work or activity is undertaken by the Permittee or by others on the Permittee's behalf.

If the United States or an agency, department, or board of the United States is the Permittee, the first two paragraphs of this General Provision Number 28 (beginning "The Permittee agrees to indemnify…" and "It is the intent of the parties…") are replaced by the following paragraph:

Claims for personal injury, death, or property damage allegedly caused by the negligent or wrongful act or omission of any employee of the United States acting within the scope of their official duties are subject to the Federal Tort Claims Act, as amended, 28 U.S.C. § 1346 and § 2671 et seq. (Chapter 171).

29. **NO PRECEDENT ESTABLISHED:** This encroachment permit is issued with the understanding that it does not establish a precedent.
30. **FEDERAL CIVIL RIGHTS REQUIREMENTS FOR PUBLIC ACCOMMODATION:**
    a) As part of the consideration for being issued this encroachment permit, the Permittee, on behalf of Permittee and on behalf of Permittee's personal representatives, successors in interest, and assigns, does hereby covenant and agree that:
        i) No person on the grounds of race, color, or national origin may be excluded from participation in, be denied the benefits of, or be otherwise subjected to discrimination in the use of said facilities.
        ii) That in connection with the construction of any improvements on said lands and the furnishings of services thereon, no discrimination must be practiced in the selection and retention of first-tier subcontractors in the selection of second-tier subcontractors.
        iii) That such discrimination must not be practiced against the public in their access to and use of the facilities and services provided for public accommodations (such as eating, sleeping, rest, recreation), and operation on, over, or under the space of the State highway right-of-way.
        iv) That the Permittee must use the premises in compliance with all other requirements imposed pursuant to Title 15, Code of Federal Regulations, Commerce and Foreign Trade, Subtitle A. Office of the Secretary of Commerce, Part 8 (15 C.F.R. Part 8) and as said Regulations may be amended.
    b) That in the event of breach of any of the above nondiscrimination covenants, the State and the Department have the right to terminate this encroachment permit and to re-enter and repossess said land and the facilities thereon and hold the same as if said permit had never been made or issued.
31. **MAINTENANCE:** The Permittee is responsible at Permittee's sole expense for the encroachment, and the inspection, maintenance, repair, and condition thereof, and is responsible to ensure the encroachment does not negatively impact State highway safety, maintenance, operations, construction, State facilities, activities related to construction/reconstruction, or other encroachments. The Permittee's obligations in the preceding sentence take effect immediately upon issuance of this encroachment permit and continue until the encroachment is entirely and permanently removed. Additional encroachment permits or approval documents may be required authorizing work related to inspection, repair, and/or maintenance activities. Contact the Department for information.
32. **SPECIAL EVENTS:** In accordance with subdivision (a) of Streets and Highways Code section 682.5 and 682.7, the Department is not responsible for the conduct or operation of the permitted activity, and the applicant agrees to defend, indemnify, and hold harmless the United States, the State, the Department, and the Directors, officers, employees, agents, and contractors of the State and/or of the Department, including but not limited to the Director of Transportation and the Deputy Directors, from any and all claims, demands, damages, costs, liability, suits, or actions of every name, kind and description arising out of any activity for which this encroachment permit is issued.

    The Permittee is required, as a condition of this encroachment permit, for any event that awards prize compensation to competitors in gendered categories, for any participant level that receives prize compensation, to ensure the prize compensation for each gendered category is identical at each participant level. (Streets and Highways Code, section 682.7.)

    The Permittee understands and agrees to comply with the obligations of Titles II and III of the Americans with Disabilities Act in the conduct of the event, and further agrees to defend, indemnify, and save harmless the United State, the State and the Department, and the Directors, officers, and employees of the State and/or Department, including but not limited to the Director of the Department and the Deputy Directors, from any and all claims, demands, damages, costs, liability, suits, or actions of every name, kind and description arising out of or by virtue of the Americans with Disabilities Act.
33. **PRIVATE USE OF STATE HIGHWAY RIGHT-OF-WAY:** State highway right-of-way must not be used for private purposes without compensation to the State. The gifting

of public property uses and therefore public funds is prohibited under the California Constitution, Article XVI, Section 6.

34. **FIELD WORK REIMBURSEMENT:** Permittee must reimburse the Department for field work performed by or on behalf of the Department to correct or remedy issues created by the Permittee or by others acting on behalf of the Permittee, including but not limited to hazards or damaged facilities, or to clear refuse, debris, etc. not attended to by the Permittee or by others acting on behalf of the Permittee.
35. **LANE CLOSURE REQUEST SUBMITTALS AND NOTIFICATION OF CLOSURES TO THE DEPARTMENT:** Lane closure request submittals and notifications must be in accordance with Section 12-4.02, and Section 12.4-04, of the Department's Standard Specifications or as directed by the Department's representative. The Permittee must notify the Department's representative and the Traffic Management Center ("TMC") before initiating a lane closure or conducting an activity that may cause a traffic impact. In emergency situations when the corrective work or the emergency itself may affect traffic, the Department's representative and the TMC must be notified as soon as possible.
36. **SUSPENSION OF TRAFFIC CONTROL OPERATION:** The Permittee, upon notification by the Department's representative, must immediately suspend all traffic lane, bike lane, sidewalk, crosswalk, and/or shoulder closure operations and any operation that impedes the flow of traffic. All costs associated with this suspension must be borne by the Permittee.
37. **UNDERGROUND SERVICE ALERT (USA) NOTIFICATION:** Any excavation requires compliance with the provisions of Government Code section 4216 et seq., including but not limited to notice to a regional notification center, such as Underground Service Alert (USA). The Permittee must provide notification to the Department representative at least five (5) business days before, and the regional notification center at least forty-eight (48) hours before, performing any excavation work within the State highway right-of-way.
38. **COMPLIANCE WITH THE AMERICANS WITH DISABILITIES ACT (ADA):** All work within the State highway right-of-way to construct and/or maintain any public facility must be designed, maintained, and constructed strictly in accordance with all applicable Federal Access laws and regulations (including but not limited to Section 504 of the Rehabilitation Act of 1973, codified at 29 U.S.C. § 794), California Access laws and regulations relating to ADA, along with its implementing regulations, Title 28 of the Code of Federal Regulations Parts 35 and 36 (28 C.F.R., Ch. I, Part 35, § 35.101 et seq., and Part 36, § 36.101 et seq.), Title 36 of the Code of Federal Regulations Part 1191 (36 C.F.R., Ch. XI, Part 1191, § 1119.1 et seq.), Title 49 of the Code of Federal Regulations Part 37 (49 C.F.R., Ch. A, Part 37, § 37.1 et seq.), the United States Department of Justice Title II and Title III for the ADA, and California Government Code section 4450 et seq., which require public facilities be made accessible to persons with disabilities.

    Notwithstanding the requirements of the previous paragraph, all construction, design, and maintenance of public facilities must also comply with the Department's Design Information Bulletin 82, "Pedestrian Accessibility Guidelines for Highway Projects" and Standard Plans & Specifications on "Temporary Pedestrian Access Routes."
39. **STORMWATER:** The Permittee is responsible for full compliance with the following:
    a) For all projects, the Department's Storm Water Program and the Department's National Pollutant Discharge Elimination System (NPDES) Permit requirements under Order No. 2012-0011-DWQ, NPDES No CAS000003; and
    b) In addition, for projects disturbing one acre or more of soil, with the California Construction General Permit Order No. 2009-0009-DWQ, NPDES No CAS000002; and
    c) In addition, for projects disturbing one acre or more of soil in the Lahontan Region with Order No. R6T-2016-0010, NPDES No CAG616002.
    d) For all projects, it is the Permittee's responsibility to install, inspect, repair, and maintain all facilities and devices used for water pollution control practices (Best Management Practices/BMPs) before performing daily work activities.

UTILITY UNDERGROUND PROVISIONS (UG)

TR-0163 (Rev. 07/2023)

In addition to the attached Encroachment Permit General Provisions (TR-0045), the following special provisions are also applicable:

High priority utilities, pressurized facilities, pipes or ducts six (6) inches or larger in diameter, or placement of multiple pipes or ducts regardless of diameters are required to be encased on both conventional and access-controlled State highway right-of-way. An exception to this encasement policy may be allowed on a case-by-case basis with the "Uncased High-Pressure Natural Gas Pipeline" Special Provisions (TR-0158).

A "High Priority Utility" is defined as: 1) natural gas pipelines greater than six (6) inches in diameter, or with normal operating pressures greater than sixty (60) psig; 2) petroleum pipelines; 3) pressurized sanitary sewer pipelines; 4) high-voltage electric supply lines, conductors, or cables that have a potential to ground of greater than or equal to sixty (60) kV; or 5) hazardous materials pipelines that are potentially harmful to workers or the public if damaged.

The pavement or roadway must not be open cut unless specifically allowed. Utility installations are not allowed inside culverts or drainage structures.

All installations must comply with Chapter 17 of the Caltrans Project Development Procedures Manual for utility clearance and offset requirements.

For additional details regarding longitudinal utility encroachments on both conventional and access-controlled State highway right-of-way, see Section 602 of the Encroachment Permits Manual.

UG 1. ENCASEMENT: Casings must have an inside diameter sufficiently larger than the outside diameter of the pipe or duct to accommodate placement and removal.

When Horizontal Directional Drilling (HDD) is authorized, High-Density Polyethylene (HDPE) is acceptable as the casing.

When Reinforced Concrete pipe in accordance with Section 65-2 of Caltrans Standard Specifications is installed by Bore & Jack, it must have rubber gaskets at the joints and see "D" below for grouting of voids left by jacking operations.

A. Spiral welded casings may be allowed provided the casing is new and the weld is smooth.

B. The ends of the casing must be plugged with ungrouted bricks or other suitable material approved by the Department's representative.

C. Minimum wall thicknesses of steel encasements for different lengths and diameters of pipes are as follows:

Minimum Wall Thickness

Casing Diameter	Up to 150 feet in length	Over 150 feet in length
6 to 28 inches	1/4 inch	1/4 inch
30 to 38 inches	3/8 inch	1/2 inch
40 to 60 inches	1/2 inch	3/4 inch
62 to 72 inches	3/4 inch	3/4 inch

D. When required by the Department's representative, the permittee must pressure grout to fill any voids caused by the permitted work at the permittee's expense. The grout holes when placed the inside of the casing must be on eight (8) feet centers, longitudinally and offset twenty-two (22) degrees from the vertical axis of the casing and staggered to the left and right of the top longitudinal axis of the casing. Grout pressure must not exceed five (5) psig for a duration sufficient to fill all voids.

E. When the placement of multiple encasements is requested, the distance between multiple encasements must be the greater of twenty-four (24) inches or twice the diameter of the larger pipe being installed.

F. Casings within access-controlled highways must extend to the right-of-way lines.

G. Wing cutters, if used, must be a maximum of one (1) inch larger in diameter than the outside diameter of the casing. Voids caused by the use of wing cutters must be grouted in accordance with "D" above.

H. A band welded to the leading edge of the casing must be placed square to the alignment and not on the bottom edge. A flared lead section on bores over one hundred (100) feet is not allowed.

I. The length of the auger strand must be equal to that of the section of encasement pipe.

J. The casings within conventional highways must extend at least five (5) feet beyond the back of curb or edge of pavement, or to the right-of-way line if less. Where Portland Cement Concrete (PCC) cross-gutter exists, the casings must extend at least five (5)

feet beyond the back of the cross-gutter, or to the right-of-way line if less.

UG 2. OPEN-CUT METHOD: When the encroachment permit authorizes installation by the open-cut method, surfacing and base materials and thickness thereof must be as specified in the encroachment permit.

No more than one (1) lane of the highway pavement must be open cut at any time unless otherwise approved in writing by the Department's representative. After the pipe is placed in the open-cut section, the trench must be backfilled in accordance with Section 19-3 of Caltrans Standard Specifications. The backfilled section must be open to traffic safely with temporary repairs to the surfacing before the next section of pavement is cut.

If backfilling operations have not been properly completed at the end of a working day, steel plate bridging is required to make the entire highway facility open to traffic in accordance with the "Steel Plate Bridging Utility" Special Provisions (TR-0157).

Sides of open-cut trenches in paved areas must be kept as nearly vertical as possible. Trenches must not be two (2) feet wider than the sum of the outside diameter of the pipe to be laid therein plus the necessary width to accommodate shoring.

UG 3. TRENCHLESS CONSTRUCTION: The following provisions are applicable for installing conduit with the bore diameter less than thirty (30) inches using trenchless methods (e.g., Bore & Jack, HDD, Microtunneling, Pipe Bursting, Pipe Ramming, etc.). For installations with the bore diameter equal to or greater than thirty (30) inches, permittees must comply with Non-Standard Special Provision (NSSP) 19-15, Trenchless Construction. A copy of the NSSP 19-15 can be obtained from the Department's representative or District Encroachment Permits Office.

3.1. Definitions

Bore: Borehole excavated using trenchless construction for the installation of conduit.

Overcut: Radial annular gap between bore and outer pipe wall.

3.2. Construction: The superintendent must be at the site at all times when work is being conducted, if the borehole diameter is greater than ten (10) inches and the depth of installation is less than eight (8) times the diameter of the borehole.

Trenchless excavation and conduit installation must be performed to the line and grade shown. When excavation or installation is out of line or grade, make immediate alignment correction.

Existing structures, pavement, and utilities must be protected during installation. Restore and repair immediately any damage resulting from construction.

Repair or replace any damaged pipe sections.

Overcut must be less than:

A. One (1) inch or five (5) percent of the conduit outside radius, whichever is less, and
B. Two (2) inches for trenchless construction using HDD method

Notify the Department's representative immediately if you encounter obstruction or condition that impedes construction.

3.3. Quality Assurance

3.3-1. Pre-construction Meeting: Contact the Department's representative to schedule and have a pre-construction meeting at least seven (7) business days before the start of trenchless construction or as identified in the permit.

Attendees should include:

1. The Department's representative
2. Your project manager
3. Your project superintendent
4. The contractor for trenchless construction

Provide and present:

1. Trenchless construction shop drawings, work plans, and calculations
2. Mitigation plans for both during and after construction
3. Construction timeline and critical path activities

3.3-2. Contractor Qualifications: The contractor must employ a superintendent, who has successfully completed at least five (5) of such projects, if the borehole diameter is greater than ten (10) inches and the depth of installation is less than eight (8) times the diameter of the borehole. Before pre-construction meeting, the following must be submitted to Department's representative if requested:

1. Summary of the contractor's experience demonstrating that the contractor has successfully completed at least five (5) projects in the past five (5) years using similar trenchless construction in similar ground and groundwater conditions with similar drive lengths and diameter range.
2. Summary of the superintendent's experience demonstrating that the superintendent has successfully completed at least five (5) projects using similar construction methods for trenchless construction in similar ground and groundwater

conditions with similar drive lengths and diameter range.

3.3-3. Conduit Line, Grade, and Shape: When monitoring is required:

1. Survey and record control lines at least seven (7) business days before trenchless construction.
2. Observe and adjust measurements of survey control lines weekly. Report discrepancies to the Department's representative.

Survey and record the centerline of the constructed conduit after each section is advanced or every five (5) feet of advancement, whichever is shorter.

3.3-4. Ground Surface Movement Monitoring: Ground surface movement monitoring is required if the installation meets the following criteria or if required by the Department's representative:

1. Bore diameter is greater than ten (10) inches, and
2. Minimum vertical distance between the pavement or sidewalk surface and the top of bore is less than eight (8) times the diameter of the borehole.

Mark monitoring points on critical structures and utilities at locations shown. Include these points in monitoring surveys. Perform monitoring surveys before noon and at ambient temperature below eighty-five (85) degrees Fahrenheit. Perform ground surface survey under the Caltrans Surveys Manual and supplemental guidance.

Establish a minimum of four (4) control points for ground surface movement monitoring. Perform baseline ground surface survey at least fifteen (15) business days before trenchless construction. Notify the Department's representative at least ten (10) business days before the survey.

Develop baseline surface model. Use the baseline surface model to determine the movement of ground surface and embankment slope. See Encroachment Permit Survey Grid (TR-0151) in Appendix E of the Encroachment Permits Manual for survey grid spacing and other requirements.

Perform ground surface movement monitoring survey:

1. Weekly during construction or as required by the Department's representative
2. Biweekly for one (1) month after completion of each installation or as required by the Department's representative

Produce the surface model based on the monitoring survey data and calculate the movement of monitoring points using baseline surface model. Each monitoring survey may have different grid points.

Each ground surface horizontal and vertical measurement must be accurate to ±0.03 feet on pavement and ±0.1 feet on unpaved surfaces at the ninety-five (95) percent confidence level. Vertical movement produced by comparing current surface model with pre-construction surface model must be accurate to ±0.01 feet on pavement and ±0.1 feet on unpaved surfaces at the ninety-five (95) percent confidence level.

If ground surface movement in the pavement above the advancing pipe meets the requirements for two (2) consecutive weeks, the frequency of monitoring survey may be reduced to biweekly.

Notify the Department's representative at completion of each installation. Ground surface vertical movement requirements are:

Ground Surface Vertical Movement

Quality Characteristic	Requirement
Critical Structure Monitoring Points - Horizontal or Vertical (max, feet)	0.02
Highway surface (max, feet)	0.04
Embankment slope (max, feet)	0.2

If ground surface vertical movement requirements are not met:

1. Stop work immediately.
2. Notify the Department's representative.
3. Submit an alternative construction method.
4. Submit a mitigation plan that includes methods to fill the voids created under the ground surface and restore the density of subsurface materials.
5. Monitor ground surface movement in the area above the advancing pipe:
   5.1. Daily until no additional vertical movement is detected in the areas that exceed the movement requirements
   5.2. Every two (2) working days until the vertical movement meets the requirements for two (2) consecutive weeks

3.4. Submittals

3.4-1. Monitoring Plans: Submit monitoring plans for:

1. Conduit grade and alignment control, including monitoring instruments, layout of instrumentation points, construction details, and monitoring frequency
2. Logging of excavated materials, including anticipated volume of excavation and measured volume of removed spoil
3. Critical operations of applicable trenchless construction, including excavation, boring, spoil removal, lubrication, jacking, installation, and grouting
4. Ground surface movement, including digital surface survey method, survey data processing and analysis

method, and digital surface file for the bore diameter greater than ten (10) inches and the vertical distance between the pavement or sidewalk surface and the top of bore less than eight (8) times the diameter of the borehole

3.4-2. Daily Construction Record: Maintain Daily Construction Record and submit to the Department's representative upon request.

Daily Construction Record must include:

1. Date and time of operation
2. Names of key personnel
3. Length of constructed conduit, including coordinates and elevation of the beginning and ending (latitude, longitude and northing, easting, elevation) of the conduit advanced during each work shift. Record must reference the project coordinate system.
4. Rate of advance
5. Jacking force
6. Problems encountered, possible causes, and mitigation performed
7. Geological log of excavated face and materials, with the logging performed by a geologist who is registered as an engineering geologist in the State
8. Records and field note of:
   - 8.1. Any visible cracks
   - 8.2. Conduit line and grade control
   - 8.3. Anticipated and actual volumes of spoil removed and causes of the volume discrepancy
   - 8.4. Groundwater table elevation if dewatering is required

3.4-3. Ground Surface Movement Monitoring Records: Submit:

1. Before construction: survey data and surface model to demonstrate compliance with the Caltrans Surveys Manual and supplemental guidance
2. During and after construction: survey data, surface model, and vertical movement based on the comparison between current and pre-construction surface model

3.4-4. Contact Grouting Record: Maintain Contact Grouting Record and submit to the Department's representative upon request.

Contact Grouting Record must include:

1. Injection locations
2. Grout quantity]
3. Grout pressure
4. Measurements and observations, including heave, casing or carrier pipe movement, grout loss quantity, communication between grout ports, ground surface, and nearby utilities and storm drains
5. Problems encountered, possible causes, and mitigation performed

3.4-5. Post-Construction Record: Maintain Post-Construction Record and submit to the Department's representative upon request.

Post-Construction Record must include:

1. Completed conduit construction inspection records, including video recording and photographs
2. As-built plans showing details and alignment of the constructed conduit, horizontal and elevation survey based on project coordinate system, any problems encountered, and mitigation actions performed
3. As-built plans showing details of pavement restoration work performed

3.5. Restore Highway Pavement: After completion of trenchless construction of conduit, restore highway pavement to conditions as it was prior to beginning of construction activities or better. Restore Asphalt Concrete (AC) pavement with mill and fill. Repair or replace AC pavement with dowels for any cracks and spalling caused by construction.

UG 4. Bore and receiving pits must:

1. be located at least ten (10) feet from the edge of pavement on rural conventional highways.
2. be located at least five (5) feet beyond the concrete curb and gutter or AC dike on urban conventional highways.
3. be located at least five (5) feet beyond the toe of slope of embankments.
4. be located outside access-controlled highway right-of-way.
5. be protected by placement of six (6)-foot chain link fence or Type K railing around them.
6. be adequately shored in accordance with Cal/OSHA requirements. Shoring for jacking and receiving pits located within fifteen (15) feet of traffic lanes on a State highway must not extend more than thirty-six (36) inches above the pavement grade unless otherwise authorized by Department's representative. Reflectors must be affixed to the shoring on the sides facing traffic. A six (6)-foot chain link fence must be installed around the perimeter of the pits during non-working hours.
7. have crushed rock and sump areas to clear groundwater and water used to clean the casing. Where groundwater is found and pumping is required, the pits must be lined with filter fabric.

UG 5. LIMIT OF EXCAVATION: No excavation is allowed within ten (10) feet from the edge of pavement

except in curbed urban areas or as specified in the encroachment permit. Where no curb exists and excavations within ten (10) feet of the traveled way are to remain open, a temporary Type K railing must be placed at a 10:1 taper or as otherwise directed by the Department's representative.

UG 6. TUNNELING: In addition to the requirements of "**UG 1**" and Section 603.6 of the Encroachment Permits Manual, the following requirements are also applicable:

A. For this provision, a tunnel is defined as any installation that is thirty (30) inches or greater in diameter.
B. When tunneling is authorized, the permittee must provide full-time inspection of tunneling operations. The Department's representative must monitor projects.
C. Sand shields may be required as ground conditions change.
D. Pressure grouting for liner plate, rib and spiling, or rib and lagging tunnels must be at every eight (8) feet section or the end of work shift before the next section is excavated. All grouting must be completed by the end of each workday.
E. The headway must be secured at the end of each workday. Breast boards or plates must be installed during working hours for running sand or super-saturated soil.

UG 7. FACILITIES EXEMPT FROM UTILITY POLICIES: The following utilities are exempt from the requirements for location and depiction on the project plans unless the depiction of the utility is needed for interconnectivity with the proposed work (see Chapter 17 of the Project Development Procedures Manual):

- Natural gas service lines less than two (2) inches in pipe diameter that have normal operating pressures of sixty (60) psig or less
- Service connections (laterals) for water, sewer, electric, and telecommunication including fiber optic and cable service

All State-owned utilities must be plotted on the plans.

UG 8. DETECTOR STRIP: A continuous metallic detectable strip must be provided for non-metallic main utility installations. Service connections must be installed at right angles to the centerline of the State highway.

UG 9. BACKFILLING: All backfilling operations must be in accordance with Section 19-3 of Caltrans Standard Specifications.

Any required compaction tests must be performed by a certified laboratory at no cost to the Department and the laboratory report must be furnished to the Department's representative.

UG 10. ROADWAY SURFACING AND BASE MATERIALS: Temporary repairs to pavements must be made and maintained upon completion of backfill until permanent repairs are made. Permanent repairs to pavements must be made within thirty (30) calendar days of completion of backfill unless otherwise authorized by the Department's representative. Temporary pavement patches must be placed and maintained in a smooth riding plane free of humps and depressions.

UG 11. DAMAGE TO TREE ROOTS: Tree roots three (3) inches or larger in diameter must not be cut within the tree drip line when trenching or other underground work is necessary adjacent to roadside trees. If such roots are encountered, they must be tunneled under, wrapped in burlap, and kept moist until the trench is backfilled. Trenching machines must not be used under trees if the trunk or limbs can be damaged by their use. Manholes must not be installed within twenty (20) feet of any trunk.

If the trees involved are close together and of such sizes that it is impractical to protect all roots three (3) inches or larger in diameter, or when roots are less than four (4) inches in diameter, outside tree drip line, special arrangements may be made whereby pruning of the tree tops to balance the root loss can be done by the permittee only when approved by and under the close supervision of the District Landscape Specialist or District Tree Maintenance Supervisor.

UG 12. PIPES ALONG ROADWAY: Pipes and conduits paralleling the pavement must be located as shown on the plans or as close as possible to the right-of-way line.

UG 13. BORROW AND WASTE: Borrow and waste must not be allowed within the work limits unless otherwise specified in the encroachment permit.

UG 14. MARKERS: All markers must not create a safety hazard for the traveling public or highway workers.

UG 15. CATHODIC PROTECTION: The permittee must perform stray current interference tests on underground utilities under cathodic protection and notify the Department's representative prior to the tests. The permittee must perform any corrective measures as necessary and authorized by the Department's representative.

UG 16. PAVEMENT REMOVAL: ASPHALT CONCRETE (AC) pavement must be saw cut to the full depth to provide a neat and straight pavement break along sides of the trench. Portland Cement Concrete (PCC)

pavement must be saw cut at the slab joints and to the full slab depth.

Where the edge of the trench is within two (2) feet of the existing curb and gutter or pavement edge, the AC pavement between the trench and the curb or pavement edge must be removed.

UG 17. EXCAVATION UNDER FACILITIES: Where it is necessary to excavate under the existing curb and gutter or underground facilities, the void must be backfilled with two (2) sack cement-sand slurry.

UG 18. PERMANENT REPAIRS TO PCC PAVEMENT: Repairs must be of PCC containing at least six hundred fifty-eight (658) pounds or seven (7) sacks of cement per cubic yard. The new pavement must have the same thickness as the adjacent pavement. The PCC must be satisfactorily cured and protected from disturbance until it can be open to traffic with a compressive strength of at least 3,000 psig or for not less than forty-eight (48) hours. The new pavement may be open to traffic after six (6) hours of curing when no more than two (2) percent by weight of calcium chloride is added to the PCC mix as an accelerating chemical admixture.

UG 19. REMOVAL OF PCC SIDEWALKS OR CURBS: PCC sidewalks or curbs must be saw cut to the nearest score marks and reconstructed to match the existing sidewalk or curb.

UG 20. SPOILS: No earth or construction materials must be tracked onto the highway pavement and public or private approach. The permittee must remove these materials immediately if tracked from the highway pavement and public or private approach.

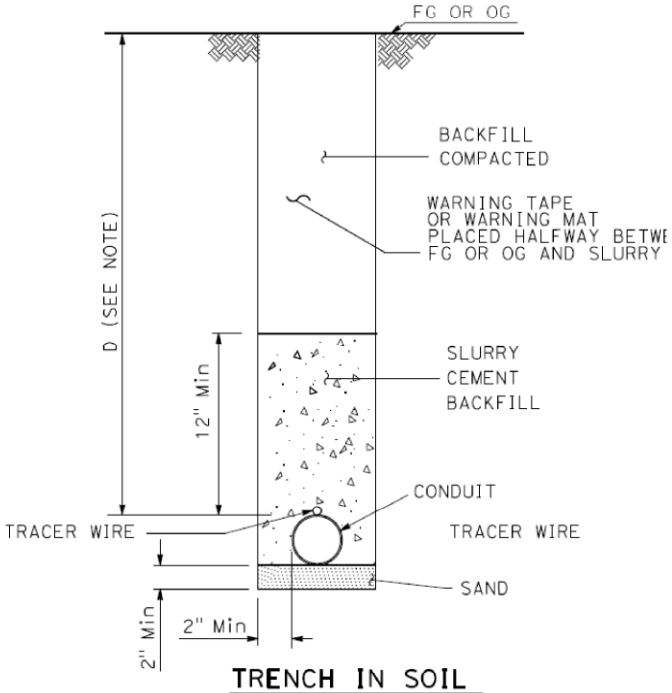
SURVEYS (SV)

In addition to the attached Encroachment Permit General Provisions (TR-0045), the following special provisions are also applicable:

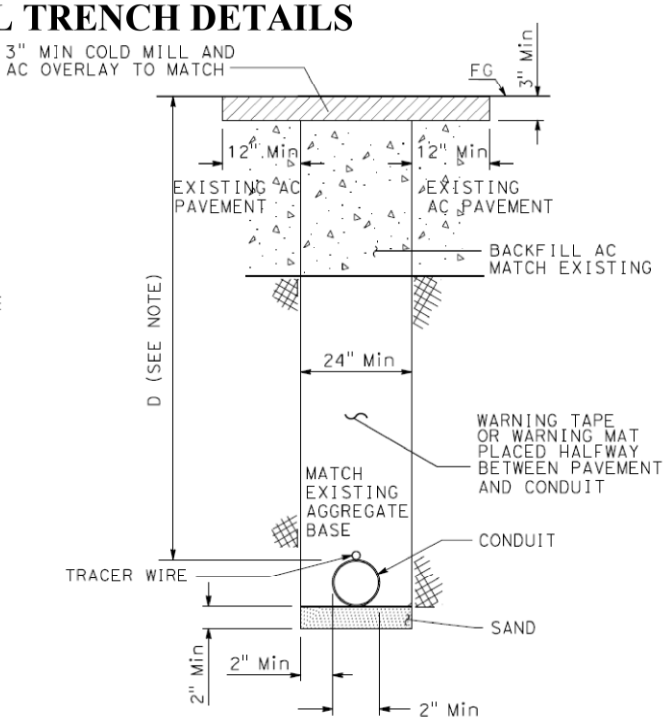
1. Two days before work is started under this permit, contact _____ concerning the permittee's operation.
2. All survey operations shall be conducted off the traveled way except where necessary to cross pavements and medians.
3. When survey operations are being conducted, the permittee shall furnish, place and maintain signs and safety equipment in accordance with the latest edition of the "California Manual on Uniform Traffic Control Devices" (Part 6, Temporary Traffic Control).
4. All personnel shall wear hard hats and orange vests, shirts or jackets as appropriate. Any painted markings shall be made with water soluble paint.
5. Permission is also granted to park survey vehicles temporarily within the right of way, outside the shoulders, while survey work is in progress.
6. SURVEY WORK IS PROHIBITED ON FREEWAYS.
7. Survey information and assistance may be obtained upon request to: Survey Section, Department of Transportation,_____.

ENCROACHMENT PERMIT TRENCH DETAIL

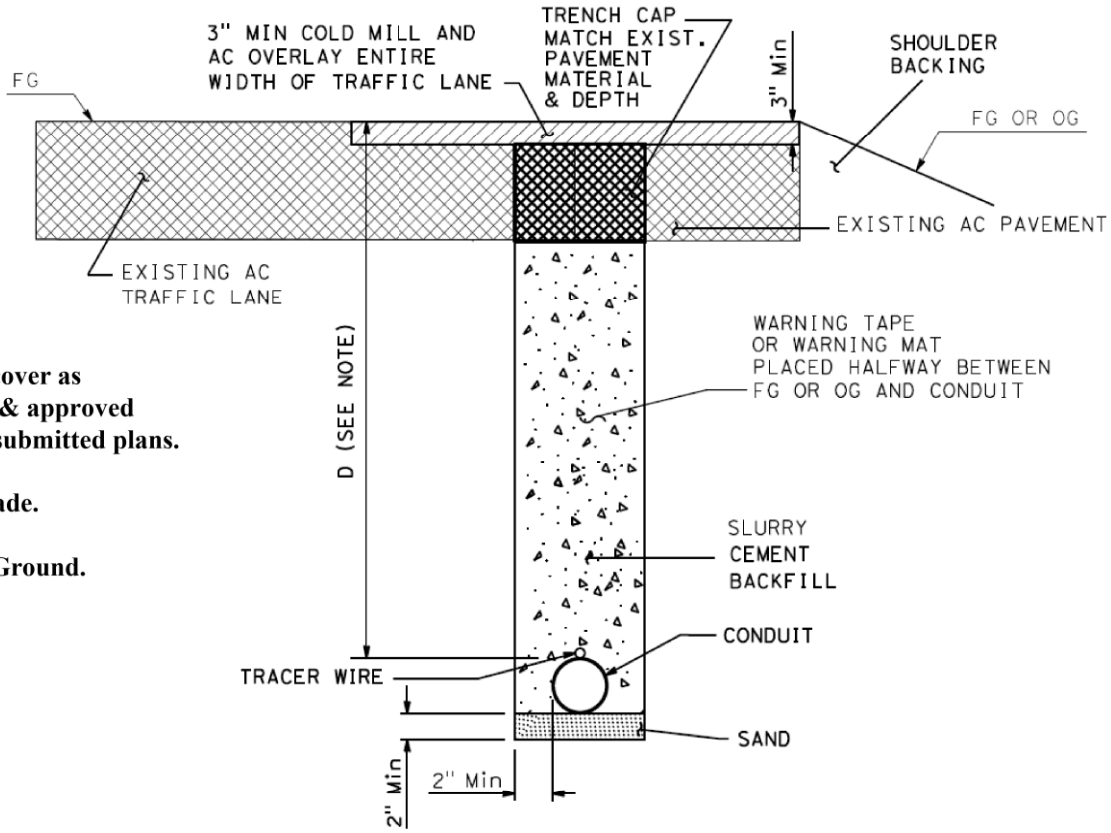
TYPICAL TRENCH DETAILS



TRENCH IN SOIL



TRENCH IN ASPHALT PAVEMENT



LONGGITUDINAL TRENCH IN ASPHALT PAVEMENT

Notes: D - Depth of cover as identified & approved based on submitted plans.

FG - Finish Grade.

OG - Original Ground.

- All work must be authorized by the encroachment permit, and/or as directed by the State's representative.

(Notes continue on page 2)

- Must include tracer wire or other continuous measure to provide positive subsurface detection for the life of the facility (Project Development Procedures Manual (PDPM) Chapter 17).
- Open trench installation of underground utility facilities must include warning tape or warning mats complying with the American Public Works Association (APWA) Uniform Color Code for identifying the type of underground utility. Where mechanical protection is installed, warning tape must be placed above the mechanical protection and below the roadbed subgrade as shown on the details. (PDPM Chapter 17).
- Clearance between the trench wall and conduit of less than 6 inches in width shall be a minimum of 2 inches. Clearance between the trench wall and conduit of greater than 6 inches in width shall be a minimum of 6 inches.
- When the trench width is less than 24 inches the backfill for subgrade must consist of slurry cement. Controlled Low-Strength Material (CLSM) can be substituted at the discretion of the State's representative.
- When trench width is greater than 24 inches compacted aggregate base may be used for backfilling.
- Structure backfill and compaction must conform to Section 19-3.02C and 3.03 of the Standard Specifications.
- For trench located under unimproved surface, structure backfill can use the original soil. Soil must be compacted by mechanical means. Ponding, jetting or flooding are not allowed. Slurry cement backfill is not optional unless approved by the Caltrans District.
- Slurry cement backfill must conform to Section 19-3.02E of the Standard Specifications.
- Aggregate base and its compaction shall conform to Section 26 of the Standard Specifications.
- CLSM if used must conform to Section 19-3.02G of the Standard Specifications. When CLSM is utilized the mix design and test results must be submitted to the State's representative. See Appendix H of the Encroachment Permits Manual for additional information.
- Cold planed surface and overlay shall be to the nearest lane line for the entire length of the trench/disturbed areas, and/or as directed by the State's representative.
- When Hot mix asphalt (HMA) is used to backfill Asphalt Concrete (AC) Section of the road, HMA must conform to Section 39 of the Standard Specifications.
- A paving notch ("T" Cut) shall be cold planed in exist asphalt concrete to a minimum width of 12 inches beyond each side of the trench and to a depth of 3 inches for the final layer of HMA.
- AC used to replace pavement section shall match existing pavement depth, unless directed otherwise by the State's representative.
- A tack coat of asphaltic emulsion conforming to Section 39-2.01C (3) (f) shall be applied.
- When the trench is within 4 feet of curb and gutter, additional cold planning may be required at the discretion of the State's representative. Potholes or trenches separated / adjoined by 10 feet or less to be overlaid together at the discretion of the State's representative.
- Pavement markings and/or striping removed or damaged during construction must be replaced in kind as directed by the State's representative.
- Other trench related details are shown in Chapter 6 of the Encroachment Permits Manual as well as the Trenching and Shoring Manual. Both publications can be found on the State of California, Department of Transportation's website.
- If trench is located in the roadway where Portland Cement Concrete (PCC) exist, remove the concrete to a depth of at least 3 feet below finished grade as per standard Specification 15-1.03B. Replace entire concrete slab from joint to joint as directed by State's representative.
- Electrical systems installations that are part of State Highway System must be installed in compliance with Caltrans Standard Specifications, Section 87.

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

ENCROACHMENT PERMIT STEEL PLATE BRIDGING UTILITY PROVISIONS

TR -0157 (Rev. 04/2018)

To accommodate excavation work, steel plate bridging may be necessary. All conditions for use of steel plate bridging should be set forth in the special provisions.

Consideration of steel plate bridging should take into account the following factors:

1. Traffic speed.
2. Traffic Volume and Composition.
3. Duration and dimensions (width & daily estimated lengths) of the proposed excavation.
4. Weather conditions.

When backfilling operations of an excavation in the traveled way, whether transverse or longitudinal, cannot be properly completed within a work day, steel plate bridging with a non-skid surface and shoring (see Trenching & Shoring) may be required to preserve unobstructed traffic flow. In such cases, the following conditions shall apply:

1. Steel plate bridging on freeways is not allowed.
2. Steel plates used for bridging must extend a minimum of 12" beyond the edges of the trench.
3. Steel plate bridging shall be installed to operate with minimum noise.
4. The trench shall be adequately shored, (as mentioned in Section 603.6B-2 of the Encroachment Permits Manual) to support the bridging and traffic loads.
5. Temporary paving with cold asphalt concrete shall be used to feather the edges of the plates, if plate installation by Method (2) described below, is used.
6. Bridging shall be secured against displacement by using adjustable cleats, shims, or other devices.

As required by the district, steel plate bridging and shoring shall be installed using either Method (1) or (2):

Method 1 For speeds of 45 MPH or greater:

The pavement shall be cold planed to a depth equal to the thickness of the plate and to a width and length equal to the dimensions of the plate.

Approach plate(s) and ending plate (if longitudinal placement) shall be attached to the roadway by a minimum of 2 dowels pre-drilled into the corners of the plate and drilled 2" into the pavement. Subsequent plates are to be butted and tack welded to each other.

Method 2 For Speeds less than 45 mph:

Approach plate(s) and ending plate (if longitudinal placement) shall be attached to the roadway by a minimum of 2 dowels pre-drilled into the corners of the plate and drilled 2" into the pavement. Subsequent plates are to be butted and tack welded to each other. Fine graded asphalt concrete shall be compacted to form ramps, maximum slope 8.5 % with a minimum 12" taper to cover all edges of the steel plates. When steel plates are removed, the dowel holes in the pavement shall be backfilled with either graded fines of asphalt concrete mix, concrete slurry, epoxy or an equivalent that is satisfactory to the Caltrans' representative.

The permittee is responsible for maintenance of the steel plates, shoring, asphalt concrete ramps, and ensuring that they meet minimum specifications. Unless specifically noted or granted in the special provisions, or approved by the State representative, steel plate bridging shall not exceed 4 consecutive working days in any given week. Backfilling of excavations shall be covered with a minimum 3" temporary layer of cold asphalt concrete.

The following table shows the advisory minimal thickness of steel plate bridging required for a given trench width (A-36 grade steel, designed for HS20-44 truck loading per Caltrans Bridge Design Specifications Manual).

Trench Width	Minimum Plate Thickness
10”	½”
1’-11”	¾”
2’-7”	7/8”
3’-5”	1”
5’-3”	1 ¾”

NOTE: For spans greater than 5'-3", a structural design shall be prepared by a California registered civil engineer.

All steel plates within the right of way whether used in or out of the traveled way shall be without deformation. Inspectors can determine the trueness of steel plates by using a straight edge and should reject any plate that is permanently deformed.

Steel plates used in the traveled portion of the highway shall have a surface that was manufactured with a nominal Coefficient Of Friction (COF) of 0.35 as determined by California Test Method 342 (See Appendix H, Encroachment Permits Manual). If a different test method is used, the permittee may utilize standard test plates with known coefficients of friction available from each Caltrans District Materials Engineer to correlate skid resistance results to California Test Method 342. Based on the test data, the permittee shall determine what amount of surface wear is acceptable, and independently ascertain when to remove, test, or resurface an individual plate.

Caltrans Inspectors should not enforce plate removal unless it is permanently deformed or delivered without the required surfacing. However, an inspector should document in a diary all contacts with the contractor.

A “Rough Road” (W8-8) sign and a “Steel Plate Ahead” (W8-24) sign with black lettering on an orange background must be used in advance of steel plate bridging along with the required construction area signs. These signs must be used along with any other construction area signs.

Surfacing requirements are not necessary for steel plates used in parking strips, on shoulders not used for turning movements, or on connecting driveways, etc., not open to the public.

STATE OF CALIFORNIA • DEPARTMENT OF TRANSPORTATION

HAZARDOUS MATERIALS AND HAZARDOUS WASTE MANAGEMENT SPECIAL PROVISIONS

TR-0408 (New 09/2017)

By acceptance of this encroachment permit, Permittee hereby agrees that:

1. All construction debris/materials/water/excess soil must become the property of the Permittee, and must be transported and disposed of, outside of Caltrans' right-of-way, in accordance with all applicable environmental laws and regulations. The Permittee must be identified as the generator for all construction debris/materials/water/excess soil and must be responsible for proper identification (including sampling and analysis) and management of all construction and contaminated debris/materials/water/excess soil that are removed, and/or excavated, from the work site. If hazardous waste is generated, the Permittee must obtain an Environmental Protection Agency (EPA) Identification Number issued in their name. State Permit Inspector does not sign any manifests or shipping papers. The Permittee must be named as the generator on all Uniform Hazardous Waste Manifests and shipping papers. Caltrans must not be identified or written anywhere on the manifests or shipping papers. Prior to waste disposal, the Permittee should submit the waste generator form(s) to State Permit Inspector for verification. The Permittee must submit to the State Permit Inspector, a copy of all manifests and/or shipping papers generated for materials removed, transported and/or excavated from the state right-of-way.

2. If contaminated material is encountered, Permittee is to stop work and contact the State Permit Inspector immediately. The Permittee must submit a Sampling and Analysis Plan (SAP), and a Health and Safety Plan (HaSP) prepared by a Certified Industrial Hygienist (CIH) and in conformance with California Code of Regulations title 8, section 5192, "Hazardous Waste Operations and Emergency Response" for sampling activity through a separate permit application. Upon the permit review, additional environmental documents may be required prior to resumption of construction activity.

3. Permittee is responsible for any violation, penalty, enforcement action, corrective action, remedial action, and any other type of consequences resulting from cross contamination of groundwater (including perched groundwater), improper handling/managing of hazardous materials and/or placement of contaminated materials inside Caltrans right-of-way.

4. It is the Permittee's responsibility to comply with the Department of Toxic Substances Control (DTSC) ADL requirements for roadway soil management. Reuse of soils containing greater than 80 mg/kg total lead is not allowed without written approval of the DTSC and Caltrans. The Soil Management Agreement for Aerially Deposited Lead-Contaminated Soils between Caltrans and the DTSC does not constitute written approval for the Permittee to reuse soils containing greater than 80 mg/kg total lead.

5. The Permittee must implement the emergency notification requirements established in the California Office of Emergency Management Hazardous Materials, Spill / Release Notification Guidance (http://www.caloes.ca.gov/).

6. Any imported material used for backfill must be free of contamination, and a certificate of the material as "clean" with the source area of the material must be provided to Permit Inspector upon request. Importing soils containing greater than 80 mg/kg total lead for use in state right-of-way is not allowed.

7. Stockpiles of material containing aerially deposited lead shall not be placed where affected by surface run-on or run-off. Stockpiles shall be covered with plastic sheeting 13 mils minimum thickness or with one foot of nonhazardous material. Stockpiles shall not be placed in environmentally sensitive areas. Stockpiled material shall not enter storm drains, inlets, or waters of the State.

STORMWATER SPECIAL PROVISIONS FOR MINIMAL OR NO IMPACT (SWSP)

TR-0400 (Rev 05/2018)

1. **GENERAL:** The purpose of these Special Provisions is to provide the Permittee with specifications for water pollution control to minimize, prevent, or control the discharge of material into the air, surface waters, groundwater, and storm sewers owned by the State or local agencies. These provisions are not intended to take the place of the Caltrans Water Pollution Control Program (WPCP) for projects where soil disturbance from work activities less than one acre, or work activities of one acre or more subject to the preparation of the Caltrans Storm Water Pollution Prevention Plan (SWPPP). The Permittee must comply with the following Special Provisions and the direction of the State Representative. All Stormwater Best Management Practices (BMPs) must conform to Section 13 Water Pollution Control of Caltrans' Standard Specifications.
2. **NPDES REQUIREMENTS:** The Permittee must be responsible for full compliance with the Caltrans Storm Water Program and the Caltrans National Pollutant Discharge Elimination System (NPDES) Permit requirements (*Order No. 2012-0011-DWQ, NPDES No CAS000003*) and for and projects disturbing one acre or more of soil, full compliance with the California Construction General Permit *(Order No. 2009-0009-DWQ, NPDES No CAS000002)* or for projects for projects that have one acre or more of soil disturbance in the Lahontan Region *(Order No. R6T-2016-0010, NPDES No CAG616002).* It is the Permittee's responsibility to install, inspect, and repair or maintain facilities and devices used for water pollution control practices (BMPs) before performing daily work activities. Installation, inspection and maintenance responsibilities on the job site include: 1) soil stabilization materials in work areas that are inactive or prior to storm events, 2) water pollution control devices to control sediment and erosion, 3) implementation of spill and leak prevention procedures for chemical and hazardous substances stored on the job site, 4) material storage, 5) stockpile management, 6) waste management, 7) non-stormwater management, 8) water conservation, 9) tracking controls and 10) illicit connection, illegal discharge detection and reporting. The Permittee must report to the State representative when discharges enter into receiving waters, adjacent property, drainage systems or when discharges could be a cause or a threat for water pollution. The Permittee must also control illicit discharges or illegal dumping prior to start of daily work schedule. Copies of written notices or orders from the Regional Water Quality Control Board or other regulatory agency must be provided to the State representative within 48 hours of reported activity. F or additional information on stormwater compliance, visit the State Water Resources Control Boards storm water Website at:

http://www.waterboards.ca.gov/water_issues/programs/stormwater

3. **RESPONSIBILITY FOR DEBRIS REMOVAL:** The Permittee must be responsible for preventing sediment, trash, debris, and other construction waste from entering the street, the storm drains, local creeks, or any other bodies of water.
4. **SPOILS AND RESIDUE:** The Permittee must vacuum any saw-cut concrete waste material, debris, residue, etc. No spoils, debris, residue, etc. must be washed into a drainage system.
5. **SWEEPING:** Sweep paved roads at construction entrance and exit locations and surrounding paved areas daily within the job site during: 1) clearing and grubbing, 2) earthwork, 3) trenching, 4) soil disturbance, 5) pavement grinding and/or cutting, and 6) after observing tracking of material onto or off the State property. Keep dust to a minimum during sweeping activities. Use vacuum whenever dust generation is excessive or sediment pickup is ineffective.
   Roadways or work areas must not be washed down with water. Street sweeping operations must conform to Section 13 Water Pollution Control of Caltrans' Standard Specifications.
6. **VEHICLES AND EQUIPMENT:** Permittee must prevent all vehicles, equipment, etc. from leakage or mud tracking onto roadways. If leaks cannot be repaired immediately, remove the vehicle or equipment from the job site.
7. **MAINTENANCE AND FUELING OF VEHICLES AND EQUIPMENT:** Maintenance and fueling of equipment must not result in any pollution at the job site. The Permittee must immediately clean up spills/leaks, and properly dispose of contaminated soil and materials.
8. **CLEANING VEHICLES AND EQUIPMENT:** Limit vehicle and equipment cleaning or washing at the job site except what is necessary to control vehicle tracking or hazardous waste. The Permittee must clean all equipment within a bermed area or over a drip pan large enough to prevent run-off. No soaps, solvents, degreasers, etc. must be used in State right-of-way. Any water from this operation must be collected and disposed of at an appropriate site. Containment berms or dikes must be used for fueling, washing, maintaining and washing vehicles or equipment in outside areas. Containment must be performed at least 100 feet from concentrated flows of

storm water, drainage courses, and storm drain inlets if within a flood plain, otherwise at least 50 feet if outside the floodplain. Keep adequate quantities of absorbent spill- cleanup material and spill kits in the fueling or maintenance area and on fueling trucks.

9. **DIESEL FUELS:** The use of diesel fuel from petroleum or other fossil fuel as a form-oil or solvent is not allowed.
10. **WEATHER CONDITIONS AT WORKSITE:** Any activity that would generate fine particles or dust that could be transported off site by stormwater must be performed during dry weather.
11. **WIND EROSION PROTECTION**: The use of Wind Erosion BMPs must be deployed year-round in instances where dust or fine particles could be transported off site.
12. **HOT MIX ASPHALT:** Runoff from washing hot mix asphalt must not enter into any drainage conveyances.
13. **PROTECTION OF DRAINAGE FACILITIES:** The Permittee must protect/cover gutters, ditches, drainage courses, and inlets with gravel bags, fiber rolls, State approved fabric filters, etc., to the satisfaction of the State representative during grading, paving, saw-cutting, etc. and materials must conform to Section 13-6.02 Materials for Water Pollution Control of Caltrans' Standard Specifications. No such protection measures must cause an obstruction to the traveling public. The Permittee must implement spill and leak prevention procedures for chemicals and hazardous substances stored on the job site (including secondary containment requirements) in accordance with section 13-4.03B Spill Prevention and Control, and 14-11 Hazardous Waste and Contamination, Water Pollution Control of Caltrans' Standard Specifications.
14. **PAINT:** Rinsing of painting equipment and materials is not permitted in State right-of-way. When thoroughly dry, dispose of the following as solid waste: dry latex paint, paint cans, used brushes, rags, gloves, absorbent materials, and drop cloths. Oil based paint sludge and unusable thinner must be disposed of at an approved hazardous waste site.
15. **CONSTRUCTION MATERIALS:** Stockpile of all construction materials, including, but not limited to; pressure treated wood, asphalt concrete, cold mix asphalt concrete, concrete, grout, cement containing premixes, and mortar, must conform to section 13-4.03C (2) Material Storage & 13-4.03C (3) Stockpile Management of Caltrans' Standard Specifications.
16. **CONCRETE EQUIPMENT:** Concrete equipment must be washed in a designated washing area in a way that does not contaminate soil, receiving waters, or storm drain systems.
17. **EXISTING VEGETATION:** Established existing vegetation is the best form of erosion control. Minimize disturbance to existing vegetation. Damaged or removed vegetation must be replaced as directed by the State Representative.
18. **SOIL DISTURBANCE:** Soil disturbing activities must be avoided during the wet weather season. I f construction activities during wet weather are allowed in your permit, all necessary erosion control and soil stabilization measures must be implemented in advance of soil disturbing activity.
19. **SLOPE STABILIZATION AND SEDIMENT CONTROL:** Consider a certified expert in Erosion and Sediment control in cases where slopes are disturbed during construction. The Permittee is directed to comply with Section 13.5 Temporary Soil Stabilization and Section 21 Erosion Control of Caltrans' Standard Specifications during application of temporary soil stabilization measures to the soil surface. Fiber rolls or silt fences may be required down slope until permanent soil stabilization is established. Remove the accumulated sediment whenever the sediment accumulates to 1/3 of the linear sediment barrier height. The Permittee must limit the use of plastic materials when more sustainable, environmentally friendly alternatives exist or when environmental regulations prohibit their use within the project.
20. **STOCKPILES:** Stockpiles containing aggregate and/or soil must be stored at least 100 feet from concentrated flows of storm water, drainage courses, and storm drain inlets if within a flood plain, otherwise at least 50 feet if outside the floodplain, and must be covered and protected with a temporary perimeter sediment barrier. Cold mix stockpiles must be stored on an impermeable surface and covered with 9 mil plastic to prevent contact with water. Minimize stockpiling of materials on the job site. Manage stockpiles by implementing the water pollution control practices in Section 13-4.03C (3) Stockpile Management of the State of California standard specifications for construction.
21. **DISCOVERY OF CONTAMINATION:** The State Representative must be notified in case any unusual discoloration, odor, or texture of ground water, is found in excavated material or if abandoned, underground tanks, pipes, or buried debris are encountered.
22. **SANITARY AND SEPTIC WASTE:** Do not bury or discharge wastewater from a sanitary or septic system within the highway. Properly connected sewer facilities are free from leaks. With State Representative approval place portable sanitary facility at least 50 feet away from storm drains, receiving waters, and flow lines. Permittee must comply with local health agency provisions when using an on-site disposal system.
23. **LIQUID WASTE:** Prevent job site liquid waste from entering storm drain systems and receiving waters. Drilling slurries, grease or oil-free waste water or rinse water, dredging, wash water or rinse water running off a surface or other non-storm water liquids not covered

under separate waste water permits must be held in structurally sound, leak-proof containers, such as portable bins or portable tanks. Store containers at least 50 feet away from moving vehicles and equipment. Liquid waste may require testing to determine hazardous material content prior to disposal. All measures must conform to section 13-4.03D (5) Liquid Waste, Water Pollution Control of Caltrans' Standard Specifications.

24. **WATER CONTROL AND CONSERVATION:** Manage water use in a w ay that will prevent erosion and the discharge of pollutants into storm drain systems and receiving waters. Direct runoff, including water from water line repair from the job site to areas where it can infiltrate into the ground. Direct water from off-site sources around the job site or from contact with jobsite runoff.
25. **PILE DRIVING:** Keep spill kits and cleanup materials at pile driving locations. Park pile driving equipment over drip pans, absorbent pads, or plastic sheeting with absorbent material, and away from stormwater run-on when not in use.
26. **DEWATERING**: Dewatering consists of discharging accumulated storm water, groundwater, or surface water from excavations or temporary containment facilities. All dewatering operations must comply with the latest Caltrans guidelines including the Field Guide for Construction Site Dewatering. Contact State representative for approval of dewatering discharge by infiltration or evaporation, otherwise, any effluent discharged into a permitted storm water system requires approval from the Regional Water Quality Control Board. Prior to the start of dewatering, the Permittee must provide the State Representative with a dewatering and discharge work plan that complies with section 13-4.03G Dewatering, Water Pollution Control of Caltrans' Standard Specifications. A copy of the Waste Discharge Permit and a copy of a valid WDID number issued by the Regional Board must be provided to the State representative.

Appendix A2
Caltrans - Encroachment Permit Rider

STATE OF CALIFORNIA • DEPARTMENT OF TRANSPORTATION

ENCROACHMENT PERMIT RIDER

DOT TR-0122 (REV 05/2023)

Collected By	Permit No.
	04-23-N-US-1659
Rider Fee Paid	Dist/Co/Rte/PM
$ 0.00	04/SON/101/PM 34
Date	Rider Number
January 17, 2024	04-24-N-RD-0102

TO:

City of Healdsburg
C/O: Scott Greenwood
2020 Research Park Drive
Davis CA 95618
(530)756-5905

, PERMITTEE

In compliance with our request of January 17, 2024 (DATE) we are hereby amending the above numbered encroachment permit as follows

This rider grant permission to City of Healdsburg to trim 6 trees and remove 1 tree along Son 101 on State Highway 04-SON-101, Post Mile 34.0, in the City of Healdsburg: In addition to the parent permit attachments, attached is ""Tree Removal Special Provisions" (TR-0171), all work permitted herein must comply with the attachments and following provisions.

Please include the conditions following conditions:

- Trim trees in compliance with the seasonal restrictions specified in the Migratory Bird Treaty Act.
- Do not trim more than 15% of the live canopy. Follow ANSI and ISA pruning standards. No flat-topping or disfiguring cuts are allowed. Trees must be trimmed to balance and retain shape characteristic to their species.
- Clean/disinfect pruning tools in advance of all trimming work.
- Apply wood chip mulch to a depth of 4" beneath trimmed trees, extending 5' beyond the dripline of the tree and avoiding contact with the trunk. Do not place mulch in drainage ditches, in paved areas, or closer than 5' of the paved roadway edge.
- Remove trees in compliance with the seasonal restrictions specified in the Migratory Bird Treaty Act.
- Grind tree stumps (4" DBH and larger) to 8" below grade. Apply wood chips to a depth of 3" to disturbed soil areas.
- Remove the felled tree and all debris from the site by the end of each workday.

Except as amended, all other terms and provisions of the original permit shall remain in effect.

CC:
#1: MOHAMMAD R SHIRAZI
#2: ROLI ELSOTARI
#3: CHAD C KLEIN
#4:

APPROVED

Dina El-Tawansy, District Director

BY

Jae-Myung Lee
Jae-Myung Lee (Jan 17, 2024 14:13 PST)

JAE-MYUNG LEE, District Permit Engineer

ENCROACHMENT PERMIT GENERAL PROVISIONS

TR-0045 (REV. 12/2022)

1. **AUTHORITY:** The California Department of Transportation ("Department") has authority to issue encroachment permits under Division 1, Chapter 3, Article 1, Sections 660 through 734 of the Streets and Highways Code.
2. **REVOCATION:** Encroachment permits are revocable on five (5) business days' notice unless otherwise stated on the permit or otherwise provided by law, and except as provided by law for public corporations, franchise holders, and utilities. Notwithstanding the foregoing, in an emergency situation as determined by the Department, an encroachment permit may be revoked immediately. These General Provisions and any applicable Special Provisions are subject to modification or abrogation by the Department at any time. Permittees' joint use agreements, franchise rights, reserved rights or any other agreements for operating purposes in State of California ("State") highway right-of-way may be exceptions to this revocation.
3. **DENIAL FOR NONPAYMENT OF FEES:** Failure to pay encroachment permit fees when due may result in rejection of future applications, denial of encroachment permits, and revocation of the encroachment permit if already issued.
4. **PERMITTEE AUTHORIZATION FOR OTHERS TO PERFORM WORK:** This encroachment permit allows only the Permittee and/or Permittee's authorized contractor or agent to work within or encroach upon the State highway right-of-way, and the Permittee may not assign or transfer this encroachment permit. Any attempt to assign or transfer this encroachment permit shall be null and void. Permittee shall provide to the Department a list of Permittee's authorized contractors/agents, in the form and at the time specified by the Department but if no time is specified then no later than the pre-construction meeting. Permittee shall keep the list current and shall provide updates to the Department immediately upon any change to the list of authorized contractors/agents, including but not limited the addition, removal, or substitution of an authorized contractor/agent, or a new address or contact information for an existing authorized contractor/agent. Permittee is responsible for the acts and/or omissions of any person or entity acting on behalf of the Permittee, even if such person or entity is not included on Permittee's list of authorized contractors and/or agents.
5. **ACCEPTANCE OF PROVISIONS:** Permittee, and the Permittee's authorized contractors and/or agents, understand and agree to accept and comply with these General Provisions, the Special Provisions, any and all terms and/or conditions contained in or incorporated into the encroachment permit, and all attachments to the encroachment permit (collectively "the Permit Conditions"), for any encroachment, work, and/or activity to be performed under this encroachment permit and/or under color of authority of this encroachment permit. Permittee understands and agrees the Permit Conditions are applicable to and enforceable against Permittee as long as the encroachment remains in, under, or over any part of the State highway right-of-way. The Permittee's authorized contractors and/or agents, are also bound by the Permit Conditions. Non-compliance with the Permit Conditions by the Permittee's authorized contractor and/or agent will be deemed non-compliance by the Permittee.
6. **BEGINNING OF WORK:** When traffic is not impacted (see General Provision Number 35), the Permittee must notify the Department's representative two (2) business days before starting permitted work. Permittee must notify the Department's representative if the work is to be interrupted for a period of five (5) business days or more, unless otherwise agreed upon. All work must be performed on weekdays during regular work hours, excluding holidays, unless otherwise specified in this encroachment permit.
7. **STANDARDS OF CONSTRUCTION:** All work performed within State highway right-of-way must conform to all applicable Departmental construction standards including but not limited to: Standard Specifications, Standard Plans, Project Development Procedures Manual, Highway Design Manual and Special Provisions.

   Other than as expressly provided by these General Provisions, the Special Provisions, the Standard Specifications, Standard Plans, and other applicable Departmental standards, nothing in these General Provisions is intended to give any third party any legal or equitable right, remedy, or claim with respect to the encroachment permit and/or to these General Provisions or any provision herein. These General Provisions are for the sole and exclusive benefit of the Permittee and the Department.

   Where reference is made in such standards to "Contractor" and "Engineer," these are amended to be read as "Permittee" and "Department's representative," respectively, for purposes of this encroachment permit.
8. **PLAN CHANGES:** Deviations from plans, specifications, and/or the Permit Conditions as defined in General Provision Number 5 are not allowed without prior approval from the Department's representative and the Federal Highway Administration ("FHWA") representative if applicable.
9. **RIGHT OF ENTRY, INSPECTION AND APPROVAL:** All work is subject to monitoring and inspection. The United States, the State, the Department, and the Directors, officers, employees, agents, and/or contractors of the State and/or of the Department, and other state, and federal agencies, and the FHWA, through their agents or representatives, must have full access to highway

facilities/encroachment area, at any and all times for the purpose of inspection, maintenance, activities needed for construction/reconstruction, and operation of the State highway right-of-way.

Upon completion of work, Permittee must request a final inspection for acceptance and approval by the Department. The local public agency Permittee must not give final construction approval to its contractor until final acceptance and approval by the Department is obtained.

10. **PERMIT AT WORKSITE:** Permittee and Permittee's authorized contractors/agents must keep the permit package and current list of authorized contractors/agents, or copies thereof, at the work site at all times and must show such documents upon request to any Department representative or law enforcement officer. If the permit package or current list of authorized contractors/agents, or copies thereof, are not kept and made available at the work site at all times, then all work must be suspended.
11. **CONFLICTING ENCROACHMENTS:** Permittee must yield start of work to ongoing, prior authorized work adjacent to or within the limits of the Permittee's project site. When existing encroachments conflict with Permittee's work, the Permittee must bear all cost for rearrangements (e.g., relocation, alteration, removal, etc.).
12. **PERMITS, APPROVALS, AND CONCURRENCES FROM OTHER AGENCIES AND/OR ENTITIES:** This encroachment permit is invalidated if the Permittee has not obtained all permits, approvals, and concurrences necessary and required by law, including but not limited to those from the California Public Utilities Commission ("CPUC"), California Occupational Safety and Health Administration ("Cal-OSHA"), local and state and federal environmental agencies, the California Coastal Commission, and any other public agency and/or entity having jurisdiction. Permittee is responsible for providing notice of the encroachment to, and obtaining concurrence from, any person or entity (whether public or private) affected by the scope of work described in the encroachment permit, regardless of whether such notice or concurrence is required by law; the Department is not responsible to provide such notice or obtain such concurrence. Permittee warrants all such permits, approvals, and concurrences have been obtained before beginning work under this encroachment permit. The Department may, at the Department's discretion, require the Permittee to demonstrate that Permittee has obtained all such permits, approvals, and concurrences, and Permittee shall demonstrate this at the time and in the manner specified by the Department.
13. **PEDESTRIAN AND BICYCLIST SAFETY:** A safe continuous passageway must be maintained through the work area at existing pedestrian or bicycle facilities. At no time must pedestrians be diverted onto a portion of the street used for vehicular traffic. At locations where safe alternate passageways cannot be provided, appropriate signs and barricades must be installed at the limits of construction and in advance of the limits of construction at the nearest crosswalk or intersection to detour pedestrians to facilities across the street. Attention is directed to Section 7-1.04 "Public Safety," and to Section 12-4.04 "Temporary Pedestrian Access Routes," and to Section 16-2.02 "Temporary Pedestrian Facility," of the Department's Standard Specifications, and to California Vehicle Code section 21760, subdivision (c).
14. **PUBLIC TRAFFIC CONTROL:** The Permittee must provide traffic control protection, warning signs, lights, safety devices, etc., and take all other measures necessary for the traveling public's safety as required by law and/or the Department. While providing traffic control, the needs of all road users, including but not limited to motorists, bicyclists and pedestrians, including persons with disabilities in accordance with the Americans with Disabilities Act, must be an essential part of the work activity.

    Lane, Bike Lane, Sidewalk, Crosswalk, and/or shoulder closures must comply with the Department's Standard Specifications and Standard Plans for Temporary Traffic Control Systems & Temporary Pedestrian Access Routes, and with the applicable Special Provisions. Where issues are not addressed in the Standard Specifications, Standard Plans, and/or Special Provisions, the California Manual on Uniform Traffic Control Devices (Part 6, Temporary Traffic Control) must be followed.
15. **MINIMUM INTERFERENCE WITH TRAFFIC:** Permittee must plan and conduct work so as to create the least possible inconvenience to the traveling public (motorized vehicles, unmotorized vehicles such as bicycles, pedestrians, person(s) with disabilities, etc.), such that traffic is not unreasonably delayed.
16. **STORAGE OF EQUIPMENT AND MATERIALS:** The storage of equipment or materials is not allowed within State highway right-of-way, unless specified within the Special Provisions of this encroachment permit. If encroachment permit Special Provisions allow for the storage of equipment or materials within the State highway right-of-way, the equipment and material storage must also comply with Section 7-1.04, Public Safety, of the Department's Standard Specifications.
17. **CARE OF DRAINAGE:** Permittee must provide alternate drainage for any work interfering with an existing drainage facility in compliance with the Department's Standard Specifications, Standard Plans, and/or as directed by the Department's representative.
18. **RESTORATION AND REPAIRS IN STATE HIGHWAY RIGHT-OF-WAY:** Permittee is responsible for restoration and repair of State highway right-of-way resulting from permitted work (Streets and Highways Code, section 670 et seq.).
19. **STATE HIGHWAY RIGHT-OF-WAY CLEAN UP:** Upon completion of work, Permittee must remove and dispose of all scraps, refuse, brush, timber, materials, etc. off the State highway right-of-way. The aesthetics of the highway must be as it was before work started or better.
20. **COST OF WORK:** Unless stated otherwise in the encroachment permit or a separate written agreement with the Department, the Permittee must bear all costs

incurred for work within the State highway right-of-way and waives all claims for indemnification or contribution from the United States, the State, the Department, and from the Directors, officers, and employees of the State and/or the Department. Removal of Permittee's personal property and improvements shall be at no cost to the United States, the State, and the Department.

21. **ACTUAL COST BILLING:** When specified in the permit, the Department will bill the Permittee actual costs at the currently set Standard Hourly Rate for encroachment permits.
22. **AS-BUILT PLANS:** When required, Permittee must submit one (1) set of folded as-built plans within thirty (30) calendar days after completion and acceptance of work in compliance with requirements listed as follows:
    a) Upon completion of the work provided herein, the Permittee must submit a paper set of As-Built plans to the Department's representative.
    b) All changes in the work will be shown on the plans, as issued with the permit, including changes approved by Encroachment Permit Rider.
    c) The plans are to be prominently stamped or otherwise noted "AS-BUILT" by the Permittee's representative who was responsible for overseeing the work. Any original plan that was approved with a Department stamp, or by signature of the Department's representative, must be used for producing the As-Built plans.
    d) If construction plans include signing or striping, the dates of signing or striping removal, relocation, or installation must be shown on the As-Built plans when required as a condition of the encroachment permit. When the construction plans show signing and striping for staged construction on separate sheets, the sheet for each stage must show the removal, relocation, and installation dates of the appropriate staged striping and signing.
    e) As-Built plans must contain the Encroachment Permit Number, County, Route, and Post Mile on each sheet.
    f) The As-Built Plans must not include a disclaimer statement of any kind that differs from the obligations and protections provided by sections 6735 through 6735.6 of the California Business and Professions Code. Such statements constitute non-compliance with Encroachment Permit requirements and may result in the Department retaining Performance Bonds or deposits until proper plans are submitted. Failure to comply may also result in denial of future encroachment permits or a provision requiring a public agency to supply additional bonding.
23. **PERMITS FOR RECORD PURPOSES ONLY:** When work in the State highway right-of-way is within an area under a Joint Use Agreement (JUA) or a Consent to Common Use Agreement (CCUA), a fee exempt encroachment permit is issued to the Permittee for the purpose of providing a notice and record of work. The Permittee's prior rights must be preserved without the intention of creating new or different rights or obligations. "Notice and Record Purposes Only" must be stamped across the face of the encroachment permit.
24. **BONDING:** The Permittee must file bond(s), in advance, in the amount(s) set by the Department and using forms acceptable to the Department. The bonds must name the Department as obligee. Failure to maintain bond(s) in full force and effect will result in the Department stopping all work under this encroachment permit and possibly revoking other encroachment permit(s). Bonds are not required of public corporations or privately-owned utilities unless Permittee failed to comply with the provisions and/or conditions of a prior encroachment permit. The surety company is responsible for any latent defects as provided in California Code of Civil Procedure section 337.15. A local public agency Permittee also must comply with the following requirements:
    a) In recognition that project construction work done on State property will not be directly funded and paid by State, for the purpose of protecting stop notice claimants and the interests of State relative to successful project completion, the local public agency Permittee agrees to require the construction contractor to furnish both a payment and performance bond in the local public agency's name with both bonds complying with the requirements set forth in Section 3-1.05 Contract Bonds of the Department's Standard Specifications before performing any project construction work.
    b) The local public agency Permittee must defend, indemnify, and hold harmless the United States, the State and the Department, and the Directors, officers, and employees of the State and/or Department, from all project construction related claims by contractors, subcontractors, and suppliers, and from all stop notice and/or mechanic's lien claimants. The local public agency also agrees to remedy, in a timely manner and to the Department's satisfaction, any latent defects occurring as a result of the project construction work.
25. **FUTURE MOVING OF INSTALLATIONS:** Permittee understands and agrees to relocate a permitted installation upon notice by the Department. Unless under prior property right or agreement, the Permittee must comply with said notice at the Permittee's sole expense.
26. **ENVIRONMENTAL:**
    a) ARCHAEOLOGICAL/HISTORICAL: If any archaeological or historical resources are identified or encountered in the work vicinity, the Permittee must immediately stop work, notify the Department's representative, retain a qualified archaeologist who must evaluate the site at Permittee's sole expense, and make recommendations to the Department's representative regarding the continuance of work.
    b) HAZARDOUS MATERIALS: If any hazardous waste or materials (such as underground storage tanks, asbestos pipes, contaminated soil, etc.) are identified or encountered in the work vicinity, the Permittee must immediately stop work, notify the Department's representative, retain a qualified hazardous

waste/material specialist who must evaluate the site at the Permittee's sole expense, and make recommendations to the Department's representative regarding the continuance of work.

Attention is directed to potential aerially deposited lead (ADL) presence in unpaved areas along highways. It is the Permittee's responsibility to take all appropriate measures to protect workers in conformance with California Code of Regulations Title 8, Section 1532.1, "Lead," and with Cal-OSHA Construction Safety Orders, and to ensure roadway soil management is in compliance with Department of Toxic Substances Control (DTSC) requirements.

c) BIOLOGICAL: If any regional, state, or federally listed biological resource is identified or encountered in the work vicinity, the Permittee must immediately stop work, notify the Department's representative, retain a qualified biologist who must evaluate the site at Permittee's sole expense, and make recommendations to the Department's representative regarding the continuance of work.

27. **PREVAILING WAGES:** Work performed by or under an encroachment permit may require Permittee's contractors and subcontractors to pay appropriate prevailing wages as set by the California Department of Industrial Relations. Inquiries or requests for interpretations relative to enforcement of prevailing wage requirements must be directed to the California Department of Industrial Relations.
28. **LIABILITY, DEFENSE, AND INDEMNITY:** The Permittee agrees to indemnify and save harmless the United States, the State, the Department, and the Directors, officers, employees, agents and/or contractors of the State and/or of the Department, including but not limited to the Director of Transportation and the Deputy Directors, from any and all claims, demands, damages, costs, liability, suits, or actions of every name, kind, and description, including but not limited to those brought for or on account of property damage, invasion of privacy, violation or deprivation of a right under a state or federal law, environmental damage or penalty, or injury to or death of any person including but not limited to members of the public, the Permittee, persons employed by the Permittee, and/or persons acting on behalf of the Permittee, arising out of or in connection with: (a) the issuance and/or use of this encroachment permit; and/or (b) the encroachment, work, and/or activity conducted pursuant to this encroachment permit, or under color of authority of this encroachment permit but not in full compliance with the Permit Conditions as defined in General Provision Number 5 ("Unauthorized Work or Activity"); and/or (c) the installation, placement, design, existence, operation, and/or maintenance of the encroachment, work, and/or activity; and/or (d) the failure by the Permittee, or by anyone acting for or on behalf of the Permittee, to perform the Permittee's obligations under any part of the Permit Conditions as defined in General Provision Number 5, in respect to maintenance or any other obligation; and/or (e) any change to the Department's property or adjacent property, including but not limited to the features or conditions of either of them, made by the Permittee or anyone acting on behalf of the Permittee; and/or (f) a defect or obstruction related to or caused by the encroachment, work, and/or activity whether conducted in compliance with the Permit Conditions as defined in General Provision Number 5 or constituting Unauthorized Work or Activity, or from any cause whatsoever. The duty of the Permittee to indemnify and save harmless includes the duties to defend as set forth in Section 2778 of the Civil Code.

It is the intent of the Department and the Permittee that except as prohibited by law, the Permittee will defend, indemnify, and hold harmless as set forth in this General Provision Number 28 regardless of the existence or degree of fault or negligence, whether active or passive, primary or secondary, on the part of: the United States, the State; the Department; the Directors, officers, employees, agents and/or contractors of the State and/or of the Department, including but not limited to the Director of Transportation and the Deputy Directors; the Permittee; persons employed by the Permittee; and/or persons acting on behalf of the Permittee.

The Permittee waives any and all rights to any type of expressed or implied indemnity from or against the United States, the State, the Department, and the Directors, officers, employees, agents, and/or contractors of the State and/or of the Department, including but not limited to the Director of Transportation and the Deputy Directors.

The Permittee understands and agrees to comply with the obligations of Titles II and III of the Americans with Disabilities Act in the conduct of the encroachment, work, and/or activity whether conducted pursuant to this encroachment permit or constituting Unauthorized Work or Activity, and further agrees to defend, indemnify, and save harmless the United States, the State, the Department, and the Directors, officers, employees, agents, and/or contractors of the State and/or of the Department, including but not limited to the Director of Transportation and the Deputy Directors, from any and all claims, demands, damages, costs, penalties, liability, suits, or actions of every name, kind, and description arising out of or by virtue of the Americans with Disabilities Act.

The Permittee understands and agrees the Directors, officers, employees, agents, and/or contractors of the State and/or of the Department, including but not limited to the Director of Transportation and the Deputy Directors, are not personally responsible for any liability arising from or by virtue of this encroachment permit.

For the purpose of this General Provision Number 28 and all paragraphs herein, "contractors of the State and/or of the Department" includes contractors, and their subcontractors, under contract to the State and/or the Department.

This General Provision Number 28 and all paragraphs herein take effect immediately upon issuance of this encroachment permit, and apply before, during, and after the encroachment, work, and/or activity

contemplated under this encroachment permit, whether such work is in compliance with the Permit Conditions as defined in General Provision Number 5 or constitutes Unauthorized Work or Activity, except as otherwise provided by California law. The Permittee's obligations to defend, indemnify, and save harmless under this General Provision Number 28 take effect immediately upon issuance of this encroachment permit and have no expiration date, including but not limited to situations in which this encroachment permit expires or is revoked, the work or activity performed under this encroachment permit is accepted or not accepted by the Department, the encroachment, work, and/or activity is conducted in compliance with the Permit Conditions as defined in General Provision Number 5 or constitutes Unauthorized Work or Activity, and/or no work or activity is undertaken by the Permittee or by others on the Permittee's behalf.

If the United States or an agency, department, or board of the United States is the Permittee, the first two paragraphs of this General Provision Number 28 (beginning "The Permittee agrees to indemnify…" and "It is the intent of the parties…") are replaced by the following paragraph:

Claims for personal injury, death, or property damage allegedly caused by the negligent or wrongful act or omission of any employee of the United States acting within the scope of their official duties are subject to the Federal Tort Claims Act, as amended, 28 U.S.C. § 1346 and § 2671 et seq. (Chapter 171).

29. **NO PRECEDENT ESTABLISHED:** This encroachment permit is issued with the understanding that it does not establish a precedent.
30. **FEDERAL CIVIL RIGHTS REQUIREMENTS FOR PUBLIC ACCOMMODATION:**
    a) As part of the consideration for being issued this encroachment permit, the Permittee, on behalf of Permittee and on behalf of Permittee's personal representatives, successors in interest, and assigns, does hereby covenant and agree that:
        i) No person on the grounds of race, color, or national origin may be excluded from participation in, be denied the benefits of, or be otherwise subjected to discrimination in the use of said facilities.
        ii) That in connection with the construction of any improvements on said lands and the furnishings of services thereon, no discrimination must be practiced in the selection and retention of first-tier subcontractors in the selection of second-tier subcontractors.
        iii) That such discrimination must not be practiced against the public in their access to and use of the facilities and services provided for public accommodations (such as eating, sleeping, rest, recreation), and operation on, over, or under the space of the State highway right-of-way.
        iv) That the Permittee must use the premises in compliance with all other requirements imposed pursuant to Title 15, Code of Federal Regulations, Commerce and Foreign Trade, Subtitle A. Office of the Secretary of Commerce, Part 8 (15 C.F.R. Part 8) and as said Regulations may be amended.
    b) That in the event of breach of any of the above nondiscrimination covenants, the State and the Department have the right to terminate this encroachment permit and to re-enter and repossess said land and the facilities thereon and hold the same as if said permit had never been made or issued.
31. **MAINTENANCE:** The Permittee is responsible at Permittee's sole expense for the encroachment, and the inspection, maintenance, repair, and condition thereof, and is responsible to ensure the encroachment does not negatively impact State highway safety, maintenance, operations, construction, State facilities, activities related to construction/reconstruction, or other encroachments. The Permittee's obligations in the preceding sentence take effect immediately upon issuance of this encroachment permit and continue until the encroachment is entirely and permanently removed. Additional encroachment permits or approval documents may be required authorizing work related to inspection, repair, and/or maintenance activities. Contact the Department for information.
32. **SPECIAL EVENTS:** In accordance with subdivision (a) of Streets and Highways Code section 682.5 and 682.7, the Department is not responsible for the conduct or operation of the permitted activity, and the applicant agrees to defend, indemnify, and hold harmless the United States, the State, the Department, and the Directors, officers, employees, agents, and contractors of the State and/or of the Department, including but not limited to the Director of Transportation and the Deputy Directors, from any and all claims, demands, damages, costs, liability, suits, or actions of every name, kind and description arising out of any activity for which this encroachment permit is issued.

    The Permittee is required, as a condition of this encroachment permit, for any event that awards prize compensation to competitors in gendered categories, for any participant level that receives prize compensation, to ensure the prize compensation for each gendered category is identical at each participant level. (Streets and Highways Code, section 682.7.)

    The Permittee understands and agrees to comply with the obligations of Titles II and III of the Americans with Disabilities Act in the conduct of the event, and further agrees to defend, indemnify, and save harmless the United State, the State and the Department, and the Directors, officers, and employees of the State and/or Department, including but not limited to the Director of the Department and the Deputy Directors, from any and all claims, demands, damages, costs, liability, suits, or actions of every name, kind and description arising out of or by virtue of the Americans with Disabilities Act.
33. **PRIVATE USE OF STATE HIGHWAY RIGHT-OF-WAY:** State highway right-of-way must not be used for private purposes without compensation to the State. The gifting

of public property uses and therefore public funds is prohibited under the California Constitution, Article XVI, Section 6.

34. **FIELD WORK REIMBURSEMENT:** Permittee must reimburse the Department for field work performed by or on behalf of the Department to correct or remedy issues created by the Permittee or by others acting on behalf of the Permittee, including but not limited to hazards or damaged facilities, or to clear refuse, debris, etc. not attended to by the Permittee or by others acting on behalf of the Permittee.
35. **LANE CLOSURE REQUEST SUBMITTALS AND NOTIFICATION OF CLOSURES TO THE DEPARTMENT:** Lane closure request submittals and notifications must be in accordance with Section 12-4.02, and Section 12.4-04, of the Department's Standard Specifications or as directed by the Department's representative. The Permittee must notify the Department's representative and the Traffic Management Center ("TMC") before initiating a lane closure or conducting an activity that may cause a traffic impact. In emergency situations when the corrective work or the emergency itself may affect traffic, the Department's representative and the TMC must be notified as soon as possible.
36. **SUSPENSION OF TRAFFIC CONTROL OPERATION:** The Permittee, upon notification by the Department's representative, must immediately suspend all traffic lane, bike lane, sidewalk, crosswalk, and/or shoulder closure operations and any operation that impedes the flow of traffic. All costs associated with this suspension must be borne by the Permittee.
37. **UNDERGROUND SERVICE ALERT (USA) NOTIFICATION:** Any excavation requires compliance with the provisions of Government Code section 4216 et seq., including but not limited to notice to a regional notification center, such as Underground Service Alert (USA). The Permittee must provide notification to the Department representative at least five (5) business days before, and the regional notification center at least forty-eight (48) hours before, performing any excavation work within the State highway right-of-way.
38. **COMPLIANCE WITH THE AMERICANS WITH DISABILITIES ACT (ADA):** All work within the State highway right-of-way to construct and/or maintain any public facility must be designed, maintained, and constructed strictly in accordance with all applicable Federal Access laws and regulations (including but not limited to Section 504 of the Rehabilitation Act of 1973, codified at 29 U.S.C. § 794), California Access laws and regulations relating to ADA, along with its implementing regulations, Title 28 of the Code of Federal Regulations Parts 35 and 36 (28 C.F.R., Ch. I, Part 35, § 35.101 et seq., and Part 36, § 36.101 et seq.), Title 36 of the Code of Federal Regulations Part 1191 (36 C.F.R., Ch. XI, Part 1191, § 1119.1 et seq.), Title 49 of the Code of Federal Regulations Part 37 (49 C.F.R., Ch. A, Part 37, § 37.1 et seq.), the United States Department of Justice Title II and Title III for the ADA, and California Government Code section 4450 et seq., which require public facilities be made accessible to persons with disabilities.

    Notwithstanding the requirements of the previous paragraph, all construction, design, and maintenance of public facilities must also comply with the Department's Design Information Bulletin 82, "Pedestrian Accessibility Guidelines for Highway Projects" and Standard Plans & Specifications on "Temporary Pedestrian Access Routes."
39. **STORMWATER:** The Permittee is responsible for full compliance with the following:
    a) For all projects, the Department's Storm Water Program and the Department's National Pollutant Discharge Elimination System (NPDES) Permit requirements under Order No. 2012-0011-DWQ, NPDES No CAS000003; and
    b) In addition, for projects disturbing one acre or more of soil, with the California Construction General Permit Order No. 2009-0009-DWQ, NPDES No CAS000002; and
    c) In addition, for projects disturbing one acre or more of soil in the Lahontan Region with Order No. R6T-2016-0010, NPDES No CAG616002.
    d) For all projects, it is the Permittee's responsibility to install, inspect, repair, and maintain all facilities and devices used for water pollution control practices (Best Management Practices/BMPs) before performing daily work activities.

TREE REMOVAL

TR – 0171 (Rev 7/2022)

In addition to the attached Encroachment Permit General Provisions (TR-0045), the following special provisions are also applicable:

I. GENERAL (Applies to BOTH Non-Utility and Utility Projects):

1. Scheduled removal work may be restricted by Caltrans to maintain mobility during special events, commuter traffic, or other periods of projected high traffic volumes.
   i. Traffic control must conform to requirements shown in the State Standard Plans. When required, the use of a flashing arrow board is MANDATORY.
   ii. Suspend removal work during inclement weather, such as heavy fog, if lane or shoulder closures will be required. Do not perform removal work during periods of high wind to minimize the spread of debris into the traveled way.
2. Remove trees in compliance with the seasonal restrictions specified in the Migratory Bird Act.
3. Contractors must be licensed by the California State Contractors State License Board and hold a current C61/D49 license.
4. When a permit is issued for removal, pruning, or addressing structural deficiencies of a tree as an independent operation or as a part of other work, the entire stump must be taken out to a depth of at least 12-inches below the ground surface. All debris must be removed from the right of way. The hole left by the stump must be backfilled and thoroughly tamped and the site left in a safe presentable condition.
5. Remove debris, cuttings, and limbs from the State right-of-way at the end of each workday, leaving the work area in a safe and presentable condition. In regions where debris, cuttings, limbs and bark may harbor pests or disease (such as pine pitch canker, eucalyptus psyllid, eucalyptus borer beetles, Dutch elm disease, or sudden oak death) dispose the vegetative materials in accordance with Federal, State, and local agency requirements.
6. Permittee or their contractors may collect woodchips produced by removing trees located both inside and outside Caltrans right-of-way, and dispose of these woodchips by placing them in locations within Caltrans right-of-way, when approved in advance by Caltrans Maintenance. Woodchips must not create a fire hazard, encourage illegal dumping, block traveler sightlines, or obstruct drainage ditches or drain inlets.
7. Pruning (Trimming) and/or Removal of vegetation to improve visibility to or from a residential development or commercial building is not allowed.
8. This permit does not restrict a utility company from complying with California Public Resources, California Public Utility Commission (CPUC) General Orders, and other Federal, State or local laws that require clearances between vegetation and gas lines or energized power lines.
9. Permittee and the authorized agents must keep a copy of the signed Tree Removal Request at the work site during tree removal operations.

APPENDIX B

OSHA Division of Mines, Underground Classification

DEPARTMENT OF INDUSTRIAL RELATIONS
DIVISION OF OCCUPATIONAL SAFETY AND HEALTH
MINING AND TUNNELING UNIT
1750 Howe Avenue, Suite 450
Sacramento, California 95825
DoshMTsac@dir.ca.gov

Telephone (916) 574-2540
FAX (916) 574-2542

November 17, 2023

City of Healdsburg
401 Grove Street
Healdsburg, CA 95448

Attention: Patrick Fuss

Subject: Project: 24024 – Municipal Recycled Water Pipeline, Sonoma County
Classification: Potentially Gassy with Special Conditions
Number Attached: 1 (A)

The information provided to this office relative to the above project has been reviewed. Based on this analysis, an Underground Classification of "Potentially Gassy with Special Conditions" has been assigned to the tunnel identified on your submittal. Please retain the original Classification for your records and deliver a true and correct copy of the Classification to the tunnel contractor for posting at the job site.

When the contractor who will be performing the work is selected, please advise them to notify this office to schedule the mandated Pre-Job Conference with the Division prior to commencing any activity associated with boring of the tunnel. A Pre-Job Request Form is enclosed.

Should you have another bore under construction that is not required to have an Underground Classification (i.e.: less than 30 inches in diameter), please contact the Mining and Tunneling Unit prior to any employee's entry into such a space.

If you have any questions on this subject, please contact this office at your earliest convenience.

Sincerely,

Jeffrey Wallace
Senior Safety Engineer

enc: Classification
Pre-Job Request Form

cc: pfuss@healdsburg.gov

Scott Greenwood
sgreenwood@westyost.com

State of California

Department of Industrial Relations

DIVISION OF OCCUPATIONAL SAFETY AND HEALTH
MINING AND TUNNELING UNIT

Underground Classification

24024A097CT **CITY OF HEALDSBURG**

of **401 GROVE STREET, HEALDSBURG, CA 95448**

at **MUNICIPAL RECYCLED WATER PIPELINE**

has been classified as ***** POTENTIALLY GASSY WITH SPECIAL CONDITIONS *****

as required by the California Labor Code § 7955.

The Division shall be notified if sufficient quantities of flammable gas or vapors have been encountered underground. Classifications are based on the California Labor Code Part 9, Tunnel Safety Orders and Mine Safety Orders.

*****SPECIAL CONDITIONS*****

1. **Mechanical ventilation shall be so arranged to exhaust return air at any time an employee is working in the underground environment. The primary ventilation fans must be located outside of the underground environment and shall be reversible by a single switch near the fan location.**
2. **The Division shall be notified immediately if a flammable gas or petroleum vapor exceeds 5 percent of the Lower Explosive Limit (LEL).**

12-INCH-DIAMETER NATURAL GAS, 2-INCH-DIAMETER FIBER OPTIC (2), TELECOM (TO BE RELOCATED) AND 48-INCH-DIAMETER RECYCLED WATER

One 36-inch-diameter by approximately 162-feet-long steel casing located beneath US-101 approximately 100 feet south of the northbound US-101 Exit 503 "Central Healdsburg" off-ramp (PM 34.3), Healdsburg, Sonoma County

This classification shall be conspicuously posted at the place of employment.

Jeffrey Wallace, Senior Safety Engineer

November 17, 2023

State of California
Department of Industrial Relations
Division of Occupational Safety & Health

REQUEST FOR PRE-JOB (TUNNEL)

ATTACH COPY OF CLASSIFICATION AND DIESEL PERMIT

Company Name:_____

Phone_____FAX:_____

DATE FAXED: _____

PLEASE NOTE: THE BORING CONTRACTOR SHOULD SCHEDULE THE PREJOB AS FAR IN ADVANCE AS POSSIBLE – AT LEAST 3-4 DAYS IN ADVANCE. THE DIVISION REQUIRES THE JOB TO BE SET UP WHEN THE FIELD ENGINEER ARRIVES FOR THE PREJOB. THIS MEANS THAT THE BORE PIT HAS BEEN DUG AND PROPERLY GUARDED, THE CRANE IS IN PLACE AND READY TO LIFT, THE BORING MACHINE IS IN THE PIT AND READY TO GO, AND THE CREW IS READY TO BEGIN BORING THE TUNNEL. IF THERE IS A DELAY IN SETTING UP THE JOB, THE BORING CONTRACTOR SHOULD CONTACT THE DIVISION IMMEDIATELY.

PRE-JOB REQUEST DATE & TIME: _____

ON-SITE SUPERVISOR & CELL NO.: _____

CLASSIFICATION #: _____ **DIESEL PERMIT #:** _____

BORE DIAMETER AND LENGTH: _____ _____
(Diameter) (Length)

IS BORE ENTRY ANTICIPATED? YES NO
(Circle One)

You MUST contact the Division if entry is planned, REGARDLESS of the bore diameter.

MANNER OF EXCAVATION: _____

_____

JOB-SITE LOCATION AND DIRECTIONS: _____

_____

_____

GENERAL CONTRACTOR: _____

SUBMITTED BY: _____

REVIEWED BY: _____ **DATE:** _____

☐ *Mining & Tunneling Unit, District 1*
1750 Howe Ave., Suite 450
Sacramento, California 95825-2400
(916) 574-2540; ***FAX: (916) 574-2542***

☐ *Mining & Tunneling Unit, District 2*
6150 Van Nuys Blvd., Suite 310
Van Nuys, California 91401-3333
(818) 901-5420; ***FAX: (818) 901-5579***

☐ *Mining & Tunneling Unit, District 3*
464 West Fourth Street, Suite 354
San Bernardino, California 92401-1442
(909) 383-6782; ***FAX: (909) 388-7132***

APPENDIX C

Sonoma-Marin Area Rail Transit (SMART)
Application for Entry Permit

APPLICATION FOR ENTRY PERMIT

SMART Internal Use Only
MP _____
_____

1. **To be completed for Public Agency/Organization/Corporation**

Permittee: _____ Daytime Phone: _____ Fax Number:_____
Address: _____
Email Address: _____

2. **This application is submitted for permission to perform the following in the SMART Right of Way:**

Check all that apply:
- Excavate/Survey ☐
- Construct Temporary Improvement ☐
- Construct Permanent Improvement ☐
- Other:_____ ☐

Project Duration:
Start Date:_____
End Date: _____

Project Manager:
Name:
Email.:_____
Cell: _____

Submitted Documents*:
- Drawings (2 sets) ☐
- Plans & Specs. (2 Sets) ☐
- Proof of Insurance ☐

***Note:** Applicants must provide 11x17 plans. At the discretion of SMART Engineering, applicant may be asked to provide full size (24"x36") scaled drawings and/or plan sets stamped by a licensed engineer.

3. **Detailed scope of work including hours, method and location of work, nearest cross street(s), landmarks, and/or a physical address with approximate distances (use separate sheet if necessary):**

4. **Type of Construction (Mark all that apply):**

Pipe	Conduit	Excavation
Underground ☐	Type: _____ ☐	Length: _____ ☐
Surface ☐	No. of Ducts: _____ ☐	Width: _____ ☐
	Buried Cable: _____ ☐	Depth: _____ ☐

5. **Types of Vehicles/Equipment To Be Used in Permit Area (Mark all that apply):**

		6.
Passenger Cars ☐	Heavy Construction Equip. ☐	Pickups ☐
Farm Equipment ☐	Hazardous Materials Trucks ☐	Recreational Vehicles ☐
Truck-Trailers ☐	Buses ☐	Other_____ ☐

7. **Method of Work:** _____
8. **Approximate Cost of Work in Permit Area:** _____
9. **Is work within 25 ft. (vertical or horizontal) of track way?** **Y____ N ____**
10. **Is work within 50 ft. (vertical or horizontal) of track way?** **Y____ N ____**

****Note:** If YES to Questions 9 or 10, Railroad Protective Liability Insurance May Be Required

*****PLEASE INCLUDE $300 APPLICATION FEE (non-refundable) AND $1000 PERMIT FEE WITH SUBMISSION**

Mail or email application and supporting documents to: SMART 5401 Old Redwood Highway, Ste 200 Petaluma, Ca 94954 **OR** ndiamzon@sonomamarintrain.org

Applicant Signature:_____
Print Name: _____ Date: _____

***Please note that if any additional services, such as inspectors, safety monitors, traffic flagging, etc., are required, an additional deposit(s) for those items may be required prior to issuance of Permit.

SMART Internal Use Only

Permit No.: _____ **Date Issued:** _____ **Reviewed by:**

As-Built Drawings Req'd: Y____ N ____ Prepared By: _____ Engineering: _____ Risk Management: _____
As-Built Submittal Date: _____ Systems: _____ Operations: _____ Other: _____

SMART Comments or Conditions (if necessary, use separate sheet or continue on back)**:**

Permittee shall fully pay for all materials joined or affixed to Premises, and shall pay in full all persons who perform labor on Premises. As Permittor is a public entity, its property is not subject to mechanics' or materialmen's liens, and nothing in this Permit shall be construed to make its property subject to such liens. However, if any such liens are filed, Permittee shall immediately remove them at Permittee's own expense, and shall pay any judgment which may be entered. Should Permittee fail, neglect, or refuse to do so, Permittor, after 48 hours prior notice to Permittee, shall have the right to pay any amount required to release any such liens, or to defend any action brought, and to pay any judgment entered. Permittee shall be liable to Permittor for all costs, damages, reasonable fees, and any amounts expended in defending any proceedings or in the payment of any of said liens or any judgment. Permittor may post and maintain upon Premises notices of non-responsibility as provided by law.

Permittee shall cooperate with Permittor in making any tests Permittor requires of any installation or condition which in Permittor's reasonable judgment may have an adverse effect on any of the facilities of Permittor. All costs incurred by the tests, or any corrections required as a result of such tests, shall be borne by Permittee.

Permittee shall take protective measures necessary to keep Permittor's facilities, including track ballast, free of sand or debris resulting from its use of Premises. Should any damage occur to Permittor's facilities as a result of Permittee's use of Premises, Permittee shall immediately notify Permittor. Permittor may require Permittee to contact the operator of any rail service on the rail line to make arrangements to ensure the safe performance of any work and agrees to give Permittor ten (10) calendar days of written notice prior to commencement of the work in the event such arrangements need to be made. Any damage to Permittor's facilities resulting from Permittee's use of Premises will be repaired or replaced by Permittor at Permittee's sole cost and expense, which Permittee shall pay to Permittor promptly upon demand.

9. No Crossing of Tracks. Permittee shall not be permitted to cross Permittor's tracks located near Premises but shall gain access to and from Premises only by use of designated public streets.

10. No Hazardous Materials. No hazardous materials shall be handled at any time upon Premises.

11. Mechanized Equipment. Under no condition shall Permittee be permitted to place or store any mechanized equipment, tools or other materials within twenty-five feet (25') of the center line of Permittor's nearest railroad tracks.

12. Indemnity and Insurance. Permittee shall release, defend (with counsel reasonably satisfactory to Permittor) and indemnify Permittor, its successors and assigns, any railroad company operating on Premises, and their respective directors, officers, employees, and agents (collectively, "Indemnitees") from and against all liability, cost, and expense for loss

of, or damage to, property and for injuries to, or death of, any person (including, but not limited to, the property and employees of each party) when arising or resulting from the use of Premises by Permittee, its agents, employees, contractors, subcontractors, or invitees; or Permittee's breach of these provisions. The duty of Permittee to indemnify and save harmless the Indemnitees includes the duties to defend as set forth in Section 2778 of the Civil Code. It is the express intent of the parties under this Section 12, that Permittee will indemnify and hold harmless the Indemnitees from any and all claims, suits, or actions arising from any cause whatsoever as set forth above, other than the active negligence, willful misconduct, or criminal acts of the Indemnitees. Permittee waives any and all rights to any type of express or implied indemnity against the Indemnitees arising out of Permittee's use of or activities on Premises. This indemnity shall survive termination of this Permit. It is the intention of the parties that should any term of this indemnity provision be found to be void or unenforceable, the remainder of the provision shall remain in full force and effect.

All personal property of Permittee, including, but not limited to fixtures, equipment, or related materials upon the Property, will be at the risk of OWNER only, and Permittor will not be liable for any damage thereto or theft thereof, whether or not due in whole or in part to the negligence of Permittor.

Prior to entry upon the Property and commencement of construction activities, Permittee shall provide Permittor with satisfactory evidence, in the form of a Certificate of Insurance, that Permittee is insured in accordance with the following. Said insurance shall remain in effect throughout the term of this License:

a. Workers' Compensation and Employers' Liability

Permittee shall procure and maintain Workers' Compensation Insurance and Employers' Liability Insurance in accordance with the laws of the State of California. Employers' Liability Insurance shall have coverage for a minimum liability of $2,000,000, covering Permittee's employees engaged in the work. Permittee shall insure the procurement and maintenance of such insurance by all contractors or subcontractors engaged in the construction, operation or maintenance of the Conveyor.

b. Commercial General Liability

Permittee shall procure and maintain Commercial General Liability insurance covering products-completed and ongoing operations, property damage, bodily injury and personal injury using an occurrence policy form, in an amount no less than $5,000,000 per occurrence.

Said policy shall either include a Railroads CG 24 17 endorsement removing the exclusion of coverage for bodily injury or property damage arising out of construction or demolition operations within 50 feet of any railroad property and

affecting any railroad bridge, trestle, tracks, roadbeds, tunnel, underpass or crossing, or provide evidence that said policy does not have any railroad exclusions. A follow form Excess Liability policy may be utilized to satisfy the required limits of liability under this section.

c. Professional Liability

Permittee shall procure and maintain Professional Liability insurance covering liability arising out of any negligent act, error or omission in performance of design or engineering services for the Project in an amount no less than $2,000,000 per claim. If any Design Professional Services are furnished by a Subcontractor, the Subcontractor shall be required to provide professional liability coverage.

d. Automobile Liability

Permittee shall procure and maintain Automobile Liability insurance covering bodily injury and property damage in an amount no less than $2,000,000 combined single limit for each occurrence. Said insurance shall include coverage for owned, hired, and non-owned vehicles. Said policy shall also include a CA 20 70 10 13 endorsement removing the exclusion of coverage for bodily injury or property damage arising out of operations within 50 feet of any railroad bridge, trestle, track, roadbeds, tunnel, underpass or crossing.

e. Contractors Pollution Liability

Contractors Pollution Liability insurance in an amount no less than $2,000,000 per incident. The Contractor's Pollution Liability policy shall be written on an occurrence basis with coverage for bodily injury, property damage and environmental damage, including cleanup costs arising out of third party claims, for pollution conditions, and including claims of environmental authorities, for the release of pollutants caused by construction activities related to the Permit. Coverage shall include the Permittee as the named insured and shall include coverage for acts by others for whom the Permittee is legally responsible.

Coverage to be provided for bodily injury to or destruction of tangible property, including the resulting loss of use thereof, loss of use of tangible property that has been physically injured, and natural resource damage. There shall be no exclusions or limitations regarding damages or injury from existence, removal or abatement of lead paint. There shall be no insured vs. insured exclusion in the policy.

f. Railroad Protective Liability

Prior to commencement of construction activities, Permittee shall procure and maintain Railroad Protective Liability insurance, in Permittor's name, with limits of liability of no less than $5,000,000 per occurrence, for losses arising out of

injury to or death of all persons, and for physical loss or damage to or destruction of property, including the loss of use thereof. The additional named insureds shall be the Sonoma-Marin Area Rail District and shall cover all other railroads operating on the right-of-way.

Prior to entering onto the Property, Permittee shall file Certificate(s) of Insurance with Permittor evidencing the required coverage and endorsement(s) and, upon request, a certified duplicate original of any of those policies. Said endorsements and Certificate(s) of Insurance shall stipulate:

1) SMART, its officers and employees, shall be named as additional insured on all policies listed above.

2) That the policy(ies) is Primary Insurance and the insurance company(ies) providing such policy(ies) shall be liable thereunder for the full amount of any loss or claim which Permittee is liable, up to and including the total limit of liability, without right of contribution from any other insurance effected or which may be effected by the Insureds.

3) The policy shall also stipulate: Inclusion of the Insureds as additional insureds shall not in any way affect its rights either as respects any claim, demand, suit or judgment made, brought or recovered against Permittee. Said policy shall protect Permittee and the Insureds in the same manner as though a separate policy had been issued to each, but nothing in said policy shall operate to increase the insurance company's liability as set forth in its policy beyond the amount or amounts shown or to which the insurance company would have been liable if only one interest had been named as an insured.

4) Permittee hereby grants to Permittor a waiver of any right to subrogation which any insurer of said Permittee may acquire against Permittor by virtue of the payment of any loss under such insurance. Permittee agrees to obtain any endorsement that may be necessary to affect this waiver of subrogation, but this provision applies regardless of whether or not Permittor has received a waiver of subrogation endorsement from the insurer.

5) Permittee shall require and verify that all subcontractors maintain insurance meeting all requirements stated herein, and Permittee shall ensure that SMART, its officers and employees, shall be named as additional insured on insurance required from subcontractors. For CGL coverage, subcontractors shall provide coverage with a form at least as broad as CG 20 38 04 13.

The insurance policy(ies) shall be written by an insurance company or companies acceptable to Permittor. Such insurance company shall be authorized to transact business in the state of California.

Deductibles and Retentions

Permittee shall be responsible for payment of any deductible or retention on Permittee's policies without right of contribution from Permittor. Deductible and retention provisions shall not contain any restrictions as to how or by whom the deductible or retention is paid. Any deductible of retention provision limiting payment to the name insured is not acceptable.

Self-Insurance

Permittee's obligation hereunder may be satisfied in whole or in part by adequately funded self-insurance, upon evidence of financial capacity satisfactory to Permittor.

Claims Made Coverage

If any insurance specified above is written on a claims-made coverage form, Permitee shall:

1) Ensure that the retroactive date is shown on the policy, and such date must be before the date of this Permit or beginning of any work under this Permit;
2) Maintain and provide evidence of similar insurance for at least three (3) years following project completion, including the requirement of adding all additional insureds; and
3) If insurance is cancelled or non-renewed, and not replaced with another claims-made policy form with a retroactive date prior to Permit effective date, Permitee shall purchase "extending reporting" coverage for a minimum of three (3) years after completion of the work.

13. Permits from Other Agencies; Hazardous Materials. Permittee shall comply, at Permittee's expense, with all applicable laws, regulations, rules and orders with respect to the use of Premises, and shall obtain all required licenses, permits or other approvals in connection with Permittee's use of Premises. Permittee shall furnish satisfactory evidence of such compliance upon request of Permittor.

Should any discharge, leakage, spillage, emission or pollution of any type occur upon or from Premises due to Permittee's use and occupancy thereof, Permittee, at Permittee's expense, shall clean all affected property to the satisfaction of Permittor and any governmental body having jurisdiction.

Permittee shall indemnify, hold harmless and defend the Indemnitees against all liability, cost, and expense (including, without limitation, any fines, penalties, judgments, litigation costs, reasonable attorneys' fees and consulting, engineering and construction costs) incurred by Permittor as a result of Permittee's breach of this section or as a result of any such discharge, leakage, spillage, emission, or pollution by Permittee, regardless of whether such liability, cost, or expense arises during or after the term of this Permit.

Right of Entry Permit No. 2021-ROE-XXX

14. Assumption of Risk. Permittee shall assume all risk of damage to any and all other property of Permittee, or any property under the control or custody of Permittee while upon or near Premises of Permittor incident to the use of Premises; provided, however, such assumption by Permittee shall not include any damage caused by the active negligence and/or willful misconduct of Permittor. Permittee releases Permittor from any liability, including claims for damages or extra compensation, arising from construction delays due to transportation activities by Permittor or transportation operations by any agency as authorized by Permittor.

15. Subcontractors. Any person, firm or corporation Permittee authorizes to work upon Premises, shall be deemed to be Permittee's agent and shall be subject to all the applicable terms hereof.

16. Restoration of Premises. Upon termination of this Permit, Permittee, at its own expense, shall remove from Premises all property it owns or controls, all debris and other materials, and restore Premises to its condition prior to entry or to a condition reasonably satisfactory to Permittor. Upon Permittee's failure to do this, Permittor, upon forty-eight (48) hours prior notice to Permittee, may perform such work at Permittee's expense.

17. Severability. If any provision of this Permit shall be for any reason unenforceable, in any respect, such unenforceability shall not affect the other provisions of this Permit.

18. Attorneys' Fees. If any legal proceeding should be instituted by either of the parties to enforce the terms of this Permit or to determine the rights of the parties under this Permit, the prevailing party in the proceeding shall receive, in addition to all costs, reasonable attorneys' and expert fees.

19. Time of Essence. Time is and shall be of the essence of this Permit and of each and every provision contained in this Permit.

20. No Third Party Beneficiaries. Nothing contained in this Permit shall be construed to create and the parties do not intend to create any rights in third parties.

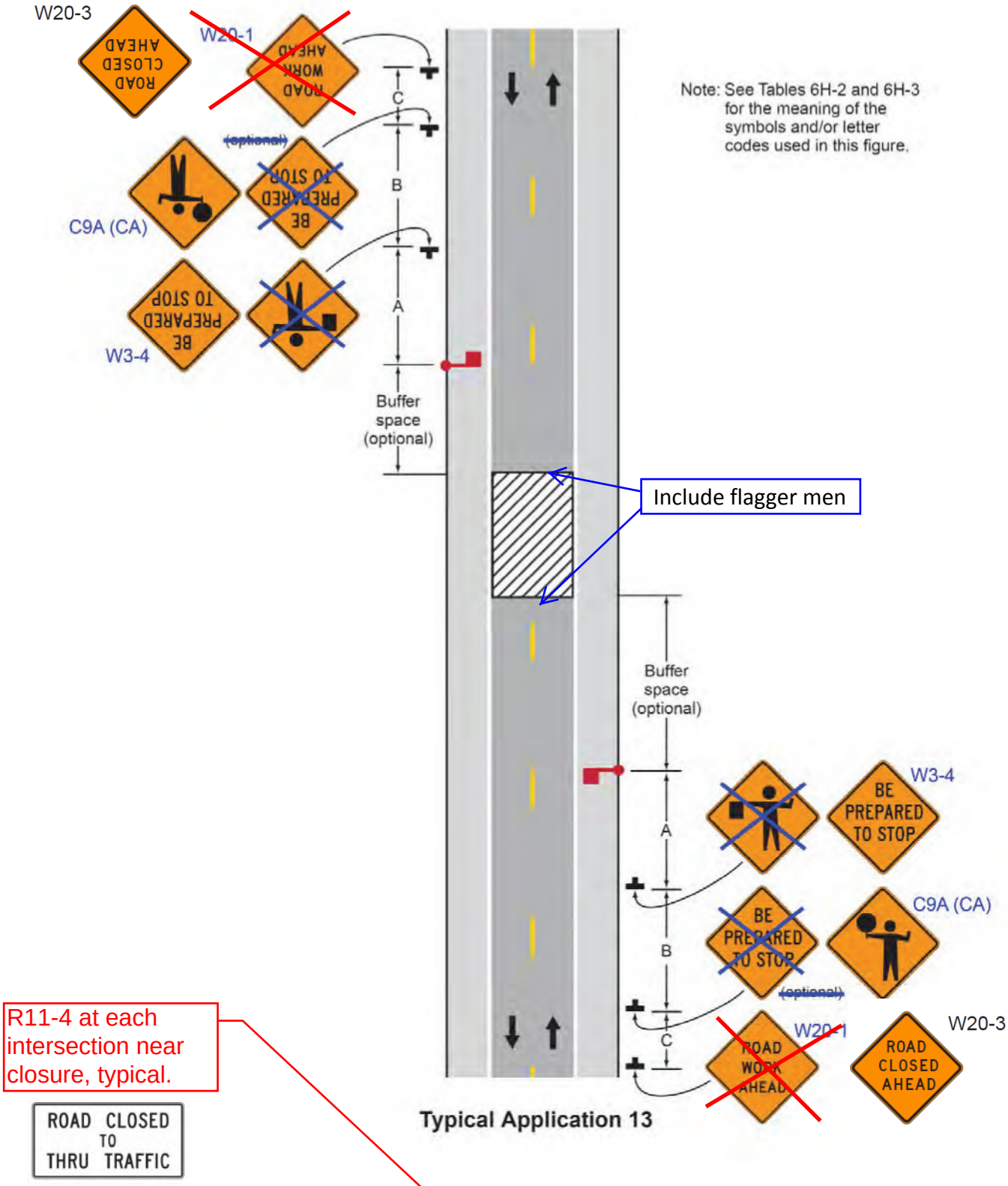
21. Construction of Agreement. The provisions in this Permit shall be construed and given effect in a manner that avoids any violation of statute, regulation or law. Permittor and Permittee agree that in the event any provision in this Permit is held to be invalid or void by any court of competent jurisdiction, the invalidity of any such provision shall in no way affect any other provision in this Permit. Permittor and Permittee acknowledge that they have each contributed to the making of this Permit and that, in the event of a dispute over the interpretation of this Permit, the language of the Permit will not be construed against one party in favor of the other. Permittor and Permitee further acknowledge that they have each had an adequate opportunity to consult with counsel in the negotiation and preparation of this Permit.

APPENDIX D

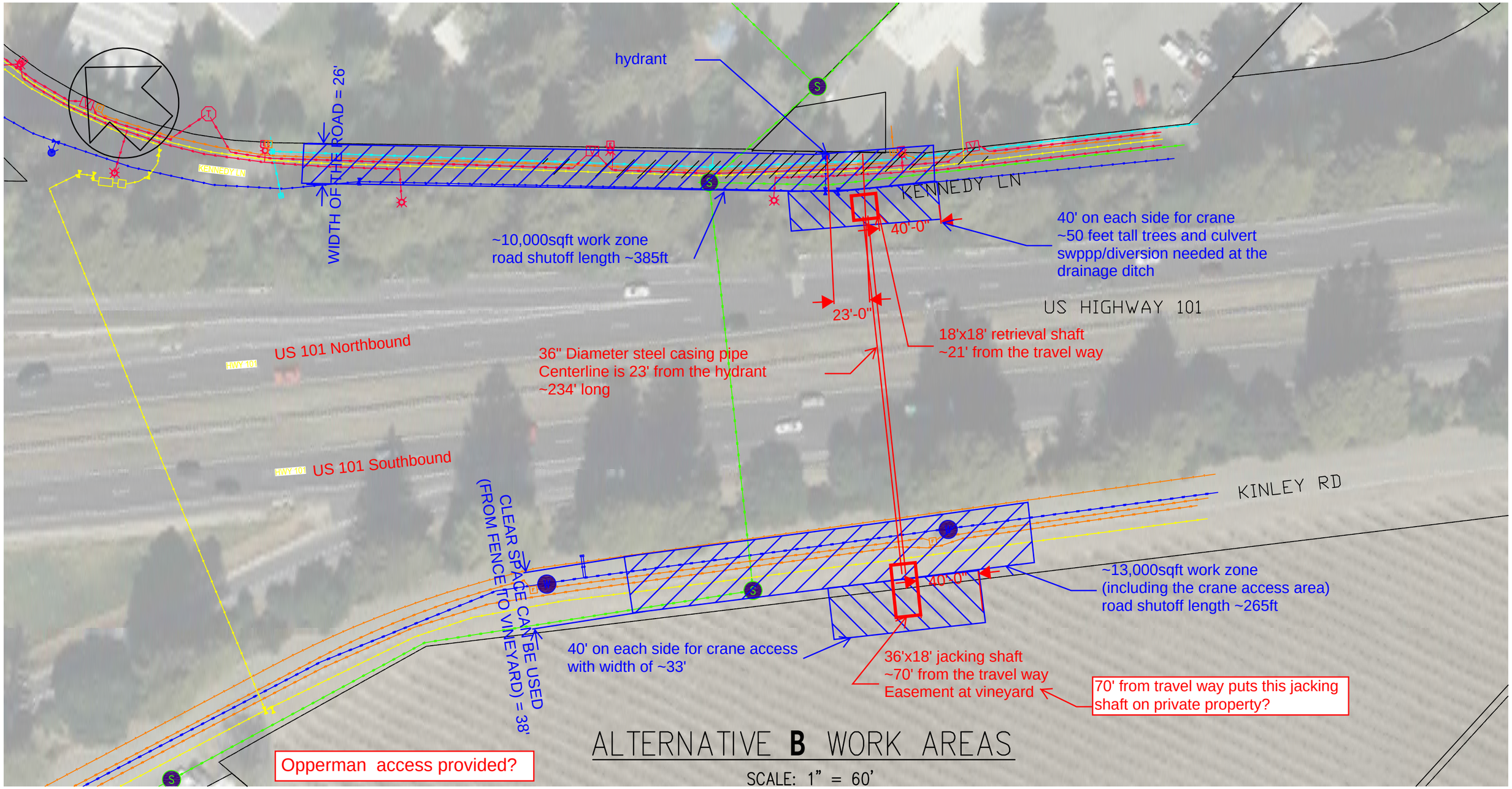
Sonoma County Encroachment Redline Comments, April 2023

Modified

Figure 6H-13. Temporary Road Closure (TA-13)



Typical Application 13

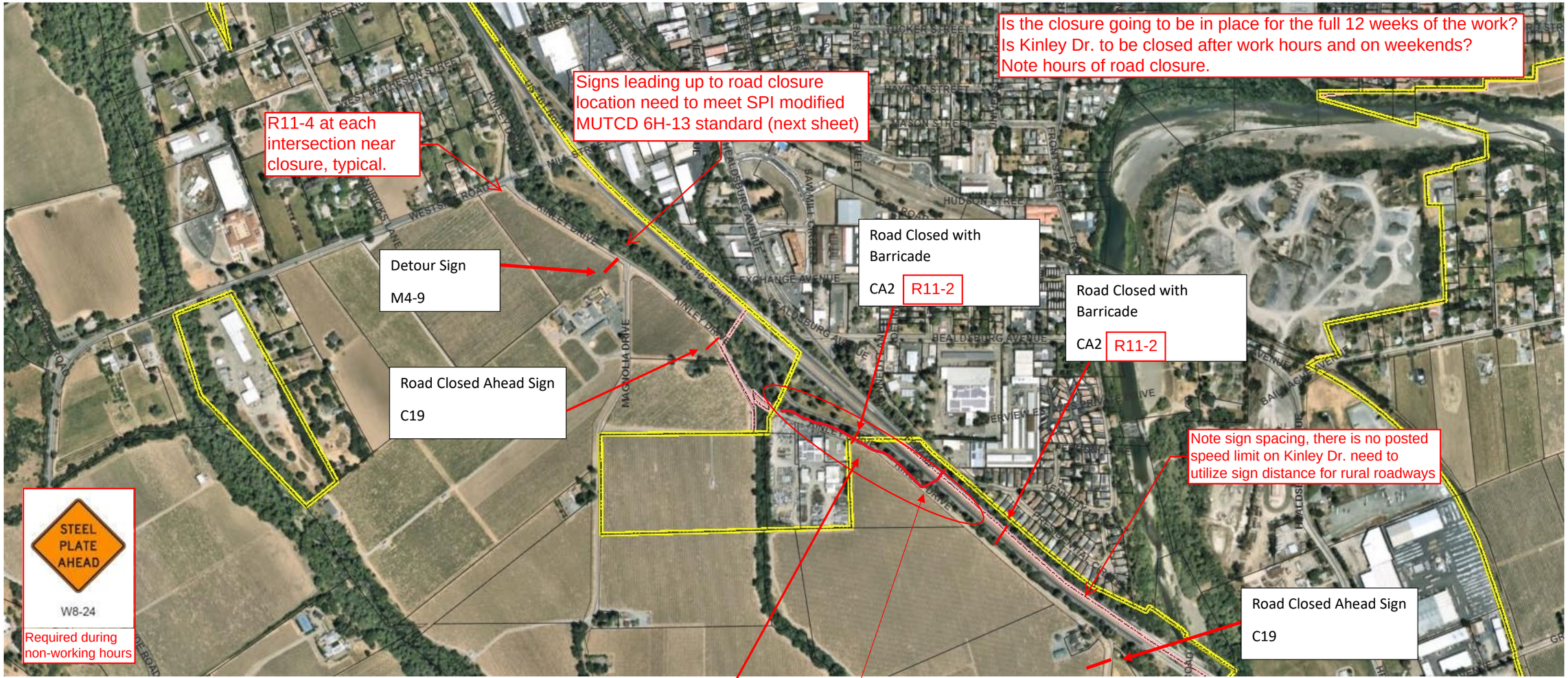


The project description and TCP states that 'the pipeline in Kinley Road will include approx. 1,200 feet of open trench construction' where is the open trenching proposed? Site plan needed.

Trenching, backfill and paving must be completed to SPI 219A & B construction standards. Include details in revised plans.

Show equipement staging location

Changeable message boards need to be shown and in place a minimum of 10 days prior to road closure.



City of Healdsburg

Municipal Recycled Water Pipeline Project

Encroachment on Kinley Road- Site Plan

28 February 2023

Include notes on revised TCP:
NOTIFICATION OF ROAD CLOSURE MUST BE EMAILED TO SPI-LandDev-Referrals@sonoma-county.org
A MINIMUM (5) DAYS PRIOR TO THE START OF WORK.
REDCOM must be notified a minimum of 48 hours prior to closure.

S:\PUBLIC WORKS\RW Water Program\WA004 Munic RW Pipeline Project\Design\Work Product\Kinley Road Encroachment Site Plan.docx

APPENDIX E

Geotechnical Data Report, June 2023

MOTT MACDONALD

City of Healdsburg Municipal Recycled Water Pipeline

Geotechnical Data Report

June 2023

This page left intentionally blank for pagination.

Mott MacDonald
155 Montgomery Street
Suite 1400
San Francisco
CA 94104
United States of America

T +1 (415) 968 3495
mottmac.com

Robert Reid
West Yost
2020 Research Park Drive,
Suite 100
Davis, CA 95618

City of Healdsburg Municipal Recycled Water Pipeline

Geotechnical Data Report

June 2023

Issue and revision record

Revision	Date	Originator	Checker	Approver	Description
0	6-16-2023	JS	EJ	MW	Draft GDR, Revision 0
1	9-19-2023	JS	EJ	MW	Final GDR, Revision 1

Document reference: 504100918 |

Information class: Standard

Contents

1 Introduction

This Geotechnical Data Report (GDR) presents the geotechnical and geologic data collected to support design and construction of the City of Healdsburg's Municipal Recycled Water Pipeline Project. Mott MacDonald Group, Inc. (Mott MacDonald) performed the work for West Yost Associates, Inc. (West Yost) on behalf of the City of Healdsburg. This report partially fulfills the requirements of Task Order No.1 between West Yost and Mott MacDonald, dated October 27, 2022.

1.1 Objectives and Scope

The proposed City of Healdsburg Recycled Water Pipeline will deliver recycled water to municipal turf at Healdsburg Elementary School, Recreation Park, Giorgi Park, Oak Mound Cemetery and Tayman Park by installing approximately 1.7 miles of new pipeline along city streets and extending an existing 12-inch water main under US Highway 101. The current project scope includes unconstructed portions of the recycled water pipeline described in a 2011 drawing set prepared by Winzler and Kelly for the City's Recycled Water System Project. As part of the current study, West Yost investigated several potential alternatives to Winzler and Kelly's 2011 alignment. Descriptions of the alternatives analysis methodology and the selected pipeline alignment are presented in the project document titled Preliminary Design Report (West Yost, 2023). The selected alignment includes modifications to the 2011 design, most notably a new crossing beneath US Highway 101, located south of the proposed 2011 crossing. These adjustments to the original alignment created geotechnical data gaps and the need for additional geotechnical data. The geotechnical investigation preformed for this study was designed to supplement the data collected during previous geotechnical investigations and consisted of the following tasks:

- Collection and evaluation of historical geological and geotechnical records and maps.
- A geotechnical investigation program, including 4 geotechnical boreholes ranging in depth from 15 to 50 feet below adjacent grade.
- A geotechnical laboratory testing program to evaluate the physical and engineering characteristics of the soils encountered during the investigation. Geotechnical laboratory testing included:
  - Moisture content and unit weight,
  - Grain size and grain size distribution,
  - Hydrometer analysis,
  - Liquid Limit, Plastic Limit, and Plasticity Index (Atterberg limits),
  - Unconsolidated undrained triaxial compression test, and
  - Corrosion testing (pH, minimum electrical resistivity, soluble sulfate content, and soluble chloride content)

Geotechnical and geologic data collected during this geotechnical investigation will be used by the HDD contractor and pipeline contractor to generate a bid for construction. The data will also serve to form a basis for a Geotechnical Design Memorandum (GDM) that will provide geotechnical design recommendations and construction considerations for the trenchless crossing under US Highway 101 and the open cut portions of the project.

This GDR presents factual information collected during the geotechnical investigation, and includes:

1. A description of project geologic setting.
2. Relevant subsurface investigation data collected during previous City of Healdsburg recycled water system studies.
3. A description of the sampling and data collection methods employed during the geotechnical investigation.
4. A description of the geotechnical laboratory scope and test methods.
5. Field investigation and laboratory test results, including borehole logs and geotechnical laboratory test data.

1.2 Proposed Alignment

The proposed pipeline alignment is described below beginning at the southern pipeline terminus and ending at Oak Mound Cemetery to the north. The general site vicinity is depicted on Figure 1. Figure 2 presents the proposed alignment as well as the locations of both previous and current geotechnical boreholes.

The proposed alignment begins on the southwest side of US-101, near the northwest corner of the property located at 280 Kinley Drive. The alignment proceeds southeast down Kinley drive for approximately 1,000 feet before it turns to the north and crosses beneath US-101 as a proposed 250 foot long trenchless crossing. The alignment continues through the City of Healdsburg along Kennedy Lane, Healdsburg Avenue, South University Street, Hudson Street, and Front Street. The pipeline will cross beneath existing Sonoma Marin Area Rail Transit (SMART) tracks between South University Street and Hudson Street in a previously installed PVC conduit. North of the intersection of Front and Mason Streets the alignment follows 1st Street, Piper Street, and Cemetery Lane. Approximately 600 feet north of the Intersection of Piper Street and Cemetery Lane the pipeline will divide into two branches with a northern branch terminating in Oak Mound Cemetery and an eastern branch terminating in the Tayman Park.

1.3 Document Organization

The Geotechnical Data Report (GDR) is organized into the following sections.

- Section 1 presents an introduction, including the objectives and scope of the investigation;
- Section 2 describes site conditions, historical geologic information, and existing relevant geotechnical data;
- Section 3 describes geotechnical investigation program;
- Section 4 describes the geotechnical laboratory testing program and summarizes the laboratory testing results;
- Section 5 presents references cited in this report.

1.4 Limitations

This document has been prepared in connection with the City of Healdsburg Recycled Water Pipeline (HRWP) project and may not be relied upon or used on any other project or under any differing circumstances or applications on the HRWP project without an independent check being carried out as to its applicability to the project or differing circumstances or application and the prior written authorization of Mott MacDonald with respect to the data gathered and presented. Mott MacDonald accepts no responsibility or liability for the consequence of this

document being used for a purpose other than the purposes and circumstances for which it was commissioned.

This GDR presents factual data gathered during geotechnical investigations carried out by Mott MacDonald. Variations in subsurface conditions should be expected between exploration locations. It is possible that soil and groundwater conditions could vary between or beyond the points and depths explored. The geotechnical data presented in this GDR are intended only for the purposes, site location, and project described in this report. It is possible that future exploration or groundwater monitoring efforts will be required to address changes to or refine design of key features of the project during design development. The interpretation of the geotechnical data is outside the scope of this GDR and will be covered by other design documents. Mott MacDonald is not responsible for interpretations, professional opinions, or advice given by others regarding any geotechnical data presented in this report.

Sampling and testing of soil and groundwater for environmental site characterization (hazardous materials) was not performed by Mott MacDonald as part of the ground investigation, as this is outside the scope of this GDR.

2 Site Background and Existing Conditions

2.1 Site Condition

Surface conditions in areas of planned open cut construction generally consist of surface streets covered by impermeable pavements. Drainage of storm water is by sheet flow to municipal storm drains. The launching and receiving shaft locations for the proposed trenchless crossing beneath US-101 are anticipated to be within the Caltrans and/or City of Healdsburg right-of-way. The end of South University Street appears to be dirt paved with minor vegetation consisting of shrubs and grasses growing adjacent to the alignment and SMART crossing.

2.2 Existing Geotechnical Data and Information

Available geologic and geotechnical information was collected and reviewed to identify relevant existing documents and data sources. The following document types and data sources were reviewed:

- Geotechnical data and reports (City of Healdsburg, California Department of Transportation),
- Soil survey maps and data (United States Department of Agriculture Natural Resources Conservation Service),
- Geologic and hydrologic maps (United States Geological Survey (USGS) and California Geological Survey (CGS)),
- Geologic hazard maps, seismic hazard maps, and fault maps (USGS and CGS),
- Historic topographic maps (USGS),
- Aerial photographs (Sonoma County), and
- Utility maps (City of Healdsburg)

Pertinent geotechnical information from these sources has been incorporated into this data report and aided in the formation of a general geological understanding of subsurface conditions along the proposed alignment.

An existing Geotechnical Engineering Investigation Report was prepared by DCM/GeoEngineers for Winzler & Kelly at the request of the City of Healdsburg in 2009. The DCM/GeoEngineers investigation was conducted in support of design for the initial phases of the recycled water pipeline. The investigation included 23 exploratory borings drilled from 9.5 to 51.5 feet below existing grade. Relevant borehole logs from the 2009 DCM/GeoEngineers report are included in Appendix C and presented on Figure 2.

2.3 Geologic and Seismic Setting

2.3.1 Regional Geology

The project region is within the central portion of Coast Ranges geomorphic province of California. This region is characterized by northwest-trending valleys and mountain ranges shaped by the tectonic processes as part of the San Andreas Fault Zone. Healdsburg is located in the central portion of the Russian River Watershed.

2.3.2 Site Geology

The site has been mapped by the California Geological Survey (CGS) as part of the 7.5' Healdsburg Quadrangle (Delattre, 2011) and incorporated in Witter et al. (2006). The CGS geologic map indicates most of the site is underlain by Holocene age (11,000 years old to present) stream terrace deposits and Holocene to late Pleistocene age alluvial deposits. The Holocene stream terrace deposits comprising moderately to poorly sorted compositions of sand, gravel, silt, and occasionally clay are mapped in the southern portion of the project alignment, from Kinley Road to the approximate intersection of Mason Street north and Front Street. The northern portion of the project site, from Mason to the cemetery property is mapped as Holocene to latest Pleistocene age alluvial deposits, increasing in age as the alignment proceeds to the north. The Pleistocene alluvial deposit units are described as relatively flat or gently sloping surfaces with slightly to moderately weathered, and slightly to moderately dissected deposits of gravel, sand, silt, and minor clay. The extreme north portion of the alignment is mapped as late Pleistocene alluvial deposits, described as orange to red-stained, poorly sorted gravels and sand, with clasts varying from subangular to well-rounded, and up to small boulder size. Figure 3 presents the proposed alignment relative to the geologic units mapped by Witter et al. (2006).

2.4 Geologic and Seismic Hazards

The project site may be subject to geologic hazards and strong ground motions from nearby active faults such as the Rodgers Creek-Healdsburg, Macama, and San Andreas faults during the design life of the pipeline.

This section discusses potential seismic and geologic hazards that may affect the proposed recycled water pipeline.

2.4.1 Ground Rupture

The project alignment is not located within a state designated Alquist-Priolo Earthquake Fault Zone (California Geological Survey, 1983) and does not cross known active or potentially active faults. Based on a hazard deaggregation performed using the USGS Unified Hazard Tool (UHT; USGS, 2020) a site-to-fault distance of approximately 2.55 miles was identified for the Kinley Road trenchless crossing location and the Rodgers Creek-Healdsburg fault. The site-to-fault distance of about 6 miles was identified between the trenchless crossing location and the Macama fault. Recent mapping of Healdsburg Fault by Hecker and Loar (2018) indicates that the Healdsburg fault is approximately 0.5 miles east of the northern end of the proposed alignment, in the vicinity of Oak Mound Cemetery. Mapped quaternary fault locations and historic seismicity in the region are presented on Figure 4.

2.4.2 Flooding

The proposed pipeline alignment is not within the 0.2% or 1% annual chance of flood hazard as depicted within FEMA's National Flood Hazard Maps. Front Street north of the intersection with Hudson Street borders the 0.2% annual chance of exceedance flood zone along the eastern side of Front Street.

2.4.3 Liquefaction and Lateral Spreading

Liquefaction is the loss of strength of saturated cohesionless soil caused by the propagation of seismic ground motion. Soil types most susceptible to liquefaction are loose, saturate silty to clean sands, and low plasticity silts. The proposed alignment is within a CGS Seismic Hazard Zone Unevaluated Area. However, based on mapped liquefaction susceptibility by the USGS

(Witter et al. 2006) the majority of the proposed alignment traverses areas classified as having moderate to low susceptibility to liquefaction. Figure 5 presents the proposed alignment relative to mapped liquefaction susceptibility.

2.5 Subsurface Conditions

Artificial fill was encountered in borehole MM-01, reference boreholes B-4, B-8, and B-1. The depth of fill ranged from approximately 2 feet at MM-01 to 5 feet at B-4. Fill soils consisted of dense poorly graded sands with silt and gravel, and soft to very stiff lean clay with varying percentages of sand and gravel (SP-SM and CL soil types based upon the Unified Soil Classification System, USCS). Asphalt and asphalt base was encountered in several of the boreholes.

In the vicinity of the proposed trenchless crossing (US-101), boreholes MM-01 and MM-02, the soils encountered consisted of 12 to 15.5 feet of cohesive stiff to very stiff silt, clay, and clayey sand (ML, CL, SC), overlaying cohesionless soils to the maximum depth explored (51.5 feet). Cohesionless soils consist of medium dense to very dense clayey sand, poorly graded sand, and gravel with varying percentages clay, silt, and sand (SC, SP, GP, GC, GP-GC, and GM soil types). One layer of very stiff to hard lean clay (CL) is encountered at 40 feet in MM-01 and 48 feet in MM-02.

Native soils encountered outside the trenchless portion of the alignment consist of sand, clay and gravel in varying proportions and thicknesses typical of stream terrace and alluvial deposits, USCS groups consisting of GC, GW-GC, SW-SC, SM, SW, SC, ML, CL. Consistency of cohesive soils range from soft to hard with stiff to medium stiff being most representative. The density of cohesionless soils range from medium dense to very dense.

At the northern end of the alignment borehole MM-04 encountered gravel, cobbles, and boulders within the top 4.5 feet of profile. These soils overlay stiff to hard lean clay (CL) deposits. Additionally, possible cobbles were noted during drilling at borehole location MM-01 at a depth of 22 feet. Cobbles and boulders are not identified in other borehole locations, however, given the geologic setting and depositional history of the site cobbles and boulders may be present at other locations along the project alignment.

2.6 Groundwater

Groundwater depths encountered in geotechnical boreholes, as well as data from previous studies performed along the proposed alignment, indicate the depth to groundwater in the project area south of approximately Mason Street typically ranges from approximately 7 to 12 feet below adjacent grade. Groundwater was not encountered in the shallow 15-foot borehole drilled near Oak Mound Cemetery.

Borehole MM-01 was completed as a standpipe piezometer with a screen interval from 15.5 to 25.5 feet below grade. Table 2-2 summarizes groundwater data collected during field investigation activities. Groundwater readings collected during previous investigations are presented in Table 2-3.

Fluctuations of the groundwater level, localized zones of perched water, and variations in soil moisture content should be anticipated during and following the rainy season. Additionally, irrigation of landscaped areas on and adjacent to alignment, as well as leaking or damaged water and sewer infrastructure can also cause a fluctuation of local groundwater levels.

Table 2-1. Groundwater Readings, Recent 2023 Investigation

Location ID	Date Completed	Borehole Depth (ft)[1]	Groundwater Depth (ft)[1]
MM-01	5/3/2023	50.8	7.0[3]
MM-02	3/16/2023	51.5[2]	7.2
MM-03	3/16/2023	16.5[2]	7.0
MM-04	3/17/2023	16.5[2]	Not Encountered

Notes:

1. Depth measured from adjacent grade.
2. Measured during drilling.
3. Measured at time of installation, prior to well development.

Table 2-2. Groundwater Readings, Historical Investigations (DCM GeoEngineers. 2009)

Location ID	Date Completed	Borehole Depth (ft)[1]	Groundwater Seepage Depth During Drilling (ft)[2]	Groundwater Depth, After Completion of Drilling (ft)[3]
RB-1	4/15/2003	31.5	NR	15
RB-2/2B	4/15/2003	20	16	14.5
B-4	2/20/2009	19.75	11	10
B-3	2/20/2009	29	12	9
B-10	3/31/2009	14	Not Encountered	Not Encountered
B-8	3/30/2009	14	Not Encountered	Not Encountered
B-7	3/30/2009	14	12.5	11.5
B-1	2/20/2009	19	Not Encountered	Not Encountered

Notes:

1. Depth measured from adjacent grade.
2. Groundwater seepage depth inferred while drilling from visible wetness on drilling rods/augers, saturated sampled soils, and tape measurements.
3. Groundwater readings prior to backfilling borehole.

3 Geotechnical Investigation

A site-specific geotechnical sampling program consisting of four soil borings was performed along the proposed alignment to obtain samples for visual classification and geotechnical laboratory testing. Borings were advanced to depths ranging from 16.5 to 51.5 to feet below existing adjacent grade. Geotechnical borehole logs are presented in Attachment A.

3.1 Pre Field Investigation Activities

Before conducting any invasive geotechnical sampling activities, a field engineer performed an initial site reconnaissance at each investigation location to assess equipment access and potential logistical constraints, find evidence of existing buried utilities, identify overhead conflicts, and observe the geomorphology of the location and surrounding area.

The general area of each proposed subsurface sampling was pre-marked in white paint and Underground Service Alert (USA) was notified. USA ticket numbers were generated for each borehole location and utility owners who may have utilities in the vicinity of the borehole locations were requested to respond and mark out utility lines at the ground surface. Prior to the start of drilling, it was visually confirmed that member utilities had been marked and that the field markings were consistent with visible cues of possible subsurface utilities.

Prior to drilling Sonoma County well drilling permits were obtained for borehole locations MM-01 and MM-02 (well drilling permits were not required for boreholes MM-03 and MM-04). Required encroachment and access agreements were obtained through the City of Healdsburg, Sonoma County, and private property owners depending on the borehole location.

3.2 Geotechnical Boreholes

Four geotechnical borings were drilled and logged as part of the subsurface investigation along the proposed alignment. Geotechnical drilling and sampling activities were performed by Gregg Drilling, LLC under the direction of Mott MacDonald from March 15th, 2023 through March 17th, 2023 for borehole MM-02 to MM-04. Borehole MM-01 was drilled from May 2nd, 2023 through May 3rd, 2023.

3.2.1 Geotechnical Drilling Methods

Geotechnical boreholes were advanced using a combination of hand auger, hollow stem auger, and rotary wash methods. Drilling was performed with a truck-mounted B-80 drilling rig drill to depths ranging from 16.5 feet to 51.5 feet below adjacent grade. At all borehole locations, hand-augering was performed in the upper five feet to obtain shallow subsurface information, identify unknown buried utilities or conflicts, and collect bulk soil samples. Below a depth of 5 feet, hollow stem auger drilling, using a 6 inch inside diameter auger, was performed in accordance with ASTM D6151 (ASTM, 2016a) until groundwater was encountered and recorded on the field borehole log. Mud rotary drilling, using a 3-7/8-inch diameter bit, was performed in accordance with ASTM D5783 (ASTM, 2018a) at depths greater than the observed groundwater depth at the time of drilling. When necessary, 4.5 to 6.5-inch outside diameter casing was used in the upper portions of the borehole to prevent fluid loss and the sloughing of loose sidewall material.

At the completion of drilling, borehole MM-01 was completed as piezometer for groundwater measurements. Boreholes MM-02 through MM-04 were backfilled with neat cement grout using the tremie method, to the full depth explored.

The as-built locations of borings were recorded by measuring from existing features such as driveway entrances, sewer manholes, painted roadway lines, and fire hydrants. The horizontal coordinates presented on the borehole logs were collected with a handheld GPS unit and are based on NAD 1983 State Plane, CA Zone II (US Feet).

3.2.2 Sampling and Field Logging

A Mott MacDonald engineer maintained a log of the boring, classified the soils encountered, and obtained both disturbed and relatively undisturbed samples of the subsurface materials during drilling. Soil classification was performed in general accordance with relevant portions of the Unified Soil Classification System (American Society for Testing and Materials International [ASTM] D2488 visual-manual procedure) and the Caltrans Soil and Rock Logging Classification Manual (Caltrans, 2019).

Samplers were driven or pushed at each borehole to obtain soil samples for visual-manual soil classification and for geotechnical laboratory testing. Sampling consisted of the following:

- SPT sampling was performed in accordance with ASTM D1586 (ASTM, 2022);
- Three-inch outside diameter split-barrel (Modified California) and Dames & Moore ring lined sampling was performed in general accordance with ASTM D3550 (ASTM, 2018b);
- Thin-walled Shelby sampling was performed in accordance with ASTM D1587 (ASTM, 2016b).

SPT and Modified California samplers were driven into undisturbed soil using a 140-pound automatic hammer, freefalling 30 inches. The hammer blow counts were recorded at 6-inch intervals for each driven sample and are presented on the borehole logs in Appendix A. A correction factor was applied to the recorded hammer blow counts when estimating the apparent density of coarse-grained material sampled with the Modified California sampler. Blow counts shown on the borehole logs in Appendix A have not been corrected for the effects of overburden pressure, rod length, sampler size, or hammer efficiency.

Pocket penetrometer tests were performed on select cohesive samples to estimate unconfined compressive strength. Pocket penetrometer tests were performed in accordance with the recommendations provided by the device manufacturer. Field tests for plasticity, dry strength, dilatancy, and toughness were also performed on appropriate cohesive samples to identify and describe the soil, in accordance with ASTM D2488 (ASTM, 2017a).

Soil classifications made in the field from samples and auger cuttings were in accordance with ASTM D2488. Field classifications were re-evaluated after further examination and laboratory testing, in accordance with ASTM D2487 (ASTM, 2017b).

Soil samples obtained from the borings were packaged and sealed in the field to reduce moisture loss and disturbance, then transported to appropriate geotechnical laboratory for analysis.

4 Laboratory Testing

Geotechnical laboratory testing was performed on select soil samples to evaluate their physical properties and engineering characteristics. Geotechnical laboratory testing was performed by Inspection Services, Inc. of Berkeley, California. Tests assigned as part of our geotechnical laboratory testing program are described below. Geotechnical laboratory results are presented in Appendix B.

4.1 Sample Review and Laboratory Test Assignment

Before geotechnical laboratory testing, each soil sample was inspected and classified according to the visual-manual procedures described in ASTM D2488 (ASTM, 2017c) to backcheck the visual-manual classifications made in the field and to ensure consistency with the ASTM standard.

Following field classification backchecking and sample review, representative soil samples were identified, and specific geotechnical laboratory tests were assigned. Samples were selected based on color, physical appearance, and structural features. Samples with known discontinuities or signs of disturbance were considered for index tests.

The laboratory tests assigned as part of this laboratory testing program are described in Sections 4.2 through 4.4.

4.2 Testing for Index Properties

Geotechnical laboratory tests to determine basic soil index properties for material classification were performed in accordance with current ASTM standards. Index tests performed include the following:

Moisture Content – ASTM D2216 (ASTM, 2019)

Moisture content tests were performed to determine the percent of the weight of water in a given soil mass to the weight of solid particles and to provide general correlations with strength, settlement, and other properties.

Unit Weight – ASTM D7263 (ASTM, 2021)

Unit weight tests were performed on undisturbed soil samples to determine the relationship between the weight and volume of a sample. Dry and wet unit values, along with the moisture content of the soil, are used to compute void ratio, porosity, and degree of saturation.

Grain Size Distribution – ASTM D6913 (ASTM, 2017d)

Grain size distribution testing was performed to determine the textural classification of soils (gravel, sand, silty clay, etc.) and to support site characterization and the development of engineering design parameters.

Percent Passing No. 200 Sieve – ASTM D1140 (ASTM, 2017e)

Tests were performed to determine the percentage of particles in a sample that are smaller than No. 200 sieve (< 0.075 millimeter), the boundary between coarse- and fine-grained soils.

Hydrometer Analysis – ASTM D7928 (ASTM, 2017f)

Hydrometer tests were performed to determine the distribution (percentage) of particle sizes smaller than No. 200 sieve (< 0.075 millimeter) and identify the silt, clay, and colloid percentages in the soil.

Atterberg Liquid Limit, Plastic Limit, and Plasticity Index of Soils ASTM D4318 (ASTM, 2017c)

Atterberg liquid and plastic limit tests were performed to determine the water contents which define the limits of various stages of consistency for fine-grained soils. The liquid limit and plastic limit define the upper and lower limits of the plastic range of soil. The numerical difference between these two limits expresses the plasticity index of the soil. Atterberg limits provide general correlations with strength, settlement, and other properties.

4.3 Testing for Design Properties

Geotechnical laboratory tests to determine the soil strength characteristics were performed in accordance with current ASTM standards, as follows:

Unconsolidated-Undrained Triaxial Compression Test – ASTM D2850 (ASTM, 2023)

Unconsolidated-undrained triaxial tests were performed to measure the undrained shear strength of cohesive soil samples. No drainage of the specimen is permitted during the application of the confining pressure or during the compression phase of the test.

4.4 Corrosion Testing

Analytical tests including pH, minimum electrical resistivity, soluble sulfate content, and soluble chloride content will be performed on select samples to inform a screening level evaluation of the corrosion potential of soils encountered.

5 Field Investigation and Laboratory Testing Results

5.1 Geotechnical Boreholes

Borehole logs summarizing the data collected during geotechnical drilling and sampling were prepared for each of the four exploratory borings. The borehole logs present information regarding the drilling methods used to perform the investigation, the type of sampling performed, how the sampler was advanced, the location and description of the soil encountered, and select laboratory test result data.

Notably, the depth at which a material change occurs may be uncertain because the borehole sampling occurred at discrete intervals, and layer boundaries between soil units may fall between sampling locations. In addition to the visual-manual classification performed on the samples collected, the boundaries, or contacts, presented on the borehole logs were identified based on visual observations of cuttings, drill rig behavior during drilling, or both.

Borehole logs and legend sheets defining the terms and symbols used are presented in Appendix B. Borehole logs from previous investigations are presented in Appendix C.

5.2 Laboratory Testing Results

Geotechnical laboratory tests to determine the index properties and strength characteristics of representative soil samples were performed in accordance with current ASTM standards. Laboratory test result reports are presented in Appendix B and summarized in Table 5-1. Laboratory test result reports from previous investigations are presented in Appendix D and summarized in Table 5-2.

Table 5-1. Laboratory Test Results, Mott McDonald 2023

Boring ID	Sample Depth (ft)	Sample ID	Material Description	Moisture Content[1] (%)	Density (pcf)		Atterberg Limits		Gradation			Hydrometer		Triaxial Test Unconsolidated Undrained (UU)		Direct Shear		Unconfined Compression Stregth[8] (ksf)
					Wet Density (pcf)	Dry Density (pcf)	Liquid Limit (%)	Plasticity Index (%)	Gravel (%)	Sand (%)	Fines (%)	Silt (%)	Clay (%)	Confining Pressure σ_3 (psf)	Deviator Stress (σ_1-σ_3) (psf)	Friction Angle Ø (deg)	Cohesion (psi)	
MM-01	5.5	MC-2B	SANDY Lean CLAY (CL)	22.9	125.4	102.1	25	9										
MM-01	6	MC-2A	SANDY SILT (ML)								59.3							
MM-01	11.5	SH-3	SANDY Lean CLAY (CL)				29	11						1200	860			
MM-01	15	MC-4A	SILTY SAND with GRAVEL (SM)	14.4	140.8	123.1			25	56	19	12	7					
MM-01	15.3	MC-4B																
MM-01	21.5	U-5	Poorly-graded GRAVEL with CLAY and SAND (GP-GC)	12	138.7	123.9			49	42	9							
MM-01	30	SPT-7	CLAYEY SAND with GRAVEL (SC)						37	47	16							
MM-01	38.5	MC-9		11.2	143.7	129.2												
MM-01	42.3	MC-11.5		16.8	141.7	121.3												
MM-01	45	SPT-12	Well graded SAND with CLAY and GRAVEL (SW-SC)						36	52	12							
MM-02	5	MC-3	CLAYEY SAND (SC)	14.5	121.6	106.2	26	7			48.9							
MM-02	10	MC-4A	SANDY Lean CLAY (CL)	18.8	131.9	111	25	12										
MM-02	15	SS-5	CLAYEY SAND with GRAVEL (SC)						46	40	14							
MM-02	27	U-6	Well-graded GRAVEL with clay and SAND (GW-GC)						65	29	6							
MM-02	27.3	U-6.5		5.2														
MM-02	40	U-9		12.1	152	135.6												
MM-03	5	MC-3	Lean CLAY with SAND (CL)	13	97.2	86	26	11										
MM-03	7.5	MC-4B		19.9	131.4	109.5												
MM-03	10	SS-5	Clayey SAND (SC)								23.9							
MM-03	15.5	MC-6A		13.2	124.4	109.9												
MM-04	5	SS-1	SANDY Lean CLAY (CL)								54.4							
MM-04	10.7	MC-2B	Fat CLAY with SAND (CL)	28.8	111.5	86.5	66	37			77.6							
MM-04	15.5	MC-3	Lean CLAY with SAND (CL)	26.1	110.1	87.3					76.3							

Table 5-2. Laboratory Test Results, Previous Geotechnical Investigations

Boring ID	Sample Depth (ft)	Sample ID	Material Description	Moisture Content[1] (%)	Density (pcf)		Atterberg Limits		Gradation			Hydrometer		Triaxial Test Unconsolidated Undrained (UU)		Direct Shear		Unconfined Compression Stregth[8] (ksf)
					Wet Density (pcf)	Dry Density (pcf)	Liquid Limit (%)	Plasticity Index (%)	Gravel (%)	Sand (%)	Fines (%)	Silt (%)	Clay (%)	Confining Pressure σ_3 (psi)	Deviator Stress (σ_1-σ_3) (psi)	Friction Angle Ø (deg)	Cohesion (psf)	
RB-1	5	1	Lean CLAY (CL)	26		94												2.73
RB-1	6.5	2	Lean CLAY (CL)						0	9	91	45	46					
RB-1	10	3	Lean CLAY (CL)	25		98												
RB-1	11.5	4	Lean CLAY (CL)				38	15										
RB-1	15	5	Lean CLAY (CL)	25		102			0	11	89	47	42					1.36
RB-1	20	7	Clayey SAND with GRAVEL (SC)	14		124			30	42	28							
RB-1	25	9	Clayey SAND with GRAVEL (SC)	11		131												
RB-2	5	1	Lean CLAY (CL)	24			28	8										
RB-2	10	2	SANDY lean CLAY (CL)	22		104										21	870	0.9
RB-2	11.5	3	SANDY lean CLAY (CL)	24		101			0	30	70	32	38					
RB-2	16	4	CLAYEY GRAVEL with SAND (GC)	10		127			40	34	26							
RB-2B	22	1	CLAYEY GRAVEL with SAND (GC)	16		118												
RB-2B	27	2	CLAYEY SAND with GRAVEL (GC)	21		101												
RB-2B	33	4	CLAYEY SAND with GRAVEL (SC)	16		122												
RB-2B	38	6	CLAYEY SAND with GRAVEL (SC)	12		131												
B-1	4	1	Lean CLAY with SAND and GRAVEL	18		100												
B-1	7.5	2	SILTY SAND (SM)	9		107	38	12										
B-1	12.5	3	CLAYEY SAND with GRAVEL (SC)	13														
B-1	17.5	4	CLAYEY SAND with GRAVEL (SC)	15														
B-3	2.5	1	CLAYEY GRAVEl with SAND (GC)	11		110			43	36	21	12	9					1.79
B-3	7.5	2	CLAYEY GRAVEL with SAND (GC)	9		119			46	33	21	11	10					3.48
B-3	12.5	4	CLAYEY GRAVEL with SAND (GC)	13		123	41											1.68
B-3	17.5	6	Well-graded GRAVEL with CLAY and SAND (GW- GC)	14		127												1.7
B-3	19	7	Well-graded GRAVEL with CLAY and SAND (GW- GC)						55	33	12	6	6					
B-3	22.5	8	CLAYEY SAND with GRAVEL (SC)	13														

Boring ID	Sample Depth (ft)	Sample ID	Material Description	Moisture Content[1] (%)	Density (pcf)		Atterberg Limits		Gradation			Hydrometer		Triaxial Test Unconsolidated Undrained (UU)		Direct Shear		Unconfined Compression Stregth[8] (ksf)
					Wet Density (pcf)	Dry Density (pcf)	Liquid Limit (%)	Plasticity Index (%)	Gravel (%)	Sand (%)	Fines (%)	Silt (%)	Clay (%)	Confining Pressure σ_3 (psi)	Deviator Stress (σ_1-σ_3) (psi)	Friction Angle Ø (deg)	Cohesion (psf)	
B-4	2.5	1	Lean CLAY with SAND and GRAVEL (CL)	12		106												0.77
B-4	7.5	2	Clayey GRAVEL with SAND (GC)	11		109												1.1
B-4	12.5	4	Well-graded SAND with CLAY and GRAVEL (SW- SC)	12		124												2.1
B-4	14	5	Well-graded SAND with CLAY and GRAVEL (SW- SC)						38	52	10							
B-4	17.5	6	Well-graded SAND with CLAY and GRAVEL (SW- SC)	10														
B-8	2.5	1	Lean CLAY with SAND (CL)	14														
B-8	7.5	3	CLAYEY SAND with GRAVEL (SC)	13		118	56	31										2.39
B-8	9	4	CLAYEY SAND with GRAVEL (SC)						41	43	16							
B-8	12.5	5	CLAYEY SAND with GRAVEL (SC)	10		126												
B-10	2.5	1	SANDY Lean CLAY with Gravel (CL)	17														
B-10	4	2	CLAYEY SAND with GRAVEL (SC)	12														
B-10	7.5	3	CLAYEY SAND (SC)	8														
B-10	12.5	4	CLAYEY SAND (SC)	11														
B-7	2.5	1	Lean CLAY with SAND (CL)	15		111												0.62
B-7	7.5	3	CLAYEY SAND (SC)	24		100	51	25										1.41
B-7	9	4	CLAYEY SAND (SC)						0	64	36							
B-7	12.5	5	CLAYEY SAND (SC) and SILTY SAND (SM)	25		95												

6 References

ASTM, 2016b. ASTM D1587/D1587M-15, *Standard Practice for Thin-Walled Tube Sampling of Fine-Grained Soils for Geotechnical Purposes*, ASTM International, West Conshohocken, Pennsylvania, at URL http://www.astm.org

ASTM, 2016a. ASTM D6151/D6151M-15, *Standard Practice for Using Hollow-Stem Augers for Geotechnical Exploration and Soil Sampling*. ASTM International, West Conshohocken, Pennsylvania, at URL www.astm.org.

ASTM, 2017a. ASTM D2488-17e1, Standard Practice for Description and Identification of Soils (Visual-Manual Procedures), ASTM International, West Conshohocken, Pennsylvania, at URL http://www.astm.org.

ASTM, 2017b. ASTM D2487-17e1, *Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)*, ASTM International, West Conshohocken, Pennsylvania, at URL http://www.astm.org.

ASTM, 2017c. ASTM D4318-17e1, *Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils*, ASTM International, West Conshohocken, Pennsylvania, at URL http://www.astm.org.

ASTM, 2017d. ASTM D6913 / D6913M-17, *Standard Test Methods for Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis*, ASTM International, West Conshohocken, Pennsylvania, at URL http://www.astm.org.

ASTM, 2017e. ASTM D1140-17, *Standard Test Methods for Determining the Amount of Material Finer than 75-µm (No. 200) Sieve in Soils by Washing*. ASTM International, West Conshohocken, Pennsylvania, at URL www.astm.org.

ASTM, 2017f. ASTM D7928-17, *Standard Test Method for Particle-Size Distribution (Gradation) of Fine-Grained Soils Using the Sedimentation (Hydrometer) Analysis*, ASTM International, West Conshohocken, Pennsylvania, at URL http://www.astm.org.

ASTM, 2018b. ASTM D3550/D3550M-17, *Standard Practice for Thick Wall, Ring-Lined, Split Barrel, Drive Sampling of Soils*, ASTM International, West Conshohocken, Pennsylvania, at URL http://www.astm.org.

ASTM, 2018a. ASTM 5783-18, *Standard Guide for Use of Direct Rotary Drilling with Water-Based Drilling Fluid for Geoenvironmental Exploration and the Installation of Subsurface Water-Quality Monitoring Devices*, ASTM International, West Conshohocken, Pennsylvania, at URL http://www.astm.org.

ASTM, 2019. ASTM D2216-19, *Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass*. ASTM International, West Conshohocken, Pennsylvania, at URL http://www.astm.org.

ASTM, 2021. ASTM D7263-21, *Standard Test Methods for Laboratory Determination of Density and Unit Weight of Soil Specimens*. ASTM International, West Conshohocken, Pennsylvania, at URL http://www.astm.org.

ASTM, 2022. ASTM D1586/D1586M-18e1, *Standard Test Method for Standard Penetration Test (SPT) and Split-Barrel Sampling of Soils*. ASTM International, West Conshohocken, Pennsylvania, at URL http://www.astm.org.

ASTM, 2023. ASTM D2850-23, *Standard Test Method for Unconsolidated-Undrained Triaxial Compression Test on Cohesive Soils*. ASTM International, West Conshohocken, Pennsylvania, at URL http://www.astm.org.

State of California Department of Transportation (Caltrans), Division of engineering Services, Geotechnical Services. 2010. *Logging Classification, and Presentation Manual.*

California Geologic Survey. 1983. *State of California Special Studies Zones, Healdsburg Quadrangle, Revised Official Map.* July 1983.

Delatre. M., California Geologic Survey. 2011. *Preliminary Geologic Map of The Healdsburg 7.5' Quadrangle, Sonoma County, California: A Digital Database.*

DCM GeoEngineers. 2009. *Geotechnical Engineering Investigation Report, City of Healdsburg Recycled Water Systems Project, Healdsburg, California*. September 2009

Hecker, S. and Randolph Loar, C.E. United States Geologic Survey. 2018. *Map of Recently Active Traces of the Rodgers Creek Fault, Sonoma County, California.*

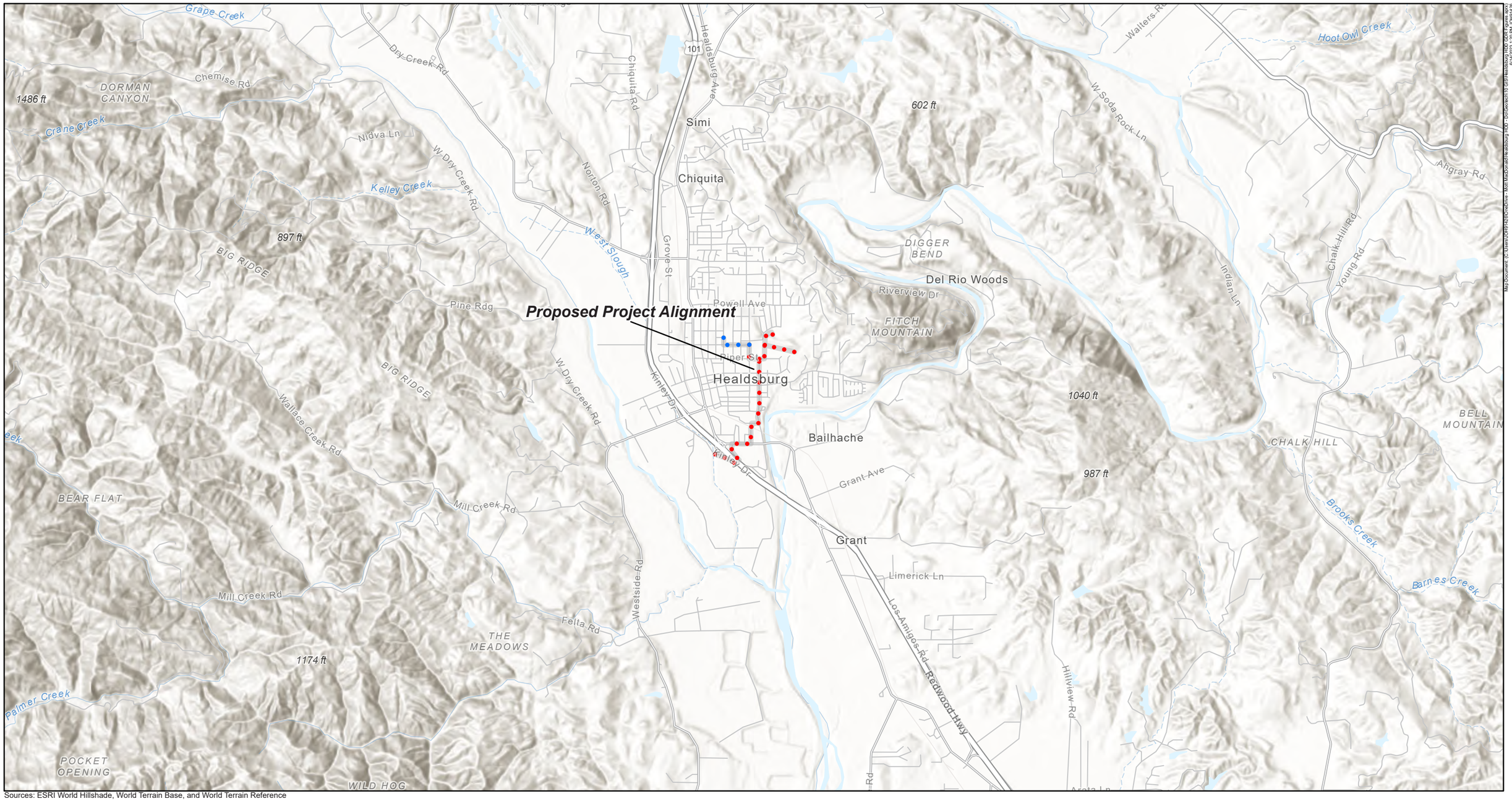
Robert C. Witter, Keith L. Knudsen, Janet M. Sowers, Carl M. Wentworth, Richard D. Koehler, Carolyn E. Randolph. United States Geologic Survey. 2006. *Maps of Quaternary Deposits and Liquefaction Susceptibility in the Central San Francisco Bay Region, California, Liquefaction Susceptibility*.

United States Geologic Survey (USGS), *Unified Hazard Tool*, Retrieved 3/26/2023, from https://earthquake.usgs.gov/hazards/interactive/

West Yost. 2007. *Title 22 Recycled Water Engineering Report*. September 2007.

West Yost. 2023. *Municipal Recycled Water Pipeline Preliminary Design Report*. April 2023.

.



Sources: ESRI World Hillshade, World Terrain Base, and World Terrain Reference

N
W E
S

0 1 Miles

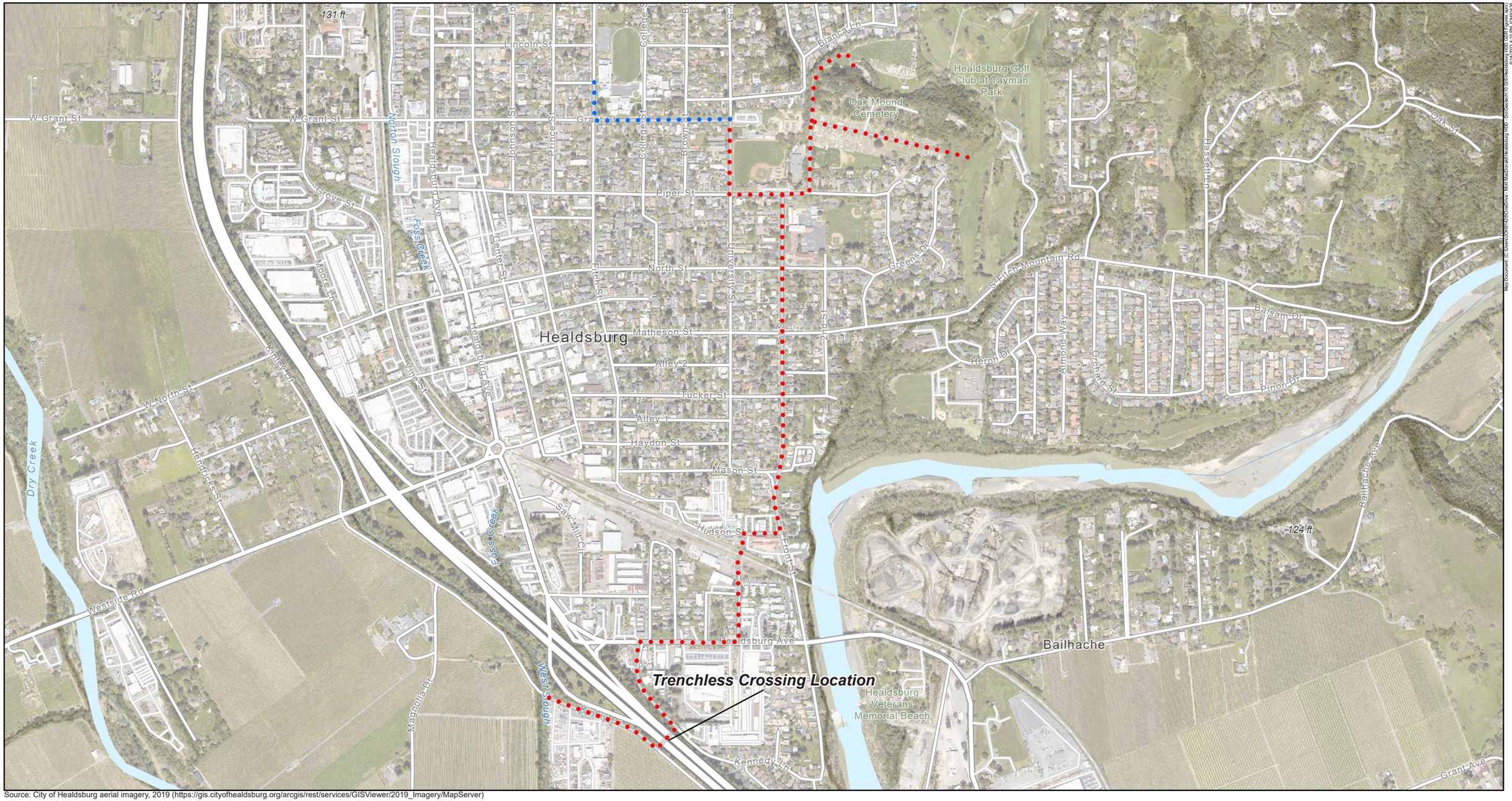
Site Vicinity Map

Geotechnical Data Report
Municipal Recycled Water Pipeline
City of Healdsburg
Sonoma County, California

June 2023

MOTT MACDONALD

Figure 1



Source: City of Healdsburg aerial imagery, 2019 (https://gis.cityofhealdsburg.org/arcgis/rest/services/GISViewer/2019_Imagery/MapServer)

N
W E
S

0 1,000 Feet

Proposed Project Alignment
Optional Project Alignment

Proposed Alignment and Investigation Locations

Geotechnical Data Report
Municipal Recycled Water Pipeline
City of Healdsburg
Sonoma County, California

June 2023

MOTT MACDONALD

Figure 2

Geologic Units

- Artificial fill (af)
- Bedrock (br)
- Artificial dam fill, historical (adf)
- Gravel quarries and percolation ponds (gq)
- Historical stream channel deposits (Qhc)
- Stream terrace deposits (Qhty)
- Latest Holocene alluvial deposits, undifferentiated (Qhay)
- Stream terrace deposits (Qht)
- Holocene alluvial deposits, undifferentiated (Qha)
- Stream terrace deposits (Qt)
- Latest Pleistocene to Holocene alluvial deposits, undifferentiated (Qa)
- Stream terrace deposits (Qpt)
- Latest Pleistocene alluvial deposits, undifferentiated (Qpa)
- Early to late Pleistocene alluvial deposits, undifferentiated (Qoa)
- Younger alluvial deposits, undifferentiated (Qoa1)
- water

Source: Witter, R.C., Knudsen, K.L, Sowers, J.M., Wentworth, C.M., Koehler, R.D., Randolph, C. E. , Brooks, S.K., and Gans, K.D., 2006, Maps of Quaternary Deposits and Liquefaction Susceptibility in the Central San Francisco Bay Region, California: U.S.

N
W E
S

0 2,000 Feet

- Proposed Project Alignment
- Optional Project Alignment

Regional Geology

Geotechnical Data Report
Municipal Recycled Water Pipeline
City of Healdsburg
Sonoma County, California

June 2023

MOTT MACDONALD

Figure 3

USGS Quaternary Faults

- historical (<150 years), well constrained location
- historical (<150 years), moderately constrained location
- historical (<150 years), inferred location
- latest Quaternary (<15,000 years), well constrained location
- latest Quaternary (<15,000 years), moderately constrained location
- latest Quaternary (<15,000 years), inferred location
- late Quaternary (<130,000 years), well constrained location
- late Quaternary (<130,000 years), moderately constrained location
- late Quaternary (<130,000 years), inferred location
- undifferentiated Quaternary(<1.6 million years), well constrained location
- undifferentiated Quaternary(<1.6 million years), moderately constrained location
- undifferentiated Quaternary(<1.6 million years), inferred location

Source: U.S. Geological Survey and California Geological Survey, Quaternary fault and fold database for the United States, accessed September 2021, at: https://www.usgs.gov/natural-hazards/earthquake-hazards/faults

N
W E
S

0 4 Miles

Historic Earthquakes, M3.5 and greater

- Magnitude 3.5 to 4.0
- Magnitude 4.0 to 5.0

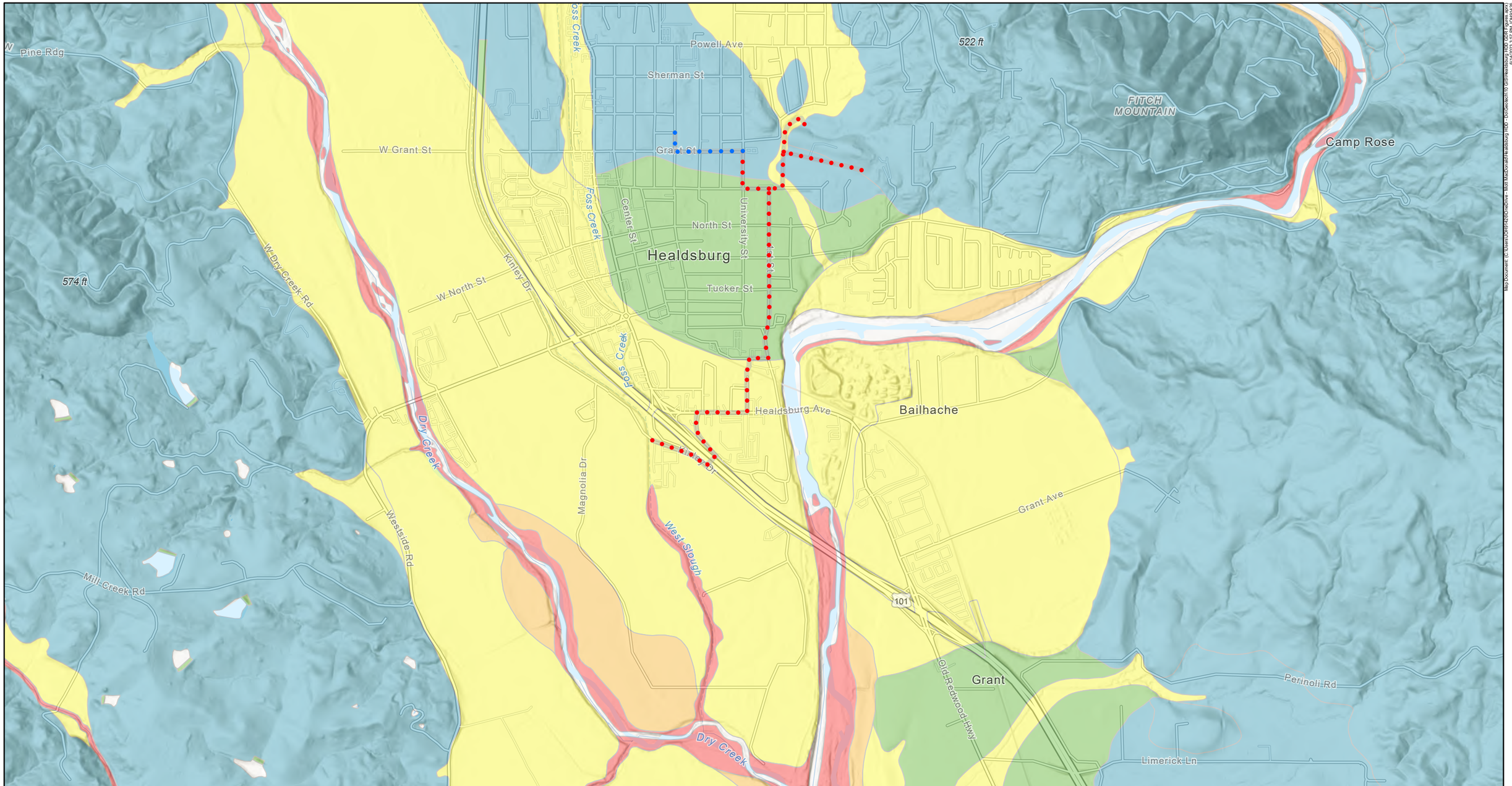
Quaternary Faults and Historic Seismicity

Geotechnical Data Report
Municipal Recycled Water Pipeline
City of Healdsburg
Sonoma County, California

June 2023

MOTT MACDONALD

Figure 4



Source: Witter, R.C., Knudsen, K.L, Sowers, J.M., Wentworth, C.M., Koehler, R.D., Randolph, C. E. , Brooks, S.K., and Gans, K.D., 2006, Maps of Quaternary Deposits and Liquefaction Susceptibility in the Central San Francisco Bay Region, California: U.S.

N
W E
S

0 2,000 Feet

Mapped Liquefaction Susceptibility

- Very High
- High
- Moderate
- Low
- Very Low

- Proposed Project Alignment
- Optional Project Alignment

Mapped Liquefaction Susceptibility

Geotechnical Data Report
Municipal Recycled Water Pipeline
City of Healdsburg
Sonoma County, California

June 2023

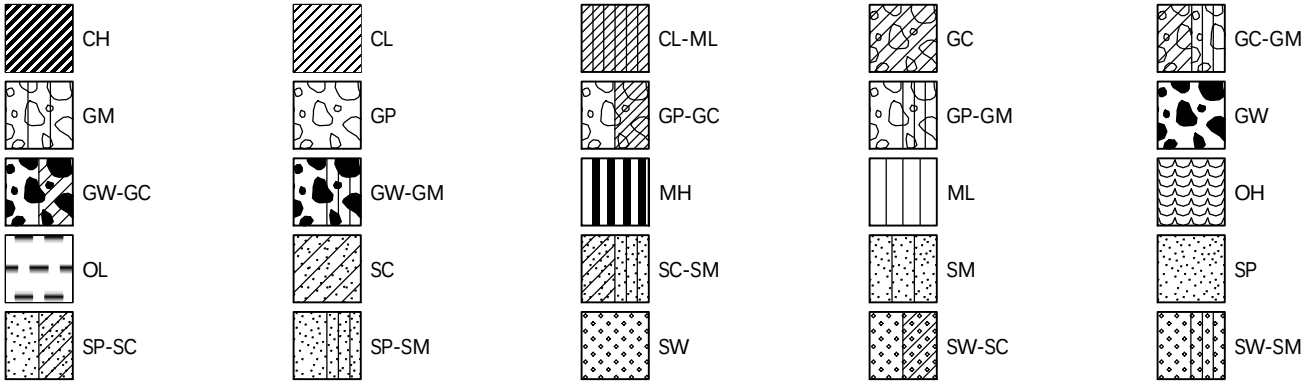
MOTT MACDONALD

Figure 5

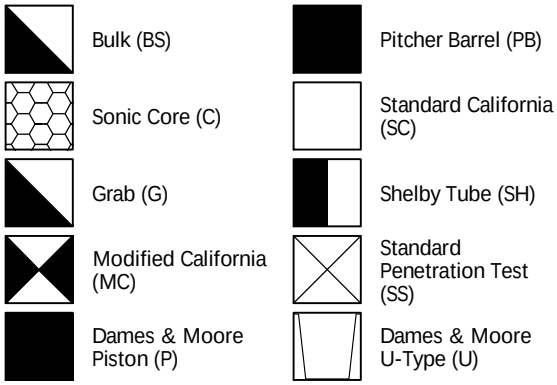
Appendices

A. Borehole Logs

SOIL STRATIGRAPHY



SAMPLE TYPE



NOTES

1. Classification of Soils per Caltrans Logging Manual (2010) with the exception of N-value to density correlations, which are not adjusted for ER_i.

2. A solid layer line boundary indicates that the layer change was observed in the retained sample or through cuttings and rig behavior.

3. A dashed layer line boundary indicates a layer change occurred between samples, but was not observed from cuttings or rig behavior.

SAMPLER DIMENSIONS

Sample Type	BS	G	MC	P	PB	SC	SH	SS	U
Length (in.)	Varies	Varies	18	18	30	18	30	18	18
Inside Dia. (in.)			2.375	2.375	2.875	2.0	2.875	1.375	2.375
Hammer Wt. (lb.)			140	Hydraulic	Hydraulic	140	Hydraulic	140	140
Hammer Fall (in.)			30	Push	Push	30	Push	30	30

ABBREVIATIONS

LL	LIQUID LIMIT (%)	OC	ORGANIC CONTENT	CONSOL	ONE DIMENSIONAL CONSOLIDATION
PL	PLASTIC LIMIT (%)	AL	ATTERBERG LIMITS	TXUU	UNCONSOLIDATED UNDRAINED
PI	PLASTIC INDEX (%)	P200	PASSING NO. 200 SIEVE (%)	TXCU	TRIAXIAL CONSOLIDATED UNDRAINED
MC	MOISTURE CONTENT	PSD	PARTICLE SIZE DISTRIBUTION	TXCD	TRIAXIAL CONSOLIDATED DRAINED
MD	MOISTURE AND DENSITY	H	HYDROMETER ANALYSIS	VWP	TRIAXIAL VIBRATING WIRE PIEZOMETER
SG	SPECIFIC GRAVITY	DS	DIRECT SIMPLE SHEAR		

CONSISTENCY

Cohesive Soils	Blows/ft (SPT)	PP (tsf)	PTV (tsf)
Very Soft	0 - 2	< 0.25	< 0.12
Soft	2 - 4	< 0.50	< 0.25
Medium Stiff	4 - 8	< 1.00	< 0.50
Stiff	8 - 15	< 2.00	< 1.00
Very Stiff	15 - 30	< 4.00	< 2.00
Hard	> 30	> 4.00	> 2.00

RELATIVE DENSITY

Granular Soils	Blows/ft (SPT)
Very Loose	0 - 5
Loose	5 - 10
Medium Dense	10 - 30
Dense	30 - 50
Very Dense	> 50

SOIL PROPORTION

Term	(%)
Trace	< 5
Few	< 10
Little	< 30
Some	< 50
Mostly	> 50

MOTT MACDONALD

Municipal Recycled Water Pipeline

City of Healdsburg

TERMS AND SYMBOLS

BOREHOLE LOG

BOREHOLE NO.
MM-01

Project:	Healdsburg-Municipal Recycled Water Pipeline Project	**Project No.:**	504100918
Client:	West Yost	**Date Start:**	05/02/2023
Location:	Kinley Drive	**Date End:**	05/03/2023
Field Staff:	Joseph Ang	**Drill Rig:**	Mobile B-80
Drilling Co.:	Gregg Drilling	**Hammer Type:**	Automatic hammer
Drillers:	Jamie, Luis	**Hammer Energy:**	%
Northing:	1,982,033.548 **Easting:** 6,314,354.254	**H. Datum:**	NAD 1983 State Plane, CA Zone II (US Feet)
Elevation:	97.7 ft	**V. Datum:**	NAVD88

Elevation (ft)	Depth (ft)	Sample Graphic	Sample Number	Recovery[1] (in) (Penetration) (in)	Blow Counts Pressure (psi)	Stratum Graphic	USCS Symbol	Material Description[2] [3]	Remarks
							SP-SM	Poorly graded SAND with SILT and GRAVEL (SP-SM); dense; brown; dry to moist; mostly fine to coarse sand; little fine to coarse GRAVEL; few SILT; (FILL).	9:58-10:25 hand auger to 5 feet. 10:25 to 10:55 loosen top 2 feet of soil with 18 garbage barrel to prep for box Mud rotary from 0' to 50.8'
			G-1					SANDY lean CLAY (CL); medium stiff; dark brown; moist; little very fine sand; nonplastic.	
93	5		MC-2	18 (18)			CL		At 5 feet switch to 5 inch mud rotary
									At 6.5 feet PP = 0.5 tsf
88	10		SS	18 (18)	3 3 4			Sandy lean CLAY (CL); medium stiff; dark brown; wet; some fine SAND, few fine GRAVEL; low plasticity; medium dry strength.	
			SH-3	30 (30)	375		CL		
83	15		MC-4	17 (18)	3 6 6				
							SM	Silty SAND with GRAVEL (SM); medium dense; dark brown with reddish brown and greenish grey mottling; wet; fine to coarse GRAVEL, fine to coarse SAND, few CLAY fines.	
78								SILTY GRAVEL with SAND (GM); dense; brown; wet; fine to coarse rounded GRAVEL; some fine SAND.	

Water Level Depth (ft)

Date	Bottom of Hole	Bottom of Casing	Water	Drilling Fluid

Sample Type

Notes:

1.) Light gray shading indicates length of sample recovery.

2.) Soil descriptions between sampled depths logged from cuttings or rig behavior.

3.) Maximum Particle Size observed may be limited by sampler dimensions.

BOREHOLE LOG

BOREHOLE NO.
MM-01

Elevation (ft)	Depth (ft)	Sample Number	Recovery[1] (in) (Penetration) (in)	Blow Counts Pressure (psi)	USCS Symbol	Material Description[2,3]	Remarks
		SS	0 (18)	21 21 13	GM	SILTY GRAVEL with SAND (GM); dense; brown; wet; fine to coarse rounded GRAVEL; some fine SAND.	2 inch gravel plugs SPT shoe
		U-5	8 (18)	7 14 20	GP-GC	Poorly graded GRAVEL with CLAY and SAND (GP-GC); Dense; brown; wet; mostly fine to coarse GRAVEL, little fine to coarse SAND, rounded GRAVEL; trace Silt.	3 to 4 inch cobbles in cuttings
73	25	U-6	6 (12)	14 50/6"			
					SC	CLAYEY SAND with GRAVEL (SC); very dense; yellowish brown; wet; coarse SAND; little fine to coarse GRAVEL; low plasticity fines.	At 29 feet, gravel broken by SPT
68	30	SS-7	8 (18)	22 35 36			
					GC	CLAYEY GRAVEL with SAND (GC); very dense; yellowish brown; wet; fine to coarse GRAVEL; medium to coarse SAND; low plasticity fines. At 35 feet quartz cobble in sample.	At 33 feet driller notes clayey drilling
63	35	U-8	6 (18)	31 39 42			
		MC-9	8 (12)	25 50/6"			
58	40	SS-10	12 (18)	13 20 14	CL	Lean CLAY (CL); very stiff to hard; greenish gray; wet; few fine to coarse GRAVEL; low plasticity.	
		MC-11	14 (18)		GC	CLAYEY GRAVEL with SAND (GC); very dense; greenish gray; wet; mostly fine to coarse sub-angular GRAVEL; little medium to coarse SAND; low plasticity fines.	At 42 feet clear clay plugging drill bit. Blow counts not recorded 5" casing installed to 44'
53	45	SS-12	11.5 (12)	22 50/6"	SW-SC	Well graded SAND with CLAY and GRAVEL (SW-SC); very dense; dark brown; wet; fine GRAVEL; medium coarse SAND. Grades with few clay at 50 feet.	
48							

1.) Light gray shading indicates length of sample recovery.

2.) Soil descriptions between sampled depths logged from cuttings or rig behavior.

3.) Maximum Particle Size observed may be limited by sampler dimensions.

BOREHOLE LOG

BOREHOLE NO.
MM-01

Elevation (ft)	Depth (ft)	Sample Graphic	Sample Number	Recovery[1] (in) (Penetration) (in)	Blow Counts Pressure (psi)	Stratum Graphic	USCS Symbol	Material Description[2] [3]	Remarks
			U-13	4 (9)	25 50/3"			Well graded SAND with CLAY and GRAVEL (SW-SC); very dense; dark brown; wet; fine GRAVEL; medium coarse SAND. Grades with few clay at 50 feet.	
								Borehole terminated at a depth of 50.8 feet below ground surface and completed as a standpipe piezometer.	
43	55								
38	60								
33	65								
28	70								
23	75								
18									

1.) Light gray shading indicates length of sample recovery.

2.) Soil descriptions between sampled depths logged from cuttings or rig behavior.

3.) Maximum Particle Size observed may be limited by sampler dimensions.

BOREHOLE LOG

BOREHOLE NO.
MM-02

Project:	Healdsburg-Municipal Recycled Water Pipeline Project	**Project No.:**	504100918
Client:	West Yost	**Date Start:**	03/15/2023
Location:	Kennedy Lane	**Date End:**	03/16/2023
Field Staff:	Joseph Ang	**Drill Rig:**	Mobile B-80
Drilling Co.:	Gregg Drilling	**Hammer Type:**	Automatic hammer
Drillers:	Jaime, Luis	**Hammer Energy:**	%
Northing:	1,982,223.927 **Easting:** 6,314,525.002	**H. Datum:**	NAD 1983 State Plane, CA Zone II (US Feet)
Elevation:	97 ft	**V. Datum:**	NAVD88

Elevation (ft)	Depth (ft)	Sample Graphic	Sample Number	Recovery[1] (in) (Penetration) (in)	Blow Counts	Stratum Graphic	USCS Symbol	Material Description[2] [3]	Remarks
							-	1.5 inches of asphalt.;	
			G-G-1				-	22.5 inches of asphalt base;	Hand auger to 5 feet Mud rotary from 0' to 51.5'
			G-G-2				SC	CLAYEY SAND (SC); very stiff; brown; dry; some fine sand; few fine to coarse GRAVEL; nonplastic; 3 feet grades moist.	
92	5		MC-3	14 (18)	4 6 8		SC	Rootlets, low dry strength grades moist to wet, no coarse GRAVEL (SC);	At 6 feet PP = 3.0 tsf
	▼								At 10 feet encounter water table
87	10		MC-4	14 (18)	2 4 4		CL	SANDY Lean CLAY (CL); medium stiff; brown; wet; some fine sand; trace of fine GRAVEL; low plasticity.	At 11 feet PP = 0.75 tsf Wait 45 min, then read groundwater at 7.37 feet below ground surface.
82	15		SS-5	8 (18)	10 13 13		SP	CLAYEY SAND with GRAVEL (SP); medium dense; brown with orange and white mottling; wet; mostly fine to coarse sand; little fine to coarse rounded gravel up to 1.5 inches.	12:00 -13:15 setup rotary wash. At 12 feet medium sand in cuttings. From 12 to 30 feet fluid loss of approximately 200 gallons, Gregg adds more drilling mud.

Water Level Depth (ft)

Date	Bottom of Hole	Bottom of Casing	Water	Drilling Fluid
03/15/23		10	10	
03/15/23		10	7.4	
03/15/23			7.2	
03/15/23			7.3	

Sample Type

Notes:

1.) Light gray shading indicates length of sample recovery.

2.) Soil descriptions between sampled depths logged from cuttings or rig behavior.

3.) Maximum Particle Size observed may be limited by sampler dimensions.

BOREHOLE LOG

BOREHOLE NO.
MM-02

Elevation (ft)	Depth (ft)	Sample Graphic	Sample Number	Recovery[1] (in) (Penetration) (in)	Blow Counts	Stratum Graphic	USCS Symbol	Material Description[2] [3]	Remarks
			U	0.1 (18)	3 3 6			Well-graded GRAVEL with CLAY and SAND (GW-GC); medium dense;; brown; wet; mostly fine to coarse GRAVEL, subangular to rounded up to 3 inches; some medium to coarse SAND; low plasticity fines.	Hole caves, flush hole and add more drilling mud.
			U	0.1 (18)	3 7 17				14:32 attempt U sample at 22 feet but hole caved 5 feet, install casing to 22 feet.
72	25		U-6	7 (18)	9 29 30				
67	30		U-7	6.5 (18)	5 16 27		GW-GC		
62	35		SS-8	8 (18)	13 19 15				
57	40		U-9	6 (18)	16 34 38			CLAYEY GRAVEl with SAND (GC); dense: brown with white and orange mottling; wet; some fine to coarse subangular to rounded GRAVEL; some coarse SAND; moderate cementation.	3 inch cobble in rings
52	45		U-10	12 (18)	29 30 30		GC		
							CL	LEAN CLAY (CL); hard; dark brown with orange mottling; moist; few coarse sand; low plasticity; at 50 feet grades with coarse sand.	At 48 feet driller notes easier drilling.

1.) Light gray shading indicates length of sample recovery.

2.) Soil descriptions between sampled depths logged from cuttings or rig behavior.

3.) Maximum Particle Size observed may be limited by sampler dimensions.

BOREHOLE LOG

BOREHOLE NO.
MM-02

Elevation (ft)	Depth (ft)	Sample Graphic	Sample Number	Recovery[1] (in) (Penetration) (in)	Blow Counts	Stratum Graphic	USCS Symbol	Material Description[2] [3]	Remarks
			SS-11	14 (18)	9 20 25			LEAN CLAY (CL); hard; dark brown with orange mottling; moist; few coarse sand; low plasticity; at 50 feet grades with coarse sand.	
								Borehole terminated at a depth of 51.5 feet below ground surface and backfilled with neat cement grout, tremie method, full depth.	
42	55								
37	60								
32	65								
27	70								
22	75								

1.) Light gray shading indicates length of sample recovery.

2.) Soil descriptions between sampled depths logged from cuttings or rig behavior.

3.) Maximum Particle Size observed may be limited by sampler dimensions.

BOREHOLE LOG

BOREHOLE NO.
MM-03

Project:	Healdsburg-Municipal Recycled Water Pipeline Project	**Project No.:**	504100918
Client:	West Yost	**Date Start:**	03/16/2023
Location:	Healdsburg Avenue	**Date End:**	03/16/2023
Field Staff:	Joseph Ang	**Drill Rig:**	Mobile B-80
Drilling Co.:	Gregg Drilling	**Hammer Type:**	Automatic hammer
Drillers:	Jaime, Luis	**Hammer Energy:**	%
Northing:	1,982,915.164 **Easting:** 6,314,715.896	**H. Datum:**	NAD 1983 State Plane, CA Zone II (US Feet)
Elevation:	99 ft	**V. Datum:**	NAVD88

Elevation (ft)	Depth (ft)	Sample Graphic	Sample Number	Recovery[1] (in) (Penetration) (in)	Blow Counts	Stratum Graphic	USCS Symbol	Material Description[2] [3]	Remarks
							-	6 inches of asphalt pavement;	Hand auger to 5 feet below ground surface. HSA from 0' to 16.5'
			G-1				SW-SC	Well graded SAND with CLAY and GRAVEL (SW-SC); dense; dark brown; moist; fine to coarse SAND; little fine GRAVEL.	
			G-2				CL	Lean CLAY with SAND (CL) (CL); medium stiff; brown; moist to wet; some fine SAND; low plasticity; high dry strength	
94	5		MC-3	2 (18)	5 4 4				
			MC-4	18 (18)	3 3 3		CL	Lean CLAY (CL); soft to medium stiff; brown; wet; some fine sand; high dry strength	Encountered groundwater after driving sample PP = 0.5 tsf
89	10		SS-5	9 (18)	5 6 8		SC	Clayey SAND (SC); medium dense; orange brown; wet; fine to coarse SAND; few fine GRAVEL, low plasticity fines.	
84	15		MC-6	14 (18)	8 13 15		GC	CLAYEY GRAVEL with SAND (GC); medium dense; brown; wet; some fine to coarse GRAVEL up to 2.5 inches; some fine to coarse SAND; low plasticity fines	6 inch casing installed to 16.5 feet.
								Borehole terminated at a depth of 16.5 feet below ground surface and backfilled with neat cement grout, tremie method, full depth.	

Water Level Depth (ft)

Date	Bottom of Hole	Bottom of Casing	Water	Drilling Fluid
03/16/23	8.5		7	

Sample Type

Notes:

1.) Light gray shading indicates length of sample recovery.

2.) Soil descriptions between sampled depths logged from cuttings or rig behavior.

3.) Maximum Particle Size observed may be limited by sampler dimensions.

BOREHOLE LOG

Page 1 of 1

BOREHOLE NO.
MM-04

Project:	Healdsburg-Municipal Recycled Water Pipeline Project	**Project No.:**	504100918
Client:	West Yost	**Date Start:**	03/17/2023
Location:	Oak Mound Cemetery	**Date End:**	03/17/2023
Field Staff:	Joseph Ang	**Drill Rig:**	Mobile B-80
Drilling Co.:	Gregg Drilling	**Hammer Type:**	Automatic hammer
Drillers:	Jaime, Luis	**Hammer Energy:**	%
Northing:	1,987,578.083 **Easting:** 6,315,725.431	**H. Datum:**	NAD 1983 State Plane, CA Zone II (US Feet)
Elevation:	141.7 ft	**V. Datum:**	NAVD88

Elevation (ft)	Depth (ft)	Sample Graphic	Sample Number	Recovery[1] (in) (Penetration) (in)	Blow Counts	Stratum Graphic	USCS Symbol	Material Description[2] [3]	Remarks
							GW-GC	Well graded GRAVEL with CLAY and SAND (GW-GC); dense; light brown; dry; fine to coarse grounded GRAVEL up to 3 inches; fine to coarse SAND; low plasticity fines. At 2.5 feet cobbles and boulders.	HSA from 0' to 16.5' Hand auger to 2.5 feet
137	5		SS-1	8 (18)	8 14 14		CH	Fat CLAY with SAND (CH); very stiff; light brown; dry; fine to coarse SAND;	
132	10		MC-2	12 (12)	35 50/6"		CL	Lean CLAY with SAND (CL); hard; light grayish brown; dry; little fine sand; medium plasticity; high dry strength.	At 11 feet PP>4.5 tsf
127	15		MC-3	9 (18)	13 25 30				At 15.5 feet PP>4.5 tsf
122								Borehole terminated at a depth of 16.5 feet below ground surface and backfilled with neat cement grout, tremie method, full depth.	

Water Level Depth (ft)

Date	Bottom of Hole	Bottom of Casing	Water	Drilling Fluid

Sample Type

Notes:

1.) Light gray shading indicates length of sample recovery.

2.) Soil descriptions between sampled depths logged from cuttings or rig behavior.

3.) Maximum Particle Size observed may be limited by sampler dimensions.

B. Laboratory Test Results

MOISTURE & DENSITY TEST

Client : Mott MacDonald Project : Healdsburg HDD Project ISI Lab No.: G-67612 Job no : 504100918

	Boring #	MM-01	MM-01	MM-01	MM-01	MM-01	MM-02	MM-02	MM-02
	Sample #	MC-2B	MC-4B	U-5	MC-9	MC-11.5	MC-3	MC-4A	U-6.5
	Depth (ft.)	5.5	15.3	21.5	38.5	42.3	5.5	10	27.3
	Soil type: (visual)	Brown sandy clay	Grayish brown clayey sand with gravel	Brown poorly graded gravel with clay and sand	Greenish gray clayey gravel with sand	Greenish gray clay with sand	Brown silty, clayey sand	Brown sandy clay	Brown clayey gravel with sand
1.	Date tested:	06/09/23	06/09/23	06/09/23	06/09/23	06/09/23	6/9/2023	06/09/23	06/09/23
2.	Tested by:	JH	JH	JH	JH	JH	JH	JH	JH
3.	Specimen height (in.)	5.72	5.46	4.39	5.62	5.83	5.29	6.00	
4.	Wt. of specimen + tare (gm)	838.62	898.56	961.73	1224.47	965.85	984.95	924.66	
5.	Tare wt. (gm)	0.00	0.00	225.72	280.65	0.00	232.94	0.00	
6.	Diameter (in.)	2.38	2.38	2.42	2.38	2.38	2.38	2.38	
7.	Wet wt. of soil + dish wt. (gm)	345.82	644.13	922.82	1157.31	809.67	306.81	381.84	933.69
8.	Dry wt. of soil + dish wt. (gm)	297.33	588.37	844.12	1063.08	721.54	278.49	335.19	896.94
9.	Wt. of dish (gm)	85.22	200.66	188.40	223.77	197.81	83.49	87.12	186.06
10.	Dish ID								
	Wet Density (pcf)	125.4	140.8	138.7	143.7	141.7	121.6	131.9	
	Dry Density (pcf)	102.1	123.1	123.9	129.2	121.3	106.2	111.0	
	Moisture Content (%)	22.9	14.4	12.0	11.2	16.8	14.5	18.8	5.2
	Gs (Assumed)	2.70	2.70	2.70	2.70	2.70	2.70	2.70	2.70
	Void Ratio	0.650	0.369	0.360	0.304	0.389	0.586	0.518	
	Saturation (%)	94.9	105.3	90.0	99.7	116.9	66.9	98.0	

Additional data:

Wt. of dry soil + dish before washing (gm)								
Wt. of dry soil + dish after washing (gm)								
% Passing # 200 sieve								
USCS symbol								

MOISTURE & DENSITY TEST

Client : Mott MacDonald Project : Healdsburg HDD Project ISI Lab No.: G-67612 Job no : 504100918

	Boring #	MM-02	MM-03	MM-03	MM-03	MM-04	MM-04		
	Sample #	U-9	MC-3	MC-4B	MC-6A	MC-2B	MC-3		
	Depth (ft.)	40	5	7.5	15.5	10.7	15.5		
	Soil type: (visual)	Grayish brown clayey gravel with sand	Brown clay with sand	Brown sandy clay	Brown clayey gravel with sand	Grayish brown clay with sand	Grayish brown clay with sand		
1.	Date tested:	06/09/23	06/09/23	06/09/23	06/09/23	06/10/23	06/10/23		
2.	Tested by:	JH	JH	JH	JH	JH	JH		
3.	Specimen height (in.)	2.37	2.27	5.89	5.73	5.78	5.38		
4.	Wt. of specimen + tare (gm)	525.91	257.81	904.39	1083.25	753.02	692.27		
5.	Tare wt. (gm)	90.65	0.00	0.00	250.42	0.00	0.00		
6.	Diameter (in.)	2.42	2.38	2.38	2.38	2.38	2.38		
7.	Wet wt. of soil + dish wt. (gm)	517.28	110.33	261.74	1017.84	212.55	334.38		
8.	Dry wt. of soil + dish wt. (gm)	470.67	103.52	226.63	921.46	176.39	282.88		
9.	Wt. of dish (gm)	84.67	51.11	50.57	189.86	50.97	85.33		
10.	Dish ID								
	Wet Density (pcf)	152.0	97.2	131.4	124.4	111.5	110.1		
	Dry Density (pcf)	135.6	86.0	109.5	109.9	86.5	87.3		
	Moisture Content (%)	12.1	13.0	19.9	13.2	28.8	26.1		
	Gs (Assumed)	2.70	2.70	2.70	2.70	2.70	2.70	2.70	2.70
	Void Ratio	0.242	0.959	0.538	0.533	0.947	0.929		
	Saturation (%)	134.5	36.6	100.0	66.7	82.2	75.7		

Additional data:

Wt. of dry soil + dish before washing (gm)								
Wt. of dry soil + dish after washing (gm)								
% Passing # 200 sieve								
USCS symbol								

ASTM D-1140
PERCENT PASSING NO. 200 SIEVE REPORT

Method A
Specimens Soaked Overnight without Deflocculating Agent
Dry Mass Determined Directly

Client Name Mott MacDonald
Project Name Healdsburg HDD Project
Project Number 504100918

Boring Number	MM-01	MM-02	MM-03	MM-04	MM-04
Sample Number	MC-2A	MC-3	SS-5	SS-1	MC-2B
Depth (ft)	6	5	10	5	10.7
Percent of Soil Finer than No. 200 Sieve	59.3	48.9	23.9	54.4	77.6
Visual Classification	Brown sandy silt	Brown silty, clayey sand	Brown clayey sand	Yellowish brown sandy clay	Grayish brown clay with sand
Date	06/09/23	06/09/23	06/09/23	06/10/23	06/10/23
Weight of Dry Soil + Pan (before wash)	292.4	278.5	530.9	356.2	176.4
Weight of Dry Soil + Pan (after wash)	169.0	183.2	448.6	209.1	79.1
Weight of Pan	84.2	83.5	187.4	85.8	51.0

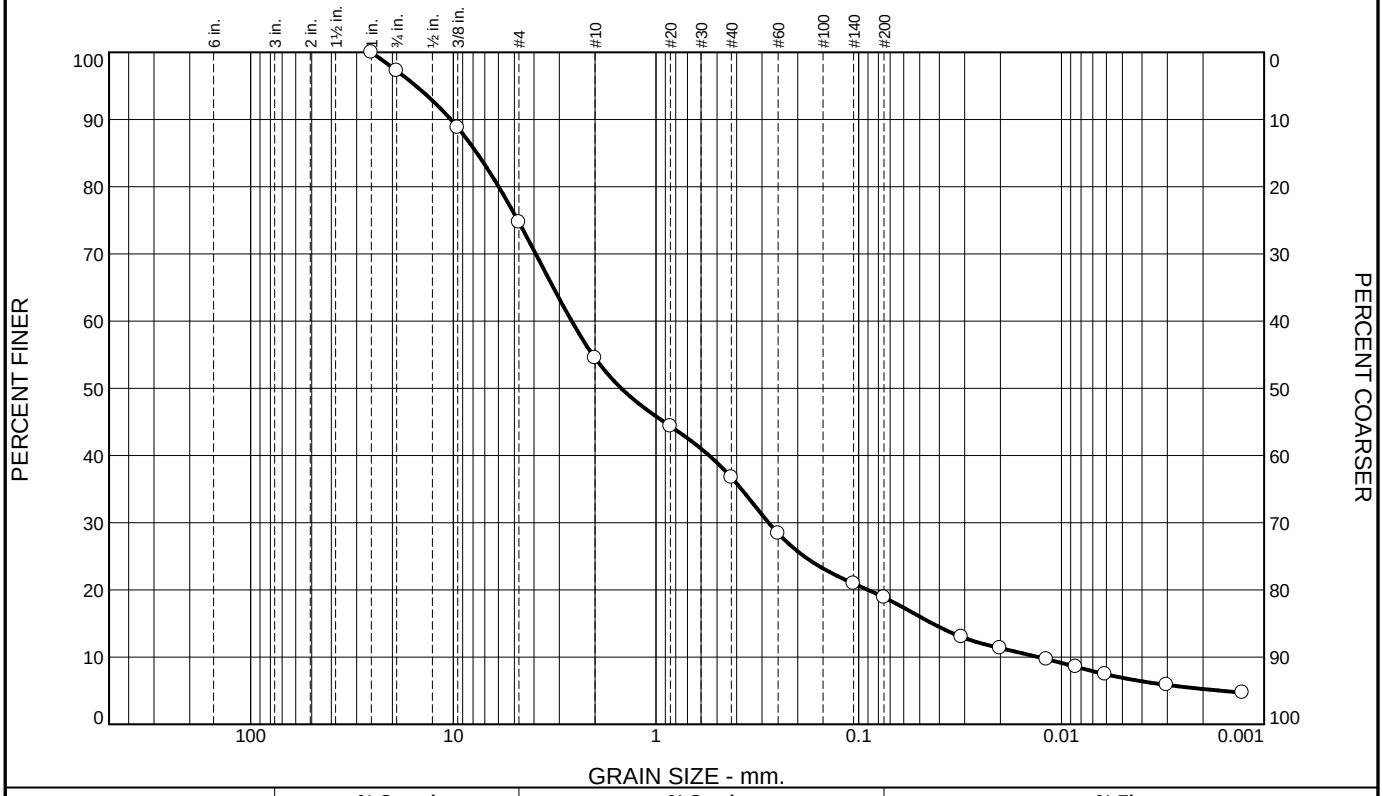
ASTM D-1140
PERCENT PASSING NO. 200 SIEVE REPORT

Method A
Specimens Soaked Overnight without Deflocculating Agent
Dry Mass Determined Directly

Client Name Mott MacDonald
Project Name Healdsburg HDD Project
Project Number 504100918

Boring Number	MM-04				
Sample Number	MC-3				
Depth (ft)	15				
Percent of Soil Finer than No. 200 Sieve	76.3				
Visual Classification	Grayish brown clay with sand				
Date	06/10/23				
Weight of Dry Soil + Pan (before wash)	282.9				
Weight of Dry Soil + Pan (after wash)	132.2				
Weight of Pan	85.3				

Particle Size Distribution Report ASTM D422



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	3	22	20	18	18	12	7

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1	100		
3/4	97		
3/8	89		
#4	75		
#10	55		
#20	44		
#40	37		
#60	28		
#140	21		
#200	19		
0.0311 mm.	13		
0.0201 mm.	11		
0.0118 mm.	9.7		
0.0085 mm.	8.6		
0.0061 mm.	7.5		
0.0030 mm.	5.9		
0.0013 mm.	4.7		

* (no specification provided)

Soil Description

Brown silty sand with gravel

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 10.2974 D_{85}= 7.6506 D_{60}= 2.6078
D_{50}= 1.4867 D_{30}= 0.2783 D_{15}= 0.0432
D_{10}= 0.0130 C_u= 200.57 C_c= 2.28

Classification

USCS= SM AASHTO=

Remarks

Source of Sample: MM-01 **Depth:** 15
Sample Number: MC-4A **Date:** 6-14-23

Client: Mott MacDonald
Project: Healdsburg HDD Project
504100918
Project No: 2966-013.0 **Figure**

Tested By: SK **Checked By:** JH

Particle Size Distribution Report ASTM D422

% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	13	36	15	10	17	9	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1.5	100		
1	96		
3/4	87		
3/8	70		
#4	51		
#10	36		
#20	31		
#40	26		
#60	19		
#140	10		
#200	8.8		

* (no specification provided)

Soil Description

Brown poorly graded gravel with clay and sand

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 20.8362 D_{85}= 17.8028 D_{60}= 6.6002
D_{50}= 4.5079 D_{30}= 0.6910 D_{15}= 0.1829
D_{10}= 0.1006 C_u= 65.59 C_c= 0.72

Classification

USCS= GP-GC AASHTO=

Remarks

Source of Sample: MM-01 **Depth:** 21.5
Sample Number: U-5 **Date:** 6-14-23

Client: Mott MacDonald
Project: Healdsburg HDD Project
504100918
Project No: 2966-013.0 **Figure**

Tested By: SK **Checked By:** JH

Particle Size Distribution Report ASTM D422

% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	10	27	10	21	16	16	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1	100		
3/4	90		
3/8	73		
#4	63		
#10	53		
#20	42		
#40	32		
#60	25		
#140	18		
#200	16		

* (no specification provided)

Soil Description

Brown clayey sand with gravel

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 18.9194 D_{85}= 16.0003 D_{60}= 3.8511
D_{50}= 1.5794 D_{30}= 0.3694 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SC AASHTO=

Remarks

Source of Sample: MM-01 **Depth:** 30
Sample Number: SPT-7

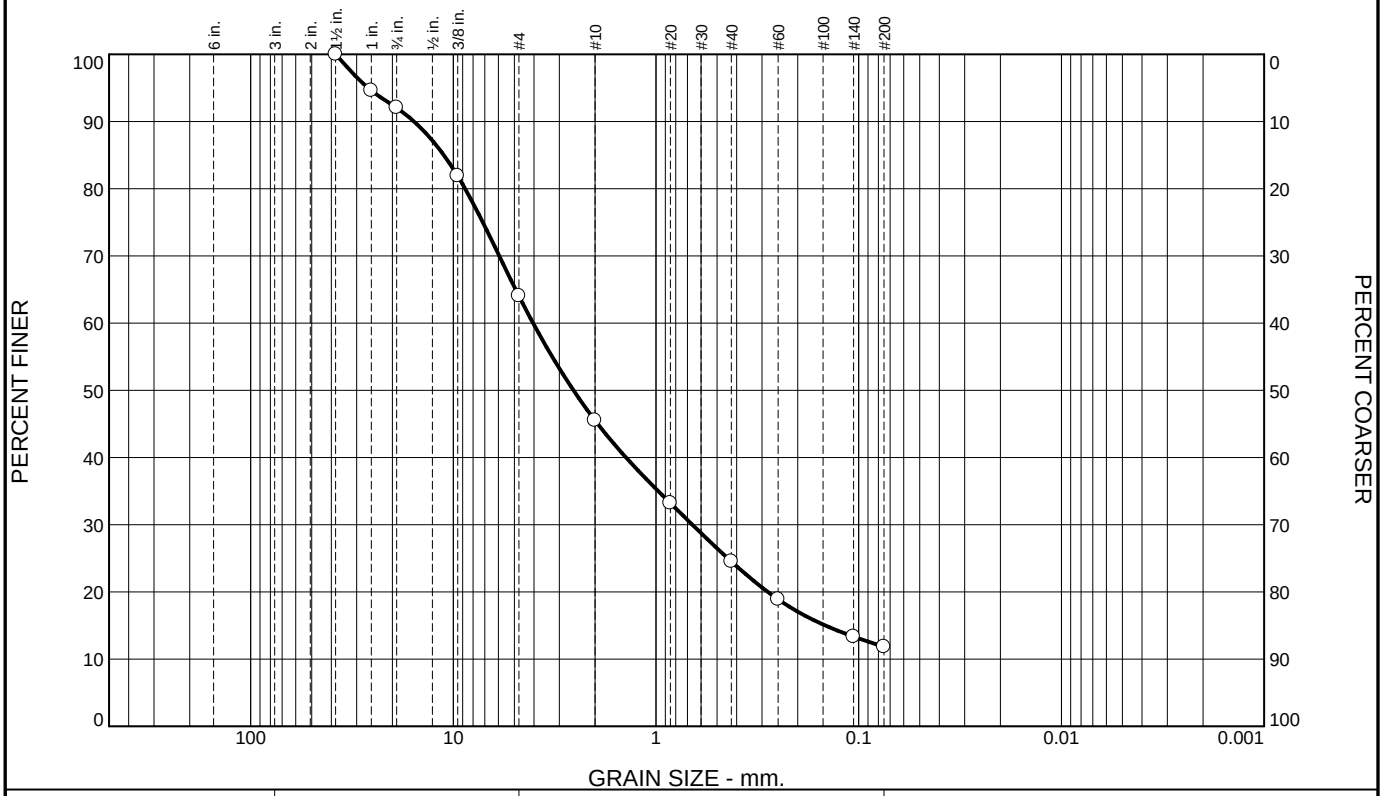
Date: 6-14-23

Client: Mott MacDonald
Project: Healdsburg HDD Project
504100918
Project No: 2966-013.0

Figure

Tested By: SK **Checked By:** JH

Particle Size Distribution Report ASTM D422



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	8	28	18	21	13	12	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1.5	100		
1	95		
3/4	92		
3/8	82		
#4	64		
#10	46		
#20	33		
#40	25		
#60	19		
#140	13		
#200	12		

* (no specification provided)

Soil Description

Brown clayey sand with gravel

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 15.6465 D_{85}= 11.1486 D_{60}= 4.0423
D_{50}= 2.5562 D_{30}= 0.6621 D_{15}= 0.1460
D_{10}= C_u= C_c=

Classification

USCS= SC AASHTO=

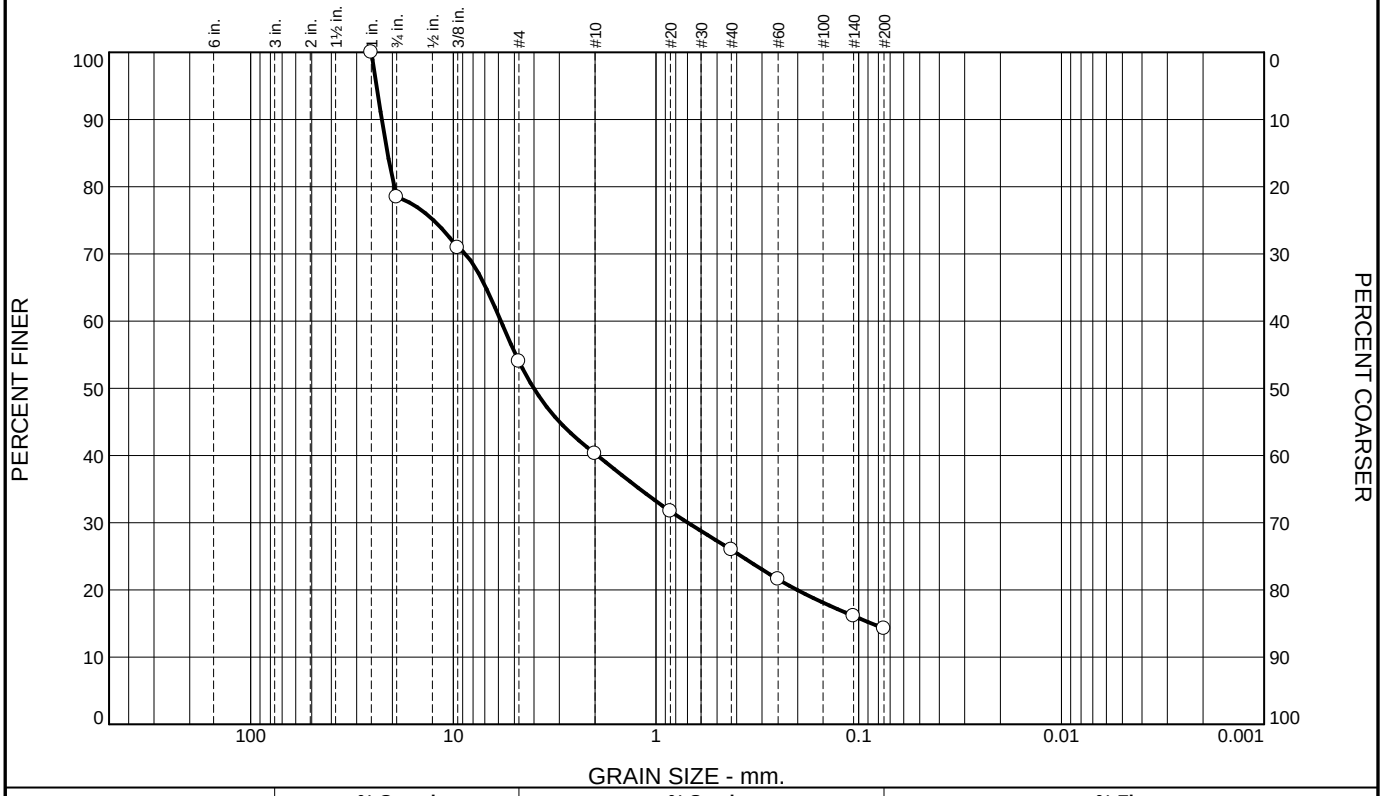
Remarks

Source of Sample: MM-01 **Depth:** 45
Sample Number: SPT-12 **Date:** 6-14-23

Client: Mott MacDonald
Project: Healdsburg HDD Project
504100918
Project No: 2966-013.0 **Figure**

Tested By: SK **Checked By:** JH

Particle Size Distribution Report ASTM D422



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	22	24	14	14	12	14	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1	100		
3/4	78		
3/8	71		
#4	54		
#10	40		
#20	32		
#40	26		
#60	22		
#140	16		
#200	14		

* (no specification provided)

Soil Description

Brown silty gravel with sand

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 22.5488 D_{85}= 21.1230 D_{60}= 5.8310
D_{50}= 4.0093 D_{30}= 0.6968 D_{15}= 0.0864
D_{10}= C_u= C_c=

Classification

USCS= GM AASHTO=

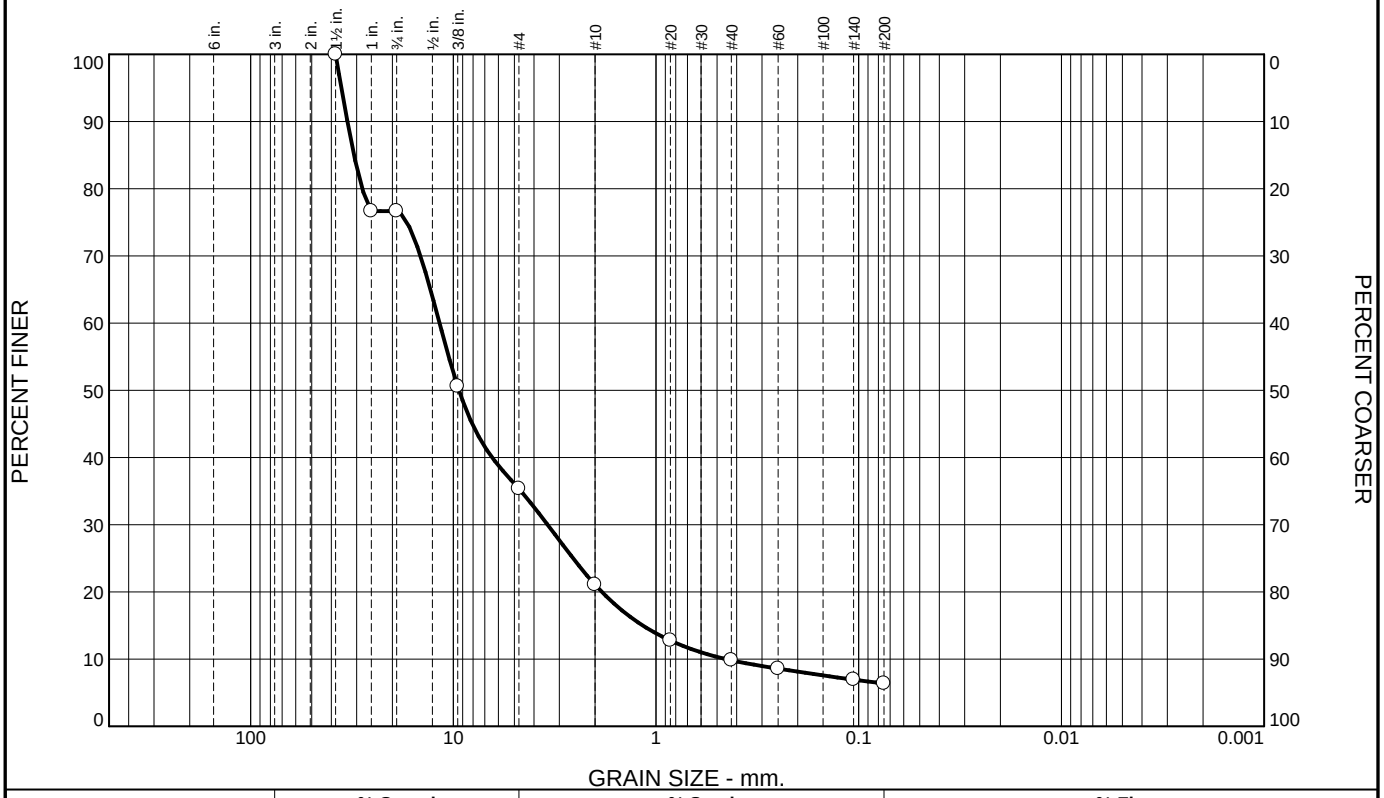
Remarks

Source of Sample: MM-02 **Depth:** 15
Sample Number: SS-5 **Date:** 6-14-23

Client: Mott MacDonald
Project: Healdsburg HDD Project
504100918
Project No: 2966-013.0 **Figure**

Tested By: SK **Checked By:** JH

Particle Size Distribution Report ASTM D422



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	23	42	14	11	4	6	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1.5	100		
1	77		
3/4	77		
3/8	51		
#4	35		
#10	21		
#20	13		
#40	10		
#60	9		
#140	7		
#200	6.4		

* (no specification provided)

Soil Description

Brown well graded gravel with clay and sand

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 33.3392 D_{85}= 30.9231 D_{60}= 11.7037
D_{50}= 9.3864 D_{30}= 3.4285 D_{15}= 1.1625
D_{10}= 0.4509 C_u= 25.96 C_c= 2.23

Classification

USCS= GW-GC AASHTO=

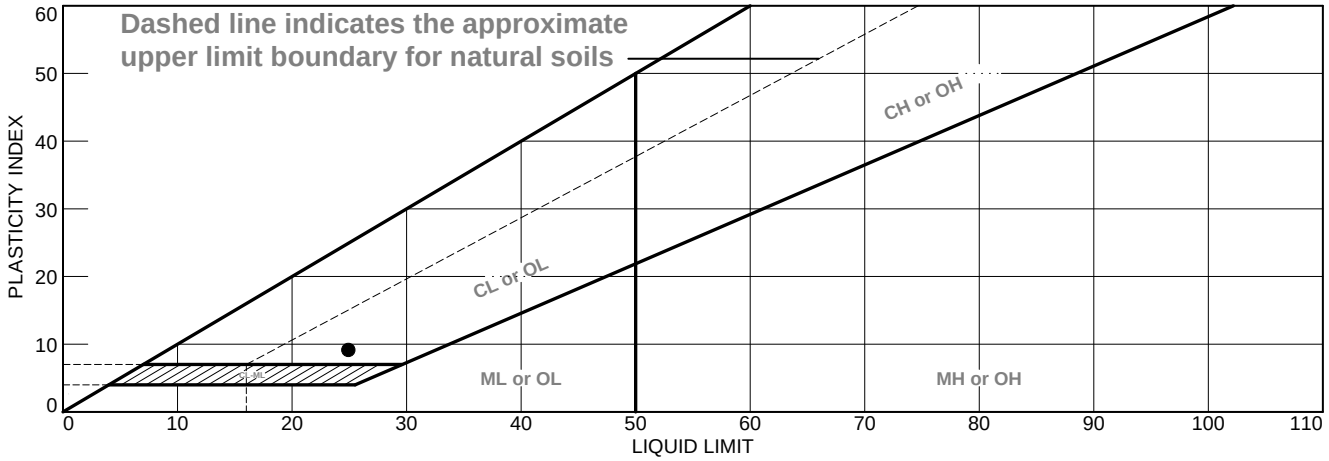
Remarks

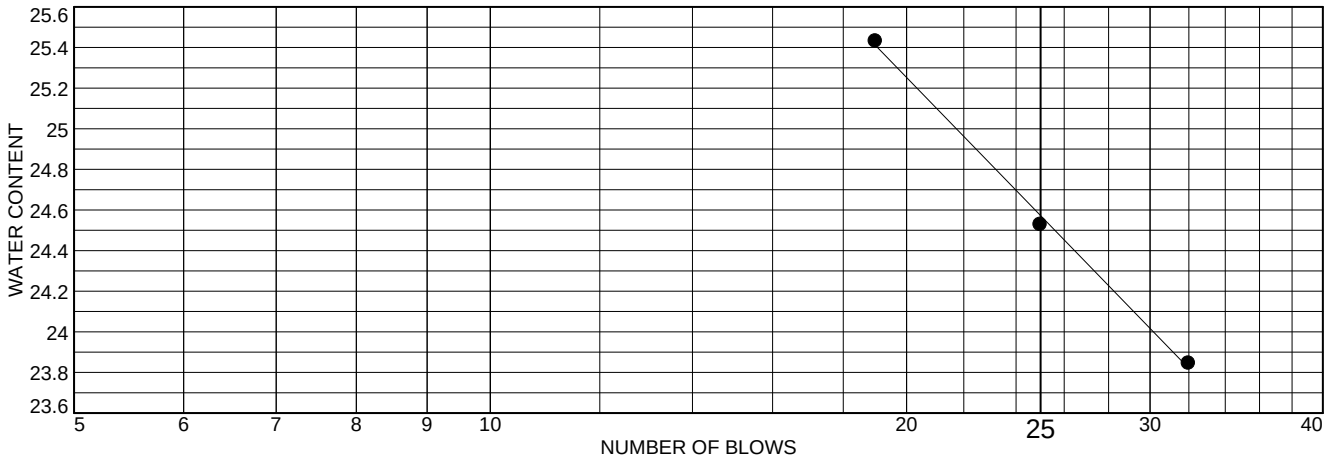
Source of Sample: MM-02 **Depth:** 27
Sample Number: U-6 **Date:** 6-14-23

Client: Mott MacDonald
Project: Healdsburg HDD Project
504100918
Project No: 2966-013.0 **Figure**

Tested By: SK **Checked By:** JH

LIQUID AND PLASTIC LIMITS TEST REPORT ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Brown sandy clay	25	16	9			SC

Project No. 2966-013.0 **Client:** Mott MacDonald

Project: Healdsburg HDD Project

504100918

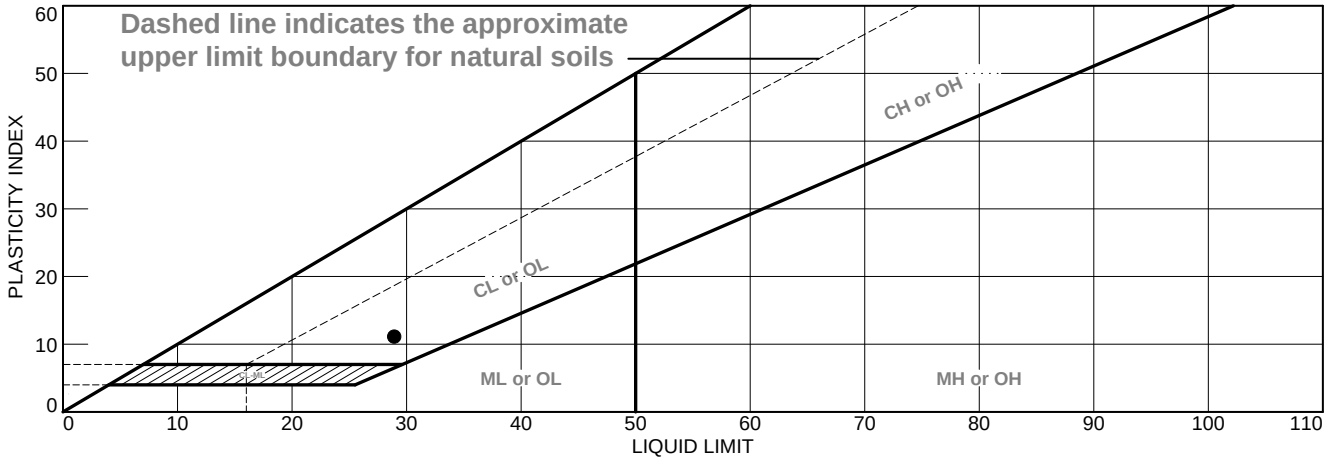
● **Source of Sample:** MM-01 **Depth:** 5.5 **Sample Number:** MC-2B

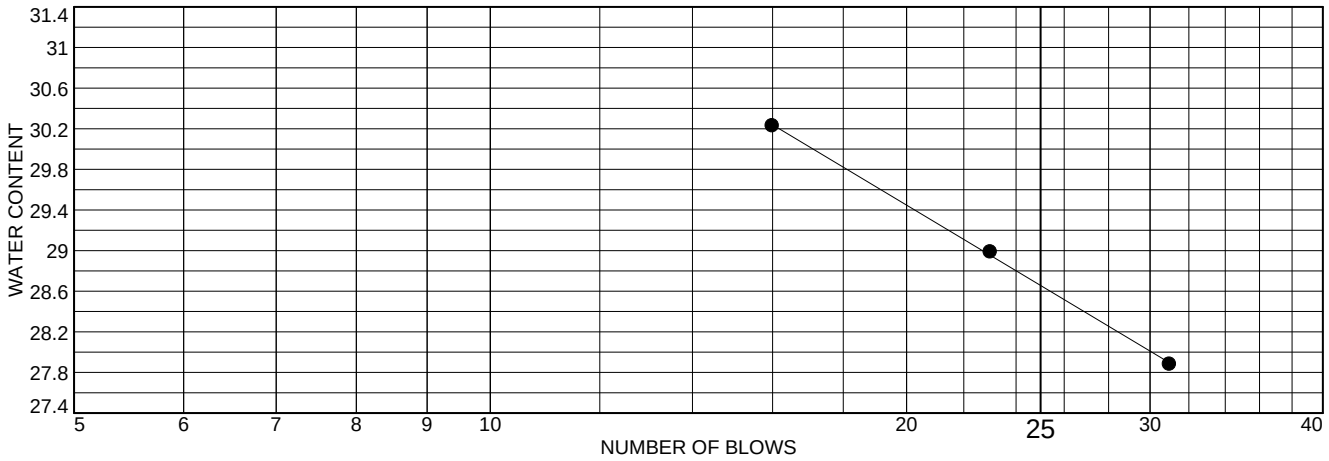
Remarks:

Figure

Tested By: JH **Checked By:** JH

LIQUID AND PLASTIC LIMITS TEST REPORT ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Brown sandy clay	29	18	11			CL

Project No. 2966-013.0 **Client:** Mott MacDonald

Project: Healdsburg HDD Project

504100918

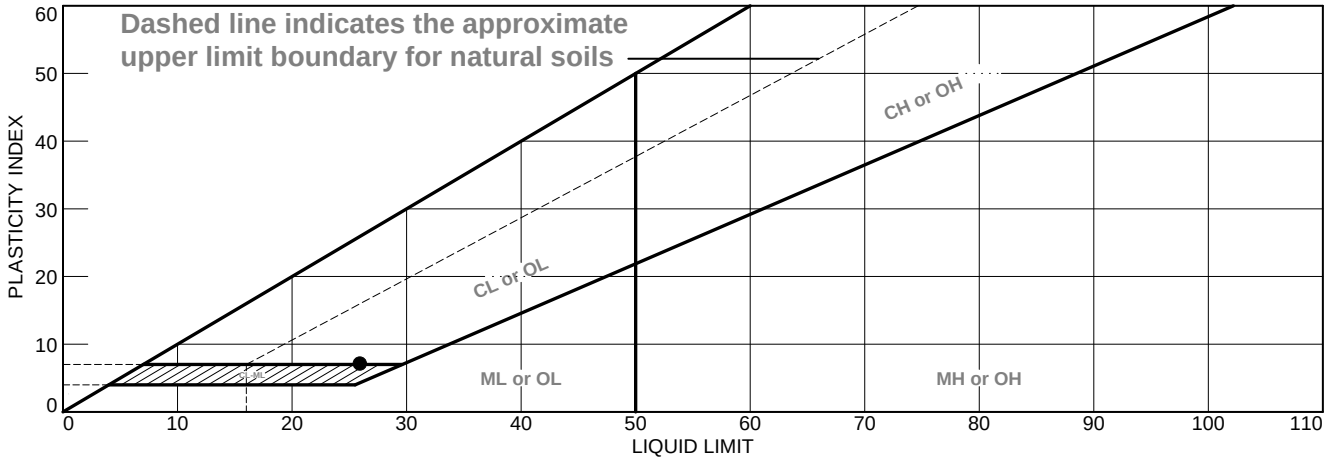
● **Source of Sample:** MM-01 **Depth:** 11.5 **Sample Number:** SH-3

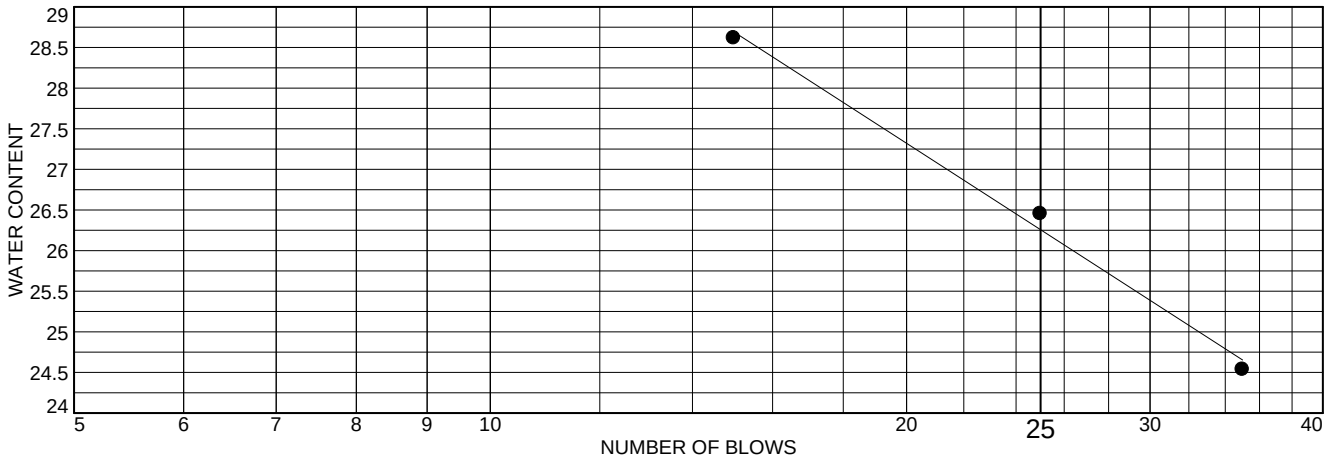
Remarks:

Figure

Tested By: JH **Checked By:** JH

LIQUID AND PLASTIC LIMITS TEST REPORT ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Brown silty, clayey sand	26	19	7		48.9	SC-SM

Project No. 2966-013.0 **Client:** Mott MacDonald

Project: Healdsburg HDD Project

504100918

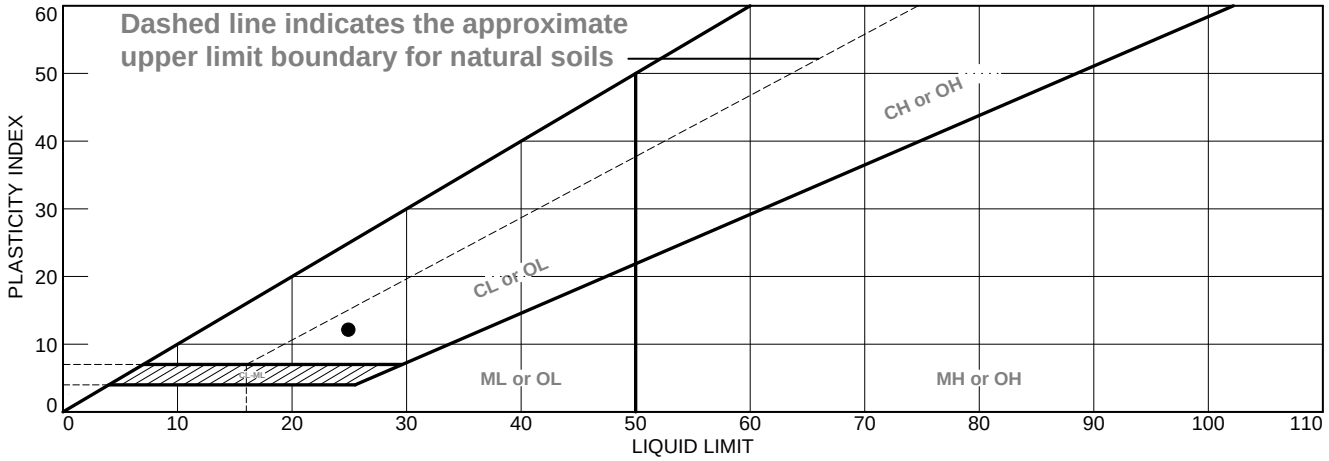
●**Source of Sample:** MM-02 **Depth:** 5 **Sample Number:** MC-3

Remarks:

Figure

Tested By: JH **Checked By:** JH

LIQUID AND PLASTIC LIMITS TEST REPORT ASTM D4318



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Brown sandy clay	25	13	12			CL

Project No. 2966-013.0 **Client:** Mott MacDonald

Project: Healdsburg HDD Project

504100918

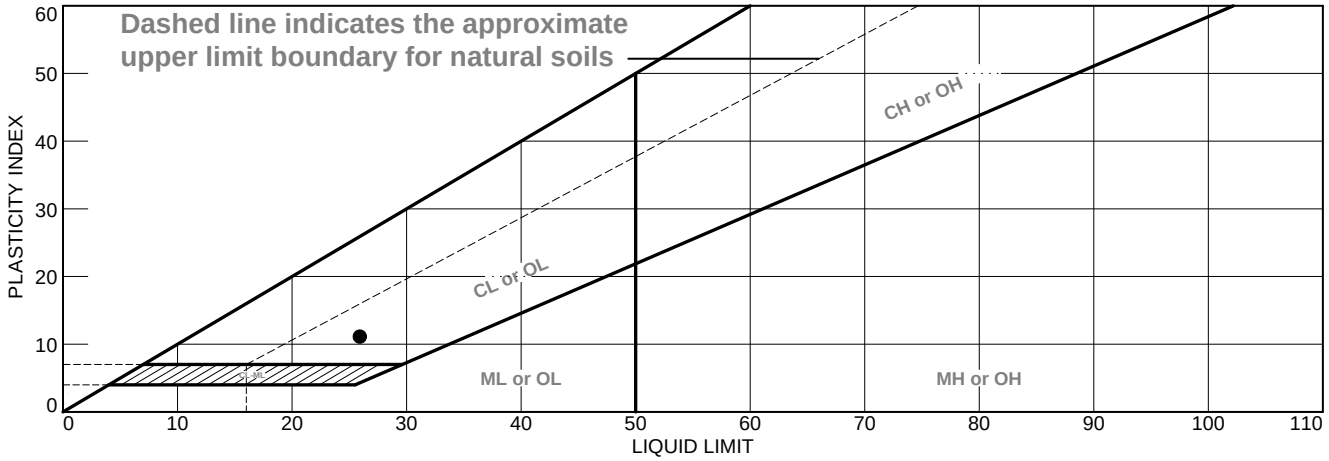
● **Source of Sample:** MM-02 **Depth:** 10 **Sample Number:** MC-4A

Remarks:

Figure

Tested By: JH **Checked By:** JH

LIQUID AND PLASTIC LIMITS TEST REPORT ASTM D4318



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Brown clay with sand	26	15	11			CL

Project No. 2966-013.0 **Client:** Mott MacDonald

Project: Healdsburg HDD Project

504100918

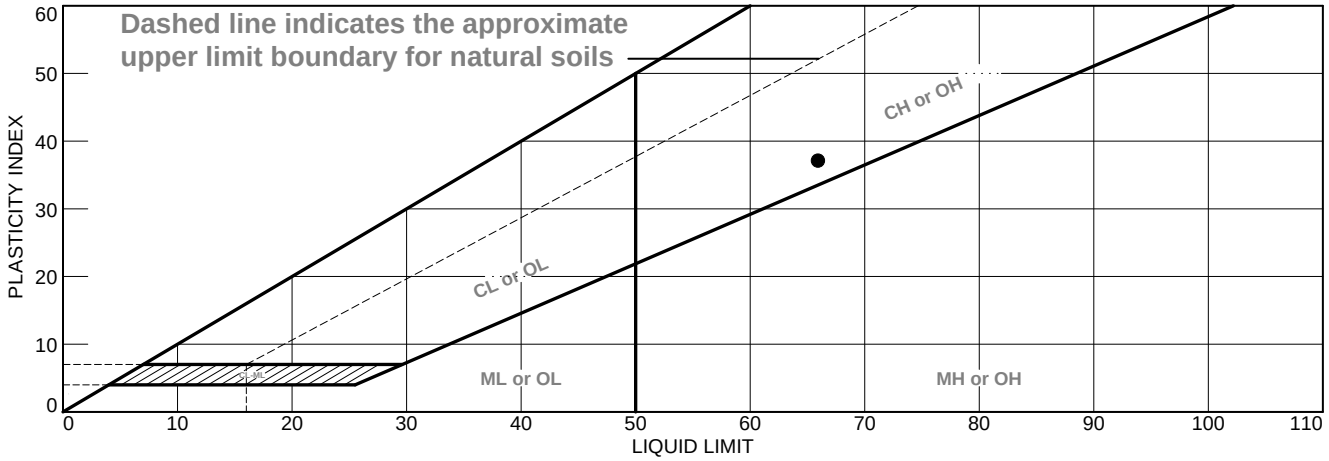
● **Source of Sample:** MM-03 **Depth:** 5 **Sample Number:** MC-3

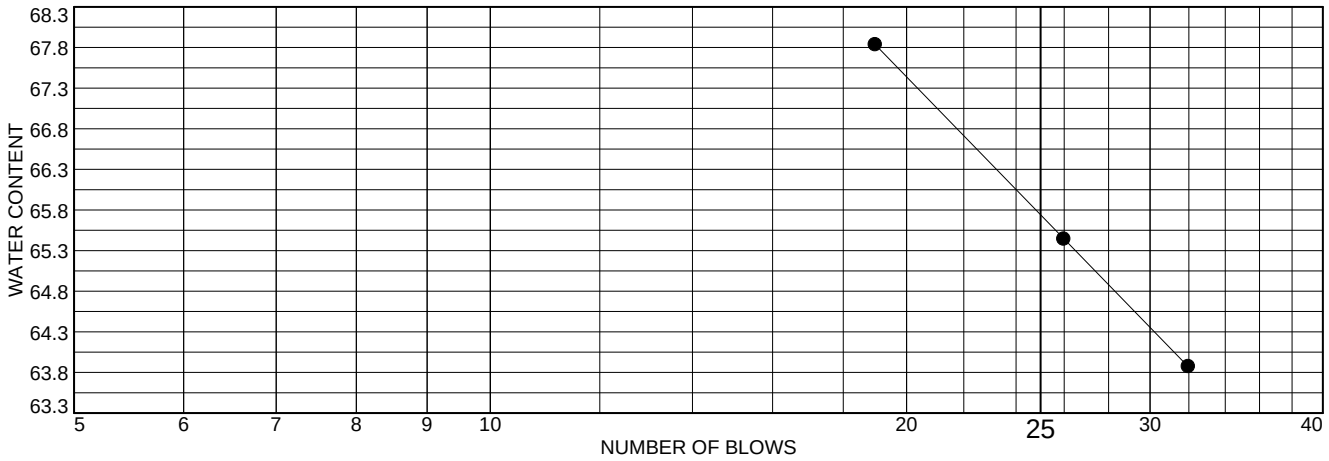
Remarks:

Figure

Tested By: JH **Checked By:** JH

LIQUID AND PLASTIC LIMITS TEST REPORT ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Grayish brown clay with sand	66	29	37		77.6	CH

Project No. 2966-013.0 **Client:** Mott MacDonald

Project: Healdsburg HDD Project

504100918

●**Source of Sample:** MM-04 **Depth:** 10.7 **Sample Number:** MC-2B

Remarks:

Figure

Tested By: JH **Checked By:** JH

CERCO analytical
1100 Willow Pass Court, Suite A
Concord, CA 94520-1006
925 462 2771 Fax. 925 462 2775
www.cercoanalytical.com

13 June, 2023

Job No. 2306015
Cust. No. 12259

Mr. John Hunt
Inspection Services Inc.
1798 University Avenue
Berkeley, CA 94703-1514

Subject: Project No.: 504100918
Project Name: Healdsburg HDD
Corrosivity Analysis – ASTM Test Methods

Dear Mr. Hunt:

Pursuant to your request, CERCO Analytical has analyzed the soil sample submitted on June 08, 2023. Based on the analytical results, this brief corrosivity evaluation is enclosed for your consideration.

Based upon the resistivity measurement, this is classified as "moderately corrosive". All buried iron, steel, cast iron, ductile iron, galvanized steel and dielectric coated steel or iron should be properly protected against corrosion depending upon the critical nature of the structure. All buried metallic pressure piping such as ductile iron firewater pipelines should be protected against corrosion.

The chloride ion concentration reflects none detected with a reporting limit of 15 mg/kg.

The sulfate ion concentration is 23 mg/kg and is determined to be insufficient to damage reinforced concrete structures and cement mortar-coated steel at this location.

The pH of the soil is 7.10 which does not present corrosion problems for buried iron, steel, mortar-coated steel and reinforced concrete structures.

The redox potential is 260-mV and is indicative of potentially "slightly corrosive" soils resulting from anaerobic soil conditions.

This corrosivity evaluation is based on general corrosion engineering standards and is non-specific in nature. For specific long-term corrosion control design recommendations or consultation, please call *JDH Corrosion Consultants, Inc. at (925) 927-6630.*

We appreciate the opportunity of working with you on this project. If you have any questions, or if you require further information, please do not hesitate to contact us.

Very truly yours,
CERCO ANALYTICAL, INC.

J. Darby Howard, Jr., P.E.
President

JDH/jdl
Enclosure

CERCO analytical
1100 Willow Pass Court, Suite A
Concord, CA 94520-1006
925 462 2771 Fax. 925 462 2775
www.cercoanalytical.com

Client: Inspection Services, Inc.
Client's Project No.: 504100918
Client's Project Name: Healdsburg HDD
Date Sampled: 15-Mar-2023
Date Received: 8-Jun-2023
Matrix: Soil
Authorization: Signed Chain of Custody

Date of Report: 13-Jun-2023

Job/Sample No.	Sample I.D.	Redox (mV)	pH	Resistivity (As Received) (ohms-cm)	Resistivity (100% Saturation) (ohms-cm)	Sulfide (mg/kg)*	Chloride (mg/kg)*	Sulfate (mg/kg)*
2306015 001	MM-02 G-2 2-2.5'	260	7.10	-	5,300	-	N.D.	23

Method:	ASTM D1498	ASTM D4972	ASTM G57	ASTM G57	ASTM D4658M	ASTM D4327	ASTM D4327
Reporting Limit:	-	-	-	-	50	15	15
Date Analyzed:	9-Jun-2023	9-Jun-2023	-	8-Jun-2023	-	12-Jun-2023	12-Jun-2023

Cheri McMillen
Chemist

* Results Reported on "As Received" Basis
N.D. - None Detected

Quality Control Summary - All laboratory quality control parameters were found to be within established limits

Chain of Custody

1100 Willow Pass Court
Concord, CA 94520-1005
925 462-2771
Fax: 925 462-2775
www.cercoanalytical.com

CERCO analytical

Page of

Job No.	CU#	Client Project I.D.
2306015	17258	504100918

Schedule
Analyte

Date Sampled	Date Due

Full Name John Hunt

Phone **Fax** **Cell** 510-859-5130 ☒ **X**

Company and/or Mailing Address ISI Berkeley

Sample Source Healdsburg HDD

ANALYSIS — **ASTM w/Brief Evaluation**

Lab No.	Sample I.D.	Date	Time	Matrix	Contain.	Size	Preserv.	Qtv.	Redox Potential	pH	Sulfate	Chloride	Resistivity-100% Saturated		Brief Evaluation
01	MM-02 G-2 2 2.5' ~~3'~~	3-15				Jugge			x	x	x	x	x		x

RUSH!!
Results by Wednesday 6-14-23

RUSH
Date Due _____

MATRIX	ABBREVIATIONS	SAMPLE RECEIPT
DW - Drinking Water	HB - Hosebib	Total No. of Containers
GW - Ground Water	PV - Petcock Valve	Rec'd Good Cond/Cold
SW - Surface Water	PT - Pressure Tank	Conforms to Record
WW - Waste Water	PH - Pump House	Temp. a t Lab -°C
Water	RR - Restroom	Sampler
SL - Sludge	GL - Glass	
S - Soil	PL - Plastic	
Product	ST - Sterile	

Relinquished By: Stanley Hamalgian	Date 6-8-23	Time 1040
Received By: Dlang	Date 6/8/23	Time 1040
Relinquished By:	Date	Time
Received By:	Date	Time
Relinquished By:	Date	Time
Received By:	Date	Time

Comments:
THERE IS AN ADDITIONAL CHARGE FOR EXTRUDING SOIL FROM TUBES

Email Address: jhunt@inspectionservices.net

C. Historical Borehole Logs

KEY TO BORING LOG

- Shelby tube sample
- Grab sample
- 1.4" I.D./2" O.D. Standard Penetration Test (ASTM D1586) sampler (SPT)
- 2.5" I.D./3" O.D. Modified California sampler (MCS) with brass liners
- 2" I.D./2.5" O.D. Split Spoon sampler (SSS)

- NSR No sample recovery
- PP Pocket Penetrometer (tsf = tons per square foot)
- Water level observed in boring at end of drilling unless noted otherwise. Not to be interpreted as the equilibrium groundwater level.
- Groundwater seepage encountered during drilling
- Approximate Planned Pipeline (ID) projected to boring

RELATIVE DENSITY		CONSISTENCY		
SANDS AND GRAVELS	SPT, N	SILTS AND CLAYS	SPT, N	UNCONFINED COMPRESSIVE STRENGTH, tsf
VERY LOOSE	0-4	VERY SOFT	0-2	0-0.25
LOOSE	4-10	SOFT	2-4	0.25-0.50
MEDIUM DENSE	10-30	MEDIUM STIFF	4-8	0.50-1.00
DENSE	30-50	STIFF	8-15	1.00-2.00
VERY DENSE	50+	VERY STIFF	15-30	2.00-4.00
		HARD	30+	>4.00

Reference: Terzaghi, K. and Peck, R., SOIL MECHANICS IN ENGINEERING PRACTICE, 2nd ed., John Wiley and Sons, New York, 1967. Page 341 Table 45.1 and pp. 347 Table 45.2.

MOISTURE CONDITION

DESCRIPTION	CRITERIA
DRY	Absence of moisture, dusty, dry to the touch
MOIST	Damp but no visible water
WET	Visible free water, usually soil is below water table

Reference: ASTM D2488, Table 3 - Criteria for Describing Moisture Condition

CONSTITUENT DESCRIPTIONS

DESCRIPTION	CRITERIA
TRACE	less than 5%
FEW	5% to 10%
LITTLE	15% to 25%
SOME	30% to 45%
MOSTLY	50% to 100%

Reference: ASTM D2488, Note 15

NOTES:

1. Lines separating strata in the logs represent approximate boundaries only and are dashed where strata change depth is less certain and queried where strata change depth is not known. Actual stratal change may be gradual. No warranty is provided as to the continuity of strata between borings. Logs represent the subsurface section observed at the boring location on the date of drilling only.

2. Penetration Resistance (blows/ft.) are the last 12" of an 18" drive or the middle 12" of a 24" drive using a 140-pound hammer falling 30 inches per blow unless noted otherwise. The Penetration Resistance values noted on the logs are actual blows per foot of penetration for the respective sampler type (i.e., MCS and SSS sampler Penetration Resistance has not been correlated to an equivalent SPT sampler "N" value).

3. All borings except Borings B-15, B-16, and B-21 were made with a Mobile B-24 drill rig using 5-inch diameter continuous flight solid stem augers. Boring B-15 was made with a CME-75 drill rig using 8-inch diameter hollow stem augers. Borings B-16 and B-21 were made with a DR5K drill rig using 8-inch diameter hollow stem augers. The largest particle that could have been sampled from our boring is less than the outside diameter of the largest sampler type used. Therefore, there may be larger particles (e.g. cobbles and/or boulders) in the bored soils than reflected on the boring logs.

DCM | GeoEngineers

FILE NO. 18423-001-00 | AUGUST 2009

WINZLER & KELLY
City of Healdsburg
Recycled Water System Project
Healdsburg, California
BORING LOG LEGEND

PLATE NO.
A-1
(1 of 2)

LOG OF BORING B-1

LOCATION: Kinley Drive, south of West Side Slough. See Plate I-2.

DEPTH feet	SAMPLE NO.	TYPE	PENETRATION RESISTANCE blows/ft.	GROUNDWATER	DESCRIPTION ①	MOISTURE CONTENT %	DRY DENSITY lbs/ft.³	UNCONFINED COMPRESSIVE STRENGTH kips/ft.²
					LEAN CLAY (CL) - very dark brown - medium plasticity clay - moist			
5	1		19		**LEAN CLAY (CL)** - dark olive brown with gray mottling - medium plasticity clay - very stiff - moist **Sample 1-2** 0% Gravel 9% Sand 45% Silt 46% Clay	26	94	2.73
	2		16					
10	3		30		**LEAN CLAY (CL)** - olive brown with orange mottling - medium plasticity clay - stiff - moist to saturated **Sample 1-4** LL = 38 PI = 15 **Sample 1-5** 0% Gravel 11% Sand 47% Silt 42% Clay	25	98	
	4		13					
15	5		12		**CLAYEY SAND WITH GRAVEL (SC)** - possibly contains cobbles and boulders - light olive brown sand and clay with multicolored gravels - gravels are both rounded and angular - gravels contain black basalt pieces and red and yellow sandstone pieces - medium plasticity clay - medium dense - saturated	25	102	1.36
	6		23					
20	7		25			14	124	
	8		35		**CLAYEY SAND WITH GRAVEL (SC)** - possibly contains cobbles and boulders - light olive brown sand and clay with multicolored gravels - gravels are both rounded and angular - medium plasticity clay - dense - saturated **Sample 1-7** 30% Gravel 42% Sand 28% Silt/Clay			
25	9		56			11	131	
	10		45					
					LEAN CLAY (CL) - gray with olive brown streaks - little to some sand and silt - medium plasticity clay - very stiff - saturated			
30	11		28		**BOTTOM OF BORING AT APPROXIMATELY 31.5 FEET**			

REMARKS: ① Boring drilled on Tuesday, April 15, 2003 using a truck-mounted Mobile B-24 drill rig.

DCM/Joyal Engineering

FILE NO. J-4763-1 | MAY 2003

WINZLER & KELLY
City of Healdsburg
Highway 101 Utility Undercrossings
Healdsburg, California
LOG OF BORING B-1

PLATE NO. B-1

REFERENCE:
① Draft Geotechnical Engineering Investigation Report, City of Healdsburg Highway 101 Utility Undercrossings (2003) by DCM/Joyal Engineering.

DCM | GeoEngineers

FILE NO. 18423-001-00 | AUGUST 2009

WINZLER & KELLY
City of Healdsburg
Recycled Water System Project
Healdsburg, California
REFERENCE BORING RB-1

PLATE NO. D-10

LOG OF BORING B-2

LOCATION: Near the intersection of Healdsburg Avenue and Kennedy Lane. See Plate I-2.

DEPTH feet	SAMPLE NO.	TYPE	PENETRATION RESISTANCE blows/ft.	GROUNDWATER	DESCRIPTION ①	MOISTURE CONTENT %	DRY DENSITY lbs/ft.³	UNCONFINED COMPRESSIVE STRENGTH kips/ft.²
5	1		7		**LEAN CLAY (CL)** - dark olive brown - medium plasticity clay - medium stiff - moist **Sample 2-1** LL = 28 PI = 8	24		
10	2		16		**SANDY LEAN CLAY (CL)** - olive brown with orange mottling - medium plasticity clay - very stiff - moist to saturated **Sample 2-2** DIRECT SHEAR c = 870 psf Ø = 21° **Sample 2-3** 0% Gravel 30% Sand 32% Silt 38% Clay	22 24	104 101	0.90
15	3		21					
20	4		58		**CLAYEY GRAVEL WITH SAND (GC)** - possibly contains cobbles and boulders - light olive brown sand and clay with multicolored gravels - gravels are both rounded and angular - gravels contain black basalt pieces and yellow sandstone pieces - medium plasticity clay - dense to very dense - saturated **Sample 2-4** 40% Gravel 34% Sand 26% Silt/Clay	10	127	
	5		50 (6")					
25					**BOTTOM OF BORING AT APPROXIMATELY 20 FEET (REFUSAL) ②**			
30								

REMARKS: ① Boring drilled on Tuesday, April 15, 2003 using a truck-mounted CME 75 drill rig.
② Refusal declared after attempting to drill past a depth of 20 feet for approximately 10 minutes.

DCM/Joyal Engineering

FILE NO. J-4763-1 | MAY 2003

WINZLER & KELLY
City of Healdsburg
Highway 101 Utility Undercrossings
Healdsburg, California
LOG OF BORING B-2

PLATE NO. B-2

REFERENCE:
① Draft Geotechnical Engineering Investigation Report, City of Healdsburg Highway 101 Utility Undercrossings (2003) by DCM/Joyal Engineering.

DCM | GeoEngineers

FILE NO. 18423-001-00 | AUGUST 2009

WINZLER & KELLY
City of Healdsburg
Recycled Water System Project
Healdsburg, California
REFERENCE BORING RB-2

PLATE NO. D-11

LOG OF BORING B-2B

LOCATION: Near the intersection of Healdsburg Avenue and Kennedy Lane, 11 feet south of Boring B-2. See Plate I-2.

DEPTH feet	SAMPLE NO.	TYPE	PENETRATION RESISTANCE blows/ft.	GROUNDWATER	DESCRIPTION ①	MOISTURE CONTENT %	DRY DENSITY lbs/ft.³	UNCONFINED COMPRESSIVE STRENGTH kips/ft.²
5					- see log of Boring B-2 for a description of conditions within the upper approximately 20 feet..			
10				▼				
15					- driller notes harder drilling conditions below a depth of approximately 18 feet.			
					CLAYEY GRAVEL WITH SAND (GC) - possibly contains cobbles and boulders - gravels are predominantly black, angular basalt pieces - light olive brown sand and clay - medium plasticity clay - dense - saturated			
20				▽	**Sample 2-4** 42% Gravel 33% Sand 25% Silt/Clay			
	1	■	50		**CLAYEY SAND WITH GRAVEL (SC)** - possibly contains cobbles and boulders - light olive brown sand and clay with multicolored gravels - gravels are predominantly rounded - medium plasticity clay - dense - saturated	16	118	
25								
	2	■	66		**CLAYEY GRAVEL WITH SAND (GC)** - possibly contains cobbles and boulders - multicolored gravels with light olive brown sand and clay - gravels are rounded and angular - gravels contain black basalt and yellow sandstone pieces - medium plasticity clay - very dense - saturated	21	101	
	3	■	70					
30								

CONTINUED ON PLATE B-2B (2 of 2)

REMARKS: ① Boring drilled on Tuesday, April 15, 2003 using a truck-mounted CME 75 drill rig.

DCM/Joyal Engineering

FILE NO. J-4763-1 | MAY 2003

WINZLER & KELLY
City of Healdsburg
Highway 101 Utility Undercrossings
Healdsburg, California
LOG OF BORING B-2B

PLATE NO. B-2B (1 of 2)

REFERENCE:
① Draft Geotechnical Engineering Investigation Report, City of Healdsburg Highway 101 Utility Undercrossings (2003) by DCM/Joyal Engineering.

DCM | GeoEngineers

FILE NO. 18423-001-00 | AUGUST 2009

WINZLER & KELLY
City of Healdsburg
Recycled Water System Project
Healdsburg, California
REFERENCE BORING RB-2B

PLATE NO. D-12 (1 of 2)

LOG OF BORING B-2B

LOCATION: Near the intersection of Healdsburg Avenue and Kennedy Lane, 11 feet south of Boring B-2. See Plate I-2.

DEPTH feet	SAMPLE NO.	TYPE	PENETRATION RESISTANCE blows/ft.	GROUNDWATER	DESCRIPTION ①	MOISTURE CONTENT %	DRY DENSITY lbs/ft.³	UNCONFINED COMPRESSIVE STRENGTH kips/ft.²
					CONTINUED FROM PLATE B-2B (1 of 2)			
					CLAYEY GRAVEL WITH SAND (GC) - possibly contains cobbles and boulders - multicolored gravels with light olive brown sand and clay - gravels are rounded and angular - gravels contain black basalt and yellow sandstone pieces - medium plasticity clay - very dense - saturated			
35	4		50 (6")			16	122	
	5		50 (6")					
					CLAYEY SAND WITH GRAVEL (SC) - possibly contains cobbles and boulders - light olive brown sand and clay with multicolored gravels - gravels are predominantly rounded - little angular gravel-sized basalt pieces - medium plasticity clay - very dense - saturated			
	6		50 (5")			12	131	
40	7		55					
					BOTTOM OF BORING AT APPROXIMATELY 40.5 FEET			
45								
50								
55								
60								

REMARKS: ① Boring drilled on Tuesday, April 15, 2003 using a truck-mounted CME 75 drill rig.

DCM/Joyal Engineering

FILE NO. J-4763-1 | MAY 2003

WINZLER & KELLY
City of Healdsburg
Highway 101 Utility Undercrossings
Healdsburg, California
LOG OF BORING B-2B

PLATE NO. B-2B (2 of 2)

REFERENCE:
① Draft Geotechnical Engineering Investigation Report, City of Healdsburg Highway 101 Utility Undercrossings (2003) by DCM/Joyal Engineering.

DCM | GeoEngineers

FILE NO. 18423-001-00 | AUGUST 2009

WINZLER & KELLY
City of Healdsburg
Recycled Water System Project
Healdsburg, California
REFERENCE BORING RB-2B

PLATE NO. D-12 (2 of 2)

LOG OF BORING B-4

LOCATION: South side of railroad tracks at end of S. University St. (See Plate I-3) ③

APPROX. SURFACE ELEVATION: 100 feet

DEPTH feet	SAMPLE NO.	TYPE	PENETRATION RESISTANCE blows/ft.	GROUNDWATER ②	DESCRIPTION ①	MOISTURE	DRY DENSITY lbs./ft.³	LIQUID LIMIT	PLASTICITY INDEX	GRAIN SIZE Gravel (> #4 sieve) %	GRAIN SIZE Sand (#4 to #200 sieve) %	GRAIN SIZE Fines (< #200 sieve) %	UNCONFINED COMPRESSIVE STRENGTH k.s.f.	DIRECT SHEAR Cohesion p.s.f.	DIRECT SHEAR Internal Friction Angle
					1 inch Pavement (AC)										
	1		11		**FILL - LEAN CLAY WITH SAND AND GRAVEL (CL)** - dark yellowish brown - fine to coarse sand and gravel - medium plasticity - stiff - moist	12	106						0.77		
5															
	2		25		**CLAYEY GRAVEL WITH SAND (GC)** - dark yellowish brown - fine to coarse sand and gravel - medium plasticity - medium dense - moist to wet	11	109						1.10		
10	3		20												
	4		31		**WELL-GRADED SAND WITH CLAY AND GRAVEL (SW-SC)**	12	124						2.10		
	5		26		- dark yellowish brown - fine to coarse sand and gravel - possible cobbles - medium plasticity - medium dense to very dense - wet					38	52	10			
15	6		86/ 9"			10									
	7		100/ 8"		*Auger was not able to advance past 19 feet.										
20					**BOTTOM OF BORING AT APPROXIMATELY 19¾ FEET** ③										
25															

Slough Penetration Required to Reach Sampling Depth

Sample	Slough*
5	~1 ft.
6	~4½ ft.

*Elevation difference between depth drilled and depth of sampler seating resistance.

NOTES:

① Boring drilled on February 20, 2009. See Appendix A for term definitions and Appendix C for lab test results.

② Groundwater was encountered at a depth of 11 feet during drilling and was measured at a depth of 10 feet after drilling was completed. Equilibrium groundwater depth unknown.

③ The piezometer constructed in Boring B-21 is located 6 feet east of this boring's location. See Boring B-21 for a log of soil conditions to a depth of 30 feet.

DCM | GeoEngineers

FILE NO. 18423-001-00 | AUGUST 2009

WINZLER & KELLY

City of Healdsburg
Recycled Water System Project
Healdsburg, California

LOG OF BORING B-4

PLATE NO.

B-4

LOG OF BORING B-3

LOCATION: North side of railroad tracks south of Hudson Street (See Plate I-3)
APPROX. SURFACE ELEVATION: 100 feet

DEPTH feet	SAMPLE NO.	TYPE	PENETRATION RESISTANCE blows/ft.	② GROUNDWATER	DESCRIPTION ①	MOISTURE	DRY DENSITY lbs./ft.³	LIQUID LIMIT	PLASTICITY INDEX	GRAIN SIZE Gravel (> #4 sieve) %	GRAIN SIZE Sand (#4 to #200 sieve) %	GRAIN SIZE Fines (< #200 sieve) %	UNCONFINED COMPRESSIVE STRENGTH k.s.f.	DIRECT SHEAR Cohesion p.s.f.	DIRECT SHEAR Internal Friction Angle
					LEAN CLAY WITH SAND AND GRAVEL (CL) - dark grayish brown - fine to coarse sand and gravel - medium plasticity - moist										
5	1		22		**CLAYEY GRAVEL WITH SAND (GC)** - dark yellowish brown - fine to coarse sand and gravel - medium plasticity - medium dense - moist to wet	11	110			43	36	21	1.79		
	2		29	▽		9	119			46	33	21	3.48		
10	3		22												
	4		19			13	123	41	18				1.68		
15	5		27	▽											
	6		36		**WELL-GRADED GRAVEL WITH CLAY AND SAND (GW-GC)** - dark grayish brown - fine to coarse sand and gravel - medium plasticity - medium dense - wet	14	127						1.70		
20	7		20							55	33	12			
	8		53		**CLAYEY SAND WITH GRAVEL (SC)** - brown - fine to coarse sand and gravel - medium plasticity - medium dense to very dense - wet	13									
25	9		26		**BOTTOM OF BORING AT 29 FEET**										

FINES 12% Silt 9% Clay

FINES 11% Silt 10% Clay

FINES 6% Silt 6% Clay

*For Sample 4, sampler was only driven 12 in. because of slough that may have been collected when sampler was pushed through slough layer above 12½ ft.

Slough Penetration Required to Reach Sampling Depth

Sample	Slough*
4	~15 in.
6	~1½ ft.
7	~2½ ft.

*Elevation difference between depth drilled and depth of sampler seating resistance.

NOTES:
① Boring drilled on February 20, 2009. See Appendix A for term definitions and Appendix C for lab test results.
② Groundwater was encountered at a depth of 12 feet during drilling and was measured at a depth of 9 feet after drilling was completed. Equilibrium groundwater depth unknown.

DCM | GeoEngineers

FILE NO. 18423-001-00 | AUGUST 2009

WINZLER & KELLY
City of Healdsburg
Recycled Water System Project
Healdsburg, California
LOG OF BORING B-3

PLATE NO.
B-3

LOG OF BORING B-10

LOCATION: In front of 115 1st Street.
(See Plate I-3)
APPROX. SURFACE ELEVATION: 112 feet

DEPTH feet	SAMPLE NO.	TYPE	PENETRATION RESISTANCE blows/ft.	② GROUNDWATER	DESCRIPTION ①	MOISTURE	DRY DENSITY lbs./ft.³	LIQUID LIMIT	PLASTICITY INDEX	GRAIN SIZE Gravel (> #4 sieve) %	GRAIN SIZE Sand (#4 to #200 sieve) %	GRAIN SIZE Fines (< #200 sieve) %	UNCONFINED COMPRESSIVE STRENGTH k.s.f.	DIRECT SHEAR Cohesion p.s.f.	DIRECT SHEAR Internal Friction Angle
					6 inches of AC over 5 inches of AB										
	1		8		**SANDY LEAN CLAY WITH GRAVEL (CL)** - dark brown - fine to coarse sand and gravel - possible cobbles - medium stiff - medium plasticity - moist	17									
5	2		42		**CLAYEY SAND WITH GRAVEL (SC)** - dark yellowish brown - fine to coarse sand and gravel - dense - medium plasticity - moist	12									
	3		30		**WELL-GRADED SAND (SW)** - gray - fine to coarse sand - dense - trace fine to coarse gravel - dry	8									
10	4		22		**CLAYEY SAND (SC)** - olive brown - fine to coarse sand - medium dense to dense - few fine to coarse gravel - medium plasticity - moist	11									
					BOTTOM OF BORING AT 14 FEET										
15															
20															
25															

NOTES:
① Boring drilled on March 31, 2009. See Appendix A for term definitions and Appendix C for lab test results.
② No free groundwater encountered. Equilibrium groundwater depth unknown.

DCM | GeoEngineers

WINZLER & KELLY
City of Healdsburg
Recycled Water System Project
Healdsburg, California
LOG OF BORING B-10

PLATE NO.
B-10

FILE NO. 18423-001-00 | AUGUST 2009

LOG OF BORING B-8

LOCATION: Piper St. at northwest corner of intersection with 1st Street. (See Plate I-3)

APPROX. SURFACE ELEVATION: 110 feet

DEPTH feet	SAMPLE NO.	TYPE	PENETRATION RESISTANCE blows/ft.	② GROUNDWATER	DESCRIPTION ①	MOISTURE	DRY DENSITY lbs./ft.³	LIQUID LIMIT	PLASTICITY INDEX	GRAIN SIZE Gravel (> #4 sieve) %	GRAIN SIZE Sand (#4 to #200 sieve) %	GRAIN SIZE Fines (< #200 sieve) %	UNCONFINED COMPRESSIVE STRENGTH k.s.f.	DIRECT SHEAR Cohesion p.s.f.	DIRECT SHEAR Internal Friction Angle
					5 inches of AC over 7 inches of AB										
					FILL - LEAN CLAY WITH SAND (CL) - dark grayish brown - medium plasticity - fine to coarse sand - moist										
	1		24			14									
					FILL - LEAN CLAY WITH SAND (CL) - brown - medium plasticity - fine to coarse sand - very stiff - few fine to coarse gravel - moist										
5	2		33												
					CLAYEY SAND WITH GRAVEL (SC) - olive brown - fine to coarse sand and gravel - high plasticity - medium dense to dense - moist										
	3		40			13	118	56	31				2.39		
10	4		26							41	③ 43	16			
	5		55			10	126								
					BOTTOM OF BORING AT 14 FEET										
15															
20															
25															

Sample 1
Corrosion Test
Results on Plate C-7

NOTES:

① Boring drilled on March 30, 2009. See Appendix A for term definitions and Appendix C for lab test results.
② No free groundwater encountered. Equilibrium groundwater depth unknown.
③ Grain size analysis for Sample No. 4 based on sample retained on #4 and #200 sieves only.

DCM | GeoEngineers

FILE NO. 18423-001-00 | AUGUST 2009

WINZLER & KELLY
City of Healdsburg
Recycled Water System Project
Healdsburg, California
LOG OF BORING B-8

PLATE NO.
B-8

LOG OF BORING B-1

LOCATION: Southwest corner of water tank
(See Plate I-3)
APPROX. SURFACE ELEVATION: 225 feet

DEPTH feet	SAMPLE NO.	TYPE	PENETRATION RESISTANCE blows/ft.	② GROUNDWATER	DESCRIPTION ①	MOISTURE	DRY DENSITY lbs./ft.³	LIQUID LIMIT	PLASTICITY INDEX	GRAIN SIZE Gravel (> #4 sieve) %	GRAIN SIZE Sand (#4 to #200 sieve) %	GRAIN SIZE Fines (< #200 sieve) %	UNCONFINED COMPRESSIVE STRENGTH k.s.f.	DIRECT SHEAR Cohesion p.s.f.	DIRECT SHEAR Internal Friction Angle
					FILL - SANDY LEAN CLAY WITH GRAVEL (CL) - dark grayish brown - fine to coarse sand and gravel - medium plasticity - moist										
	1		11		**FILL - LEAN CLAY WITH SAND AND GRAVEL (CL)** - strong brown - fine to coarse sand and gravel - stiff - medium plasticity - moist	18	100								
5					**SILTY SAND (SM)** - yellowish brown - fine to medium sand - few fine to coarse gravel - low plasticity fines - dense - moist										
	2		48			9	107	38	12						
10															
	3		29		**CLAYEY SAND WITH GRAVEL (SC)** - dark yellowish brown - fine to coarse sand and gravel - medium dense - moist	13									
15															
	4		14			15									
					BOTTOM OF BORING AT 19 FEET										
20															
25															

NOTES:
① Boring drilled on February 20, 2009. See Appendix A for term definitions and Appendix C for lab test results.
② No free groundwater encountered. Equilibrium groundwater depth unknown.

DCM | GeoEngineers

FILE NO. 18423-001-00 | AUGUST 2009

WINZLER & KELLY
City of Healdsburg
Recycled Water System Project
Healdsburg, California
LOG OF BORING B-1

PLATE NO.
B-1

LOG OF BORING B-7

LOCATION: Fitch St. on south corner at Lincoln St.
(See Plate I-3)
APPROX. SURFACE ELEVATION: 140 feet

DEPTH feet	SAMPLE NO.	TYPE	PENETRATION RESISTANCE blows/ft.	GROUNDWATER ②	DESCRIPTION ①	MOISTURE	DRY DENSITY lbs./ft.³	LIQUID LIMIT	PLASTICITY INDEX	GRAIN SIZE Gravel (> #4 sieve) %	GRAIN SIZE Sand (#4 to #200 sieve) %	GRAIN SIZE Fines (< #200 sieve) %	UNCONFINED COMPRESSIVE STRENGTH k.s.f.	DIRECT SHEAR Cohesion p.s.f.	DIRECT SHEAR Internal Friction Angle
					5 inches of AC over 6 inches of AB										
	1		4		**FILL - LEAN CLAY WITH SAND (CL)** - strong brown - fine to coarse sand - few fine to coarse gravel - soft - medium plasticity - moist	15	111						0.62		
5	2		9		**CLAYEY SAND (SC)** - dark yellowish brown - fine to coarse sand - high plasticity - medium dense - moist										
	3		18			24	100	51	25				1.41		
10	4		13							0	③ 64	36			
	5		23		**CLAYEY SAND (SC) and SILTY SAND (SM)** - layered olive brown, light grayish brown, and strong brown - high plasticity - fine to coarse sand - medium dense - few fine to coarse gravel - wet	25	95								
15					**BOTTOM OF BORING AT 14 FEET**										
20															
25															

NOTES:
① Boring drilled on March 30, 2009. See Appendix A for term definitions and Appendix C for lab test results.
② Groundwater encountered during drilling at a depth of about 12½ feet and measured at a depth of 11½ feet 10 minutes after drilling completed. Equilibrium groundwater depth unknown.
③ Grain size analysis for Sample No. 4 based on sample retained on #4 and #200 sieves only.

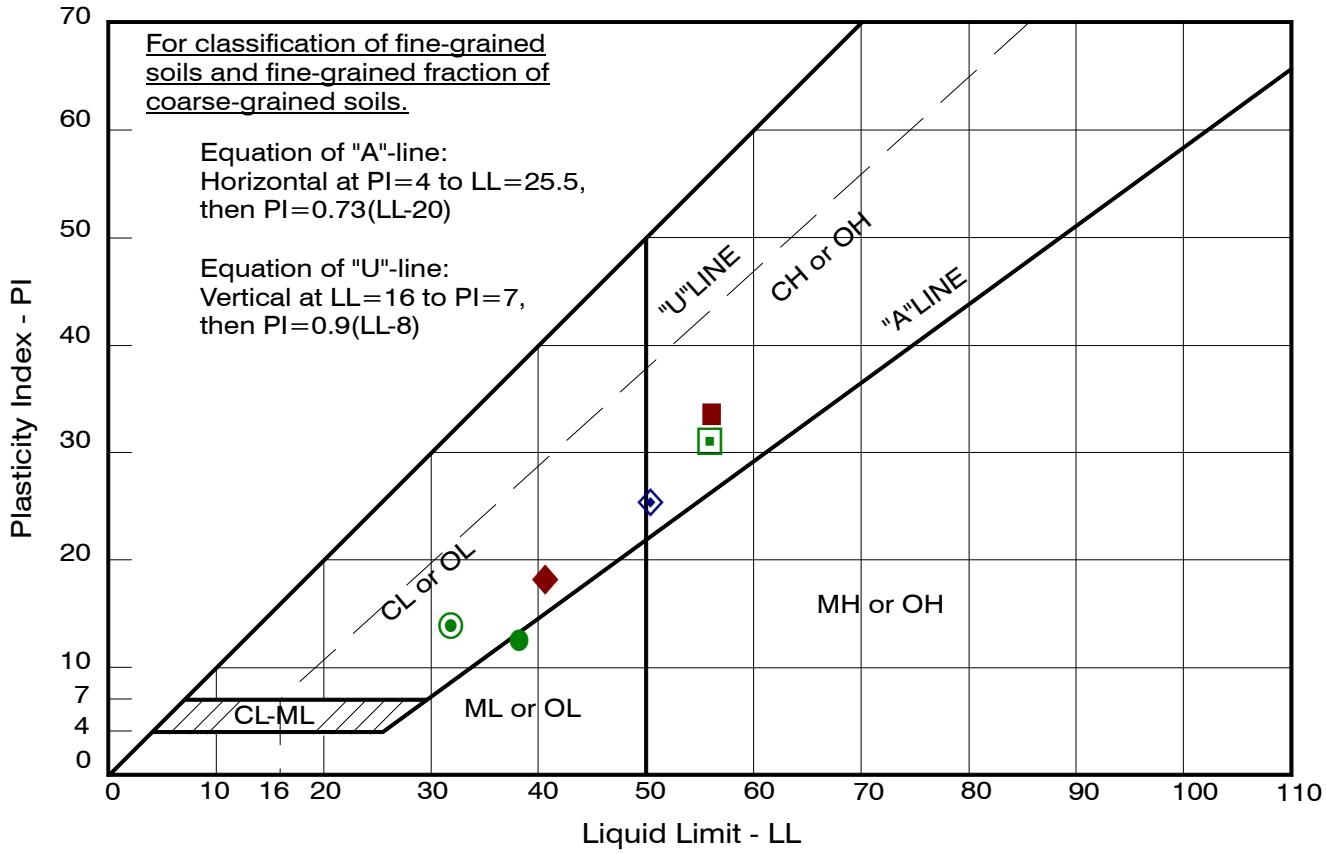
DCM | GeoEngineers

FILE NO. 18423-001-00 | AUGUST 2009

WINZLER & KELLY
City of Healdsburg
Recycled Water System Project
Healdsburg, California
LOG OF BORING B-7

PLATE NO.
B-7

D. Historical Laboratory Test Results



TEST SYMBOL	BORING SAMPLE NO.	DEPTH (ft)	LIQUID LIMIT - LL	PLASTICITY INDEX - PI	GROUP SYMBOL*
●	B-1-2	8-8½	38	12	ML
◆	B-3-4	13-13½	41	18	CL
■	B-5-2	4-5½	56	34	CH
◉	B-6-2	3½-4	32	14	CL
◈	B-7-3	8-8½	51	25	CH
▣	B-8-3	8½-9	56	31	CH

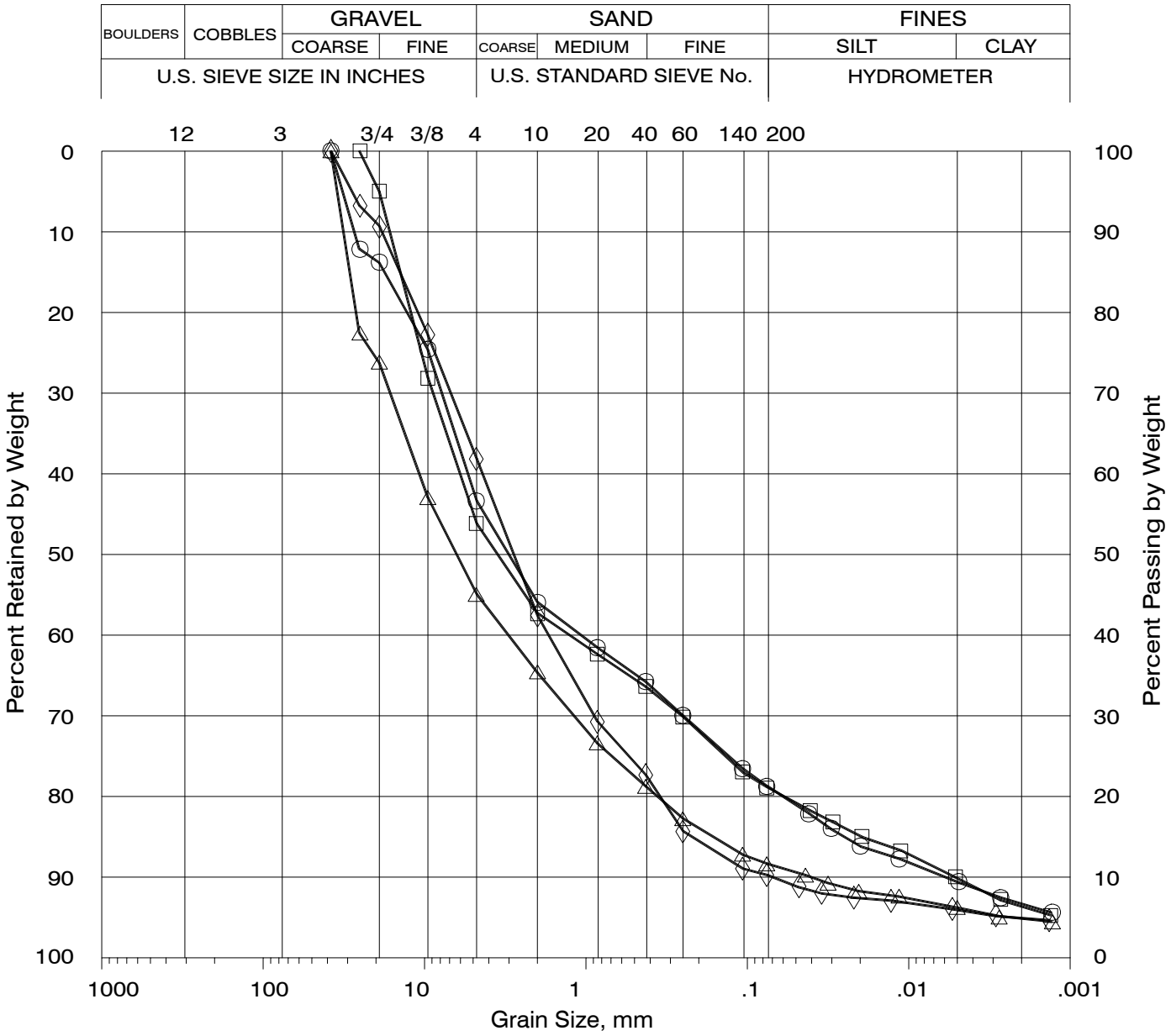
* Classification of fines < 0.425mm

DCM | GeoEngineers

FILE NO. 18423-001-00 | AUGUST 2009

WINZLER & KELLY
City of Healdsburg
Recycled Water System Project
Healdsburg, California
ATTERBERG LIMITS

PLATE NO.
C-1
(1 of 2)



TEST SYMBOL	BORING SAMPLE NO.	DEPTH (feet)	GROUP SYMBOL	DESCRIPTION
○	B-3-1	3½-4	GC	clayey gravel with sand
□	B-3-2	8½-9	GC	clayey gravel with sand
△	B-3-7	19-20½	GW-GC	well-graded gravel with clay and sand
◇	B-4-5	14-15½	SW-SC	well-graded sand with clay and gravel

NOTE:
The largest particle (grain) size that could have been sampled from our borings by our sample barrels is a function of the inside diameter of the sample barrels used (see Plate A-1). Therefore, there may be larger particles (e.g., coarse gravel, cobbles or boulders) in the soils sampled than reflected on the boring logs and grain size distribution curves provided in this report.

DCM | GeoEngineers

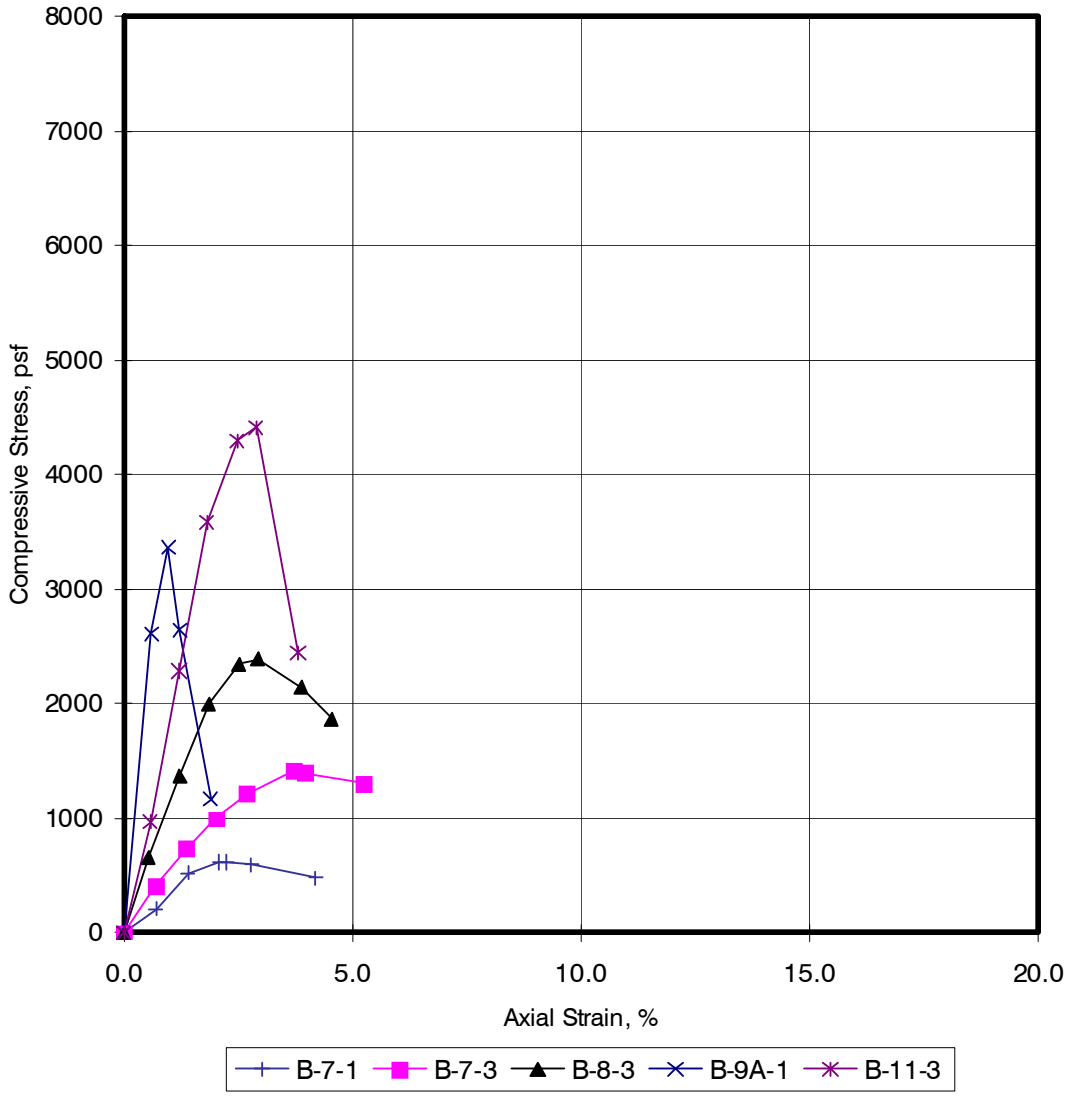
FILE NO. 18423-001-00 | AUGUST 2009

WINZLER & KELLY
City of Healdsburg
Recycled Water System Project
Healdsburg, California

GRAIN SIZE ANALYSIS

PLATE NO.
C-2
(1 of 5)

UNCONFINED COMPRESSION TEST



BORING SAMPLE NO.	B-7-1	B-7-3	B-8-3	B-9-1	B-11-3
MAXIMUM UNCONFINED STRESS, psf	618	1414	2391	3370	4420
% STRAIN @ PEAK STRESS	2.3	3.7	2.9	1.0	2.9
DEPTH, ft.	3½-4	8½-9	8½-9	3½-4	8½-9
WATER CONTENT, %	15	24	13	12	19
DRY DENSITY, pcf	111	100	118	109	106
SATURATION, %	75	95	83	61	87

Maximum Unconfined Stress cut-off = 15% strain
Average Strain Rate = 0.07 in/min.

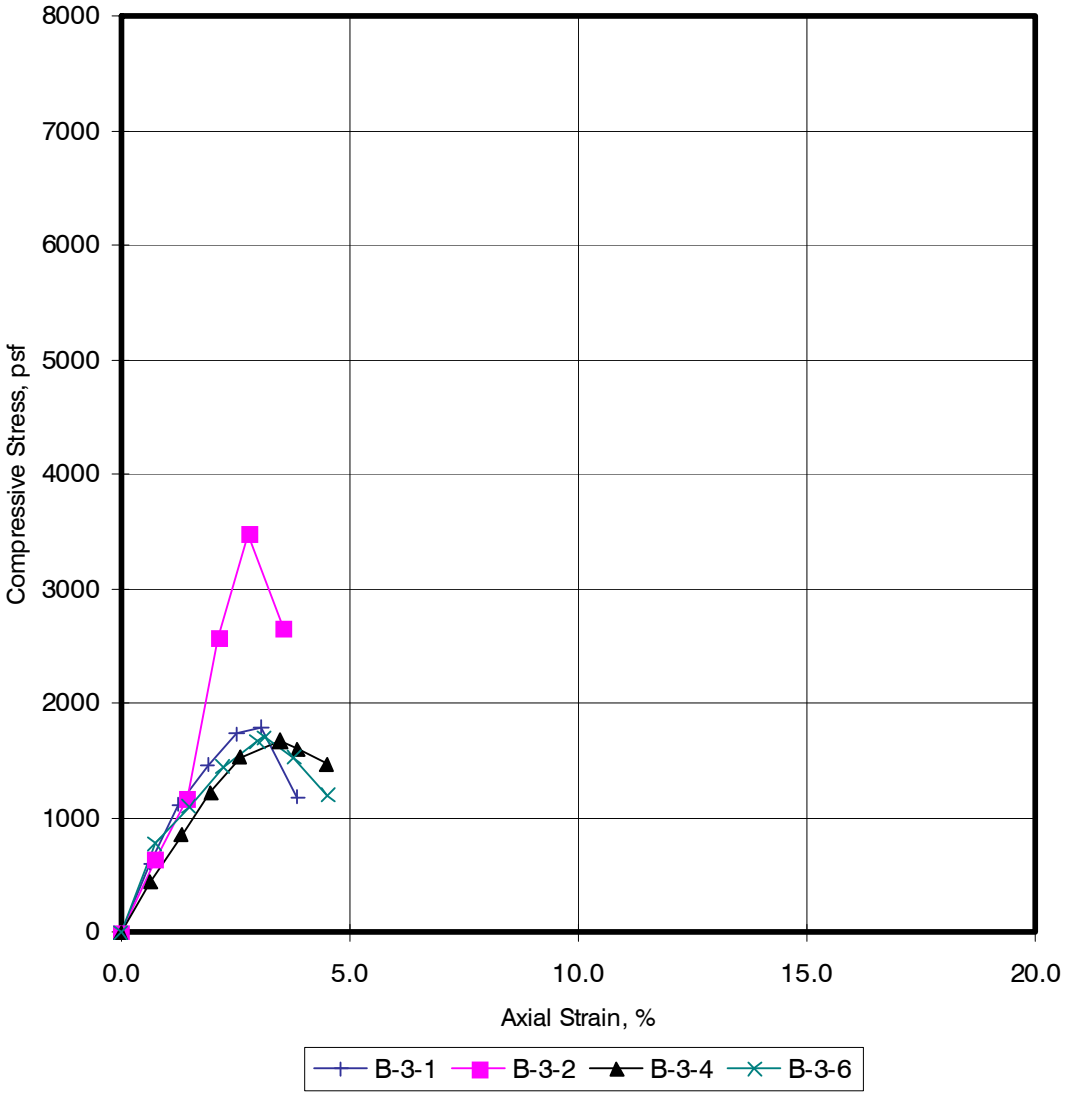
DCM | GeoEngineers

FILE NO. 18423-001-00 | AUGUST 2009

WINZLER & KELLY
City of Healdsburg
Recycled Water System Project
Healdsburg, California
UNCONFINED COMPRESSION

PLATE NO.
C-3
(3 of 5)

UNCONFINED COMPRESSION TEST



BORING SAMPLE NO.	B-3-1	B-3-2	B-3-4	B-3-6
MAXIMUM UNCONFINED STRESS, psf	1793	3478	1677	1701
% STRAIN @ PEAK STRESS	3.1	2.8	3.5	3.1
DEPTH, ft.	3½-4	8½-9	13-13½	18½-19
WATER CONTENT, %	11	9	13	14
DRY DENSITY, pcf	110	119	123	127
SATURATION, %	56	60	94	100

Maximum Unconfined Stress cut-off = 15% strain
Average Strain Rate = 0.07 in/min.

DCM | GeoEngineers

FILE NO. 18423-001-00 | AUGUST 2009

WINZLER & KELLY
City of Healdsburg
Recycled Water System Project
Healdsburg, California
UNCONFINED COMPRESSION

PLATE NO.
C-3
(1 of 5)

APPENDIX F

Geotechnical Design Memorandum, August 2023

MOTT MACDONALD

City of Healdsburg Municipal Recycled Water Pipeline

Geotechnical Design Memorandum

August 2023

This page left intentionally blank for pagination.

Mott MacDonald
155 Montgomery Street
Suite 1400
San Francisco
CA 94104
United States of America

T +1 (415) 968 3495
mottmac.com

Robert Reid
West Yost
2020 Research Park Drive,
Suite 100
Davis, CA 95618

City of Healdsburg Municipal Recycled Water Pipeline

Geotechnical Design Memorandum

August 2023

Issue and revision record

Revision	Date	Originator	Checker	Approver	Description
0		JS	EJ		Draft GDM, Revision 0
1	8/17/2023	JS	EJ		Response to comments

Document reference: 504100918 | | |

Information class: Standard

Contents

Tables

Figures

Appendices

1 Introduction

This Geotechnical Design Memorandum (GDM) presents geotechnical design recommendations and construction considerations in support of the City of Healdsburg's Municipal Recycled Water Pipeline Project. Mott MacDonald Group, Inc. (Mott MacDonald) has prepared this report for West Yost Associates, Inc. (West Yost) on behalf of the City of Healdsburg. This report partially fulfills the requirements of Task Order No.1 between West Yost and Mott MacDonald, dated October 27, 2022.

1.1 Project Description

The proposed City of Healdsburg Recycled Water Pipeline would deliver recycled water to municipal turf at Healdsburg Elementary School, Recreation Park, Giorgi Park, Oak Mound Cemetery and Tayman Park by installing over 2 miles of new pipeline along city streets and under US Highway 101. The current project scope includes unconstructed portions of the recycled water pipeline described in a 2011 drawing set prepared by Winzler and Kelly for the City's Recycled Water System Project. As part of the current study, West Yost investigated several potential alternatives to Winzler and Kelly's 2011 alignment. Descriptions of the alternatives analysis methodology and the selected pipeline alignment are presented in the project document titled Preliminary Design Report (West Yost, 2023). The selected alignment includes modifications to the 2011 design, most notably a new location for the crossing beneath US Highway 101, located south of the proposed 2011 crossing. These adjustments to the original alignment created geotechnical data gaps and the need for additional geotechnical data and updated recommendations.

1.2 Objectives and Scope of Services

The purpose of Mott MacDonalds' services was to evaluate subsurface soil conditions in terms of engineering properties, discuss pertinent geologic and geotechnical conditions that may affect the proposed pipeline, and provided geotechnical recommendations to the project design team. Geotechnical data including boring logs and the results of field and laboratory tests are contained within the Geotechnical Data Report (GDR). The GDR compliments this GDM and should be reviewed concurrently.

This GDM includes:

1. Introductions and project background
2. Discussions of local and pipeline specific subsurface soil conditions
3. Discussion of seismic hazards and geotechnical conditions relevant to the pipeline
4. Recommendations and considerations for design and construction.

1.3 Document Organization

The Geotechnical Design Memorandum (GDM) is organized into the following sections.

- Section 1 presents an introduction, including the objectives and scope
- Section 2 presents site and project background.
- Section 3 discusses subsurface conditions and provides engineering design parameters
- Section 4 discusses seismic and geologic considerations and includes an evaluation of trenchless methods considering the subsurface conditions.

- Section 5 presents recommendations relating to the proposed pipeline include lateral earth pressure, criteria for trench backfill, dewatering, and temporary support of excavation
- Section 6 presents references cited in this report.

1.4 Limitations

This document has been prepared for the City of Healdsburg Recycled Water Pipeline (HRWP) project and may not be relied upon or used on any other project or under any differing circumstances or applications on the HRWP project without an independent check being carried out as to its applicability to the project or differing circumstances or application and the prior written authorization of Mott MacDonald with respect to the discussions, conclusions and recommendations provided. Mott MacDonald accepts no responsibility or liability for the consequence of this document being used for a purpose other than the purposes and circumstances for which it was commissioned.

In the event of any change in the assumed nature or design of the proposed recycled water pipeline, the conclusions and recommendations contained in this report shall not be considered valid unless the changes are reviewed, and the conclusions of this report modified or verified in writing by Mott MacDonald.

2 Site Background and Existing Conditions

2.1 Site Conditions

Surface conditions in areas of planned open cut construction generally consist of surface streets covered by asphalt concrete pavement. Drainage of storm water is by sheet flow to municipal storm drains. The jacking and receiving pit locations for the proposed trenchless crossing beneath US-101 are anticipated to be within the County of Sonoma and Caltrans right-of-way. Additional sections of the pipeline are within the County of Sonoma and City of Healdsburg right-of-way. The end of South University Street appears to be dirt paved with minor vegetation consisting of shrubs and grasses growing adjacent to the alignment and SMART rail crossing.

2.2 Proposed Alignment

The proposed pipeline alignment is described below beginning at the southern pipeline terminus and ending at multiple locations to the north, Oak Mound Cemetery, Tayman Park, and the intersection of University Street and Grant Street. The general site vicinity is depicted on Figure 1. Figure 2 presents the proposed alignment as well as the locations of both previous and current geotechnical boreholes.

The proposed alignment begins on the southwest side of US-101, near the northwest corner of the property located at 280 Kinley Drive. The alignment proceeds southeast down Kinley drive for approximately 1,000 feet before it turns to the north and crosses beneath US-101 as a proposed approximately 168-foot-long trenchless crossing. The alignment continues through the City of Healdsburg along Kennedy Lane, Healdsburg Avenue, South University Street, Hudson Street, First Street, Piper Street, University Street, and Front Street. The pipeline will cross beneath existing Sonoma Marin Area Rail Transit (SMART) tracks between South University Street and Hudson Street in a previously installed, but unused, PVC pipeline. North of the intersection of Front and Mason Streets the alignment follows 1st Street, Piper Street, and Cemetery Lane. Approximately 600 feet north of the Intersection of Piper Street and Cemetery Lane the pipeline will divide into three branches with a northern branch terminating in Oak Mound Cemetery, an eastern branch terminating in Tayman Park, and a western branch terminating at the intersection of University Street and Grant Street.

2.3 Existing Geotechnical Data and Information

Available geologic and geotechnical information was collected and reviewed to identify relevant existing documents and data sources. The following document types and data sources were reviewed:

- Geotechnical data and reports (City of Healdsburg, California Department of Transportation),
- Soil survey maps and data (United States Department of Agriculture Natural Resources Conservation Service),
- Geologic and hydrologic maps (United States Geological Survey (USGS) and California Geological Survey (CGS)),
- Geologic hazard maps, seismic hazard maps, and fault maps (USGS and CGS),
- Historic topographic maps (USGS),
- Aerial photographs (Sonoma County), and
- Utility maps (City of Healdsburg)

Pertinent geotechnical information from these sources has been incorporated into the GDR and aided in the formation of a general geological understanding of subsurface conditions along the proposed alignment.

An existing Geotechnical Engineering Investigation Report was prepared by DCM/GeoEngineers for Winzler & Kelly at the request of the City of Healdsburg in 2009. The DCM/GeoEngineers investigation was conducted in support of design for the initial phases of the recycled water pipeline. The GDR summarizes the results of previous geotechnical investigations.

2.4 Geotechnical Investigation

Mott MacDonald has completed a site investigation for the proposed pipeline by drilling four borings to depths ranging from 16.5 feet to 51.5 feet. Geotechnical boring logs, sampling procedures, and sampler types are described in the GDR.

3 Interpretation of Subsurface Conditions

3.1 Subsurface Units

Artificial fill was encountered in borehole MM-01, reference boreholes B-4, B-8, and B-1. The depth of fill ranged from approximately 2 feet at MM-01 to 5 feet at B-4. Fill soils consisted of dense, poorly graded sands with silt and gravel, and soft to very stiff lean clay with varying percentages of sand and gravel (SP-SM and CL soil types based upon the Unified Soil Classification System, USCS). Asphalt and asphalt base was encountered in several of the boreholes.

In the vicinity of the proposed trenchless crossing (US-101), boreholes MM-01 and MM-02, the soils encountered consisted of 12 to 15.5 feet of cohesive stiff to very stiff silt and clay (ML, CL) and loose clayey sand (SC), overlaying cohesionless soils to the maximum depth explored (51.5 feet). Cohesionless soils consist of medium dense to very dense clayey sand, poorly graded sand, and gravel with varying percentages clay, silt, and sand (SC, SP, GP, GC, GP-GC, and GM soil types). One layer of very stiff to hard lean clay (CL) is encountered at 40 feet in MM-01 and 48 feet in MM-02.

Native soils encountered outside the trenchless portion of the alignment consist of sand, clay and gravel in varying proportions and thicknesses typical of stream terrace and alluvial deposits, with USCS groups consisting of GC, GW-GC, SW-SC, SM, SW, SC, ML, CL. Consistency of cohesive soils range from soft to hard with stiff to medium stiff being most representative. The density of cohesionless soils range from medium dense to very dense.

At the northern end of the alignment borehole MM-04 encountered gravel, cobbles, and boulders within the top 4.5 feet of profile. These soils overlay stiff to hard lean clay (CL) deposits. Additionally, possible cobbles were noted during drilling at borehole location MM-01 at a depth of 22 feet. Cobbles and boulders are not identified in other borehole locations; however, given the geologic setting and depositional history of the site cobbles and boulders may be present at other locations along the project alignment.

3.2 Groundwater

Groundwater readings are summarized within the GDR and displayed on boring logs. The depth to groundwater varies along the alignment. South of Mason Street shallow groundwater was encountered within the upper 10 feet. North of Mason Street groundwater becomes deeper with groundwater depths exceeding 10 feet. Several shallow borings (14 to 19 feet deep) did not encounter groundwater to the maximum depth explored. However, reference boring B-7 did encountered groundwater at a depth of 11.5 feet near the intersection of Lincoln Street and Fitch Street.

Groundwater depth for portions of the alignment south of Mason Street should be considered at 7 feet below the existing street elevation. Specifically, for the trenchless crossing beneath CA-101 a groundwater depth of 7 feet corresponds to an approximate elevation of 91 feet. North of Mason Street, depth to groundwater is likely greater than 10 feet below the existing street grade. However, based on the groundwater readings and exploration depths, groundwater should be assumed at 10 feet below existing street grade.

Fluctuations of the groundwater level, localized zones of perched water, and variations in soil moisture content should be anticipated during and following the rainy season. Additionally,

irrigation of landscaped areas on and adjacent to the site, as well as leaking or damaged water and sewer infrastructure can also cause a fluctuation of local groundwater levels.

3.3 Engineering Soil Units and Design Parameters

Subsurface soils were evaluated and grouped into four distinct Engineering Soil Units (ESU) based on their similarity and expectant behavior in an engineering context. Grouping of subsurface units considered several factors including geologic unit, laboratory test results, driven sampler blow counts or N values, and USCS soil type. Based on the similarities observed between various samples the following four ESU's are applicable to the Recycled Water Pipeline. Figure 3 depicts an interpretive profile of the CA-101 trenchless crossing with ESU I to III.

- ESU I, Artificial Fill (af): Consisting of a variety of soil types including clay, sand, and gravel as described above. ESU I may consist of poorly compacted fill or engineered fill that was properly compacted when placed. Typical compaction criteria that are used during fill placement range from 90 to 95 percent relative compaction. Debris and trash may also be encountered in ESU I although none was encountered during exploration. Thickness of artificial fill is expected to range from 2 to 5 feet. Specifically at the CA-101 trenchless crossing the contact between fill (ESUI) and native soil (ESU II) is variable and based on interpretation from borings MM-01 and MM-02. Artificial fill will be encountered above the groundwater.

- ESU II, Terrace Deposits: This unit is prevalent south of Mason Street and underlies ESU I. The unit is fine and coarse-grained and consists of stiff silt and clay with occasional layers of clayey sand. Groundwater is encountered within ESU II south of Mason Street

- ESU III, Terrace and Alluvial Deposits: South of Mason Street ESU III underlies ESU II at a depth of approximately 15 feet. North of Mason Street ESU III is typically encountered with the upper 1 to 5 feet of the existing ground surface although depth of cover is likely to vary and be transitional from south to north. ESU III is predominantly coarse-grained consisting of gravel and sand with clay. Gravel is fine to coarse and was encountered in sizes up to 3 inches. One cobble is described at a depth of 35 feet in boring MM-01 while cobbles and boulders were encountered in ESU III in boring MM-04.

- ESU IV, Alluvium – Cohesive: ESU IV is encountered at the northern end of the alignment in boring MM-04. This unit consists of very stiff, medium to high plasticity fat and lean clay. When encountered in an open trench ESU is expected to exhibit firm behavior for a limited time. However, once exposed to the atmosphere the clay will fissure and progressively fail over time.

Engineering soil properties were assigned to the different ESU's based on laboratory testing results, field SPT blow count data, and consideration of the USCS soil classification. Table 3-1 below presents engineering parameters that may be used for design.

Table 3-1. Engineering Soil Properties

Engineering Soil Unit (ESU)	Description	Unit Weight Y (pcf)	Liquid Limit, LL (%)	Plastic Limit, PI (%)	Friction Angle, Ø (deg)	Undrained Shear Strength, Su (psf)
I	Artificial fill	120	N/A	N/A	30	N/A
II	Terrace Deposits	125	28	10	32	450
III	Terrace and Alluvial Deposits	130	42	19	35	840
IV	Alluvium - Cohesive	110	66	37	28	4000

1. N/A = Not Applicable.

4 Discussions and Conclusions

4.1 Seismic Design Parameters

The American Lifelines Alliance (ALA) provides categories of targeted performance under earthquake conditions. Pipe function class is related to the importance in improving a community's post-earthquake response and recovery. The Healdsburg recycled water pipeline is assigned a pipe function class of "I" indicating the pipeline represents very low hazard to human life in the event of failure. Widespread damage to the pipeline in the event of an earthquake will not materially harm the economic wellbeing of the community.

Seismic parameters from the 2019 California Building Code (2019 CBC) are presented in Table 4-1 below. The CBC includes several seismic design parameters that are influenced by the geographic site location with respect to active and potentially active faults, and with respect to subsurface soil or rock conditions. The seismic design parameters presented herein were calculated by determining a representative latitude and longitude for the overall alignment and entering them into the ASCE 7 hazards tool. The seismic parameters were computed applying ASCE 7-16, for risk category II and site class D and are summarized in Table 4-1 below.

Table 4-1. Summary of Seismic Parameters

MCER ground motion for 0.2 sec period (S_S)	2.067 g
MCER ground motion for 1.0 sec period (S_1)	0.796 g
Site modified spectral acceleration values (S_{MS})	2.067 g
Site modified spectral acceleration values (S_{M1})	Not applicable
Numeric seismic design value at 0.2 sec SA (S_{DS})	1.378 g
Numeric seismic design value at 1.0 sec SA (S_{D1})	Not applicable
Site amplification factor at 0.2 second (F_a)	1.0
Site amplification factor at 1.0 second (F_v)	Not applicable
MCEG Peak ground acceleration (PGA)	0.870 g
MCEG Peak ground acceleration, adjusted (PGA_M)	0.957 g

4.2 Geologic and Seismic Hazards

The project site may be subject to geologic hazards and strong ground motions from nearby active faults such as the Rodgers Creek-Healdsburg, Maacama, and San Andreas faults during the design life of the pipeline.

This section discusses potential seismic and geologic hazards that may affect the proposed recycled water pipeline.

4.2.1 Ground Rupture

The project alignment is not located within a state designated Alquist-Priolo Earthquake Fault Zone (California Geological Survey, 2017) and does not cross known active or potentially active faults. Based on a hazard deaggregation performed using the USGS Unified Hazard Tool (UHT; USGS, 2020) a site-to-fault distance of approximately 2.55 miles was identified for the Kinley Road trenchless crossing location and the Rodgers Creek-Healdsburg fault. The site-to-fault distance of about 6 miles was identified between the trenchless crossing location and the

Maacama fault. Recent mapping of Healdsburg Fault by Hecker and Loar (2018) indicates that the Healdsburg fault is approximately 0.5 miles east of the northern end of the proposed alignment, in the vicinity of Oak Mound Cemetery. Mapped quaternary fault locations and historic seismicity in the region are presented on Figure 4.

4.2.2 Flooding

The proposed pipeline alignment is not within the 0.2% or 1% annual chance of flood hazard as depicted within FEMA's National Flood Hazard Maps. Front Street north of the intersection with Hudson Street borders the 0.2% annual chance of exceedance flood zone along the eastern side of Front Street.

4.2.3 Liquefaction and Lateral Spreading

Liquefaction is the loss of strength of saturated cohesionless soil caused by the propagation of seismic ground motion. Soil types most susceptible to liquefaction are loose, saturated silty to clean sands, and low plasticity silts. The proposed alignment is within a CGS Seismic Hazard Zone Unevaluated Area. However, based on mapped liquefaction susceptibility by the USGS (Witter et al. 2006) the majority of the proposed alignment traverses areas classified as having moderate to low susceptibility to liquefaction. Figure 5 presents the proposed alignment relative to mapped liquefaction susceptibility.

4.3 Feasibility of Trenchless Construction Methods

Table 1 identifies anticipated soil behaviors during pit excavation and tunneling operations of the Highway 101 crossing based on Tunnelman's ground classification provided in Appendix A. The behavior of the soil will be affected by the presence of water. Based on the geotechnical investigation, both borings MM-01 and MM-02 encountered groundwater at approximately 7 feet below ground surface, corresponding to an approximate elevation of 90 feet. As the casing pipe invert ranges from elevation 90.5 to 91.5 feet, it remains above the groundwater level.

Table 4-2. Summary of Possible Soil Behaviors for Highway 101 crossing

Soil Type	Firm	Slow Ravelling	Fast Ravelling	Squeezing	Cohesive Running	Running	Flowing	Swelling
Artificial Fill[1]					✓			
Terrace Deposit[1]	✓	✓						
Terrace Deposit[2]		✓	✓				✓	

1. Above groundwater table
2. Below groundwater table

Based on the anticipated subsurface conditions, length and diameter of the tunnel, and site-specific constraints, two trenchless methods that are considered to be feasible are horizontal auger boring (HAB) and microtunneling. Table 4-3 presents the pros and cons of these methods. HAB is the recommended trenchless method based on the alignment geometry and subsurface conditions. Details of the trenchless design were included in the preliminary design memorandum of Highway 101 crossing submitted on April 17, 2023.

Table 4-3. Pros and Cons of Different Trenchless Methods

Trenchless Methods	Pros	Cons
HAB	Cost-effective Simpler operation and relative short construction timeline Minimal impact on surface and utilities	Not suitable for soils below groundwater table Limited steering capability Approximately 2% line and grade accuracy
Microtunneling	Precise and controlled installation for accurate alignment Suitable for long-distance/curved alignments Suitable for soils above and below groundwater table High line and grade accuracy	High cost and longer duration Potential ground settlement and excavation stability issues Limited options when encountering a machine stoppage Difficulty in maintaining line and grade if obstructions encountered Requires skilled operators
HDD *Not recommended due to the presence of cobbles and boulders, required installation length, and casing requirements under Highway 101.	Suitable for longer installation distance Allows for installation under obstacles	Higher cost and equipment requirements Requires skilled operators Potential needs for drilling fluid disposal and environmental concerns Difficulty with drilling through gravels, cobbles, and boulders. Casing is required under Caltrans right-of-way. Alignment requires consideration of bending limitations of pipeline.

4.4 Construction Considerations for Trenchless Construction

MM-02 encountered tree roots at 5 feet below ground surface, which poses a risk of obstruction or damage to the auger and drilling equipment should the bore be placed within this zone. Previous subsurface exploration also indicates the presence of cobbles and boulders, which can slow the boring rate and present mining challenges, making it difficult to meet line and grade tolerances. Construction activities that are required to complete the crossing, such as shoring installation and tree removal, may generate noticeable levels of vibrations or noise for those in the surrounding area. While these activities are brief and transient, construction-related noise such as those from excavation equipment and vehicle movements, including back-up beepers and engine noise will be present throughout the duration of normal construction activities. There will be an increase in truck traffic due to delivery of materials, pumping of cellular concrete or grout, and removal of excavation spoils, all of which will utilize the designated construction haul routes.

4.5 Open Cut Trenching

Open cut trenching will be an effective means of pipeline construction outside of the trenchless crossing. Conventional construction equipment should be adequate to complete trench excavation. General trench backfill should be placed and compacted in accordance with recommendations provided in this report for engineered fill presented in section 5.5. Separate bedding and backfill recommendations for pipes are provided below.

4.5.1 Bedding and Backfill

In pipe bedding zones, special pipe bedding and backfill materials should be used to a minimum depth of 6 inches below the pipe and to a height of at least 12 inches above the top of pipe. The recommended pipe zone bedding and backfill for should comply with section 10.09 of the City of Healdsburg Public Works Standard Specifications and Details.

The majority of the existing fill and native soils encountered during the subsurface investigation program exceeds the maximum fines content (percentage of material passing the No. 200 sieve) required by the Specifications and Details for use as engineered fill. However, suitable granular materials for use in a select backfill blend may be found in limited quantities in on-site excavations.

Bedding materials (select backfill) should be compacted to a firm condition prior to placement of pipes. Initial backfill materials around the pipe zone should be placed in a manner to eliminate voids beneath the pipe. Special care should be taken in the control of utility trench backfilling and compaction under paved areas. Poor compaction may cause excessive settlements resulting in damage to the overlying pavement section. Select backfill materials should be placed in loose lifts of up to 8 inches in thickness and be compacted to at least 95 percent relative compaction based on ASTM D1557. Jetting of pipe bedding or trench backfill materials should not be allowed.

4.6 Soil Compaction

Compaction equipment and techniques should be determined based on the fill material properties and area of placement. Failure to utilize the most appropriate equipment and techniques could result in inability to achieve the required degree of relative compaction, disturbance or displacement of both subgrade and adjacent soils, and/or necessitate the removal and replacement of inadequately compacted fill.

Fine grained soils (clays and silts) typically should not be subjected to vibration or heavy widely distributed loads (such as smooth rollers or wide rubber-tired construction equipment) during the compaction process, as this will cause an increase in the soil pore water pressure resulting in ‘pumping’ or failure to consolidate the soil particles by expelling water and air. These soil types are best compacted by using a ‘kneading’ action (such as a ‘sheepsfoot’ compactor) or impact from a sharp blow on a small area (such as a dynamic or high-speed tamping foot).

Cohesionless, non-plastic soils (sands and sand/gravel combinations) typically are best compacted using a wide, smooth, heavy static device (roller, wheels, tires etc.) or with the addition of vibration to these types of equipment. Narrow profile wheels, tires, etc., and high point load equipment typically will not perform as efficiently and will cause displacement and loosening of the adjacent soil.

5 Recommendations

5.1 Site Preparation

All vegetation, uncompacted fill, trash, pavements, abandoned underground utilities, and other debris should be removed from the trench or trenchless pit areas prior to construction. Utilities that cannot be abandoned should be adequately supported and protected during construction. All stripping and debris should be removed from the site to preclude their incorporation in site excavation backfill.

All exposed subgrades at the base of shaft or trench excavations should be firm and unyielding. Subgrade soils should not be excessively wet or dry. The bottom of excavations should be scarified 6-inches and compacted prior to the placement of backfill.

Prior to scarification, compaction, and the placement of pipe bedding or fill the geotechnical engineer's representative should observe and approve excavation bottoms. Pumping, excessively wet soils, or loose soils may require remedial excavation at the direction of the engineer's representative.

5.2 Excavations

Slope height, slope inclination, or excavation depths (including utility trench excavations) should not exceed those specified in local, state, and/or federal safety regulations (e.g., OSHA Health and Safety Standards for Excavations, 29 CFR Part 1926, or successor regulations). Such regulations are strictly enforced, and, if they are not followed, the owner, contractor, or earthwork and utility subcontractors could be liable for substantial penalties. Based on our interpretation of the OSHA regulations and on the findings from this investigation, we expect that the existing near-surface soils will be predominantly Type C soils in ESU I & II and Type B soils in ESU III and IV. For planning purposes, excavations less than about 10 feet deep should have maximum allowable slopes of 1H:1V. The actual OSHA soil type classification and sloping requirements should be determined by the contractor's competent person based on the materials exposed during construction. OSHA requires that excavated slope heights in excess of 20 feet be designed by a professional engineer.

During the time excavations are open, no heavy grading equipment or other surcharge loads (i.e. excavation spoils) should be allowed within a horizontal distance from the top of any slope equal to the depth of the excavation (both distances measured from the top of the excavation slope) unless shoring is designed for surcharge loads. Adequate measures should be taken to protect any structural foundations, pavements, or utilities adjacent to any excavations.

5.3 Temporary Shoring

Temporary excavations for pits and vaults are anticipated to be approximately 5 to 8 feet in depth. In addition, open cut construction my require shoring to support excavations during construction and pipe laying. Shoring may consist of solider piles and lagging, steel sheeting, speed shore systems, hydraulic shores, shields / trench boxes or a combination of various systems. Trench boxes will not be permitted with the Caltrans right of way for the CA-101 crossing. Temporary shoring should be designed in accordance with the Caltrans Trenching and Shoring Manual.

Cantilevered shoring restraining level ground should be designed to resist active lateral earth pressures of 38 pounds per square foot (psf) per foot of depth. Lateral earth pressure at any depth (Z) can be computed as 38(Z) where Z = Depth (in feet) measured below the top of the retained ground surface behind the shoring.

Cantilevered shoring may be used to restrain sloping ground in the vicinity of Caltrans CA-101 crossing. Shoring restraining ground sloping at a 2H:1V or less may be designed for 57psf.

To limit ground movements outside the excavation deflection of the shoring system toward the excavation should be limited at 0.5 inches.

The lateral earth pressure to be resisted by shoring should be increased to allow for surcharge loads. The surcharge considered should include the loads from any structures or vehicle traffic within a distance at least equal to the height of the shoring. This includes the surcharge from construction vehicles and stockpiled material. Standard construction surcharge is presented in Figure 6. Surcharges on restrained, braced systems or cantilever shoring may be estimated using commonly accepted formulas and charts based on elastic theory (e.g. NAVFAC DM7.2 Figure 11).

Lateral (horizontal) loads may be resisted by passive resistance against embedded portions of the shoring system. Above the groundwater table an equivalent fluid weight (EFW) of 450 pounds per cubic foot (pcf) of penetration in firm, native soil may be used for passive lateral load design. Below the groundwater table an EFW of 240 pcf is appropriate for design. The resisting pressure provided is an allowable value and includes a factor of safety of 2.0. The maximum passive pressure used for design should not exceed 4500 psf.

If soldier piles and lagging are used as a support of excavation system axial loads on soldier piles may be resisted by skin friction on the piles below the depth of the excavation. The skin friction on the proposed soldier piles may be taken as 500 psf and should be multiplied by the perimeter surface area of the grouted soldier pile.

To limit sloughing, exposed soil between soldier piles should be supported by lagging and backfilled. Backfill behind lagging should consist of concrete slurry (1 to 2 sack of cement per CY) or cohesionless sand placed so that no voids remain between the lagging and the excavation face of soil. Alternatively, exposed soil supported through the use of reinforced gunite or other approved material designed to minimize soil movement. For design, the lateral earth pressure on lagging may be taken as 60% of the overall lateral earth pressure on the shoring system (need not include seismic pressure). All timber lagging to be left in the ground should be pressure treated in accordance with Standard Specifications for Public Works Construction, Section 204-2.

5.4 Dewatering

Due to the potential for shallow or perched groundwater along the entire project alignment excavations may encounter groundwater and require dewatering. Based on the design groundwater depth of 7 feet for portions of the alignment south of Mason Street and the trenchless crossing of CA-101 there is significant potential for the presence of groundwater and the need for dewatering in the excavations for the planned trenchless crossing jacking and receiving pits.

Selection of methodology and equipment for, as well as implementation and monitoring of, construction site dewatering will be the responsibility of the contractor and should be performed in accordance with federal, State, and City water quality regulations.

5.5 Thrust Blocks

Thrust blocks are anticipated to provide restraint for forces induced by the flow of water within the pipeline. Thrust blocks will exert a lateral force (live load) on the soil and a vertical force due to self-weight (dead load) on trench subgrade.

Provided the recommendations for excavations and trench backfill are carried out thrust blocks may be formed directly against the trench walls. Excavations should be cleaned of all loose or unsuitable soils and debris prior to the placement of concrete. An allowable bearing pressure of 2,000 psf is allowed for thrust blocks bearing a minimum of 2 feet below the existing ground surface. This value may be increased by 1/3 when considering transient loads such a seismic. No increase is allowed for additional embedment depth and thrust block width.

Resistance to lateral loading may be provided by friction acting along the base of the thrust block. An allowable friction factor (f) of 0.3 may be utilized with dead loads. Dead loads may include the self-weight of the thrust block and soil overburden. An equivalent fluid weight (EFW) of 450 pounds per cubic foot (pcf) of penetration in firm, native soil may be used for lateral load design. The resisting pressure provided is an allowable value. The maximum passive pressure used for design should not exceed 4500 psf.

5.6 Permanent Earth Retaining Structures

Permanent earth retaining structures are anticipated to include regulator pits or similar vault type structures. The magnitude of lateral earth pressure will be dependent on the wall of the wall, type of backfill, and drainage condition within the backfill. Wall flexibility is typically categorized as restrained or unrestrained based on the ability of the wall to deflect with increased lateral soi load.

For the purposes of design, a wall should be considered restrained if the lateral deflection of the wall is less than 0.002H, where H = height of the wall. Restrained walls should be designed for a triangular earth pressure distribution. An equivalent fluid weight “EFW” of 60 pounds per cubic foot (pcf) should be used for design and to calculate pressure with depth behind the wall. This earth pressures assumes drainage behind the wall and cohesionless backfill placed per section 5.5.

Unrestrained walls backfilled with free draining cohesionless material placed per section 5.5 should be assumed to apply a triangular pressure distribution. An EFW of 38 pcf should be used for design and to calculate pressure with depth behind the wall where permanent structures retain level ground.

Ultimate passive pressures will develop under lateral movements of about 0.02D where “D” is the embedded portion of the wall engaging passive pressure. Passive pressure should be assumed to be a triangular distribution with an EFW of 450 pcf. This value is based on a safety factor of 2 and generally corresponds to a lateral deflection of less than about ½ inch. Passive resistance in the upper 12 inches should be neglected. The passive pressure is not applicable for below the groundwater.

Resistance to lateral loading may be provided by friction acting along the foundation base. A coefficient of friction of 0.3 may be used in designing concrete retaining wall foundations in firm native soils or fill placed to 95% relative compaction and may be used with dead loads. This value includes a safety factor of 1.5. Frictional and passive resistance may be combined without further reduction.

Backfill behind retaining walls should be with soils that have been properly moisture conditioned to approximately optimum moisture content and uniformly compacted to at least 95% of maximum dry density as determined by ASTM D 1557 test procedures using mechanical compaction equipment. To aid in the compaction operation, retaining wall backfill should be placed in lifts not exceeding six inches compacted thickness.

Surcharge loads should be considered for any structure or vehicle within a 1H:1V slope extending up from the base of the wall. Surcharges based on elastic solutions for various load cases are provided in Figure 6.

Compaction within the area of a 1H:1V slope from the bottom of wall excavations should be performed by hand operated compaction equipment. This is intended to reduce potential "locked-in" lateral pressures caused by compaction with heavy grading equipment.

Weepholes, backdrains or another system to relieve groundwater pressure should be incorporated into the wall design. Waterproofing of retaining structures should be provided to reduce the potential for efflorescence. An appropriately qualified and experienced waterproofing specialist should be consulted for waterproofing recommendations and design.

5.7 Engineered Fill

Backfill around vaults, thrust blocks, utility trenches should consist of engineered fill. Section 5.8 below addresses specific requirements for utility trench backfill. Soils used for engineered fill should be uniformly moisture conditioned to at least 2 percent above the optimum moisture content, placed in horizontal lifts greater than 8 inches in loose thickness, and compacted to at least 95 percent relative compaction. Within the upper 12 inches of pavement subgrade areas, the soil should be uniformly moisture conditioned to slightly above the optimum moisture content and be compacted to at least 95 percent relative compaction per ASTM D 1557.

Additional fill lifts should not be placed if the previous lift did not meet the required relative compaction or if soil conditions are not stable. Disking or blending may be required to uniformly moisture condition soils used for engineered fill. Ponding or jetting compaction methods should not be allowed.

All site preparation and fill placement should be observed by the geotechnical engineer of record or their authorized representative. It is important that during the stripping and scarification processes, a representative of the geotechnical engineer be present to observe whether any undesirable material is encountered in the construction area and to confirm that exposed soils are consistent with those encountered during the geotechnical site exploration.

Portions of the alignment within the Caltrans right of way subject to backfilling and the placement of engineered fill will be subject to Caltrans criteria. Fill placed outside the roadway and within the embankment that is outside the roadbed or not relied on for support by structures shall be compacted to a minimum of 90 percent relative compaction per ASTM D 1557.

All earthwork, including placement and compaction of engineered fill, should be observed and tested by the engineer’s representative during construction.

5.8 Trench Backfill and Compaction

General trench backfill should be placed and compacted in accordance with recommendations provided in this report for engineered fill (Section 5.7). Standard construction techniques should be sufficient for site utility trench excavations. The surface of utility trench backfill frequently settles even when backfill is placed under optimum conditions. Structural units or pavement

placed over such backfill should be designed to accommodate such movements. Jetting of utility trench backfill is not recommended and should not be allowed.

Backfill of utilities within rights-of-way should be placed in strict conformance with the requirements of the governing agency. However, as a minimum it is recommended that utility trench backfill should be moisture conditioned to near optimum moisture content and be uniformly compacted to at least 95% of maximum dry density using mechanical compaction equipment. To aid in the compaction operation, utility trench backfill should be placed in lifts not exceeding six inches compacted thickness.

All earthwork, including trench backfill and compaction, should be observed and tested by the engineer's representative during construction.

5.9 Instrumentation and Monitoring

Instrumentation and monitoring should be carried out on sensitive utilities or structures adjacent to excavations or above trenchless construction. Existing utilities should be reviewed considering the age, material, diameter, and importance of the utility to decide on the need and type of instrumentation and monitoring. Structures adjacent to the excavation should be monitored for settlement.

Consideration should be given to the types of instrumentation used and the frequency of monitoring. Each instrument should have a specific purpose and measure a parameter that can be used to evaluate the impact of construction on the subject utility or structure. Instrumentation may consist of borehole extensometers, utility monitoring points, surface settlement points, liquid level sensors, and inclinometers. Regular readings using a total station or level may also be part of the instrumentation and monitoring program.

An essential part of a successful instrumentation and monitoring program is determining baseline readings prior to the start of construction. Baseline readings document the existing condition at the start of construction and allow for a comparison of ground movements.

The requirements of the instrumentation and monitoring program should be documented in a specification and drawing. The drawing should indicate what instrumentation to install and where while providing details for the types of instrumentation to install.

While additional instrumentation may be required it is recommended that the existing 48-inch water line, 12-inch gas line, 8-inch stormwater line at the CA-101 trenchless crossing be monitored if trenchless construction passes below these utilities.

5.10 Soil Corrosivity

One soil sample was collected for corrosion testing during the 2023 subsurface investigation. Corrosion test results for the sample is shown below in Table 5-1. Based on Caltrans' standards, the site is considered non-corrosive to structural elements.

Table 5-1. Corrosivity Testing

Boring ID	Elevation (feet)	Minimum Resistivity (ohm-Cm)	pH	Chloride Content (ppm)	Sulfate Content (ppm)
MM-02	94.5	5,300	7.10	23	23

The test results are provided in the GDR and should be distributed to the design team for their interpretations pertaining to the corrosivity or reactivity of various construction materials (such as concrete and piping) with the soils. Tests should be conducted of the surface soils backfill to verify these interpretations, especially if the soils are mixed and additional fill is added during site preparation.

6 References

American Lifelines Alliance (ALA). 2005. *Seismic Guidelines for Water Pipelines*. G&E Report 80.01.01, Revision 0, March 2005.

California Department of Transportation (CALTRANS). 2001. *Trenching and Shoring Manual*. Revision 1, August 2011.

California Geologic Survey. 1983. *State of California Special Studies Zones, Healdsburg Quadrangle, Revised Official Map.* July 1983

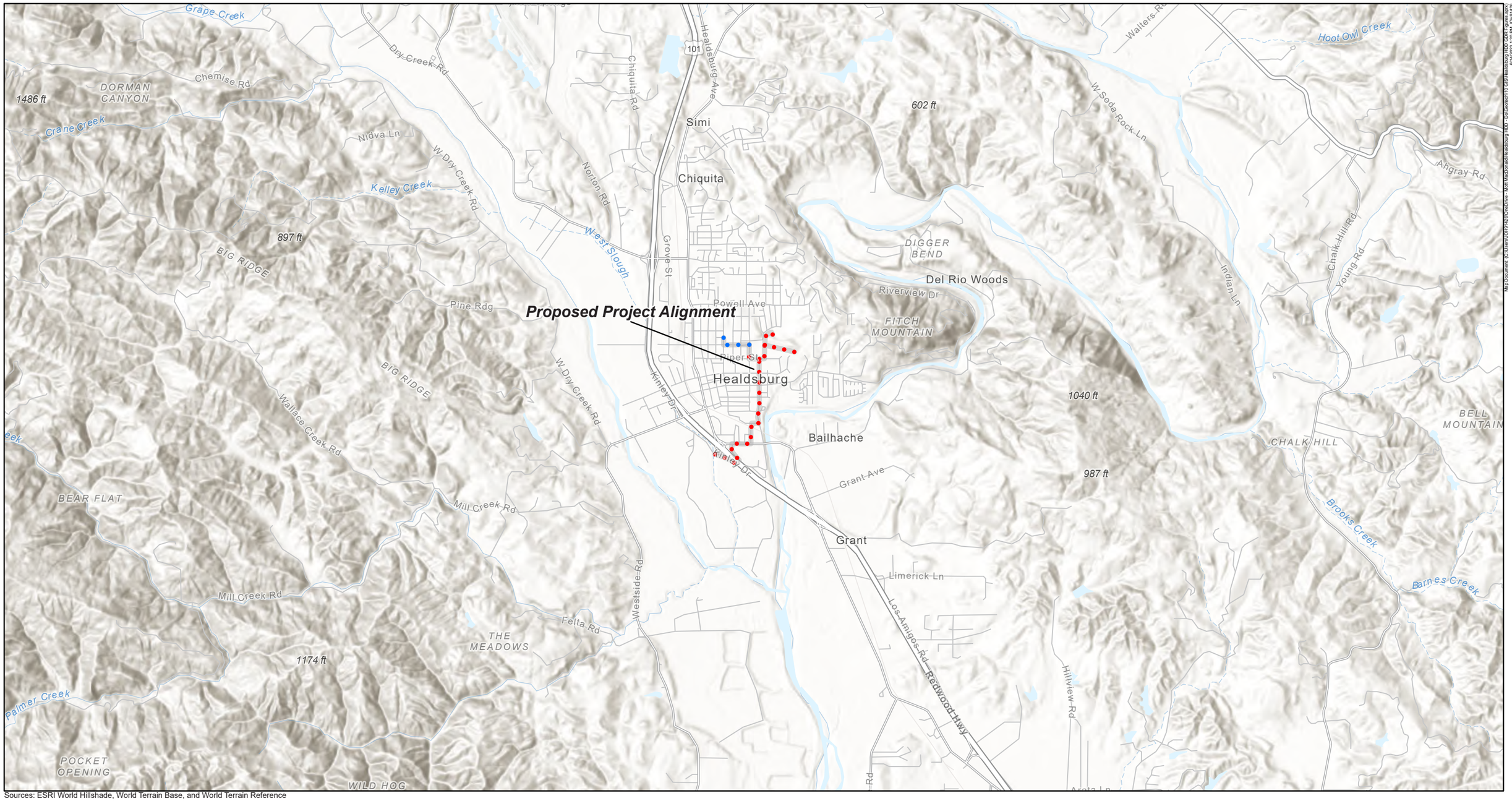
City of Healdsburg. 2008. *Public Works Standard Specifications and Details*. August 2008.

Mott MacDonald. 2023. *City of Healdsburg Municipal Recycled water Pipeline, Geotechnical Data Report.* August, 2023.

Naval Facilities Engineering Command. 1986. *Foundations and earth Structures, Design Manual 7.02*. September 1986.

Robert C. Witter, Keith L. Knudsen, Janet M. Sowers, Carl M. Wentworth, Richard D. Koehler, Carolyn E. Randolph. United States Geologic Survey. 2006. *Maps of Quaternary Deposits and Liquefaction Susceptibility in the Central San Francisco Bay Region, California, Liquefaction Susceptibility*.

United States Geologic Survey (USGS), *Unified Hazard Tool*, Retrieved 3/26/2023, from https://earthquake.usgs.gov/hazards/interactive/



Sources: ESRI World Hillshade, World Terrain Base, and World Terrain Reference

N
W E
S

0 1 Miles

Site Vicinity Map

Geotechnical Design Memorandum
Municipal Recycled Water Pipeline
City of Healdsburg
Sonoma County, California

August 2023

MOTT MACDONALD

Figure 1

Source: City of Healdsburg aerial imagery, 2019 (https://gis.cityofhealdsburg.org/arcgis/rest/services/GISViewer/2019_Imagery/MapServer)

N
W E
S

0 1,000 Feet

- Proposed Project Alignment
- Optional Project Alignment
- Geotechnical Boring (Mott MacDonald, 2023)
- Existing Geotechnical Boring (GeoEngineers, 2009)

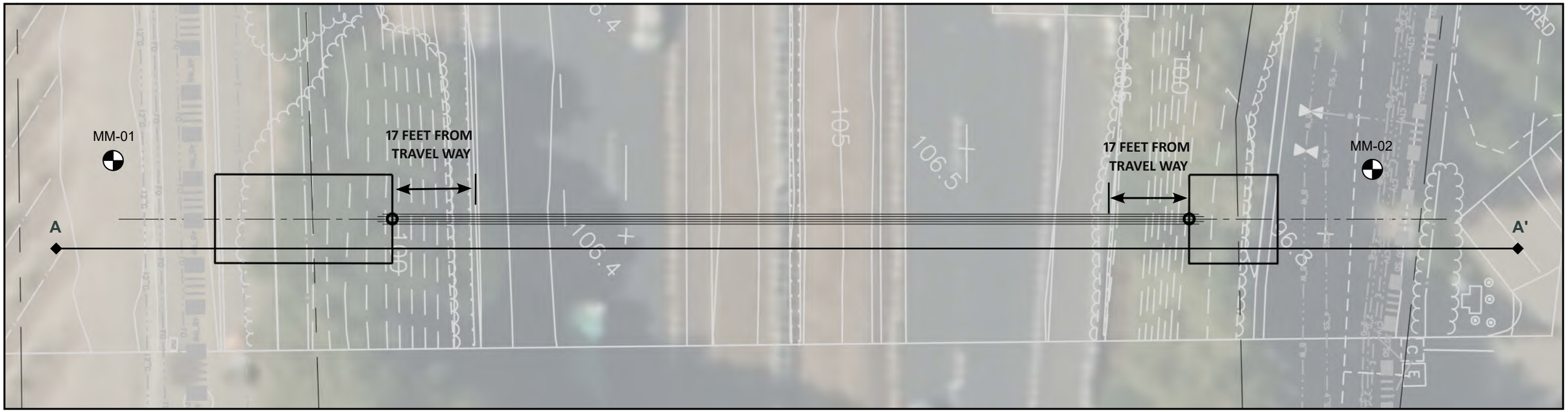
Proposed Alignment and Investigation Locations

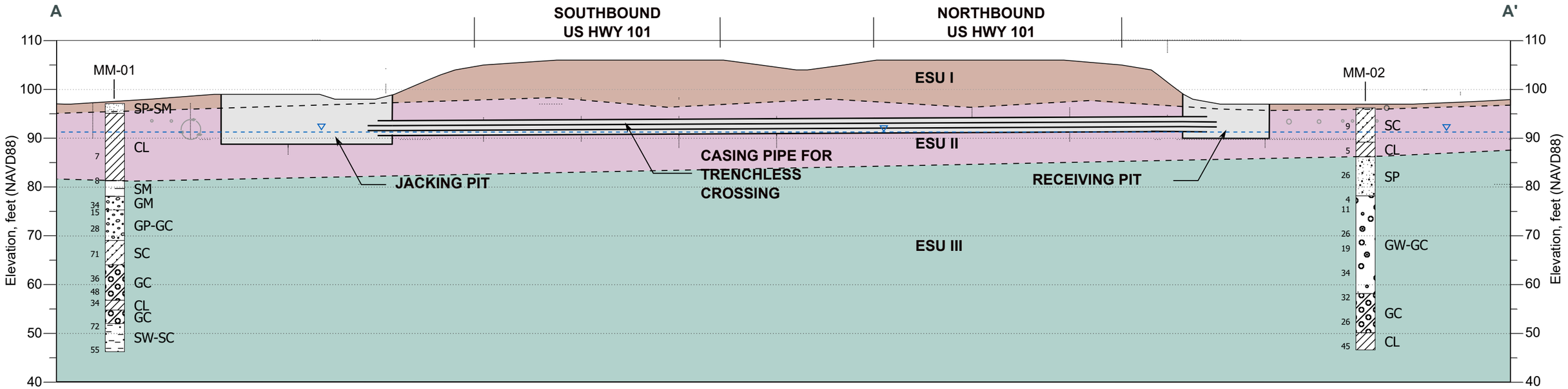
Geotechnical Design Memorandum
Municipal Recycled Water Pipeline
City of Healdsburg
Sonoma County, California

August 2023

MOTT MACDONALD

Figure 2





Legend

USCS

CH, CL, GC, GM, GP-GC, GW-GC, SC, SM, SP, SP-SM, SW-SC

SPT BLOW COUNT
STANDARD SAMPLER
2 INCH DIAMETER

SP-SM
CL
SM

= GROUNDWATER

= GEOLOGIC CONTACT

ESU III =ENGINEERING SOIL UNIT (ESU)

SCALE
1inch = 20 feet
Horizontal = Vertical

CA-101 Subsurface Profile
Geotechnical Design Memorandum
Municipal Recycled Water Pipeline
City of Healdsburg
Sonoma County, California
August 2023
MOTT MACDONALD
Figure 3

USGS Quaternary Faults

- historical (<150 years), well constrained location
- historical (<150 years), moderately constrained location
- historical (<150 years), inferred location
- latest Quaternary (<15,000 years), well constrained location
- latest Quaternary (<15,000 years), moderately constrained location
- latest Quaternary (<15,000 years), inferred location
- late Quaternary (<130,000 years), well constrained location
- late Quaternary (<130,000 years), moderately constrained location
- late Quaternary (<130,000 years), inferred location
- undifferentiated Quaternary(<1.6 million years), well constrained location
- undifferentiated Quaternary(<1.6 million years), moderately constrained location
- undifferentiated Quaternary(<1.6 million years), inferred location

Project Location

Source: U.S. Geological Survey and California Geological Survey, Quaternary fault and fold database for the United States, accessed September 2021, at: https://www.usgs.gov/natural-hazards/earthquake-hazards/faults

N
W E
S

0 4 Miles

Historic Earthquakes, M3.5 and greater

- Magnitude 3.5 to 4.0
- Magnitude 4.0 to 5.0

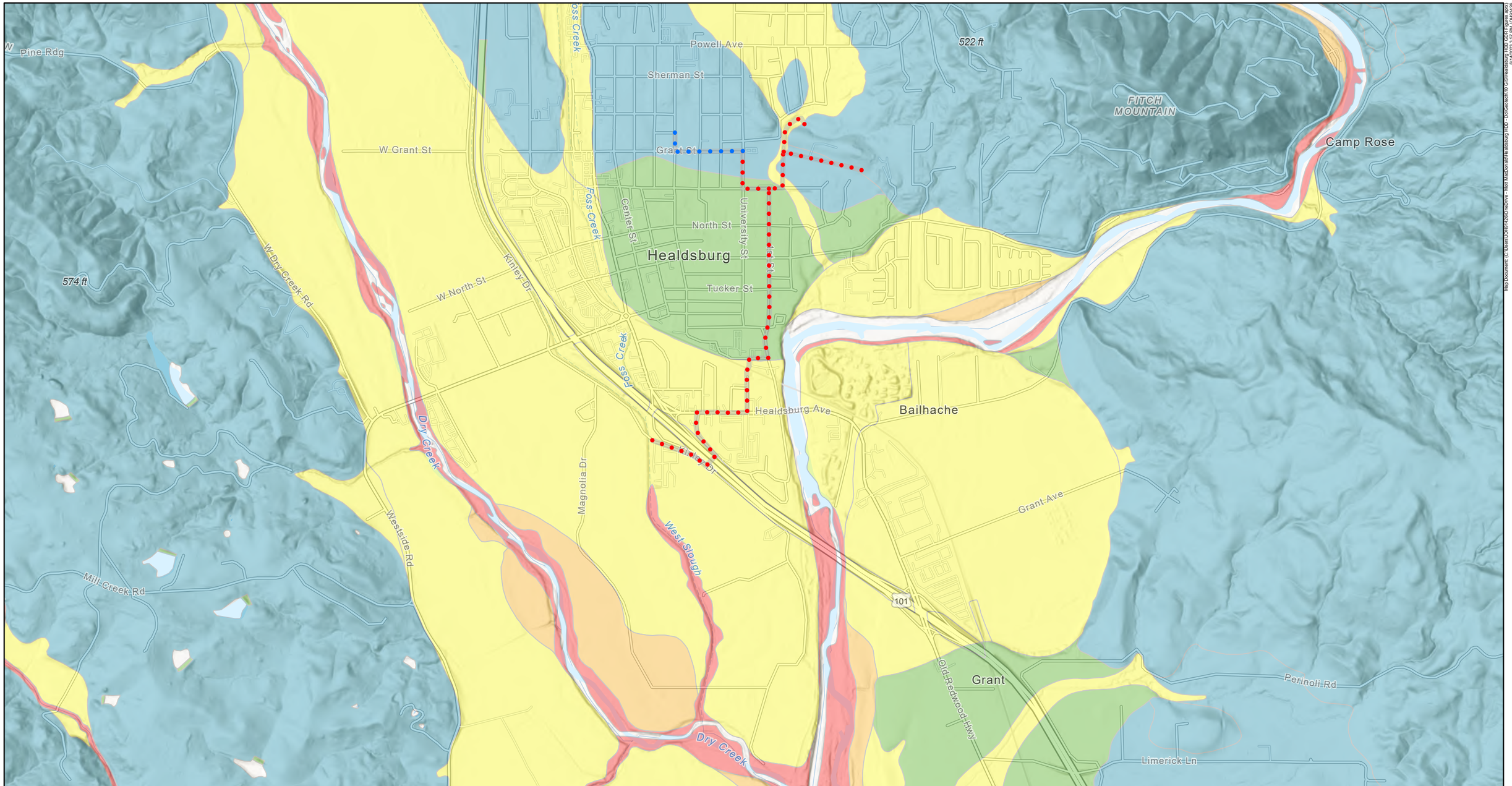
Quaternary Faults and Historic Seismicity

Geotechnical Design Memorandum
Municipal Recycled Water Pipeline
City of Healdsburg
Sonoma County, California

August 2023

MOTT MACDONALD

Figure 4



Source: Witter, R.C., Knudsen, K.L, Sowers, J.M., Wentworth, C.M., Koehler, R.D., Randolph, C. E. , Brooks, S.K., and Gans, K.D., 2006, Maps of Quaternary Deposits and Liquefaction Susceptibility in the Central San Francisco Bay Region, California: U.S.

N
W E
S

0 2,000 Feet

Mapped Liquefaction Susceptibility

- Very High
- High
- Moderate
- Low
- Very Low

- Proposed Project Alignment
- Optional Project Alignment

Mapped Liquefaction Susceptibility

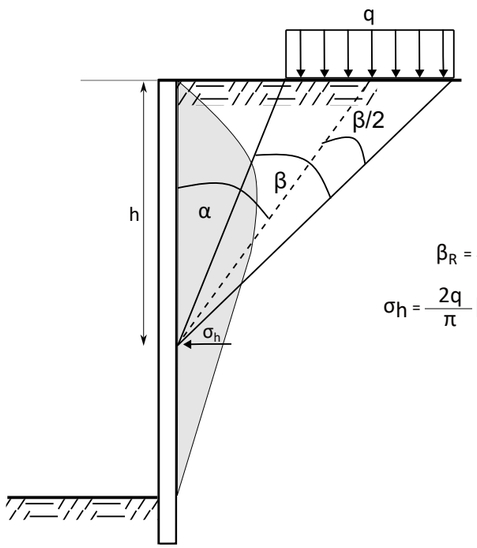
August 2023

Geotechnical Design Memorandum
Municipal Recycled Water Pipeline
City of Healdsburg
Sonoma County, California

Figure 5

MOTT MACDONALD

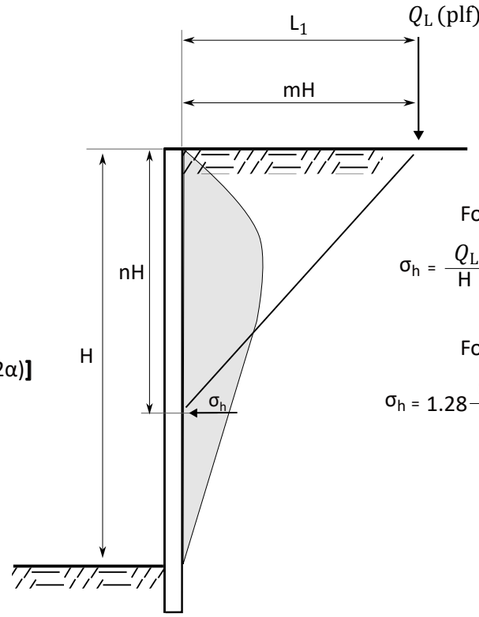
Strip Load



$$\beta_R = \frac{\beta(\pi)}{180}$$

$$\sigma_h = \frac{2q}{\pi}[\beta_R - \sin\beta\cos(2\alpha)]$$

Line Load



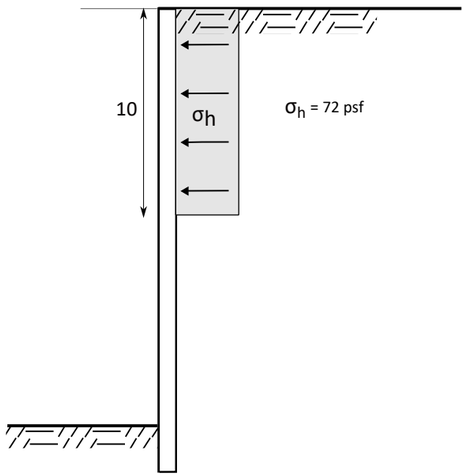
For m ≤ 0.4

$$\sigma_h = \frac{Q_L}{H}\frac{0.2n}{(0.16+n^2)^2}$$

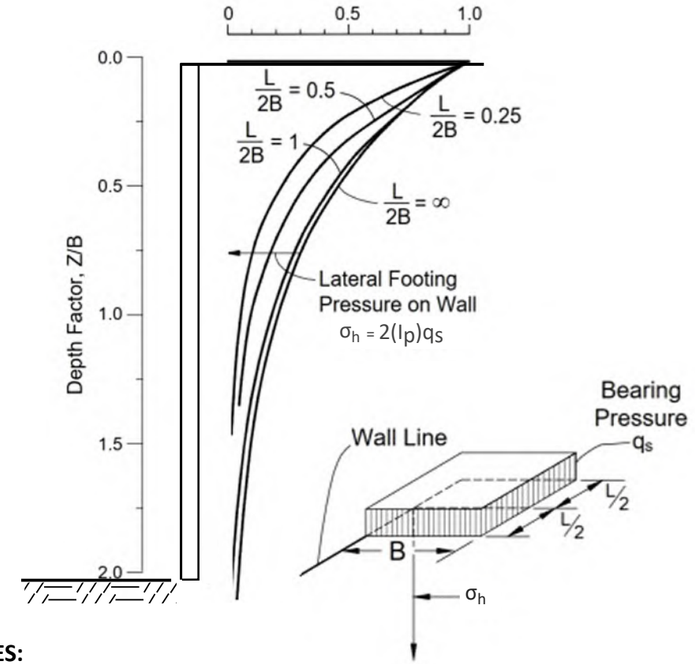
For m > 0.4

$$\sigma_h = 1.28\frac{Q_L}{H}\frac{m^2 n}{(m^2+n^2)^2}$$

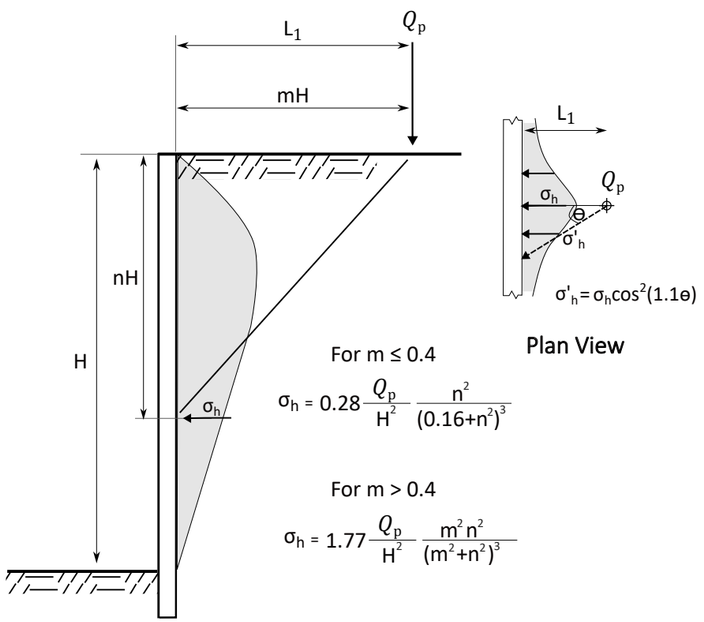
Minimum Construction Surcharge



Adjacent Footing Surcharge



Point Load



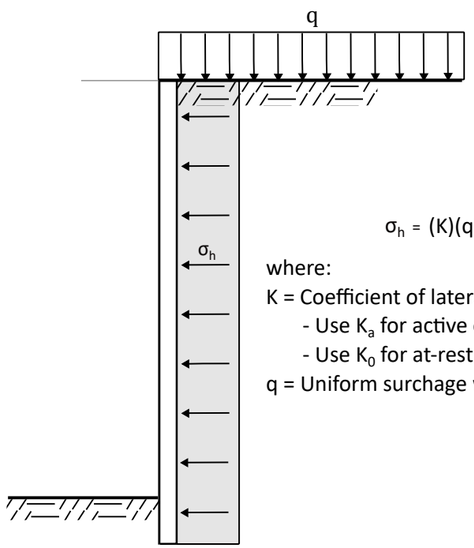
For m ≤ 0.4

$$\sigma_h = 0.28\frac{Q_p}{H^2}\frac{n^2}{(0.16+n^2)^3}$$

For m > 0.4

$$\sigma_h = 1.77\frac{Q_p}{H^2}\frac{m^2 n^2}{(m^2+n^2)^3}$$

Uniform Surcharge Load



$$\sigma_h = (K)(q)$$

where:

K = Coefficient of lateral earth pressure
- Use K_a for active earth pressure
- Use K_0 for at-rest earth pressure

q = Uniform surchage within limits of active wedge

NOTES:

Construction Surcharge

1.Construction surcharge based on Caltrans Trenching and Shoring Manual. Surcharge is a minimum and shall be applied to any shoring system regardless of whether or not the system is subjected to a surcharge.

2. Surcharges greater than the construction surcharges may be used in lieu of the minimum construction surcharge.

3. Construction surcharges accounts for personnel, minor equipment, and minor stockpiling behind the wall.

Strip loads, line loads, point loads, and footing loads

1. Equations bases on Caltrans Trenching and Shoring Manual 2011, Revision 1, and NAVFAC DM7.02, Chapter 3, figure 11.

Surcharge Loadings

Geotechnical Design Memorandum
Municipal Recycled Water Pipeline
City of Healdsburg
Sonoma County, California

August 2023

MOTT MACDONALD

Figure 6

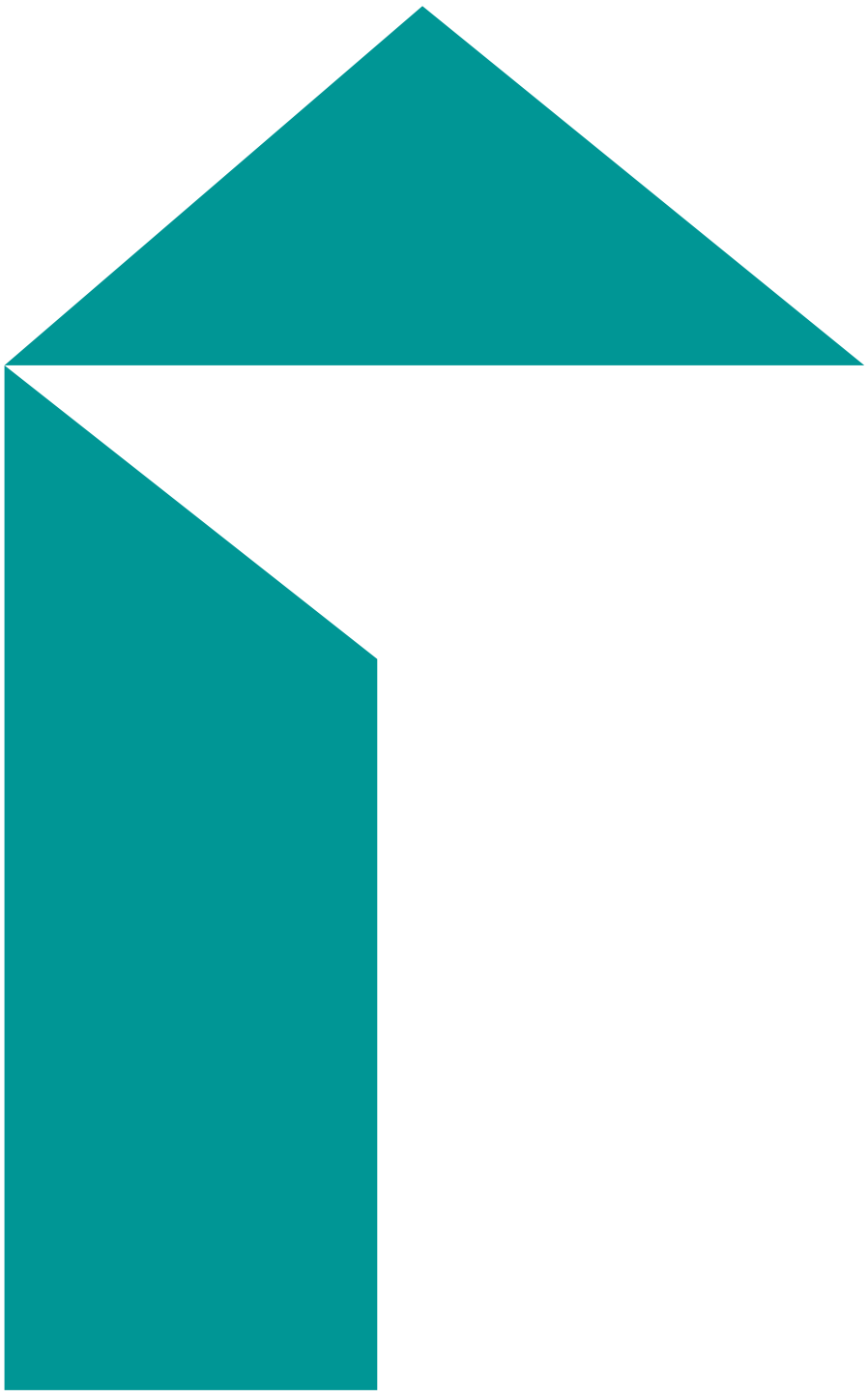
Appendices

A. Tunnelman’s Ground Classification

Tunnelman's Ground Classification for Soils[1]

Classification		Behavior	Typical Soil Types
Firm		Heading can be advanced without initial support, and final lining can be constructed before ground starts to move.	Loess above water table; hard clay, marl, cemented sand and gravel when not highly overstressed.
Raveling	**Slow raveling ----- Fast raveling**	Chunks or flakes of material begin to drop out of the arch or walls sometime after the ground has been exposed, due to loosening or to over-stress and "brittle" fracture (ground separates or breaks along distinct surfaces, opposed to squeezing ground). In fast raveling ground, the process starts within a few minutes, otherwise the ground is slow raveling.	Residual soils or sand with small amounts of binder may be fast raveling below the water tale, slow raveling above. Stiff fissured clays may be slow or fast raveling depending upon degree of overstress.
Squeezing		Ground squeezes or extrudes plastically into tunnel, without visible fracturing or loss of continuity, and without perceptible increase in water content. Ductile, plastic yield and flow due to overstress.	Ground with low frictional strength. Rate of squeeze depends on degree of overstress. Occurs at shallow to medium depth in clay of very soft to medium consistency. Stiff to hard clay under high cover may move in combination of raveling at excavation surface and squeezing at depth behind surface.
Running	**Cohesive -running ----- Running**	Granular materials without cohesion are unstable at a slope greater than their angle of repose (+/- 30° – 35°). When exposed at steeper slopes they run like granulated sugar or dune sand until the slope flattens to the angle of repose.	Clean, dry granular materials. Apparent cohesion in moist sand, or weak cementation in any granular soil, may allow the material to stand for a brief period of raveling before it breaks down and runs. Such behavior is cohesive-running.
Flowing		A mixture of soil and water flows into the tunnel like a viscous fluid. The material can enter the tunnel from the invert as well as from the face, crown, and walls, and can flow for great distances, completely filling the tunnel in some cases.	Below the water table in silt, sand, or gravel without enough clay content to give significant cohesion and plasticity. May also occur in highly sensitive clay when such material is disturbed.
Swelling		Ground absorbs water, increases in volume, and expands slowly into the tunnel.	Highly preconsolidated clay with plasticity index in excess of about 30, generally containing significant percentages of montmorillonite.

1. Modified by Heuer (1974) from Terzaghi (1950)



APPENDIX G

Public Works Standard Specifications and Details

City of Healdsburg

Public Works Standard Specifications and Details

CITY OF HEALDSBURG
401 Grove Street
Healdsburg, CA 95448

Phone:	707.431.3346
Fax:	707.431.2710
Inspection Request Line	707.547.0556

visit us at: www.ci.healdsburg.ca.us

August 2008

TABLE OF CONTENTS

ENGINEERING DESIGN STANDARDS

SPECIFIC PROVISIONS

APPROVED MATERIALS LIST

INDEX OF STANDARD DETAILS

ENGINEERING DESIGN STANDARDS

SECTION 1

GENERAL

1.01 PURPOSE:

The purpose of these Public Works Standard Specifications and Details is to provide certain minimum standards for the design, construction, repair and alterations of streets, roadways, alleys, storm drain system, sewer system, water supply system, landscaping and irrigation, including all other public improvements and all appurtenances thereunto, within the City of Healdsburg, where any portion of such improvement is to be transferred over to the City of Healdsburg for operation and/or maintenance. Any items that are not included in the Public Works Standard Specifications and Details shall be designed as required by the City Engineer.

1.02 DEFINITIONS:

The intent and meaning of the following terms as used in the Healdsburg Public Works Standard Specifications and Details shall be as defined below:

A. Caltrans Highway Design Manual: Shall mean the latest edition of the California Department of Transportation's "Highway Design Manual".

B. Caltrans Warning Signs Manual: Shall mean the latest edition of the California Department of Transportation's "Manual of Warning Signs, Lights, and Devices for Use in Performance of Work Upon Highways".

C. Caltrans Standard Plans: Shall mean the latest edition of the California Department of Transportation's "Standard Plans".

D. Caltrans Standard Specifications: Shall mean the latest edition of the California Department of Transportation's "Standard Specifications".

E. City: Shall mean the City of Healdsburg, a municipal corporation.

F. City Code: Shall mean the latest edition of the Code of the City of Healdsburg, including all adopted ordinances and resolutions that superceded or otherwise update the various provisions of the City Code.

G. City Engineer: Shall mean the City Engineer of the City of Healdsburg.

H. Consulting Engineer: Any person or persons, firm, partnership, or corporation legally authorized to practice civil engineering in the State of California.

I. Consulting Land Surveyor: Any person or persons, firm, partnership, or corporation legally authorized to practice land surveying in the State of California.

J. Developer: Shall mean any person, firm, corporation, partnership or association engaged in the development of property in part or in whole by the placing of any improvements thereon, whether the property was previously developed in whole, in part, or at all.

K. Easement: Shall mean an easement dedicated to the City or Public Utility that shall be continuing and irrevocable unless formally abandoned.

L. General Plan: Shall mean the General Plan, including all revisions, as adopted by the City Council of the City of Healdsburg.

M. Geotechnical (Soils) Report: Shall mean a report as prepared by any person or persons, firm, partnership, or corporation legally licensed to prepare "Geotechnical Reports" in the

State of California and shall include all amendments, addendums, etc. Reports shall be submitted in 8-1/2 x 11 inch bound folders. The analysis must at a minimum include a map of the subject area showing existing streets, contours and location and type/characteristics of soils samples obtained. Where possible, the proposed street pattern shall be shown. The results of all field data and laboratory tests shall be included. Design for proposed street sections shall be based on the minimum criteria contained herein. Street structural section design shall include recommendations for: natural subgrade, sub base, base and pavement compaction and thickness to achieve design strength. In no instance shall structural sections be less than those outlined in the Street Design Section of these Public Works Standards.

N. Improvements: Refers to street work, sidewalk, curb, gutter, driveways, water supply systems, sanitary sewer systems, storm drain systems, other public utilities, landscaping, and fences to be installed by the Developer on land to be used for public right-of-way.

O. NAD83: Shall mean North American Datum of 1983 California State Planes, Zone II, US Foot (horizontal).

P. NAVD88: Shall mean North American Vertical Datum of 1988.

Q. Project Lead Person: The person appointed by the Developer to act as the contact between the Developer and his agents (e.g., Consulting Engineer, Consulting Surveyor, etc.) and City staff regarding the processing of the construction plans and maps (parcel map or final map).

R. Public Work Standards: Shall mean the latest edition of the City of Healdsburg Public Works Department Standard Specifications and Details.

S. Specific Plan: Shall mean any and all specific plan documents which have been adopted for a given design area by the City Council of the City of Healdsburg.

T. Subdivision Map Act: Shall mean the latest edition of the Subdivision Map Act as adopted in the Government Code of the State of California.

U. Subdivision Ordinance: Shall mean Chapter 17A of the City Code as adopted by the City Council of the City of Healdsburg, and any subsequent amending legislation thereof.

V. Tentative Map: Shall mean the Tentative Map and attached Conditions of Approval for the specific project as approved by the City Council of the City of Healdsburg.

W. Zoning Ordinance: Shall mean Chapter 18 of the City Code as adopted by the City Council of the City of Healdsburg, and any subsequent amending legislation thereof.

1.03 CONFLICT RESOLUTION:

In the event that these Public Works Standards conflict with the General Plan, Zoning Ordinance, Subdivision Ordinance, Specific Plan or Approved Tentative Map, the conflicting provisions of the General Plan, Zoning Ordinance, Subdivision Ordinance, Specific Plan or approved Tentative Map shall prevail over these Public Works Standards. In the event that these Public Works Standards conflict with any other City ordinance, these Public Works Standards shall prevail unless otherwise approved by the City Engineer.

In the case of conflict occurring between the various sections of these Public Works Standards, the following order of precedence shall apply:

A. The Specific Provisions (green) shall prevail over all other sections;

B. The Specific Provisions (green) and Engineering Design Standards (gold) shall prevail over the Public Works Standard Details (white).

SECTION 2

CONSTRUCTION PLANS AND MAPS

2.01 GENERAL:

Complete plans and specifications for all proposed improvements including any necessary dedications and easements shall be submitted to the Public Works Department for approval and must be approved in writing by the City Engineer prior to the beginning of construction of any such improvements. This shall apply where it is the intent that any portion of such improvement will be transferred to the City. Such plans shall be prepared by a Consulting Engineer.

2.02 CONSTRUCTION PLANS:

A. Preparation of Construction Plans: Construction plans shall be prepared in accordance with the following requirements. In cases of extreme grades, extremely curved streets, or other unusual circumstance, the City Engineer may approve reasonable deviations from these requirements.

1. All Sheets: Each drawing shall include the following minimum information, as appropriate:
   a. Dimensions: Construction plans shall be 24 inches by 36 inches with a 1.5 inch clear margin on the left edge and 1 inch margins on all other edges.
   b. Scale (written and graphic) and north arrow:
      - Horizontal scale: 1 inch = 40 feet;
      - Vertical scale: 1 inch = 4 feet
   c. Title Block: All of the following information shall be provided in the Title Block located along lower edge or right edge of sheet:
      - Consulting Engineer's name, signature and seal with the registration number and expiration date.
      - Date plans prepared.
      - Title of project.
      - Title of sheet (i.e., UTILITY PLAN for Healdsburg Avenue).
      - Sheet number and total number of sheets.
      - Revision Block.
   d. Improvements: All existing, proposed and future (if known) improvements shall be provided within and 100 feet past the project boundary.
   e. Stationing: The survey stationing shall normally read from left to right with the north arrow pointing either to the top or left edge of the sheet. All stationing shall be a continuation of existing improvements where possible.
   f. Elevations: All vertical elevation information shall be on the NAVD88 Datum.
2. Title Sheet: All of the following shall be incorporated into the Title Sheet, unless otherwise approved by the City Engineer. Additional sheets may be added as needed.
   a. Name of Subdivision or Project.
   b. Vicinity Map with north arrow. The vicinity map shall identify the nearest Highway 101 on-ramp and off-ramp with a logical route to the project.

c. Index of sheets.

d. Approval Signature Blocks.

e. Legend defining all symbols used in the plans.

f. Construction notes not covered by the plan specific notes (i.e., Utility Plan Notes, Grading Plan Notes, etc.).

g. Abbreviations list, all abbreviations shall be per industry standards.

h. Typical Street Section for each varying street width. Construction plans shall indicate the design "R" value and traffic index (TI) for the roadway.

i. Temporary and permanent benchmarks, including the physical description, location and shall use NAVD88 datum.

j. Name, address and telephone number of Developer, Consulting Engineer and Geotechnical Engineer.

k. Project Layout: Plan view of the entire project, drawn to a scale of no smaller than 1 inch = 100 feet that shows the following elements:
   - Street right-of-way;
   - Water and sewer mains;
   - Storm drainage system;
   - Lot numbers;
   - Sheet index;
   - Flow arrows; and
   - Other miscellaneous improvements to be installed.

3. Street and Utility Plan: All public and private streets, utilities and the related improvements shall be shown as follows:

   a. Plan view of each street to be improved shall be shown on a separate sheet (extremely short streets may be shown on a single page). Construction plans shall include centerline stationing with all utilities including manholes, curb inlets, sewer laterals, water services, fire services, air release valves (ARV), blowoffs, water sample stations, driveways, etc.

   b. Profile view of each street shall be clearly shown immediately above its plan view. Both the inside top and bottom of all pipes shall be shown. Top of curb elevations shall be shown at grade break points, manhole and curb inlet inverts, and crossings of water, sewer and/or storm drain pipes, and at each lot line or every 100 feet, whichever is less.

   c. Cross Section views of new street improvements where, in the opinion of the City Engineer, the cross sections are necessary to graphically show that the new street sections conform to existing street sections. Cross sections shall clearly show existing cross slopes, proposed cross slopes, curb and gutter.

   d. Notes specific to street and utility plan improvements.

4. Site Development (Grading) Plan: All public and private drainage, grading and the related improvements specific to Site Development Plans Improvements.

5. Signing and Striping Plan: All traffic control devices, including all signing and striping with quantities tabularized on the plan specific to the Signing and Striping Plan Improvements. Where applicable, designations for type of striping shall conform to the Caltrans Standard Plans.

6. Storm Water Pollution Prevention Plan (SWPPP): All measures proposed to prevent and control erosion shall be provided for the entire site. In addition, the erosion prevention plan shall include construction notes specific to the Erosion Prevention Plan work.

7. Landscaping and Irrigation Plan: The landscaping and irrigation plan shall identify the proposed location and type of all street trees, other required vegetation and irrigation systems as required. In addition, the landscaping and irrigation plan shall include construction notes specific to Landscaping and Irrigation Plan Improvements.

B. Submittal of Construction Plans: Construction plans shall be submitted by the Project Lead Person to the City Engineer for review along with the proposed subdivision map (final map or parcel map) for the proposed subdivision. Complete submittals shall include the following:

1. A completed and signed "Submittal Checklist For Completeness Subdivision Improvement Plans and Final Map"
2. Ten (10) copies of the complete construction plan set.
3. Engineer's estimate for all proposed improvements with subsequent payment of City engineering review fees. Separate estimates shall be provided for the public and private improvements.
4. Payment of Public Works deposit for plan checking construction plans.
5. Storm drain system design calculations and supporting information.
6. Two (2) copies of the sewer system design calculations and supporting information.
7. Two (2) copies of the geotechnical report, including all amendments, addendums, etc.
8. Two (2) copies of the cathodic protection design for the public water system.
9. Two (2) copies of the arborist report and supporting information.
10. One (1) copy of the Storm Water Pollution Prevention Plan (SWPPP).
11. One (1) copy of the Notice of Intent (NOI) as required by the State Water Resources Control Board.
12. One (1) copy of the 401 Certification as required by the State Water Resources Control Board.
13. Other material as required by the Conditions of Approval for the project.
14. In addition to the above, repeat submittals shall satisfy all City comments from the previous submittal.

Incomplete submittals will be returned to the Project Lead Person unchecked. The City's target schedule is to return reviewed subdivision construction plan submittals within 6 weeks for the first submittal, within 4 weeks for the second submittal and 2 weeks for subsequent submittals. Should alterations or revisions to the construction plans be required, the City will return to the Project Lead Person 1 copy of the construction plan set with the required corrections indicated thereon.

C. Approval of Construction Plans: At such time as all necessary revisions have been made and the construction plans are approved for signature, the Project Lead Person shall be notified of the submittal date to the City Council. Construction plans shall not be considered approved and no construction shall begin until all of the following items have been satisfied:

1. The Healdsburg City Council has approved the map (final or parcel) for this project.

2. An electronic file of the complete construction plan set has been provided to the City Engineer in AutoCAD 2000 or City approved compatible format on compact disk.
3. The City Engineer and City Planning Director have signed the construction plans.
4. A complete photo or digitally produced Mylar set of the construction plans has been submitted for City records. This Mylar plan set shall include all final revisions and be signed by the project geotechnical engineer and the Consulting Engineer. All Mylar sheets shall be archival quality prints capable of reproducing clear and legible copies and shall be polyester 4 mil film with emulsion surface and matte surface up.
5. A minimum of 6 copies of the approved construction plan set have been submitted to the City.

No alterations, additions or changes shall be made to the approved construction plans unless such changes, corrections, or additions have been approved by the City Engineer in accordance with the revision process provided below. Excepted from approval are any features of the plans that are contrary to, in conflict with, or do not conform to any California State Law, City Code or generally accepted good engineering practice, in keeping with the standards of the profession; even though such errors, omissions or conflicts may have been overlooked by the Public Works Department. Any such items shall be immediately brought to the attention of the City Engineer.

D. Revision of Approved Construction Plans: Proposed revisions to the approved construction plans shall be submitted to the City Engineer for review similar to the submittal process provided above. A complete submittal shall include 6 copies of the construction plan sheets to be revised, along with all necessary supporting information. All proposed revisions shall be clouded and sequentially numbered. Incomplete submittals will be returned without being reviewed. The revised construction plan sheets shall not be considered approved and construction of the revised improvements shall not begin until the following items have been satisfied:

1. The Project Lead Person shall submit the revised Mylar sheets for approval by the City Engineer. Mylar sheets shall be of the same quality as required in the approval process provided above.
2. Once approved, the Project Lead Person shall provide 6 copies of the revised construction plan sheets to the City Engineer.
3. Once approved the Project Lead Person shall provide additional copies of the revised construction plan sheets to all other parties, as necessary.

All revisions to the construction plans shall be reflected in the record drawings as provided below.

E. Final Acceptance of the Subdivision: Prior to acceptance of the subdivision, the following items shall be satisfied:

1. The Developer shall complete the construction of all proposed improvements in accordance with the approved construction plans, these Public Works Standards and all other requirements.
2. The Project Lead Person shall provide to the City Engineer a complete set of Mylar construction plan record drawings. Mylar sheets shall be of the same quality as required in the approval process provided above. Record drawings shall include the following:

    a. All approved revisions of the construction plans.

b. Field located improvements. The Consulting Land Surveyor shall survey these improvements in place and show the actual constructed horizontal and vertical alignment on the record drawings.

c. Improvements required at the discretion of the project geotechnical engineer (i.e., sub-drains, keyways, etc.).

d. The Consulting Land Surveyor shall provide a letter stating the location and elevation of the benchmark established by this subdivision in accordance with section 3.03 E.2. of these Public Works Standards.

e. Other information provided by the City inspector or other City representative.

The Consulting Engineer and project geotechnical engineer shall sign the record drawings evidencing that the improvements were completed in accordance with the approved construction plans for their specific area of review.

3. The project geotechnical engineer shall provide to the City Engineer the final test results of all soils work.

4. The Developer shall provide to the City a maintenance bond as required under the provisions of the subdivision improvement agreement. The maintenance bond shall be reviewed by the City Attorney.

5. The Consulting Land Surveyor shall provide a letter stating all monuments have been set and that he has been paid for his services in accordance with the Subdivision Map Act.

6. The Consulting Engineer or other qualified special inspector shall provide a letter evidencing that they have made regular inspections of all private improvements and that these private improvements have been constructed in substantial conformance with the construction plans.

2.03 MAPS:

A. Preparation of Maps: Maps for minor and major subdivisions shall be prepared in accordance with the following requirements:

1. All Sheets: Each drawing shall include the following minimum information, as appropriate:

a. Dimensions: All map sheets shall be 18 inches by 26 inches with a 1 inch clear margin on all edges.

b. Scale (written and graphic) and North Arrow: All sheets shall be drawn to a scale no smaller than 1 inch = 50 feet.

c. Title Block: All of the following information shall be provided in the Title Block located along lower edge or right edge of sheet:

- Consulting Engineer's name, signature and seal with the registration number and expiration date.
- Date plans prepared.
- Title of map.
- Title of sheet (i.e., Supplemental Information Sheet).
- Sheet number and total number of sheets.

2. Certificate Sheet: The certificate sheet shall be organized (from right to left) with all applicable owner related certificates, followed by applicable City certificates and all applicable County certificates as provided in the following table:

Owner Certificates	City Certificates	County Certificates
Owner's Certificate	City Engineer's Certificate	County Tax Collector's Certificate
Owner's Acknowledgement	City Surveyor	County Clerk's Certificate
Trustee's Certificate (As required)	Finance Director's Reimbursement District	County Recorder's Certificate
Trustee's Acknowledgement (As required)	City Planning Commission's Certificate	
Owners of Interest Certificate (As required)	City Clerk's Certificate	
Surveyor's Certificate		

3. Map Sheet(s): Each map sheet shall be completed in conformance with the Subdivision Map Act.

4. Supplemental Information Sheet: Each minor and major subdivision map set shall include a supplemental information sheet as the last sheet in the map set, unless otherwise approved by the City Engineer. All local agency required information specific and/or unique to the project shall be provided on the Supplemental Information Sheet. In accordance with the Subdivision Map Act, the supplemental information sheet shall contain a statement that "the additional information is for informational purposes, describing conditions as of the date of filing, and is not intended to affect record title interest".

C. Submittal of Maps: Parcel maps and final maps shall be submitted by the Project Lead Person to the City Engineer for review along with the construction plans for the proposed subdivision. Complete submittals shall include the following:

D. Complete submittals shall include the following:

1. A completed and signed "Submittal Checklist For Completeness Subdivision Improvement Plans and Final Map." Ten (10) copies of the complete map set.

2. Payment of the Public Works deposit for plan checking the map.

3. A current title report (less than 3 months old) for the entire legal boundary of property being divided and other supporting documents.

4. Copy of all record documents referenced (recorded deeds, maps, etc.).

5. Closure calculations (based upon 1 common set of coordinates).

6. Joint maintenance agreements for all private facilities intended for the common use of more than 1 property or as otherwise necessary.
7. Other material as required by the Conditions of Approval for the project.
8. In addition to the above, repeat submittals shall satisfy all City comments from the previous submittal.

Incomplete submittals will be returned to the Project Lead Person unchecked. The City's target schedule is to return reviewed subdivision map submittals within 6 weeks for the first submittal, within 4 weeks for the second submittal and 2 weeks for subsequent submittals. Should alterations or revisions to the map set be required, the City will return to the Project Lead Person 1 copy of the map set with the required corrections indicated thereon.

B. Approval of Maps: Maps will only be scheduled for approval by the Healdsburg City Council only after all of the following items have been satisfied:

1. The Consulting Land Surveyor has made all necessary revisions to the map and supporting documents.
2. The Developer has executed the subdivision improvement agreement.
3. The Developer has paid all of the following City fees, as required:
    a. Annexation fees
    b. Inspection deposit for the construction of public improvements.
    c. City Electric Department construction deposit.
    d. Development (impact) fees previously deferred.
    e. Outstanding reimbursements and/or assessments.
    f. Assessment district reapportionment fees.
4. The Developer has provided to the City a faithful performance bond, and labor and materials bond as required under the provisions of the subdivision improvement agreement. The bonds shall be reviewed by the City Attorney.
5. The Developer has provided all City required insurance documents. The insurance documents shall be reviewed by the City Attorney.
6. Other supporting documents required by the Conditions of Approval for the project.
7. The Project Lead Person shall submit the following map sets with all owner's certificates completed (wet signed) for City approval.
    a. City Engineer and City Clerk Copies - 2 complete photos or digitally produced Mylar map sets. All Mylar sheets shall be archival quality prints capable of reproducing clear and legible copies and shall be polyester 4 mil film with emulsion surface and matte surface up.
    b. County Recorder Copy - 1 complete map set satisfying the requirements of the County Recorder.
    c. Consulting Land Surveyor and Developer Copies - other sets as required.
8. The Consulting Land Surveyor shall provide to the City Engineer an electronic file of the map sheet(s) and the supplemental information sheet in AutoCAD 2000 or City approved compatible format on compact disk.

SECTION 3

STREET DESIGN

3.01 GENERAL:

For purposes of geometric and structural design, streets shall be classified according to the following. The following Standards for street cross section and geometrics may be superseded by an approved Specific Plan, approved Tentative Map, or other discretionary approval granted by the Planning Commission or City Council. Any other deviation from the following standard shall require the written approval of the City Engineer.

Class	*Face-of-Curb Radius @ Intersection (Feet)	**Traffic Index	Standard Street Section (feet)	***Minimum Centerline Radius for Horizontal Curve (Feet)
Arterial	35	9	0.45 AC 1.9 AB	800
Collector	30	8	0.4 AC 1.7 AB	600
Residential	20	7	0.35 AC 1.5 AB	250
Industrial	35	9	0.45 AC 1.9 AB	250
Hillside	20	7	0.35 AC 1.5 AB	100

* At intersections of different street classes the larger face-of–curb radius shall prevail unless otherwise approved by the City Engineer.

** The traffic index may be increased at the discretion of the City Engineer if traffic warrants a higher value.

*** Actual design of horizontal curves shall be based on the design speed of the street as determined by the City Engineer. Deviations may be approved by the City Engineer especially in steep terrain, however all streets shall be appropriately signed and posted for the actual design speed based on good engineering practice.

Regardless of traffic index and/or actual "R" value tests of subgrade, no street structural section (public or private) shall be less than 3 inches of asphalt concrete and 15 inches of aggregate base. Aggregate base section may be comprised of an equivalent section of aggregate base and aggregate sub base.

3.02 GEOMETRICS:

A. All street centerlines shall intersect within 5 degrees of a right angle.

B. There shall be a minimum of 200 feet (centerline to centerline) between intersections.

C. Cul-de-sac radius shall be 45 feet with on-street parking and 40 feet without on-street parking (as measured from the face of curb) with an additional 7 feet of right-of-way behind the face of curb.

D. Curb line radii shall be tabulated in a box shown on the construction plans.

E. Gutter flow line grades shall have a minimum slope of 0.004 feet per foot and maximum as determined by the City Engineer.

F. Cross slope for new streets shall be 2 percent as shown on the standard details unless a deviation has been previously approved by the City Engineer.

G. The minimum vertical curve length allowable at the intersection of two grades shall be 100 feet. Actual design of the vertical curve shall be based on the design speed of the street and stopping sight distance as determined by the City Engineer. However, vertical curves may be omitted where the algebraic difference in grades does not exceed 1.0 percent and the design speed is 45 miles per hour or less.

H. The minimum stopping sight distance over any segment of the roadway on all streets shall conform to the Caltrans Highway Design Manual unless specific approval is received from the City Engineer.

I. Property lines at intersection corners shall run diagonally from curb return to curb return. The diagonal line joining the curb returns shall be a minimum distance of 11.5 feet from the apex of the curb radius at the corner.

3.03 APPURTENANCES:

A. Driveways:

1. No driveway shall be permitted within 2.5 feet of a property line (measured at the face of curb from the top of the driveway transition). Special consideration may be given to major and minor street driveway configurations of an unusual nature such as a shared driveway.

2. The width of driveways, as measured at the face of curb and not including the transitions at each side of the driveway, shall be as follows:

   a. Commercial driveways shall be a minimum of 20 feet wide to a maximum of 40 feet wide.

   b. Residential driveways shall be 20 feet wide. Driveway widths may be reduced to a minimum of 12 feet for a single car garage or increased to a maximum of 28 feet for a 3-car garage.

3. The minimum distance between driveways serving the same parcel shall not be less than 20 feet as measured at the face of curb from the top of the transition.

4. Not more than 40 percent of the frontage of any parcel shall be devoted to driveways. Lots fronting on a cul-de-sac and commercial lots with 1 driveway access are exempt from this requirement.

5. All unused driveway cuts shall be removed and replaced with curb, gutter and sidewalk.

B. Parking: For all single-family properties, 1 on-street parking space, 22 feet in length (18 feet on end spaces) measured along the curb, shall be provided within reasonable proximity of each single-family lot.

C. Valley Gutters: No valley gutters shall be allowed within the public right-of-way or public easement without written approval from the City Engineer.

D. Sidewalks, Curbs and Gutters:

1. Sidewalks shall be a minimum of 5 feet wide. Where the sidewalk abuts the curb, the curb is included in the 5-foot minimum width. Wider and/or separated sidewalks may be required. In these cases, increased sections and reinforcement shall be determined by the City Engineer.
2. Sidewalk, curb and gutter shall be of the design as shown on the Public Works Standard Details or as required by the City Engineer.
3. Curb ramps shall be installed at all street crossings and curb returns and shall comply with all applicable State and Federal laws and regulations.

E. Survey Monuments and Benchmarks: Survey monuments and benchmarks shall be tied to the NAD83 and NAVD88 datums. Survey monuments and benchmarks shall be installed at the centerline of the street and in accordance with the Public Works Standard Details. The brass disc shall be stamped with and clearly show the registration number of the Consulting Land Surveyor who prepared the final or parcel map. Monuments or benchmarks shall be offset 5 feet along the street centerline where obstructions, such as manholes or valve boxes, prevent standard installation as described below:

1. Monuments shall be required at all street intersections, at the beginning and end of all centerline curves and as required by the City Engineer. Horizontal accuracy standards between monuments shall have a maximum allowable error of 0.03 feet for distances up to 500 feet and 1:20,000 linear error of precision for distances greater than 500 feet.
2. A minimum of 1 benchmark shall be required to be established in all minor and major subdivisions as follows:
   a. Benchmarks information shall be added to a street centerline monument at a location specified by the City Engineer and may be required outside of the boundary of the subdivision.
   b. The elevation of the benchmarks shall be established in accordance with the following:
      - National Geodetic Survey's 2nd Order, Class 2 survey (maximum allowable error in feet = $0.05 \times M^{1/2}$ where M is the length of the circuit expressed in miles).
      - Referenced to a minimum of 2 existing City Benchmarks.
      - Tied to the NAVD88 datum.
      - Recorded to the nearest 0.01 feet.
   c. The Consulting Land Surveyor shall prepare and submit to the City Engineer a survey report identifying the type of equipment and methodology used to complete the survey, as well as the location and elevation of the existing City benchmarks referenced. The survey report shall be signed and stamped by the Consulting Land Surveyor.

F. Signing and Barricades:

1. Street names shall require approval by the Planning Director. Street signs and poles shall be installed in accordance with the Public Works Standard Details.
2. Street name signs, stop signs, and all striping shall be paid for and installed by the Developer.

3. All regulatory and warning signs shown on the construction plans or required by the City Engineer to control traffic shall be furnished and installed by the Developer at his sole expense.

4. Permanent barricades shall be installed where improvements cover only a portion of the ultimate development or as directed by the City Engineer. The barricade shall be constructed, erected, painted and signed in accordance with the Public Works Standard Details.

G. Easements: Unless otherwise provided for herein, public service, drainage, landscaping, and fence easements shall be a minimum of ten feet in width or as required to meet specific City/Utility Company needs. These easements shall be dedicated along the boundary of all public right-of-way unless specifically exempted by the City Engineer.

SECTION 4

STORM DRAIN COLLECTION SYSTEM AND EROSION CONTROL PLAN

4.01 GENERAL:
These standards are intended to insure that all local, state and federal watercourse and surface water laws are complied with and that runoff from storms up to the 100 year return frequency are conveyed in a manner which protects the public safety and prevents flood related damage to public and private improvements.

Where a development project increases (i.e., post-project flow exceeds pre-project flow) or negatively affects the historical storm water flow (i.e., re-directs or concentrates storm water flow) of the area, the Developer will be required to mitigate said impacts in accordance with these Public Works Standards. At a minimum, all additional drainage created by the development project will be required to be properly routed to an approved public drainage facility.

Where, in the sole opinion of the City Engineer, the storm water increase is measurable and the existing downstream storm drainage system may not be sufficiently sized to carry the post-project design flow, the Consulting Engineer is required to prepare a storm water routing analysis, acceptable to the City Engineer. In the event that storm waters cannot be contained within acceptable public rights-of-way, the Developer will be required to replace the downstream constrictions. If, in the sole opinion of the City Engineer, no reasonable improvement of the downstream system can be identified and the project site is suitable, the Developer may attenuate the increased discharge through the construction of detention facilities. Where detention facilities are allowed, the facility design shall include access for normal maintenance, additional capacity for debris build-up during maintenance cycles, a maintenance plan and a funding mechanism for the long term maintenance and replacement of the facility.

Containment of floodwaters within the public storm drain system is required at all times. Floodwaters shall be confined within the street curbs or other approved right-of-way by grading, levees or alternative means acceptable to the City Engineer.

The diversion of natural drainage shall be allowed only within the limits of a proposed improvement. All natural drainage must leave the improved area at its original horizontal and vertical alignment unless a special agreement, approved by the City Engineer, has been executed with the adjoining property owners.

Where required by the City Engineer, the Consulting Engineer shall prepare and submit the following information for review:

4.02 COLLECTION SYSTEM DESIGN: All collection system components are required to be designed for a 50 year design life. Storm drainage design calculations shall be completed in accordance with the latest edition of the Sonoma County Water Agency Flood Control Design Criteria guide, except as modified herein.

A. Design Storm: The following design storm events shall be used in drainage calculations for the design of all waterway classifications (e.g., major, secondary and minor waterways) for both private and public drainage improvements. These shall be considered minimum requirements only and shall be increased by the Consulting Engineer when circumstances warrant:

   1. 25 Year Event – Shall be contained and conveyed within all underground drainage pipes. All storm water conveyance structures shall be designed to function without surcharging.

   2. 100 Year Event – Shall be contained and conveyed within the street curbs, open channels and creeks. In those areas where the failure of a drainage inlet would allow storm water to break out of the approved drainage facility (e.g., the street, open

channel, etc.), a secondary routing analysis shall be performed. Based on this analysis, additional improvements such as overland relief channels, redundant inlets, etc. shall be required to adequately contain and convey the drainage.

B. Hydrology Maps:

1. Watershed: A topographic map of the overall watershed showing the following criteria:
   a. Relationship between the proposed development (on-site areas) and the remainder of the watershed (off-site areas).
   b. Acreage of each sub-area within the on-site and off-site areas.
   c. Runoff coefficients of each sub-area within the on-site and off-site areas.

2. Project Site: A map of the proposed development showing the following:
   a. All applicable existing and proposed storm drainage improvements.
   b. Time of concentration at each hydraulic structure.
   c. The magnitude and direction (indicated by arrows) of flow in each pipe and flow to each structure contributed by its tributary area. All flow rates shall be expressed in cubic feet per second (cfs).
   d. Elevation of all pipe inverts and the top of structure elevation at each structure.
   e. Slopes of all storm water pipes and open channels.

C. Storm Water Runoff Calculations: The Rational Method for calculating storm runoff discharge shall be used for areas smaller than 640 acres, using the following formula:

$$Q = C\ I\ A\ K$$

Where: Q = Design runoff (cubic feet per second);

C = Coefficient of runoff based on the City's General Plan for the ultimate development of the watershed from Plate No. B-1 of the Sonoma County Water Agency Flood Control Design Criteria Appendix;

I = Rainfall intensity (inches per hour) from the following equations, where "t" is the time of concentration (minutes):

- 25 year event: $I_{25} = 7.90/t^{0.516}$
- 100 year event: $I_{100} = 10.15/t^{0.529}$

A = Tributary watershed area (acres)

K = K Factor constant for Healdsburg = 1.35

D. Profile of Hydraulic Grade Line: The hydraulic grade line shall be calculated and plotted for the design storm for all underground drainage pipes and open channels. All computations, including a narrative of the design shall be clearly documented and submitted to the City Engineer for approval.

E. Storm Drain Pipes: Piping systems shall be designed in accordance with the following:

1. Size: The minimum inside diameter shall be 15 inches.
2. Vertical Alignment: All pipes shall be designed to be self-cleaning with a minimum flow velocity of 2.5 feet per second at the design flow.

3. Horizontal Alignment: Storm drainage pipes shall be parallel with the centerline of the street, with the outside face of pipe 1.5 feet behind the face of curb (see Public Works Standard Detail ST01). Where the sidewalk is wider than 5 feet, separated from the curb or where no sidewalk is required, the centerline of the storm drainage pipe shall be maintained at 18 inches behind the face of curb. Although deflection into and out of curb inlets may be necessary, unnecessary meandering and angular changes shall be avoided. Pipe curvature shall not exceed manufacturer's recommendations.

4. Connections: All connections or junction points of storm drainage pipes shall be made at an approved drainage structure. No blind connections shall be allowed. Connections shall not be made adverse to the direction of flow. At intersections of pipes, the downstream pipe shall have a crown elevation that is less than or equal to the crowns of all upstream connecting pipes. Pipe diameters shall not decrease in the downstream direction.

5. Materials: Pipes within the City right-of-way and easements shall be Class III reinforced concrete pipe (RCP) unless otherwise approved. Where circumstances dictate (see cover requirements below), a higher class RCP shall be specified on the construction plans.

6. Cover Requirements: The following chart lists the minimum allowable classes of RCP. For use in this chart, cover is defined as the distance from the inside top of pipe to either the top of curb or finished grade, whichever is applicable.

Cover in Feet	Minimum Class, RCP	
Less than 2.5*	Class IV	(2000 D)
2.5 - 7.9	Class III	(1500 D)
8.0 - 11.9	Class IV	(2000 D)
12.0 - 17.0	Class V	(3000 D)

*All storm drain pipe alignments shall be designed such that the top of pipe lies at least 6 inches below street sub grade. If, for sound engineering reasons, the above requirements cannot be met, RCP Class V pipe shall be used. If necessary, the pipe shall be encased in concrete or provided with a concrete cover as required by the City Engineer.

F. Open Channels: The term open channel shall include creeks, channels, ditches, swales, etc. Drainage shall not be conveyed through a development in open channels without the written approval of the City Engineer. Open channels shall be designed in accordance with the following:

1. Size: All open channels shall have a minimum depth of 6 inches. Side slopes shall be as follows:

   a. Concrete lined channels = 1 foot horizontal to 1 foot vertical or flatter.

   b. Rock lined channels = 2 feet horizontal to 1 foot vertical or flatter.

   c. Earthen channels = 2 feet horizontal to 1 foot vertical or flatter.

2. Vertical Alignment: Open channels shall be designed such that velocities are within the following limits:

   a. Unlined channels = 2 to 5 feet per second.

   b. Lined channels = 2 to 12 feet per second.

Profiles of the existing channel for a minimum of 100 feet upstream and downstream of the development shall be shown on the construction plans to establish an average profile grade.

3. Connections: All open channels shall terminate into an approved drainage structure, unless otherwise approved.

4. Freeboard: A minimum freeboard of 3 inches shall be provided in shallow, minor swales and ditches. A minimum of 12 inches of freeboard shall be provided in creeks and major drainage ways.

   Materials: Where flow velocity, stability of underlying soils and/or risk to adjacent properties warrant, open channels shall be lined with finished concrete, rock rip-rap, or other lining approved by the City Engineer. Concrete lined channels shall conform to the Public Works Standard Details. Rock rip-rap lined channels shall be No. 1 Backing, Method B Placement per State of California Standard Specifications Section 72-2.

G. Drainage Structures: Pipe diameters shall not decrease in the downstream direction. The inverts of all pipes into and out of each drainage structure shall be labeled on the profile view of the subject Utility Plan.

   1. Curb Inlets: Curb inlets shall conform to the Public Works Standard Details.
      a. Location: Curb inlets shall be located at junction points and changes in the pipe slope or pipe size.

      b. Connections: At the curb inlet, the invert of all upstream pipes shall be a minimum of 0.1 feet above the invert of the downstream pipe

      c. Spacing Requirements: Spacing of approved points of access to the storm drain shall not exceed 300 feet. Curb inlets and manholes shall both be included to satisfy this maximum spacing requirement. Curb inlets shall be designed and spaced such that they intercept and fully contain the 25-year storm event. At a minimum, curb inlets shall be required at all points where any of the following criteria is met:

         - Length of gutter flow exceeds 750 feet.
         - Gutter runoff exceeds 3.0 cfs.
         - Water depth in gutter reaches 0.4 feet at the face of curb or within 0.1 feet of the top of curbs having less than a 6 inch high face.

      d. Special Conditions: Drainage structures shall be sized in accordance with the manufacturer's recommendations.

         - Streets steeper than 5 percent grade may require the installation of galleries.
         - Isolated low points may require the installation of multiple curb inlets side by side (e.g., double draining curb inlets).

   2. Manholes: Manholes shall conform to the Public Works Standard Details.

      a. Location: Manholes shall be located at junction points and changes in grade or pipe size.

      b. Connections: At all manholes, the invert of all upstream pipes shall be a minimum of 0.1 feet above the invert of the downstream pipe. Drop manholes shall not be allowed.

   3. Field Drains, Drop Inlets and Area Drains: Shall conform to the manufacturer's recommendations. Field drain tops shall be solid aluminum or galvanized diamond plate with the edges and corners rounded, and bolted down. Side openings 12

inches and taller, shall be fitted with guard rods in accordance with the manufacturer's recommendations. Where grated tops are required, the grate shall be bolted down.

4. Culverts: Shall be designed on an individual basis to the satisfaction of the City Engineer. A flared inlet or equivalent shall be installed on the upstream end of all culverts. Where appropriate, a rock rip-rap apron shall be installed using No. 1 Backing, Method B Placement per State of California Standard Specifications Section 72-2.

5. Headwalls, Wingwalls, Endwalls, etc.: Shall be considered on an individual basis, and in general, designed in accordance with Section 51 of the Caltrans Standard Specifications.

6. Drainage Pump Stations: Shall not be permitted.

7. Sidewalk Drains: Shall conform to the Public Works Standard Details. Storm water drainage, concentrated in a roof downspout, ditch, swale, pipe, other storm drain facility, or by the addition of significant hard surface area shall not be allowed to directly drain across the public sidewalk. A minimum of 2 sidewalk drains shall be required on each lot to convey the on-site drainage under the sidewalk to the street.

H. Right-of-Way / Easements: Drainage pipes and channels which convey drainage from any public land or facility shall not be allowed on private property unless they lie within a dedicated public easement.

1. Minimum Easement Width: All pipes and channels shall be centered within their easements, unless otherwise approved.

a. Underground Pipes: The minimum required easement width shall be the greater of the following:

- 15 feet; or
- A width equal to the required trench width (per the standard detail for trench backfill) plus 2 additional feet for every foot of depth of the pipe (as measured from the bottom of the pipe to finished grade).
- If a service road is required by the City Engineer, a width necessary for the service road.

b. Open Channels: The minimum required easement width shall be of sufficient width to contain the open channel, plus an additional 5 feet on each side. If a service road is required by the City Engineer, the easement shall have a width sufficient for the open channel and the service road.

I. Special Conditions: Service Roads - Where determined necessary by the City Engineer, a 20-foot wide service road shall be provided as follows:

1. At changes of alignment, easement boundary lines shall have a radius sufficient to provide turning room for vehicles operating on the service road.

2. Where the road abuts a slope steeper than 3 feet horizontal to 1 foot vertical, easement boundary lines shall be a minimum of 5 feet from the toe of the slope.

3. The 20 foot wide service road shall be graded for vehicular traffic and cleared of trees, shrubbery, and other obstructions for its full width, unless otherwise approved by the City Engineer.

4. The service road shall have a minimum 15-foot wide all weather surface centered within the easement. Surface type shall be determined on a case-by-case basis by the City Engineer.

4.03 STORM WATER POLLUTION PREVENTION PLAN (SWPPP):

Storm water quality shall be addressed, and adverse impacts to water quality caused by a project shall be mitigated to the extent practicable or as required by law. In order to minimize impacts to receiving waters, all projects, regardless of size, shall prepare a Storm Water Pollution Prevention Plan (SWPPP) for approval. The SWPPP shall include both construction and post construction components. The post construction component shall outline maintenance and management practices, which will mitigate ongoing impacts of the project on storm water quality.

All projects with a land disturbance of greater than or equal to one acre, or smaller projects that are part of a larger common plan of development or sale that disturb one acre or more, are subject to waste discharge requirements from the State Water Resources Control Board (SWRCB). These projects must provide evidence of coverage under SWRCB Waste Discharge Requirements (WDRs) for Discharges of Storm Water Runoff Associated with Construction Activity (NPDES General Permit No. CAS000002). The evidence of coverage must include a completed Notice of Intent and a completed SWPPP, Permit forms, SWPPP requirements, and fee information are posted on the SWRCB website (http://www.swrcb.ca.gov/stormwtr/construction.html).

The following discussion references guidelines on Best Management Practices (BMPs) published by the Environmental Protection Agency (EPA). These guidelines are available at the EPA "National Menu of Best Management Practices for Storm Water Phase II" website (http://cfpub.epa.gov/npdes/stormwater/menuofbmps/menu.cfm).

A. Storm Water Pollution Prevention Plan: All proposed projects shall submit a storm water pollution prevention plan (SWPPP) for approval which includes the following:

   1. Site plan showing existing vegetation, existing water resources, proposed areas of land disturbance, and BMPs for construction and post-construction activity. The plan shall, at a minimum, include the following categories of BMP's:

      a. Runoff control.
      b. Erosion control.
      c. Sediment control.
      d. Good housekeeping practices (construction site waste management, spill prevention and control, control of discharge from vehicle maintenance and washing).

B. Minimum Construction BMPs: At a minimum, the following BMPs for sediment control, erosion control, runoff control, and good housekeeping practices shall be included in the SWPPP:

   1. Disturbed areas shall be stabilized between October 15th and April 15th using suitable construction practices such as seeding, mulching, sod stabilization, vegetative buffer strips, etc.

   2. Protect downstream areas using vegetative buffer strips, sediment barriers, dikes, etc.

   3. Require fencing around all sensitive areas not to be disturbed such as tree drip lines, wetlands areas, etc.

   4. Use sediment controls and filtration to remove silt from water generated by runoff and dewatering operations.

   5. Use proper material storage, disposal, vehicle cleaning, fueling and maintenance practices.

   Additional specific BMPs as may be required by the City Engineer.

SECTION 5

SANITARY SEWER SYSTEM

5.01 GENERAL:

These standards are intended to insure that the development of new sewer system or the re-use of existing sewer systems are adequate for a 50 year design life and sized to serve the entire tributary area at the build out densities conforming to the City's General Plan.

5.02 COLLECTION SYSTEM DESIGN:

Engineering calculations to support the sewer system design shall be submitted to the City Engineer for review with applicable development projects, as follows:

- Map indicating service area within the sewer system including any future contributing development with projected land use, zoning, and any physical features contributing to the sewer system design.
- Sanitary sewer waste volumes either existing or proposed within the service area of the system.
- Size and slope of each pipe segment.
- Invert elevations of each pipe and appurtenant structure. Rim elevations for each structure shall be shown on the construction plans.

A. Sewer Mains:

1. Design Flow: The design of sanitary sewer flow shall be computed using the following formula: $Q_d = Q_p$ (Residential + Non-Residential) + Q_i, where:

   a. Q_d = design flow (gallons per day)

   b. Q_p (Residential) = The peak flow for residential service areas is defined as 2.5 times the average flow, with the average flow for the service area being computed from two basic assumptions:

      - 3.5 persons per single-family dwelling.
      - 90 gallons per person per day.

   c. Q_p (Non-Residential) = The peak flow for non-residential service areas are calculated as follows:

		Average Flow (Gal./Acre/Day)	Peak Flow (Gal./Acre/Day)
Commercial Areas	=	1500	4500
Light Industrial Areas	=	2000	4000
Heavy Industrial Areas	=	Sewage flow rate shall be considered on a case-by-case basis and may require special design.	

   d. Q_i = Infiltration and inflow shall be computed assuming 5,000 gallons per inch diameter mile per day for new (1990 or newer) sewer mains and laterals and 15,000 gallons per inch diameter mile per day for existing sewer mains and laterals (older than 1990). Residential laterals shall be assumed to be a 4-inch diameter with a minimum length of 75 feet.

2. Size: The minimum inside diameter of any new sewer mains shall be as follows:

   a. Public mains: 8 inches.

   b. Private mains: 6 inches.

3. Capacity: Manning's Formula [$Q = A\ (1.49/n)\ R^{2/3}\ S^{1/2}$] shall be used to determine pipe capacity. The "n" value shall be 0.013 or the pipe manufacturer's recommendation, whichever is greater.

4. Horizontal and Vertical Alignment:

   a. Sewer mains shall run in a straight line and at a constant slope between manholes.

   b. Sewer mains shall run parallel with and be located 6 feet to the south or west side of the street centerline. The location of trunk sewer mains shall be determined on a case-by-case basis by the City Engineer.

   c. Minimum slope - sewer velocity shall be equal to or greater than 2 feet per second for all sewers when flowing full.

   d. Maximum slope - gravity sewers shall not exceed 15%. Where conditions, such as steep slopes, require sewers to be sloped greater than 15% restrained joints and trench dams shall be required.

   e. The termination of all sewer mains (e.g., uphill end), including in cul-de-sacs, shall be at a manhole. Where the street and the underlying sewer main are planned to be extended, a mainline cleanout may be used to temporarily terminate the sewer main at the subdivision boundary.

   f. Other utilities shall not, under any circumstances, be installed directly over and parallel to any sanitary sewer line installation.

5. Cover and Clearance Requirements:

   a. Minimum depth of 5 feet shall be required (as measured from the top of the pipe to the finished grade).

   b. Minimum horizontal separation shall be maintained as follows (as measured between the outside faces of the pipes), unless otherwise approved by the City Engineer:

      - Sewer mains shall be separated from water mains a minimum of 10 feet at all times.

      - Sewer mains shall be separated from storm drain mains and/or other utilities a minimum of 5 feet.

   c. Minimum vertical clearance of 12 inches shall be maintained from the water and storm drain lines, and 6 inches clearance from all other improvements and utilities.

   d. If conditions make it impractical to meet the minimum cover and/or clearance requirements, the following shall be required:

      - The condition(s) shall be noted in the profile of the construction plans at the location of the condition.

      - Each location shall require special approval.

- Special pipe, bedding and/or backfill shall be required as directed by the City Engineer.

6. Right-of-Way / Easements: All public sewer mains and appurtenances shall be located within the street right-of-way or utility easements dedicated and accepted for public use. All pipes shall be centered within their easements whenever possible.

   a. Minimum Easement Width - The minimum easement width shall be the greater of the following:

      - 20 feet; or
      - A width equal to the required trench width (per the standard detail for trench backfill) plus 3 additional feet for every foot of depth of the pipe (as measured from the bottom of the pipe to finished grade).
      - If a service road is required by the City Engineer, a width necessary for the service road.

B. Sewer Laterals: The lateral is that portion of the sewer system maintained by the City between the sewer main and the property line cleanout.

   1. Size: Laterals shall be the following inside diameter, unless otherwise required by the California Plumbing Code:

      a. 4 inch where grade requirements can be met and the laterals intended use is to serve a single-family residence or other similar domestic type of use.

      b. 6 inch or larger where the intended use is industrial, commercial or greater than that of a single-family residential unit. All sewer laterals 6-inch diameter and larger shall be connected to the sewer main at a manhole.

   2. Cover Requirements: Laterals shall have a minimum cover of 30 inches at the face of curb (as measured from the top of pipe to the flowline of the gutter pan).

   3. Connections: In all new subdivision work and/or whenever a new sewer main is installed, an appropriate lateral shall be extended to each existing property, and to each reasonably contemplated property, within the anticipated service area. Individual parcels shall be served by a single sewer lateral, unless otherwise approved by the City Engineer. All unused laterals are to be abandoned by capping the line at the public main and removing all piping and appurtenances within the public right-of-way. The following special conditions may be considered on a case-by-case basis:

      a. Multiple laterals to a single parcel: May be approved for residential and commercial properties where different types of uses or proximity to the sewer main make it advantageous for multiple buildings on an individual parcel to have separate laterals. Multiple sewer laterals shall not be permitted to industrially zoned properties. Where multiple laterals are approved, each building shall be structurally independent and have a separate water service.
      b. Joint-use laterals: May be approved where more than 1 residential or commercial lot is to be served by a joint-use lateral, such as via a private street.

      The following connections are prohibited:

      - Force sewer mains – laterals shall not be directly connected to pressurized sewer mains.
      - Building downspouts or other storm water drainage facilities shall not be connected to the sanitary sewer system.

4. Vertical Alignment: Minimum slope of all sewer laterals shall be 2 percent, unless otherwise approved by the City Engineer. When connected at a manhole, the lateral shall be connected within 2 feet of the invert of the manhole base.

5. Horizontal Alignment: All laterals, from the property line cleanout to the point of connection with the sewer main, shall run straight and at a constant grade. No bends or fittings shall be allowed (not including fittings at the saddle or wye connection). Laterals shall be connected to the sewer main at a manhole whenever possible. At manhole connections, the lateral shall not run adverse to the direction of flow of the portion of the main that is downstream of the manhole. At non-manhole connections (i.e., connected directly to the sewer main line), the lateral shall be perpendicular to the sewer main.

   All laterals shall be within the property lines extended for the property being served. Laterals shall maintain a minimum separation of 5 feet from all water services and fire hydrants, and 10 feet from all water mains. Each lateral shall be referenced to the construction plan stationing.

6. Reuse of Existing Lateral: When a development project constructs a new building or intensifies an existing building's use of the public sewer system, the Developer is required to prove to the satisfaction of the City Engineer that the existing sewer lateral is sufficient to serve the needs of the project in accordance with the above sewer system design criteria. This requirement can typically be satisfied through video inspection. This inspection requirement applies to all development projects (residential and non-residential).

C. Cleanouts: A property line cleanout shall be provided at the back of sidewalk on each and every sewer lateral in accordance with the Public Works Standard Details, except as follows:
   1. No existing or proposed sidewalk: The property line cleanout shall be installed within 2 feet of the back of curb when sidewalk is not planned along the frontage of the property in question.
   2. Easements: The property line cleanout shall be required at the easement boundary line when the lateral is not installed within the street right-of-way.

D. Sewer Manholes: Sewer manholes shall conform to the Public Works Standard Details.
   1. Location: Manholes shall be located at junction points, changes in horizontal or vertical alignment, changes in pipe size and the upstream end of the sewer main (mainline cleanouts are only allowed on a temporary basis where the sewer main is subject to future extension).
   2. Connections: At the manhole, the invert of all upstream pipes shall be from 0.1 to 2.0 feet above the flow line of the manhole. Drop manholes shall not be allowed. Pipe diameters shall not decrease in the downstream direction. The invert in, invert out, and rim elevation of each manhole shall be labeled on the profile view of the construction plans.
   3. Spacing Requirements: Manholes shall be spaced a maximum of 300 feet apart.
   4. Special Conditions: Bolt down lids are required for manholes within 100 feet of a waterway where an overflow could discharge directly into the waterway.

E. Special Conditions:
   1. Backwater Valves: If the elevation of the building pad is less than 2 feet above the next upstream manhole, a backwater valve, approved by the City Engineer, shall be

required in accordance with Section 710 of the California Plumbing Code. For all new construction, it shall be the responsibility of the Consulting Engineer to identify which structures and/or properties require back water valves.

2. Force Mains: The design of sewer force mains or other unusual features or structures shall require individual study and approval by the City Engineer.
3. Wastewater Sampling Stations: Where existing or future wastewater discharges may be subject to a Wastewater Discharge Permit, a monitoring manhole shall be required at the back of the sidewalk in place of the standard property line cleanout.
4. Service Roads: Where sewer mains are installed outside of the street right-of-way, a 20-foot wide service road shall be provided as follows:
   a. At changes of alignment, easement boundary lines shall have a 50 foot minimum radius (measured from inside of roadway surface).
   b. Where the road abuts a slope steeper than 3 feet horizontal to 1 foot vertical, easement boundary lines shall be a minimum of 5 feet from the toe of the slope.
   c. The 20 foot wide service road shall be graded for vehicular traffic and cleared of trees, shrubbery, and other obstructions for its full width, unless otherwise approved by the City Engineer.
   d. The service road shall be a minimum 15 foot wide, 3/4 inch shale, 8 inch minimum depth, centered within the easement. If the grade of the road exceeds 10 percent it shall be paved with an asphaltic concrete surface a minimum of 2 inches in depth over 6 inches of class 2 aggregate base compacted to 95 percent.

SECTION 6

WATER DISTRIBUTION SYSTEM

6.01 GENERAL:

All improvements including extensions, replacements, and repairs shall conform to the requirements of the California Plumbing Code, National Board of Fire Underwriters, American Water Works Association Standards, Title 22, Chapter 16 of the California Code of Regulations, the City Code, and these Public Works Standards.

The City's water system includes nine separate pressure zones in its distribution system. All properties are served from gravity fed tank storage. The system is complex, and the City Engineer should be contacted for design information.

6.02 DISTRIBUTION SYSTEM DESIGN:

The distribution system is required to be designed for a 50 year design life and constructed in a grid or loop system to provide for pressure equalization and redundancy.

A. WATER MAINS:

1. Sizes: The minimum inside diameter shall be 8 inches. The installation of 6 inch mains may be permitted in cul-de-sacs with no fire hydrant. In all cases, water mains shall be of sufficient size to meet fire flow requirements as outlined by the requirements of the City Fire Marshall.

2. Horizontal Alignment: Water mains shall run parallel with and be located 6 feet to the north or east of the street centerline. However, where the street curves, the water main shall be deflected to maintain standard alignment as follows:

   a. In larger radii curves, the following minimum radii may be used for 20 foot lengths of the standard PVC pipe:

Pipe Diameter	Minimum Radius
6 inches	300 foot
8 inches	400 foot.
12 inches	500 foot.

   In no case shall the pipe be deflected at the joint, nor shall the radius be tighter than the manufacturer's recommended minimum radius.

   b. In smaller radii curves, standard approved fittings shall be used at all bends in the water line of 11.25 degrees and greater.

3. Cover and Clearance Requirements: The standard depth shall be 42 inches below finished grade (measured from the top of pipe), unless otherwise approved. Minimum horizontal separation shall be maintained as follows (measured between the outside faces of the pipes), unless otherwise approved by the City Engineer:

   a. Water mains shall be separated from sewer mains a minimum of 10 feet at all times.

   b. Water mains shall be separated from storm drain mains and/or other utilities a minimum of 5 feet.

   Minimum vertical clearance of 12 inches shall be maintained from sewer and storm drain lines, and 6 inches clearance from all other improvements and utilities.

   If, in the opinion of the City Engineer, conditions make it impractical to meet the minimum cover and/or clearance requirements, the condition(s) shall be noted in the

profile of the construction plans at the location of the condition and special pipe, bedding and/or backfill shall be required as directed by the City Engineer.

B. VALVES:

1. Intersection of Mains – A mainline valve cluster is required on all legs (i.e., 3 valves for "T" intersection and 4 valves for cross intersection).

2. Spacing – Maximum spacing of 500 feet between mainline valves. In no case shall more than 2 fire hydrants be removed from service by the shutdown of a single run of water main.

3. Special Conditions – A mainline valve shall be installed on each side of services to hospitals, schools, and major industrial sites.

C. RIGHT-OF-WAY / EASEMENTS: All public water mains and appurtenances shall be located within the street right-of-way or utility easements dedicated and accepted for public use. All pipes shall be centered within their easements whenever possible.

1. Minimum Easement Width - The minimum easement width shall be the greater of the following:

   a. 20 feet; or

   b. A width equal to the required trench width (per the standard detail for trench backfill) plus 3 additional feet for every foot of depth of the pipe (as measured from the bottom of the pipe to finished grade).

   c. If a service road is required by the City Engineer, a width necessary for the service road.

D. FIRE HYDRANTS: Fire hydrants shall be installed as specified in the Public Works Standard Details. The minimum size water main serving a single fire hydrant shall be 6 inches and no more than two hydrants shall be allowed on any 8-inch line between intersecting lines.

Fire hydrants shall be located at the curb return of an intersection. If the hydrant cannot be located at an intersection, it shall be placed on a property line or where it will minimize interference with the use of the property.

The center of the fire hydrant shall be located 18 inches behind the back of sidewalk. Where the sidewalk is separated from the curb by a planter strip or where no sidewalk is planned, the center of the fire hydrant shall be located 3 feet behind the face of curb.

Fire hydrants shall not be closer than 5 feet to driveway (measured from the top of the transition), parking space or other area adjacent to vehicular traffic.

A minimum clear space of 3 feet shall be maintained between the outer most edge of the fire hydrant (i.e., the valve stem) and all vertical obstructions (i.e., retaining walls, fences, buildings, etc.).

1. Spacing Requirements:

   a. Residential Areas – Maximum spacing of 400 feet between hydrants.

   b. Non-Residential Areas – Maximum spacing of 300 feet between hydrants.

At identified fault zones, fire hydrants shall be placed approximately 50 feet to each side of the delineated fault line. A mainline valve shall be installed immediately adjacent to each hydrant between the hydrant and the fault line.

E. WATER SERVICES: Water services shall include domestic, irrigation and dedicated fire services. The water service is that portion of the service line maintained by the City that is between the water main and the back of the water meter or the property line for dedicated fire services (up to, but not including the backflow prevention assembly).

1. Size: All new water service lines shall have a minimum inside diameter of 1 inch, and may be required to be larger based on fire flow (see table below) or other requirements. Water services larger than 1 inch diameter shall require the installation of a valve on the service line at the main and shall conform to the City's typical service sizes of 2 inch, 4 inch, 6 inch and 8 inch diameter.

2. Cover Requirements: Water services shall have 30 to 42 inches of coverage at the face of curb (as measured from the top of pipe to the flowline of the gutterpan).

3. Service Pressure: The following table is intended to assist Developers and their agents (i.e., fire system designers, Consulting Engineers, etc.) in designing the water system improvements within the public right of way for available water system pressure. Where required due to available service pressure, it shall be the responsibility of the Developer and/or Consulting Engineer to verify that domestic and fire water services conform to the following special requirements:

Elevation difference between lowest floor of building and top of City reservoir	**Elevation difference between highest floor of building and bottom of City reservoir**	**Special Requirements**
More than 185 feet		Domestic Service - install pressure reducing valve per California Plumbing Code. Fire Service - design for calculated pressure based on elevation difference between bottom of City reservoir to highest portion of ceiling within the building.
	185 – 92 feet	Domestic Service – none. Fire Service - design for calculated pressure based on elevation difference between bottom of City reservoir to highest portion of ceiling within the building.
	92 – 34 feet	Domestic Service - install booster system per California Plumbing Code, install double check backflow assembly per Public Works Standard WA06 and requires minimum 2 inch diameter service. Fire Service - design fire system for pressure supplied by booster system.
	Less than 34 feet	***Prohibited*** – no subdivision of property or building permit to construct a new building shall be allowed where there is less than 34 feet elevation difference between the highest floor of the building and the bottom of the City reservoir (i.e., less than 15 psi).

Table of City Reservoir Elevations

City Reservoir[2]	**Top of Reservoir Elevation** (feet[1])	**Bottom of Reservoir Elevation** (feet[1])
Cadoul	472	463
Iverson (North, South & West)	418	403
Hidden Acres[3]	363	363
Latimer[3]	343	343
Panorama	315	295
Sunset	543	526
Tayman	246	222

[1] All elevations are referenced to the North American Vertical Datum of 1988 (NAVD88).

[2] To lookup which reservoir serves the property in question download the Water Service Zone Map from the City's website at www.cityofhealdsburg.org, click on "Documents for Download" in the upper left corner, click on Public Works, click on Maps.

[3] The Hidden Acres and Latimer Reservoir service zones are served through pressure reducing valves. The top and bottom reservoir elevations are expressed as equivalent elevations based upon the pressure provided and are therefore equal.

4. Connections: In all new subdivision work and/or whenever a new water main is installed, an appropriately sized water line service shall be extended to each existing property, and to each reasonably contemplated property, within the anticipated service area. Where multiple meters (domestic and irrigation use) are allowed within an individual parcel, all meters are required to be manifolded off of a single water service line, appropriately sized.

   Separate water meters are required for each individual parcel (including condominium and common area parcels) as follows:

   a. Residential Properties: Residential properties may have up to one water meter per residential dwelling unit. Where warranted, multi-family dwelling units may have an additional house water meter for landscaping, centralized laundry rooms or other common use improvements.

   b. Non-Residential Properties: Commercial properties and industrial properties are required to be master-metered for domestic use through a single water meter. Where warranted, the City Engineer may approve an additional domestic use water meter for separate buildings within a parcel where the building is structurally independent and served by a separate sewer lateral. Properties with significant landscaping water needs are encouraged to install a separate meter for landscape water.

   c. Mixed Use Properties: The residential and non-residential portions of a property are required to be separately metered in accordance with the requirements of the specific uses as noted above.

5. Horizontal Alignment: All water service lines shall run straight and perpendicular to the water main. Water meter boxes shall be placed flush to the back of sidewalk and shall not be located within the curb cut or transition area of the driveway. All water service

lines shall be within the property lines extended for the property being served. Water services shall maintain a minimum separation of 5 feet from all sewer laterals and 10 feet from all sewer mains.

Each water service shall be referenced to the construction plan stationing.

F. CATHODIC PROTECTION: All metallic components of the water system (i.e., water services, fire hydrants, valves, fittings, air release valve, blow off, etc.) are require to be cathodically protected in accordance with the Public Works Standard Details, except as follows:

1. Where the City Engineer has identified that the existing public water main does not require cathodic protection, only the copper components installed will require cathodic protection.

G. SPECIAL CONDITIONS:

1. Air Release Valve: Air release valves are required at locations in the system that are one pipe diameter or more, higher in elevation than the surrounding system (i.e., over a hilltop or the upper end of a dead end main such as in a cul-de-sac).
2. Blow-Off Device: A blow-off device is required at the termination of all water mains, including at the boundary of development where the water main is intended to be extended. Where a water main permanently terminates at the end of a cul-de-sac, a fire hydrant installed at the end of the main shall satisfy the requirement for a blow-off.
3. Water Sampling Stations: At the discretion of the City Engineer, the Developer may be required to install a water sampling station. Water sampling stations shall be installed in accordance with these Public Works Standards.
4. Backflow Protection Requirements: Backflow prevention assemblies shall be required in accordance with the City's Cross Connection Control program per the City Code. Backflow preventers are required to be placed immediately behind the water meter and shall not be closer than 5 feet from a driveway, parking space or other area adjacent to vehicular traffic.
5. Service Roads: Where water mains are installed outside of the street right-of-way, a 20-foot wide service road shall be provided as follows:

    a. At changes of alignment, easement boundary lines shall have a 50 foot minimum radius (measured from inside of roadway surface).

    b. Where the road abuts a slope steeper than 3 feet horizontal to 1 foot vertical, easement boundary lines shall be a minimum of 5 feet from the toe of the slope.

    c. The 20 foot wide service road shall be graded for vehicular traffic and cleared of trees, shrubbery, and other obstructions for its full width.

    d. The service road shall be a minimum 15 foot wide, 3/4 inch shale, 8 inch minimum depth, centered within the easement. If the grade of the road exceeds 10 percent it shall be paved with an asphaltic concrete surface a minimum of 2 inches in depth over 6 inches of class 2 aggregate base compacted to 95 percent.

SECTION 7

LANDSCAPE AND IRRIGATION

7.01 GENERAL:

Complete plans and specifications for all proposed landscape and irrigation improvements shall be submitted to the City Arborist for review and approval prior to beginning work. This requirement shall apply for all proposed work within the public right- of way or any other area in which the proposed improvements are intended to be the direct or indirect maintenance responsibility of the City of Healdsburg. Said plans shall be prepared by a landscape architect or irrigation designer who is registered in accordance with the provisions of the California Business and Professions Code.

7.02 IRRIGATION:

All irrigation systems shall be designed to operate efficiently and effectively and to create a suitable environment for long-term plant viability in the locally heavy soils and extreme winds. Three sets of irrigation calculations shall be supplied with the plans and specification for review by the City Arborist. Assumptions used for wind, soil permeability, evapotranspiration, system efficiency, etc. shall be clearly stated in a tabular format. The ability of the system to efficiently provide water to the landscape shall be clearly demonstrated by the designer.

The required calculations shall include, but not be limited to:

1. Precipitation rate of each system type (i.e. large area rotors, small area pop-up sprays, grid emitterline system, spot emitter system).
2. System zone calculations listing the friction losses for the longest line (zone) on the system and the heaviest line (zone) on the system include all pipe, heads, valves and appurtenances to the water meter or point of connection. On systems larger that 1.5 inches take the calculations to the City water main tap.
3. Pressure loss due to the required Reduced Pressure Principal Backflow Assembly (not less than 12 psi).

In addition to the above requirements, the system shall be designed with the following minimum safety factors. The system designer shall illustrate the ability of the system to adequately irrigate the landscape both with, and without these additional factors of safety.

1. The water service to the site, up to but excluding the meter and backflow device, shall be sized to deliver a minimum of 25 percent more water than required by all contemplated landscaping.
2. An additional head loss, above that calculated, of 5 percent shall be taken across the meter and back flow device.
3. All other line, fitting, and equipment losses shall be increased by 10 percent.
4. The irrigation controller specified shall have a minimum of 10 percent and no fewer than 2, of its stations unused and available for future use by the City.

If the calculations show that a system is marginal, then the system shall include an electric booster pump, complete with controls, power hook up and enclosure (use Cornell pumps or approved equal). This pump shall be designed, specified and installed to the satisfaction of the City Arborist.

7.03 LANDSCAPING:

The landscape design shall utilize only the highest quality plants and materials, which are properly suited for the local area. In general, the Healdsburg area has a very high water table and extremely heavy soils. These factors and all other local conditions shall be carefully considered and mitigated through the design. The resulting plans and specifications are expected to yield a

beautiful, thriving landscape that requires an absolute minimum of maintenance effort and expense.

Local soils are extremely heavy. In many locations within the City, it is necessary to rip the soil in two directions to a minimum depth of three feet, as well as install a sub-drainage system, however this operation should not be performed within the dripline of existing trees and or vegetation. In consideration of this fact, the landscape architect shall personally investigate the site and pay particular attention to soil quality, character, and suitability, site drainage, water table and other factors pertinent to the proposed planting environment prior to submitting plans for an initial plan check. A complete soil analysis, including amendment and fertilization rates or installation is required prior to planting and following finish grading. The City Arborist, upon reviewing the initial recommendations by the landscape architect, may require project proponent to supply a soils and fertility analysis of the base site prior to the completion of the plans and/or specifications.

7.04 PARKSTRIPS (landscaped buffer between sidewalk and back of curb):
Parkstrips must be a minimum of 5 feet wide. An irrigation system is required. The type of trees must be approved by the City Arborist and shall be installed with an approved linear root barrier.

SPECIFIC PROVISIONS

SECTION 1

GENERAL

1.01 INSPECTION REQUIRED:
Inspection is required by the City Engineer for all work within the Public right-of-way, all public easements, and for any work for which an encroachment permit has been granted by or to the City of Healdsburg. Inspections shall be performed at all phases of the work in order to insure complete conformance with the requirements of these Specifications. The City Engineer shall be the sole judge as to the number and type of inspections required. The City Engineer shall at all times have access to the work during its construction, and the Contractor shall provide proper and safe facilities for such access and inspection. The City Engineer shall be furnished with every reasonable facility for ascertaining that the materials and the workmanship are in accordance with the requirements and intentions of these Specifications. The Contractor, shall, at any time when requested, submit to the City Engineer properly authenticated documents or other satisfactory proof of compliance with the requirements of these Specifications. The work shall be done under the supervision and to the complete satisfaction of the City and in accordance with the laws of the State of California.

The inspection of the work by the City Engineer shall not relieve the Contractor of any obligations to fulfill the contract as prescribed, and defective work shall be made good and unsuitable materials may be rejected, notwithstanding that such defective work and materials have been previously overlooked by the City Engineer and accepted.

At a minimum, inspections shall be performed at the following points and as required elsewhere in the Specifications:

A. Prior to the placement of any fill material.
B. Immediately after the placement of all pipe and prior to completion of the bedding or beginning backfill.
C. During the installation of cathodic protection.
D. Prior to backfill of all thrust blocks.
E. During all backfill and compaction operations.
F. During abandonment and removal of all utilities in the City right-of-way.
G. Prior to and during the placement and compaction of any Aggregate Base material.
H. Form and reinforcement inspections prior to pouring any concrete.
I. Prior to paving.
J. Monitoring of all paving operations.
K. During the adjustment of manholes and utility boxes.
L. After layout and prior to striping.
M. Immediately prior to and immediately after integration of soil amendments.
N. Irrigation coverage tests prior to placement of plant materials.

1.02 NOTIFICATION:
The Contractor shall request all inspections by using the City of Healdsburg's Public Works Department telephone voice mail Inspection Request Line. The City will endeavor to complete all requested inspections which are placed before 4 p.m. on the previous City business day. Inspection requests shall be made the day preceding the requested inspection. Same day

inspections are not allowed. Requests made more than one day in advance shall not be honored. In addition, verbal inspection requests shall not be honored.

All inspection requests shall be made by leaving a voice-mail inspection request at (707) 547-0556. Notices shall include all of the following information:

- project name
- permit number
- site address
- type of inspection
- date of requested inspection & time (a.m. or p.m.)
- name & phone number of contact person

Inspections will not be made unless all of the above information is provided. The City Engineer will endeavor to contact the Contractor if a conflict exists which requires rescheduling of an inspection. The City of Healdsburg makes no warranties regarding the timeliness of inspections and shall not be liable to the Contractor for any damages, delays, or other costs which may be incurred from late or rescheduled inspections. All reinspections or rescheduled inspections shall require the same notice. In addition, all reinspections shall require the payment of a reinspection fee to the City. Said fee shall be paid prior to the reinspection of the work by the City.

1.03 REMOVAL OF UNINSPECTED WORK:

Any work which has been performed without on-site visual inspection and approval as required by this Section or any other provision of these Specifications shall be removed as directed by the City Engineer and reinstalled at the Contractors sole expense.

1.04 CONSTRUCTION LIMITATIONS:

The contractor will be expected to conduct operations in a manner which creates minimum damage to the natural vegetation and landscape. Ingress and egress for all off road work shall be via the existing driveways. Care shall be exercised to avoid hazards that may cause injury to persons, animals or property either during working hours or after work hours, which will include dust control, backfilling trenches immediately following pipe laying and temporary fencing as required.

Prior to working in the City right-of-way the Contractor shall obtain an encroachment permit from the City. Work by City contract does not typically require an encroachment permit. It is the contractor's responsibility to determine if an encroachment permit is required prior to starting work.

All unused utilities (i.e. water, sewer, storm drain, electric, natural gas, etc.) within the public-right-of-way are to be properly abandoned and noted in the construction plans. Service laterals shall be abandoned by capping the line at the main and removing all piping and appurtenances within the public right-of-way. Utility mains and portions of associated structures less than 4 feet deep shall be removed. Utility mains and portions of associated structures more than 4 feet deep shall be removed or filled with a 2 sack cement and sand slurry.

The Contractor will be responsible for obtaining permission from the property owners for any construction outside of the work site or easements as shown on the plans. Equipment will be restricted to the immediate area of construction. Pipe trenches will be backfilled as soon as

possible and no later than the end of the work day. In paved areas temporary pavement shall be installed. Permanent paving must be completed within 30 days of trench excavation.

Receptacles for construction residue, including oil, cleaning fluids, and litter will be covered. Such residues will be disposed of in a proper manner.

Dust control and a prohibition of burning of waste construction materials or vegetation will be enforced for all construction activity.

All construction activity will be confined to Monday through Saturday, between the hours of 7:30 a.m. and 6:00 p.m., to minimize nuisances to local residences and to conform to local ordinances. Any exceptions to these time requirements, such as emergency situations and project specific conditions, must be specifically approved in writing by the City Engineer prior to commencement.

All equipment shall have sound control devices no less effective than those provided on the original equipment. No equipment should have an unmuffled exhaust.

Construction activity within the existing right-of-way will be scheduled to minimize traffic inconvenience and safety hazards to motorists, pedestrians and cyclists.

1.05 WATER FOR CONSTRUCTION AND DUST CONTROL:

Contractor shall be responsible for providing all water necessary for construction and testing. If a fire hydrant is to be used, an approved and tested backflow assembly and hydrant meter must be requested from the City of Healdsburg Public Works Department.

1.06 PROTECTION OF EXISTING FACILITIES AND PROPERTY:

Prior to commencing any type of excavation, the contractor shall notify Underground Service Alert (U.S.A.) a minimum of 48 hours in advance of the planned excavation. It shall be the contractor's responsibility to properly delineate the work area for utility mark-outs in accordance with U.S.A. guidelines. To contact Underground Service Alert (USA) call (800) 642-2444.

Prior to starting trenching operations for mainline construction, the contractor shall "pothole" and expose existing utilities at all crossings as shown on the plans, as marked out in the field after U.S.A., and as directed by the City Engineer.

Underground facilities shall be located and exposed ahead of trenching to prevent damage to the facilities, and to determine the depth and character of the all facilities that cross or infringe on the trench prism. The Contractor shall immediately notify the Engineer of any facilities found to differ from those shown on the drawings. If damage should occur to the existing facilities, the utility company and the City shall be notified immediately and repairs acceptable to the utility company or the City shall be made at the Contractors expense.

Existing facilities shall not be intentionally disturbed and shall be supported and protected against injury and maintained in good operating condition at the expense of the Contractor for the entire duration of the project.

Any proposed disruption of the existing facilities shall be approved by and coordinated with the City Engineer or the utility company affected.

1.07 TRAFFIC CONTROL:
The site of the work shall be enclosed by suitable barricades, signs and lights to warn and protect traffic effectively and shall be in accordance with those procedures as set forth by the State of California Manual for Traffic Controls for Construction and Maintenance Work Zones.

Excavation shall be backfilled before leaving the work for the night. All trenching in the travelway shall be plated with non-skid plates or paved (temporary or permanent) before leaving the work for the night. Plates are not allowed in the travelway for a period longer than 2 weeks.

All detours and traffic control Monday through Saturday shall be between 7:30a.m. and 6:00 p.m. or as directed by the City Engineer. Unobstructed two-way traffic shall be maintained at all other times. Adequate traffic control, flagmen, signing and barricades shall be provided by the Contractor at all times and as approved by the City Engineer. All elements of the approved traffic control plan shall be in place prior to the start of work each day.

1.08 PLAN FOR PROTECTION FROM CAVING**:**
In accordance with Section 6705 of the Labor Code, the Contractor shall submit to the Engineer for approval in advance of excavation a detailed plan showing the design, shoring, bracing, sloping, or other provision to be made for worker protection from the hazard of caving ground during the excavation of such trench or trenches. If such plan varies from the shoring system standards, the plan shall be prepared by a registered civil or structural engineer.

Nothing in this section shall be deemed to allow the use of shoring, sloping or protective system less effective than that required by the Construction Safety Orders.

Nothing in this section shall be construed to impose tort liability on the City, its officers, officials, employees and volunteers.

1.09 REQUIRED INFORMATION:
Prior to any work, the Contractor shall provide the City Engineer with a list of key and responsible personnel and how they may be reached at any time. The contractor is required to provide a proposed work schedule, information of off site yards, subcontractors, location of disposal and stock pile areas, and traffic control plans. All such schedules shall be subject to the approval of the Engineer and the applicable agencies.

1.10 DEFINITIONS:
The intent and meaning of the following terms as used in the Healdsburg Public Works Standard Specifications and Details shall be as defined below:

A. AWWA: Shall mean the latest edition of the American Water Works Association.

B. Caltrans Highway Design Manual: Shall mean the latest edition of the California Department of Transportation's "Highway Design Manual".

C. Caltrans Warning Signs Manual: Shall mean the latest edition of the California Department of Transportation's "Manual of Warning Signs, Lights, and Devices for Use in Performance of Work Upon Highways".

D. Caltrans Standard Plans: Shall mean the latest edition of the California Department of Transportation's "Standard Plans".

E. Caltrans Standard Specifications: Shall mean the latest edition of the California

Department of Transportation's "Standard Specifications".

F. City: Shall mean the City of Healdsburg, a municipal corporation.

G. City Engineer: Shall mean the City Engineer of the City of Healdsburg.

H. Consulting Engineer: Any person or persons, firm, partnership, or corporation legally authorized to practice civil engineering in the State of California.

I. Developer: Shall mean any person, firm, corporation, partnership or association engaged in the development of property in part or in whole by the placing of any improvements thereon, whether the property was previously developed in whole, in part, or at all.

J. Easement: Shall mean an easement dedicated to the City or Public Utility that shall be continuing and irrevocable unless formally abandoned.

K. Geotechnical (Soils) Report: Shall mean a report as prepared by any person or persons, firm, partnership, or corporation legally licensed to prepare "Geotechnical Reports" in the State of California and shall include all amendments, addendums, etc. Reports shall be submitted in 8-1/2 x 11 inch bound folders. The analysis must at a minimum include a map of the subject area showing existing streets, contours and location and type/characteristics of soils samples obtained. Where possible, the proposed street pattern shall be shown. The results of all field data and laboratory tests shall be included. Design for proposed street sections shall be based on the minimum criteria contained herein. Street structural section design shall include recommendations for: natural subgrade, subbase, base and pavement compaction and thickness to achieve design strength. In no instance shall structural sections be less than those outlined in the Street Design Section of these Public Works Standards.

L. Improvements: Refers to street work, sidewalk, curb, gutter, driveways, water supply systems, sanitary sewer systems, storm drain systems, other public utilities, landscaping, and fences to be installed by the Developer on land to be used for public right-of-way.

M. Public Works Standards: Shall mean the latest edition of the City of Healdsburg Public Works Department Standard Specifications and Details.

1.11 INTERPRETATION OF SPECIFICATIONS AND DRAWINGS:

If there is a conflict the documents with highest precedence shall control. The order of precedence shall be:

a. Permits from other agencies that may be required by law.
b. Project Specifications
c. Project Plans
d. City of Healdsburg Standard Specifications and Details
e. Caltrans Standard Specifications
f. Referenced Specifications

1.12 CONSTRUCTION STAKES:

The Engineer will set such stakes and marks as is necessary to establish such lines and grades required for the completion of the work in accordance with the approved plans and specifications. One set of each of the following stakes will be furnished by the Contractor where required: right-of-way, clearing, slope stakes, grade stakes, stakes for structures and stakes for sewers, storm drains, and water mains.

At a minimum finish grade stakes shall be offset from the edge of pavement, back of curb or sidewalk, and the center of pipe. The amount of offset shall be as agreed upon by the Engineer

and Contractor. "Cuts" or "Fills" shall be given to the nearest 0.01 foot. Stakes shall be set as follows:

a. tangent portions, a maximum of 50 foot intervals
b. horizontal or vertical curves, a maximum of 25 foot intervals
c. curb returns, at ¼ points
d. or as directed by the City Engineer

1.13 CLEAN UP:

Attention is directed to Section 4-1.02 of the Caltrans Standard Specifications.

Before final inspection of the work, the Contractor shall clean the construction site and all ground occupied in connection with the work, of all rubbish, excess materials, false-work, temporary structures, and equipment. All parts of the work shall be left in a neat and presentable condition.

Nothing herein, however, shall require the Contractor to remove warning, regulatory, and guide signs prior to formal acceptance by the Engineer.

SECTION 2

TESTING OF MATERIALS

2.01 DESCRIPTION:
Testing of materials shall be performed by the City of Healdsburg or its authorized agent following State of California Test Methods. The statistical testing procedure will not be used. Each material used shall meet the specified requirements.

It shall be the duty of the Developer/Contractor to request and coordinate all testing. All tests shall be performed in the presence of the project inspector. The City shall, at its sole discretion, have the right to reject any and/or all tests results, which do not meet this requirement, and to order a retest to be performed in the presence of the inspector. The costs for all retests so ordered shall be the responsibility of the developer/contractor.

The City, at its sole expense, will provide all initial material and compaction tests. Sampling and testing shall comply with ASTM Standard Test Methods D2922 & D3017 at a minimum. Where conditions vary, the City may perform additional testing. The cost of all retests shall be charged to the developer/contractor at the current rate as shown in the City Code. Cost for testing of materials offered in lieu of the specified materials shall be the responsibility of the developer/contractor. Cost for R-value tests when required by the City Engineer shall be the responsibility of the contractor/developer.

Testing shall only be performed on normal City working days between the hours of 8:00 a.m. and 4:00 p.m. unless other arrangements are made in advance. Tests performed outside of these hours shall be charged at twice the normal rate.

The contractor shall request all tests in writing a minimum of 2 working days in advance of the time desired. A minimum of one working day shall be allowed for compilation and reporting of data and test results after tests have been performed. No subsequent layer of material shall be placed until a passing test is obtained and acknowledged by the City.

Concrete and asphalt shall be supplied only from suppliers approved and certified by the State Department of Transportation. Proposed mix designs for all concrete and asphalt concrete to be placed within the City of Healdsburg shall be provided to and approved by the City, prior to placement.

The Contractor shall coordinate with the City for additional testing policies.

SECTION 3

EARTHWORK

3.01 DESCRIPTION:
Work under this section shall include roadway excavation, embankment construction, and subgrade preparation and shall conform with Section 19 of the Caltrans Standard Specifications except as noted herein.

3.02 GRADE TOLERANCE:
Immediately prior to placing subsequent layers of material, the grading plane of the basement material shall not vary more than 0.05 foot above or below the design grade.

3.03 RELATIVE COMPACTION:
Relative compaction shall be a minimum of 95 percent as required in the Caltrans Standard Specifications. In excavated areas the top 0.5 foot of undisturbed material (in-lieu of the top 0.8-m below finished grade as required by Section 19-5.03 of the Caltrans Standard Specifications) shall be compacted to 95 percent. Any fill material shall be considered as embankment construction.

3.04 SUBGRADE STABILITY/DEFLECTION TEST (PROOF ROLLING):
In addition to the compaction requirements above, the Contractor shall proof-roll the subgrade and the compacted basement materials beneath areas to be paved in order to test the load bearing capacity of the subgrade and the finished basement material. The Contractor shall furnish loaded trucks for the test, which shall be taken immediately after the grade is certified by the City for tolerance and compaction. The load on each rear wheel of the testing truck (typically a water truck) shall be a minimum of 4,000 pounds (16,000 pounds total gross load for a single axle with dual wheels), with a minimum tire pressure of 65 psi. The tested surface shall show no visible deflection extending more than 6 inches horizontally from the wheel track at the time of loading, or any visible cracks remaining after the loading.

SECTION 4

ENGINEERING FABRICS

4.01 DESCRIPTION:
This work shall include furnishing all the labor, materials, tools and equipment necessary to place the engineering fabrics in accordance with the approved plans and these Specifications.

Engineering fabrics shall include pavement reinforcing fabric, geotextile, and medium duty road stabilization fabrics. A Certificate of Compliance from the product manufacturer for each type of engineering fabric used shall be furnished to the City Engineer. Engineering fabrics shall be furnished in protective covers to shield against ultraviolet rays, abrasion, and water.

4.02 PAVEMENT REINFORCING FABRIC:

A. Materials: Pavement reinforcing fabric shall be manufactured from polyester, polypropylene, or polypropylene-nylon material. The fabric shall be non-woven, heat-bonded on the top side, and shall conform to the following:

Property	Minimum Requirements	Test Method
Grab Strength (lbs)	80	ASTM D4632
Elongation at break (%)	50	ASTM D4632
Asphalt Retention (gal/sy)	0.2	TF25 #8
Melting Point (degrees Fahrenheit)	300	ASTM D276

B. Installation: Pavement reinforcing fabric shall be installed in accordance with Section 39-4.03 of the Caltrans Standard Specifications and in accordance with the additional provisions listed below:
1. Before applying binder paving asphalt, the existing pavement surface shall be cleaned to the satisfaction of the City Engineer, of all debris and deleterious matter, including but not limited to leaves, dirt, sand, gravel, water, and vegetation.
2. The binder paving asphalt shall be applied with a suitably metered truck and the temperature of the paving asphalt shall range from 290 degrees to 365 degrees Fahrenheit at the time of application.
3. Pavement reinforcing fabric may be placed only when the ambient air temperature is above 50 degrees Fahrenheit and rising, the existing pavement surface is dry and the temperature of the existing pavement is above 40 degrees Fahrenheit.
4. Pavement reinforcing fabric shall not be applied farther in advance of the asphalt concrete overlay than the distance that the Contractor can maintain free to public traffic or that can be paved over with asphalt concrete within the same working day.
5. The fabric shall be lapped two to four inches (2" to 4") along all joints. No edge joints shall be lapped with more than two layers of pavement reinforcing fabric. Transverse joints shall be lapped in the direction on paving.
6. The fabric shall be placed no closer than 2 feet from the lip of gutter.
7. Pavement reinforcing fabric shall be placed with minimum wrinkles resulting in the fabric, and removal of excessive wrinkling and air bubbles shall be done prior to the binder paving asphalt setting.
8. Manual placement of the pavement reinforcing fabric shall not be allowed. Equipment

used for placing the fabric shall be fully mechanized and capable of handling and placing full rolls of fabric without creating excessive wrinkles or folds.

The pavement reinforcing fabric placed over all existing manholes and utility box covers shall be neatly cut around each cover, a minimum distance of three inches from the edge of the cover, in order to allow raising and adjusting the cover to the new pavement finish grade.

4.03 ROAD STABILIZATION FABRIC:

A. Materials: Road stabilization fabric shall be for medium duty applications and shall be manufactured from polyester, nylon, or polypropylene material, or any combination thereof. The fabric shall be a minimum 8.0 oz/sy, permeable, and shall conform to the following:

Property	Minimum Requirements	Test Method
Grab Tensile Strength (lbs)	210	ASTM D4632
Puncture Strength (psi)	110	ASTM D4833
Trapezoidal Tear (lbs)	90	ASTM D4533
Burst Strength (psi)	325	ASTM D3786

B. Installation: The subgrade to receive the geotextile fabric, immediately prior to placing, shall conform to Section 3 “Earthwork” of these Specific Provisions and as shown on the plans.

Geotextile fabric shall be handled and placed in accordance with the manufacturer's recommendations. In addition, the fabric shall be aligned and placed in a wrinkle-free manner.

Adjacent borders of the fabric shall be overlapped a minimum of 12 inches or stitched. The preceding roll shall overlap the following roll in the direction the material is being spread or shall be stitched. When the fabric is joined by stitching, it shall be stitched with yarn of a contrasting color. The size and composition of the yarn shall be as recommended by the fabric manufacturer. The stitches shall number 5 to 7 per inch of seam.

Within 24 hours after the fabric has been placed, it shall be covered with aggregate base material as shown on the plans.

During spreading and compaction of the aggregate base material, a minimum of 6 inches of such material shall be maintained between the fabric and the Contractor's equipment. Equipment or vehicles shall not be operated or driven directly on the fabric.

SECTION 5

AGGREGATE BASE

5.01 DESCRIPTION:

All work shall conform to Section 26 of the Caltrans Standard Specifications and shall be 3/4-inch maximum Class 2 aggregate base. Thickness shown on the plans shall be the minimum section allowed.

SECTION 6

ASPHALT CONCRETE

6.01 DESCRIPTION:
Shall conform to Section 39 of the Caltrans Standard Specifications, except as herein modified, and shall be Type A asphalt concrete using a steam-refined paving asphalt grade AR4000. Asphalt concrete shall be spread according to the following:

SECTION	LIFT	GRADING
0.10'-0.25'	One Lift	1/2" Max. Medium (12.5-mm)
0.20'-0.45'	Two Lifts	1/2" Max. Medium top lift (12.5-mm) 3/4" Max. Medium bottom lift (19-mm)
0.45'-0.60'	Three Lifts	1/2" Max. Medium top lift (12.5-mm) 3/4" Max. Medium lower lifts (19-mm)

All test reports (including video inspections) for the underground improvements required prior to paving operation.

6.02 SEAL, AND TACK COATS:

Asphalt Type	Grade	Rate Gals./S.Y.
Tack	SS-1	0.02 to 0.10
Fog Seal	SS-1	0.05 to 0.10

Tack coat shall be required between asphalt concrete lifts when the surface to be paved is dusty/dirty, when traffic has utilized the paving surface, or when the temperature at mid-depth of the lower asphalt lift has fallen below 120° F.

The above application rates are minimums; exact rates of application and asphalt grade will be determined by the City Engineer based on field conditions.

When specified by the City Engineer, the Contractor shall perform fog sealing. Fog sealing shall be performed at no cost to the City in all cases for aesthetic purposes where the final pavement lift has, in the opinion of the City Engineer, been excessively damaged and patched by the Contractor. The limits of the Fog Seal shall be as required by the City Engineer.

6.03 ADJUSTMENT OF IRON AND BOXES:
This work shall conform to Section 8, “Adjustment of Manholes and Utility Boxes” of the Specific Provisions. The work shall be performed no later than 3 working days following the placement of the final pavement lift. The Contractor shall accurately locate and record the location and type of all existing manhole and utility covers that are to be covered by the paving operation. A copy of said record shall be furnished to the City Engineer 24 hours minimum prior to paving.

6.04 STAGE CONSTRUCTION:
Asphalt concrete and asphalt concrete base shall be spread and compacted in layers. When spreading more than one lift, the top layer of asphalt concrete shall not exceed 0.20-foot in compacted thickness. The next lower layer shall not exceed 0.25-foot in compacted thickness,

and any lower layers shall not exceed 0.30-foot in compacted thickness. When possible, without increasing the number of lifts or violating the above requirements, asphalt shall be placed in equal lifts. Paving shall be performed in a continuous, successive operations such that the entire thickness of the required section is placed in a given days paving. When cold joints are approved by the Engineer at the end of a days paving, they shall be papered. Asphalt shall not be placed over another layer until the temperature at mid depth of the lower layer is not more than 160° F.

Pavement reinforcing fabrics are required on all street overlays unless otherwise approved in writing by the City Engineer.

Refer to Section 4 of these Specific Provisions for engineering fabrics.

6.05 MIX DESIGN:
Contractor shall submit a current (calendar year) mix design and evidence of State of California Department of Transportation Asphalt Plant certification for approval to the City of Healdsburg prior to any paving.

6.06 SPREADING AND COMPACTING EQUIPMENT:
Spreading and compacting equipment shall conform to Section 39-5 of the Caltrans Standard Specifications except as follows: Use of a motorized self-propelled Layton box for projects involving less than 50 tons of asphalt concrete shall be allowed.

Pavement which shows signs of surface distress for deformity from normal public traffic use by the morning following its placement shall be rejected as unsuitable and removed and replaced at the contractors sole expense.

6.07 SITE PREP FOR ASPHALT CONCRETE OVERLAY / RESURFACING:
The entire street to be resurfaced with asphalt concrete overlay shall be cleaned of all debris and deleterious matter, including but not limited to vegetation and organic matter, dirt, sand and gravel. Existing asphalt concrete pavement shall be removed from the concrete gutters without causing damage to the concrete, including chipping, spauling, or scaring the gutter surface.

Prior to resurfacing the street, the existing pavement surface shall be planed or leveled as necessary in order to produce with the paving operations uniform smoothness and texture.

Irregularities in the surface that are uncommonly high (greater than ½" above adjacent existing pavement) or rough areas shall be treated by blading or cold-planing. Chuckholes, spauls and low or depressed areas (greater than ½" below adjacent existing pavement) shall be treated by filling with asphalt concrete prior to placing subsequent materials, including pavement reinforcing fabrics and asphalt concrete overlay. Where fabric is required see Section 4 of these Specific Provisions.

A. Crack Sealing: The Contractor shall clean all existing pavement cracks that are more than three-eighths of an inch (3/8") wide and apply a broad spectrum, pre-emergent herbicide approved by the City, into pavement cracks, trench joints and concrete gutter lip joints, and any other areas shown on the plans or directed by the City Engineer. Herbicides shall be applied in accordance with the manufacture's recommendations and applicable laws.

   After cleaning and treating the pavement cracks, they shall be filled with an approved filler material, which shall be struck off neatly to the existing pavement grade. Approved filler material includes Rub-R-Road R-750 liquid rubber, Crafco Asphalt Rubber, or an

asphalt and aggregate hot mix subject to approval of the City Engineer.

B. Existing Pavement Markers: All existing raised ceramic or reflective pavement markers, shall be remove in accordance with Section 15-2.02C, "Pavement Markers" and disposed of pursuant to Section 15-2.03 "Disposal", of the Caltrans Standard Specifications.

C. Cold-Plane Existing Pavement: The Contractor shall cold-plane ("grind") the existing pavement where indicated on the plans or as directed by the City Engineer. The cold-planing machine shall have a cutter head at least 30 inches wide and shall be operated so as not to produce fumes or smoke. Cold-plane operations shall be performed without the use of heat to soften the pavement. The depth, width, and shape of the cut shall be as indicated on the typical cross sections on the plans or as directed by the City Engineer. The final cut shall result in a uniform surface conforming to the typical cross sections. The outside lines of the planed area shall be neat and uniform. The road surfacing to remain in place shall not be damaged in any way.

The Contractor shall clean streets and sidewalks of all grindings and construction debris prior to leaving the site each day during cold-planing operations. Residue from grinding operations shall be picked up by means of a vacuum attachment to the grinding machine and shall not be allowed to flow across the pavement nor be left on the surface of the pavement.

Temporary conforms constructed of road-mixed asphalt surfacing, having a maximum cross slope of 13%, or 12:1, shall be as placed under the following conditions:

(a) Within the same working day, where immediately after cold-planing, the height of the resulting cut edge exceeds one-tenth of one foot (0.10'); and

(b) In all other cases, within three days after cold-planing, where permanent surfacing has not been constructed.

SECTION 7

SIGNING AND STRIPING

7.01 TRAFFIC CONTROL AND CONSTRUCTION AREA SIGNAGE:
All construction and traffic control signing and devices shall conform to the latest edition of the State of California Manual of Traffic Controls for Construction and Maintenance of Work Zones and Section 12-3.06,"Constructin Area Signs" of the Caltrans Standard Specifications. A traffic control plan shall be submitted to the City Engineer for approval and all elements of the approved traffic control plan shall be in place prior to commencement of any construction activities on or adjacent to a public right-of-way.

7.02 PERMANENT SIGNING:
All permanent signing, including all regulatory, advisory, warning and guide signage shall conform to Chapter 4, "Signs", of the State of California Traffic Manual, the Public Works Standard Details, or as otherwise outlined in the Specific Provisions or shown on the project plans.

7.03 PAVEMENT STRIPING, MARKINGS AND MARKERS:
Striping shall be either thermoplastic or raised pavement markers, as specified on the plans. Pavement markings shall be thermoplastic. No painted delineation shall be allowed unless approved by the City Engineer.

Thermoplastic work shall conform to Section 84-2 "Thermoplastic Traffic Stripes and Pavement Markings" of the Caltrans Standard Specifications.

All pavement markers shall conform to Section 85 of the latest edition of the Caltrans Standard Specifications.

7.04 REMOVAL OF EXISTING FACILITIES:
All work involving the removal of existing facilities including, but not limited to signs, striping, and raised pavement markers, shall be performed in accordance with section 15-2.02 of the Caltrans Standard Specifications. Existing lines, which do not coincide, with new lines shall be removed by sandblasting or grinding, regardless of whether or not they are shown to be removed on the plans. Painting over markings as a means of eradication shall not be permitted. All existing raised ceramic or reflective pavement markers, shall be removed in accordance with Section 15-2.02C, "Pavement Markers" of the Caltrans Standard Specifications.

Removal facilities that are not to be salvaged or re-used in the work shall be disposed of pursuant to Section 15-2.03, "Disposal", of the Caltrans Standard Specifications.

SECTION 8

ADJUSTMENT OF MANHOLES AND UTILITY BOXES

8.01 DESCRIPTION:
This work shall consist of adjusting manholes, sewer cleanouts, survey monument boxes, water valve boxes, and miscellaneous utility boxes to conform with the new elevation of the street. All work shall conform to the Caltrans Standard Specifications and Details.

8.02 ADJUSTMENT:
Manholes, cleanouts, blow offs, monuments and utility boxes shall be brought to finish grade **after** the final pavement lift has been installed.

All iron shall be lowered prior to any pavement planing.

The manhole openings shall be temporarily covered by suitable means. For street reconstructions, overlays, or asphalt repairs on existing streets, manholes and valves shall be raised and asphalt concrete placed within three calendar days after permanent pavement wearing course has been placed. All non-standard or damaged iron to be adjusted shall be replaced with the current City Standard frames and covers.

The necessary portions of the subgrade, base and pavement shall be neatly cut away, the manhole built up, and the frames set to a grade flush with the surface of the adjacent pavement. The surrounding area from which the pavement, base or subgrade has been removed shall be backfilled to within 2 inches of the surface with Portland cement concrete. After the concrete has sufficiently cured, the remaining 2 inches shall be backfilled with ½-inch maximum asphalt concrete, tacked and compacted. The work shall be performed so as to present a neat and thoroughly workmanlike appearance upon completion.

SECTION 9

CONCRETE

9.01 DESCRIPTION:

Unless otherwise specified, all concrete structures shall be constructed out of Class A (6 sack) Portland Cement Concrete with ¾ inch aggregate. One pound lamp black shall be added to the concrete mix per cubic yard. The maximum slump shall be 3 inches. Minimum compression strength at 28 days shall be 3,000 pounds per square inch.

All concrete shall be provided from a source which is certified by the State of California Department of Transportation. No trailered or on-site mixed concrete shall be utilized for structural work within the public right-of-way. Trailered concrete with a rotating drum may be used on thrust blocks, kickers, and backflow device pads, and no more than 2 squares of sidewalk. The Contractor shall submit a current mix design and evidence of plant certification for approval to the City of Healdsburg prior to placing any concrete.

9.02 REMOVAL AND INSTALLATION:

A. Removal: Minimum length of curb and gutter to be replaced shall be 5 feet. If within 5 feet of a joint or crack, remove entire curb to the nearest joint. Sidewalks shall be removed to the nearest joint. Existing concrete to be removed shall be cut to a true line.

B. Subgrade Preparation: Immediately prior to placement of aggregate base, the finished subgrade shall conform to Section 3.02 “Grade Tolerance” and 3.03 “Relative Compaction”.

C. Base Material: Shall be mechanically compacted Class 2 aggregate base to the thickness shown on the plans. The minimum thickness for sidewalk shall be 4 inches, and the rock section under the curb and gutter shall be full depth to match the street rock section (i.e. subgrade shall extend horizontally to the face of curb).

D. Forms: Lumber used for forms must be surfaced on the side placed next to the concrete and shall not be less than 1-1/2 inches thick after being surfaced. Warped forms and forms not having a smooth, straight upper edge shall not be used. Multiple benders or thin planks, rigidly placed, may be used on curves, grade changes, or the curb returns.

   All forms shall be clean and coated with a light oil to prevent the concrete from adhering. All forms shall be carefully set to proper alignment and grade and shall be rigidly held in place by the use of steel or wooden stakes. Clamps, spreaders and braces shall be used where required to insure rigidity in the forms.

   Forms shall not vary from vertical grade by more than 0.02 feet and from horizontal alignment by more than 0.05 feet within a maximum distance of 25 feet. Unnecessary meandering of the alignment shall be cause for rejection and removal. All forms shall have smooth even lines in both the horizontal and vertical planes. A window of earth placed against the forms prior to placing concrete may be required to prevent bulging.

   Except for vertical curb forms, all forms shall remain in place for at least 24 hours after the concrete is placed.

E. Extruded Sidewalk, Curb and Gutter: Use of an extrusion machine will not be permitted without prior approval of the City Engineer. A test pour may be required by the City Engineer prior to approval.

F. Dowels:

- Dowels shall be No. 4 (1/2" diameter) rebar.
- Two 12" long dowels are required at every conform of new curb and gutter to existing concrete.
- Where stage construction (non –monolithic) for sidewalk is approved by the City Engineer, 6" dowels are required every 3 feet between existing curb and gutter and the new sidewalk.

G. Placing and Finishing: It shall be the Contractor's responsibility to schedule his operations such that concrete will not be placed or finished in the rain. Concrete which has been damaged by rain shall be removed and replaced at the Developer/Contractors sole expense.

All new curb, gutter and sidewalk shall be poured monolithically, in a single pour. Stage construction for new construction shall not be permitted unless approved in writing by the City Engineer. In areas where sidewalk is to be poured against existing curbs, the curbs and gutters shall be free from cracks and chips and meet the grade requirements of this section. Curbs, which do not meet these requirements, shall be removed and constructed monolithically with the new sidewalk. In areas where existing curbs and gutters are acceptable to the City Engineer, new sidewalks may be poured against the existing curb provided that the "stage construction" method is approved by the City Engineer. For minor sidewalk pours against existing curbs, no doweling is required for pours of 2 squares (ten lineal feet) or less. For new curb and gutter pours against existing curb and gutter, the curb shall be dowelled per Section 9.02 F.

At the end of each day's pour, when work is terminated, or when a delay of more than 30 minutes occurs, the joint shall be made vertical and square ended. In no case shall the end of a day's pour terminate in a driveway, handicap ramp, or other such conform where joints are not allowed.

Expansion Joints, weakened plane joints, and score marks shall be constructed according to the Public Works Standard Details.

Where new curb is poured across water and/or sewer lines, the face of the curb at the crossing shall be stamped or impressed with a "W" symbol for water or "S" symbol for sewer. City supplied stamps or approved equal (a minimum of 1/8" deep a minimum 3 high) shall be used to make the "W" or "S" impressions. The stamps are available to be checked out at the City of Healdsburg Public Works Department office.

A City approved curing compound shall be used to promote proper curing of all new concrete. Curing compound shall conform to AASHTO Designation M-148 Type II, white pigmented, and shall consist of a practically colorless, impervious liquid which will thoroughly seal the surface of the concrete and will not impart a slippery surface thereto. The liquid shall contain a coloring matter which does not permanently alter the natural color of the concrete, but which colors sufficiently at the time of application to indicate the

areas covered. The use of any membrane material which would impart slippery surface to the pavement or alter its natural color will not be permitted. The colorless impervious liquid shall contain not less than twenty-five percent (25%) solids.

It shall be the Contractors sole duty to protect the work from vandalism from the time it is poured until it is accepted by the City Council. Any damaged concrete shall be removed as directed by the City Engineer.

Any damage that compromises the structural integrity of the improvement, could potentially create a trip hazard for pedestrians and/or is unsightly shall be replaced. **Patching of concrete in not permitted**.

H. Testing: The finished concrete shall be in conformance with the tolerances for forms as stated above in Section 9.02 C and attain a minimum 28-day compressive strength of 3000 psi. Concrete test cylinders shall be taken as directed by the City Engineer. Cylinders to be provided by the contractor.

After construction, gutters shall be checked by flowing water. The City Engineer or his representative shall be present during the flow test. Any high spots or depressions exceeding 0.02 feet shall be repaired by removing that section of concrete and replacing it to the correct grade.

Finished face of curb shall not vary by more than an aggregate total of 0.05 foot from the design alignment within a maximum distance of 25 feet. Unnecessary meandering of the alignment shall be cause for rejection and removal.

9.03 DAMAGED OR UNACCEPTABLE CONCRETE:

Care shall be taken to protect adjoining in-place concrete areas. Any damage so caused shall be repaired by the contractor, as directed by the City Engineer, at the Contractors sole expense. Any substandard work shall be removed and replaced by the Contractor. Patching of breaks, chips, or other rejected work shall not be allowed. The City shall determine the limits of replacement. When more than one-half of the sidewalk between deep joints is damaged, the entire section between deep joints shall be removed and replaced at the Contractor's expense. Saw cuts may only be made at score lines or joints. Any work beyond the limits established, or any work without written consent, shall be considered completed at the Contractor's expense.

Absolutely no vehicles, materials, or other debris capable of damaging or blocking the sidewalk shall be placed on the sidewalk or driveways after concrete has been poured and cured.

SECTION 10

TRENCHING AND BACKFILL

10.01 DESCRIPTION:
A trench is defined as an excavation in which the depth is greater than the width of the bottom of the excavation.

Excavations for appurtenant structures such as, including but not limited to, manholes, transition structures, junction structures, vaults, valve boxes, catch basins, thrust blocks, and boring pits shall also be considered to be trench excavation and subject to the requirements of this section.

Excavation shall include the removal of all water and materials of any nature, which interfere with the construction work. Placement of spoil materials on adjacent asphalt pavement shall not be allowed without a valid City of Healdsburg Encroachment Permit or written permission of the City Engineer. Such permissions shall not be granted unless, in the opinion of the City Engineer, no other reasonable option exists. In no instance (including new subdivisions under construction) shall stockpiling or material storage be permitted over City sidewalks, curbs, or gutters.

Excavation for the installation of conduit or pipes shall be by open trench unless otherwise specified or shown on the drawings. Tunneling or boring and jacking shall be allowed only with prior written approval from the City Engineer.

10.02 MAXIMUM LENGTH OF OPEN TRENCH:
The maximum length of open trench at any given time shall be the distance in which pipe can be completely installed in a single day. Installed shall be defined as pipe laying, appurtenance construction, backfilling and compacting, and temporary paving, complete in place. Installation of underground pipes and conduits shall be performed in one continuous operation. In no instance shall the length of open trench exceed 300 LF. The use of steel plates as open trench covers shall not be allowed without prior approval of the City Engineer. If steel plates are approved, they shall not remain for a period longer than 2 weeks. During this time the contractor is required to maintain the plates in a safe manner with temporary conforms of road-mixed asphalt surfacing.

The requirements of this Section shall not apply to new construction sites which are closed to the public in a manner acceptable to the City Engineer.

10.03 MAXIMUM AND MINIMUM WIDTH OF TRENCH:
The maximum clear width of the trench at the top of the pipe shall not be more than the outside diameter of the pipe at any point plus 2 feet. Greater width of trench at the top of the pipe shall be permitted only on written approval by the City Engineer. In no case shall the free working space on each side of the pipe be less than 6 inches.

If the maximum trench width is exceeded, the contractor shall provide additional bedding, backfill, another type of bedding, and/or a higher strength of pipe than that shown on the plans. Any such deviation shall be subject to the approval of the City Engineer.

10.04 BRACING EXCAVATIONS:
The manner and use of bracing excavations shall be as set forth in the rules, orders, and regulations of the Division of Industrial Safety of the State of California. Failure to comply with

these regulations shall be cause for the immediate stoppage of the work.

10.05 BEDDING:
Bedding shall be defined as that material supporting and surrounding the pipe. Bedding shall be placed as shown in the Public Works Standard Details.

If soft, spongy, unstable, or similar other material is encountered upon which the bedding material or pipe is to be placed, this unsuitable material shall be removed to a depth ordered by the Engineer and replaced with bedding material suitably densified.

Bedding material shall first be placed and compacted so that the pipe is supported for the full length of the barrel with full bearing on the bottom segment of the pipe equal to a minimum of 40 percent of the outside diameter of the barrel. The remainder of the bedding shall be carefully placed to the proper depth.

Where pipe is to be installed in a new embankment (fill area), the embankment shall first be constructed and compacted to subgrade, after which the trench shall be excavated with sides nearly vertical and the pipe installed.

When water is encountered, the trench shall be kept dry until laying and jointing of the pipe and placing of the bedding material has been completed, inspected, and approved. The contractor shall over-excavate and place a minimum of 6 inches of permeable material or de-water the trench in a manner which has received prior approval of the City Engineer.

10.06 BACKFILL:
Backfill shall be defined as that material which lies above the pipe bedding or conduit bedding and below the street section or ground surface.

Backfill, for all underground structures including, but not limited to, pipes, conduits, manholes, transition structures, junction structures, vaults, valve boxes and reinforced concrete box conduits shall be Class 2 aggregate base and shall start at the surface upon which the base of the structure rests.

Except where the pipe must remain exposed for force main leakage tests and subject to the provisions herein, the contractor shall proceed as soon as possible with backfilling operations. Care shall be exercised so that the pipe or conduit will not be damaged or displaced.

The Contractor shall not place backfill against or over the top of any structures for a period of seven days. After the seven day period backfill may be placed provided that two suitable samples have been laboratory tested to a minimum of 3000 psi or 90 percent of the specified 28 day strength, whichever is greater.

Where it becomes necessary to excavate beyond the limits of normal excavation lines in order to remove boulders or other interfering objects, the voids remaining after the removal of the buried objects shall be excavated vertically to the ground surface, backfilled, and compacted with Class 2 A.B. as specified herein, or as otherwise approved by the City Engineer.

All trenches shall be backfilled that same day. In paved areas temporary pavement shall be installed. Permanent paving must be installed within one month of trench excavation.

10.07 DENSIFICATION METHODS:

A. Mechanically Compacted Backfill: All backfill shall be mechanically compacted by means of tamping rollers, sheeps foot rollers, pneumatic tire rollers, vibrating rollers, or other mechanical tampers. All such equipment shall be of a size and type selected by the Contractor and approved by the City Engineer. Permission to use specific compaction equipment shall not be construed as guaranteeing or implying that required compaction can be met with such equipment or that the use of such equipment will not result in damage to adjacent ground, existing improvements, or improvements installed under the contract. The contractor shall make his own determination in this regard.

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

1. Heavy vibratory equipment, - maximum lift depth of 2 feet.

2. Rolling equipment, including sheeps foot (both vibratory and non-vibratory), grid, vibratory smooth-wheel rollers, and vibratory pneumatic-tired rollers - maximum lift depth of 1 foot.

3. Smooth-wheel (not vibratory), pneumatic tired (non-vibratory), and segmented wheels Hand directed mechanical tampers - maximum lift depth of 8 inches.

4. Hand directed vibratory plates - 4 inches.

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

All materials which require compaction shall be compacted using mechanical compaction methods. Compaction by flooding or jetting is prohibited.

10.08 BACKFILL PLACEMENT REQUIREMENTS:

A. Method "A": Method "A" is to be used in existing streets. The area above the pipe zone shall contain Class 2 Aggregate Base mechanically compacted to a minimum relative compaction of 95 percent and a temporary layer (1 inch minimum and 2 inch maximum) of asphalt cutback placed to grade. This temporary cutback shall be maintained by the contractor to within 1/4" of finish grade until permanent paving is installed. Permanent asphalt paving shall be 1 inch greater in thickness than the existing pavement, with a minimum thickness of 4 inches and a maximum thickness of 7 inches. Existing pavement shall be over-cut a minimum of 6 inches on both sides of the trench and repaved as required in this section.

B. Method "B": Method "B" is to be used in unimproved or non-street right-of-way areas. The area of the trench between the bedding zone and the top of trench shall be backfilled with native material. Compaction shall be done mechanically in uniform lifts not

exceeding 4 feet so as to attain a minimum relative compaction of 90 percent.

10.09 BACKFILL MATERIALS

A. Bedding:

Coarse Sieve Size	All pipe except copper (3/8" chips) Percent Passing
3/4"	100
3/8"	90 - 100
#4	35 - 75
#8	0 - 15
#16	0 - 10
#30	0 - 5

In addition the 3/8" chips shall be crushed.

The bedding for all copper pipe shall be #4 grade salt-free sand.

B. Backfill: The percentage composition by weight in place shall conform to the gradings previously mentioned as determined by Test Method No. California 202. Materials as delivered shall be of uniform mixture and shall be free of vegetative material and refuse. Backfill in streets or other traffic areas shall be Class 2 Aggregate Base in accordance with Section 5 of these Specific Provisions. In areas where no traffic is anticipated select native material meeting the following requirements may be used:

Sieve Size	Percent Passing
3"	100
#4	35 - 100
#30	20 - 100

Sand Equivalent to be 20 Min.
Minimum Dry Density 110 lb / cu. ft.

C. Permeable Material: Permeable material for use in backfilling French drains and trenches shall consist of hard, durable, clean sand, gravel, or crushed stone, and shall be free from organic material, clay balls or other deleterious material. The permeable material shall be Class 1 Type B per Caltrans Standard Specifications and shall conform to the following gradings:

Sieve Size	Percent Passing
2 inch	100
1 ½ inch	95 - 100
3/4 inch	50 - 100
3/8 inch	15 - 55
No. 4	0 - 25
No. 8	0 - 5
No. 200	0 - 3

D. Drain Rock: Drain rock shall be washed coarse aggregate conforming to one of the following gradings:

1-1/2 inch		3/4 inch	
Sieve Size	Percent Passing	Sieve Size	Percent Passing
2 inch	100	1 inch	100
1-1/2 inch	90 - 100	3/4 inch	90 - 100
1 inch	20 - 55	1/2 inch	60 - 85
3/4 inch	0 - 15	3/8 inch	20 - 55

SECTION 11

STORM DRAIN SYSTEM

11.01 DESCRIPTION:
This work shall include the furnishing of all labor, materials, tools and equipment to construct and complete in an efficient and workmanlike manner the installation of the storm drainage system in accordance with the approved plans, these Specifications and the Public Works Standard Details.

11.02 MATERIALS:

A. Pipe:

1. Reinforced Concrete Pipe: All storm drain pipe shall be reinforced concrete pipe (RCP) conforming to the specifications of ASTM Designation C76 and shall be Class III unless otherwise specified on the plans, specified herein or approved by the City Engineer. Where circumstances dictate (see cover requirements in the Engineering Design Standards), a higher class RCP shall be specified on the project plans. Reinforcing shall be as specified in ASTM Designation C76. Portland cement used in the manufacture of reinforced concrete pipe shall conform to the requirements of the specifications for Type II Portland cement, ASTM Designation C150.

   Tests on reinforced concrete pipe shall be required to determine conformance with "D" load and reinforcing requirements of these Specifications.

   Pipe samples for testing shall be furnished, without charge, by the Contractor one week in advance of construction. The cost of testing the pipe shall be borne by the Contractor. One section of pipe from each lot to be used shall be tested in accordance with the procedures outlined in ASTM C76. Lots tested shall be marked with the date made as well as by lot number for shipment to the specific project for which that lot has been tested. Any pipe arriving on the job without the appropriate markings shall be rejected and sent back to the supplier until such lot or lots can be tested and accepted for use.

   In lieu of the above testing of reinforced concrete pipe, the Contractor may submit to the City Engineer the manufacturers "Certificate of Compliance" guaranteeing the requirements of ASTM C76.

2. Cast-In-Place Concrete Pipe (CIPP): CIPP shall not be used, unless specifically called for on the approved plans or approved in writing by the City Engineer. All CIPP shall conform to the requirements of Section 63 of the Caltrans Standard Specifications except that the concrete shall be placed around the full circumference in one continuous operation. Concrete shall have a minimum compressive strength of 4000 psi at 28 days. All CIPP installations shall be video inspected in the presence of the City Engineer.

3. Non-Reinforced Concrete Pipe: Shall not be allowed.

4. Polyvinyl Chloride (PVC) Pipe and Fittings: Shall at a minimum conform to the requirements of ASTM Designation D3034 as they apply to SDR 26 PVC pipe using

an elastomeric gasket joint in a bell and spigot assembly system. The use of this pipe for storm drain mains shall be restricted to shallow installations in areas of landscaping, parks, and low impact. Regardless of the area, PVC storm drain is generally not acceptable and shall not be used without prior written approval of the City Engineer.

5. High Density Polyethylene (HDPE): The use of HDPE pipe shall not be allowed.

B. Manhole and Junction Boxes: For storm drains of less than 36 inches in diameter, precast reinforced concrete manholes shall be used. Manholes shall conform to the specifications of sanitary sewer manholes and shall be placed on a minimum of 18 inches of approved and compacted stabilization material.

For storm drains of 36 inches and greater diameter, manholes and junction boxes shall be cast-in-place conforming to the Public Works Standard Details. Concrete shall be furnished, mixed, placed, and cured in accordance with the provisions of Section 90 of the Caltrans Standard Specifications and shall be 4000 psi with 1-1/2 inch maximum aggregate size. The inside dimension of manholes and junction boxes shall be such as to provide a minimum of 3 inches clearance on the outside diameter of the outfall pipe and the minimum wall thickness shall be 6 inches.

C. Catch Basins: Storm drain catch basin bases and boxes shall be either cast-in-place or pre-cast conforming to the Public Works Standard Details. Concrete shall be a minimum 3000 psi with 1-1/2 inch maximum aggregate size.

Curb inlet shall be precast equal to Santa Rosa Pre-Cast Products Model 4-A with fiberglass or PVC throat form attached or cast-in-place using the Pelican series form liner with fiberglass or PVC throat form attached.

Storm Drain galleries used for additional inlet capacity shall be Pelican Series Model 6Y.

D. Headwalls, Wingwalls, Endwalls, and Railings: All headwalls, wingwalls, and endwalls shall be of 3000 psi reinforced Portland cement concrete constructed in accordance with the plans and Section 51 of the Caltrans Standard Specifications. Temporary bank protection shall be crushed rock riprap appropriately sized in accordance with State Department of Transportation and approved by the City Engineer. The minimum unit weight shall be 75 lbs, or may be grouted concrete riprap in accordance with Section 72 of the Caltrans Standard Specifications if approved by the Engineer.

11.03 INSTALLATION, GROUTING, AND BANDING:

All pipe installation and pipeline construction shall be in accordance with the manufacturer's specification for the particular pipe and fitting material. Pipe deflections shall not exceed 80 percent of the manufacturer's specifications.

11.04 ABANDONMENT:

All unused storm drain system facilities within the public-right-of-way are required to be abandoned and noted in the construction plans as follows:

A. Laterals: Storm drain laterals shall be abandoned by removing all piping and associated structures (manholes, curb inlets, filed drains, etc.) within the public right-of-way and structurally patching the manhole or curb inlet.

B. Mains: Storm drain mains and all portions of associated structures (manholes, curb inlets, field drains, etc.) less than 4 feet deep shall be removed. Storm drain mains and portions of associated structures (manholes, curb inlets, filed drains, etc.) more than 4 feet deep shall be removed or filled with a 2 sack cement and sand slurry.

11.05 TESTING:

Video Inspection: All public storm drain systems shall be subject to video inspection by the Contractor prior to acceptance. When the storm drain is ready to be video inspected, the Contractor shall notify the City in writing as to the scheduled date of the video inspection. The report information, defects and re-inspection shall be in accordance with Section 12.04-4. of these Specific Provisions with the exceptions that grade may be off up to 10 percent of the pipe diameter up to a maximum of 4 inches and that infiltration is allowed.

SECTION 12

SANITARY SEWER SYSTEM

12.01 DESCRIPTION:

This work shall include the furnishing of all the labor, materials, tools and equipment to construct and complete in an efficient and workmanlike manner the installation of the sanitary sewer mains and laterals in accordance with the approved plans, Public Works Standard Details and these Specifications. All work shall be done in an orderly and workmanlike manner and under the direction and to the satisfaction of the City Engineer.

12.02 MATERIALS:

A. Gravity Sewer Mains: All sewer pipe shall be supplied in the maximum laying lengths which are manufactured by the pipe supplier and shall also have a factory applied "witness" mark at each end to verify proper joint assembly. The City Engineer shall approve the source and supply of materials.

1. Vitrified Clay Pipe shall be extra strength, bell and spigot, conforming to ASTM Designation C700 as it applies to unglazed vitrified clay pipe. Pipe shall be provided in the maximum laying lengths available.

2. Polyvinyl Chloride (PVC) Pipe and fittings shall, at a minimum, conform to the requirements of ASTM Designation D3034 as they apply to SDR-26 and SDR-35 PVC sewer pipe using an elastomeric gasket joint in a bell and spigot assembly system. SDR-35 pipe may be used for depths up to 8 feet as measured from flow line of pipe to finish grade. For deeper installations, SDR-26 pipe shall be used. Transitions from SDR-26 to SDR-35 shall be completed at a manhole. The minimum laying length of pipe shall be 20 feet for SDR-35 and 13 feet for SDR-26.

3. Ductile Iron Pipe and fittings shall conform to the requirements of ANSI/AWWA C151/A21.51 and shall have a cement mortar lining and epoxy coating. Class of pipe shall be as required for design loads with a minimum of Class 150.

4. Other Pipe shall be as specified by the City Engineer.

B. Pressure Sewer Mains: Whenever the design of a sanitary sewer system includes the necessity of a sewage lift station and pressure mains, types of pipe shall be approved by the City Engineer for each specific case.

C. Joints and Couplings:

1. Vitrified Clay Joints shall be resilient material conforming to the requirements of ASTM Designation C425.

2. Polyvinyl Chloride joints shall be internal gasketed bell and spigot push on type conforming to the requirements of ASTM Designation D-3139 and ASTM F-477. No solvent weld joints shall be allowed.

3. Banded Rubber Couplings shall not be allowed unless otherwise approved by the City Engineer. Where allowed, couplings shall conform to the requirements of ASTM Designation C425.

D. Fittings: All fittings shall be manufactured of the same materials as the pipe and installed in accordance with Public Works Standard Details.

E. Laterals: Pipe, joints and couplings shall be SDR 35 pipe may be used for depths up to 8 feet as measured from flow line of pipe to finish grade. For deeper installations, SDR 26 pipe shall be used. Deviations shall require the approval of the City Engineer.

F. Manholes: Manhole bases may be either cast-in-place or pre-cast. Sanitary sewer manholes risers shall be of precast reinforced concrete conforming to ASTM Designation C478 except that the Portland cement shall be Type II modified cement. The manhole base, riser and cone shall have a minimum compressive strength of 4,000 psi at 28 days. Manholes shall be constructed in accordance with the Public Works Standard Details.

Iron castings for manhole covers and frames shall conform to ASTM Designation A48, Class 25 and shall be of the dimensions shown on the Public Works Standard Details. Bolt down lids are required on all manholes located within 100 feet of a waterway and where an overflow would drain directly into the waterway.

All castings shall be sound and free from shrinkage cracks, blowholes, and other defects and shall have the words “Sanitary Sewer” cast into them. All fins and burnt sand must be removed. Excessive porosity and spongy surfaces shall constitute causes for rejection. The City Engineer shall be the judge as to whether the defects are sufficient to cause rejection.

The manhole cover shall seat evenly and firmly in the frame without rocking. Cast iron frames and covers shall be dipped or painted with asphalt, which will form a tough, durable, non-scaling coating which does not have a tendency to become brittle when cold or tacky when hot. Eccentric cones shall be oriented such that the centerline of the casting overlays the center line of the sewer main.

G. Conductor Pipe: Pipe used as a conductor pipe under a highway or railroad shall be welded steel pipe. The protective lining and coating if any, shall be as shown on the plans or specified in the Special Provisions.

Welded steel pipe shall be manufactured of steel meeting the requirements of ASTM Designation A245, Commercial Grade. The method by which the pipe is manufactured shall comply with one or more of ASTM Specifications: A-134, A-135, A-139, or A-211. The pipe shall be welded by either the electric-resistance or electric-fusion process, with either spiral seam welded joint or straight seam welded joint. All joints shall be butt-welded.

When the conductor pipe is to be installed by boring and jacking, the wall thickness shall be 0.014 times the casing diameter with a minimum of 1/4 inch.

12.03 INSTALLATION:

A. Sewer Mains: All sanitary sewer pipe installations shall be accomplished as specified herein except where modified by the requirements specific to the various types of pipeline materials specified under Section 12.02. PVC pipe shall be installed per manufacturer's recommendation and as otherwise directed by the City Engineer.

All sewer mains shall be laid with a minimum of 10 feet horizontal and 12 inches vertical clearance from water and 5 feet horizontal and 6 inches vertical clearance from all other improvements and utilities, unless otherwise approved by the City Engineer. Refer to the pipe cover requirements in Section 5 of the Engineering Design Standards for minimum cover requirements. All pipe shall be laid to conform to the prescribed line and grade as shown on the plans. Each pipe length shall be checked to the grade line which the Contractor establishes from the grade stakes.

The grade line shall be established before any pipe is laid in the trench. For pipes with slopes greater than 1 percent, the string line set for trenching purposes may be used as the grade line. For pipes with slopes less than 1 percent, either: (1) a grade line shall be established in the bottom of the trench such that the top of each bell will touch the line when the pipe has been properly positioned or, (2) a grade line shall be established above the trench on firmly secured batter boards from which the grade of each pipe can be checked by using a grade pole.

Alternate use of commercial LASER grade setting systems in lieu of string lines specified herein are acceptable when the following requirements and conditions are met:

- The Contractor shall provide an instrument and operator who is qualified and trained in the operation of the LASER. Said operator shall adhere to the provisions of the State of California Construction Safety Orders issued by the Division of Industrial Safety. Attention is particularly directed to Sections 1516, 1800, and 1801 of the Orders for applicable requirements.

- All LASER control points shall be established benchmarks or construction off-set stakes identified on cut sheets and set in the field for the work. LASER set up points shall be these control points or points set directly from them by instrument.

Each length of pipe shall be laid on compacted, approved 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. "Stabbing", "Swinging In" or "Popping On" spigot ends of pipe into bell ends shall not be permitted. Each length of pipe shall be installed and seated to the factory installed “witness” mark. 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.

Adjustments of pipe to the line and grade shall be made by scraping away or filling in and tamping approved material under the body of the pipe. No wedging or blocking to support the pipe shall be permitted.

A sewer line, unless otherwise approved by the City Engineer, shall be laid, without break, upgrade from point of connection to the existing sewer and with the bell end forward or upgrade. Pipe shall not be laid when the City Engineer determines that the condition of the trench or the weather is unsuitable. When pipe laying is not in progress, the forward end of the pipe shall be kept effectively closed with an approved temporary plug or cap.

Sewer pipes, branches, stubs, or other open ends which are not to be immediately connected, shall be plugged or capped with a standard watertight plug or cap, as

approved by the City Engineer for use in the particular installation. The plug or cap shall be placed on a standard end.

All sewer pipe, with the exception of PVC pipes, shall have joints at 2-1/2 feet from the manhole base to prevent damage to the pipe or manhole from differential settlement. PVC sewer pipes shall not require such flexible jointing unless specifically called for on the project plans.

When new sewer mains and non-single family residential laterals are connected to existing active sewer lines, the new sewer shall be plugged or blocked in an approved manner to prevent construction debris and dirt from entering the in-service mains. The plug shall remain in place until such time as the new sewer section is tested, cleaned and accepted by the City Engineer. All debris shall be removed prior to removal of the plug/block to prevent main back ups.

All sewer line connections to manholes, trunk sewers, main sewers, or side sewers shall be left uncovered until they are inspected and approved by the City Engineer. After approval of the connection, the trench shall be backfilled as specified. The City Engineer may, at his discretion, require special pipe to be laid in areas that are potentially unstable or subject to settlement.

If the sewer is to be laid in an area that is to be filled, and the cover prior to filling is less than 5 feet, the pipe shall not be laid until the area has been filled to a level 5 feet above the proposed pipe and compacted as required by the soils engineer with a minimum of 90 percent relative compaction, unless otherwise authorized by the City Engineer.

1. Pressurized Sewer Lines: Ten gauge insulated, solid copper tracer wire shall be laid along the top of all pressurized sewer mains and service laterals that are within the public right of way or public easements. Locator boxes shall be placed at every horizontal change in alignment or a maximum of every 500'. The tracer wire be laid along the entire length of the pipe all shall be extended to the surface at all box locations, manholes and other locations as necessary for locator equipment to be attached. Tracer wire shall be laid and securely taped directly on top of the pipe approximately every 10 feet. Splices shall be "Burndy" (split bolt) or "Blackburn". After installation, splices shall be taped with two layers of half-lapped rubber electrical tape and two layers of half-lapped vinyl electrical tape.

B. Laterals: Attention is directed to the Public Works Standard Details for additional details and requirements pertinent to lateral installations.

Prior to any construction activity or demolition work, the existing sewer lateral shall be plugged at the City right of way or other measures as approved by the City Engineer.

Whenever lateral lines are to be installed as part of the contract for the construction of the sewer main, the use of saddles will not be permitted.

That portion of any lateral line to be placed under an existing curb and gutter and/or sidewalk shall be installed by removal of the curb, gutter, and sidewalk, open trenching, and replacing the existing curb and gutter and/or sidewalk. Boring of laterals shall not be permitted.

The lateral line shall have a clean-out at the back edge of sidewalk as shown on the Public Works Standard Details. A cover box and water-tight lid shall be installed as noted on the detail. Lateral cleanouts shall not be located in the sidewalk or driveway and shall be installed 5 feet either side of the water service where possible. Property line cleanouts are required on all sewer services and shall be one-way, oriented towards the street, and constructed in accordance with the Public Works Standard Details.

All laterals shall be installed perpendicular to the main. Where laterals are installed in a manhole, the manhole shall be core-bored 4 inches larger than the lateral size to allow for proper placement of the water stop and concrete patch.

C. Manholes: Manhole bases may be either cast-in-place or pre-cast. All precast manholes shall be excavated and backfilled in conformance with the requirements of Section 19-3 of the Caltrans Standard Specifications and installed as specified herein. All embedment materials under, around and at least 3 inches over all pipelines located within five feet of structure bases shall be mechanically compacted prior to barrel section placements.

All joint surfaces of precast sections and face of manhole base shall be thoroughly cleaned prior to setting precast sections. These various sections shall be set in “Ram-Nek”, a preformed plastic sealing gasket material manufactured by K.T. Snyder Company, Houston, Texas conforming to the requirements of FEDERAL SPECIFICATION SS-S-00210 (GSA-FSS). All gaskets shall be installed in accordance with the manufacturer's specifications.

All cast-in-place concrete bases shall be 4,000 psi, 28 day concrete with 1-1/2 inch maximum size aggregate. It shall rest on firm, undisturbed soil, and shall be of the dimensions shown on the Public Works Standard Details. Where base soils have been disturbed or are unstable in the opinion of the City Engineer, the soil shall be compacted to 90 percent and a 12-inch minimum thickness of 3/4 inch crushed rock shall be placed beneath the base.

Where sewer lines pass through manholes, the pipe shall be laid continuously as a whole pipe. After the manhole base and precast sections have been placed and sufficient time has elapsed to allow all concrete and grout to set, the top half of the pipe within the manhole shall be carefully cut off and the sides mortared to produce a smooth uniform surface. All channels so formed shall be checked with a straight edge and shall form a smooth flowing channel at all flow depths.

Temporary covers of 3/8-inch minimum steel plate of sufficient size to adequately cover the opening shall be placed on the cone until the base is complete, and after which the manhole casting shall then be installed. Suitably located ribs shall be welded to the underside of the cover to hold it in place during any grading operations.

The throat of the manhole shall be made of precast concrete rings of the proper inside diameter. Grade rings may be deleted for shallow installations with prior approval of the City Engineer. The maximum throat depth permitted shall be 18 inches of rings between the cone and frame.

When adjusting the manhole frame and cover to grade, the frame shall be wired to a 2" x 4" of sufficient length to span the excavation, and the throat completed to the correct level. As an alternative, a non organic wedge may be used to stabilize the casting at finish

grade while the base is poured, wood is not allowed. Whenever the space between the bottom of the frame and the top of a ring is less than 3 inches, the void may be filled with concrete, poured against a suitable form on the inside of the structure.

Before the start of any work to adjust or repair a manhole on an existing line, the channels in the base shall be covered with a sturdy and durable cover, which will effectively keep debris out of the lines. This cover shall be kept in place during all work. Upon completion of the work the wood strips and the canvas shall be removed from the manhole, allowing no debris to fall or remain in the manhole.

12.04 ABANDONMENT:

All unused sewer system facilities within the public-right-of-way are required to be abandoned and noted in the construction plans as follows:

A. Laterals: Sewer laterals shall be abandoned by water tight capping at the main and removing all piping and appurtenances within the right-of-way. If the connection to the main is a tap or saddle, it shall be removed and a full circle repair clamp installed.

B. Mains: Sewer mains and all portions of associated structures (manholes, cleanouts, etc.) less than 4 feet deep shall be removed. Sewer mains and portions of associated structures (manholes, cleanouts, etc.) more than 4 feet deep shall be removed or filled with a 2 sack cement and sand slurry.

12.05 TESTING:

A. Sewer Lines: All sewer tests shall be performed after all structures are installed and completed, the placing, backfilling, compaction, and certification of the trench, subgrade, and street rock grade by the City Engineer and prior to permanent surfacing. The following tests shall be done sequentially and each test shall be successfully completed prior to beginning the next test. Any failed sections shall be repaired or replaced prior to continuing of testing. In the event that a section of pipe fails a test, the testing of the entire repaired or replaced pipe segment between manholes shall be redone including repeated air, mandrel, and T.V. inspections. These inspections shall be performed and repeated until the entire sewer installation has successfully passed all of these tests sequentially without failure.

1. Cleaning and Flushing: Prior to performing a leakage test, the pipe shall be thoroughly cleaned. The Contractor, by means of an inflatable rubber ball, shall perform the cleaning. The ball shall be of a size that will fit snugly into the pipe to be flushed. The ball shall be placed in the last upstream cleanout or manhole on the pipe to be cleaned, and water introduced behind it. The ball shall pass through the pipe with only the pressure of the water impelling it. All debris flushed out ahead of the ball shall be removed at the first manhole where its presence is noted. If any wedged debris or damaged pipe shall stop the ball, the Contractor shall remove the obstruction. When a new sewer is connected to an existing line, cleaning and flushing shall be carried out to the first existing manhole downstream from the point of connection.

2. Low-Pressure Air Test: After completing backfill of a section of sewer line, the Contractor shall at his expense, conduct a Line Acceptance Test using low-pressure air. The test shall be performed in accordance with Unibell B-6-98 “Recommended Practice for Low Pressure Air Testing of Installed Sewer Pipes”. The tests shall be performed using the equipment listed below and under the supervision of the direct

City Engineer.

a. Equipment used shall meet the following minimum requirements:

1) Pneumatic plugs shall have a sealing length equal to or greater than the diameter of the pipe to be inspected.

2) Pneumatic plugs shall resist internal test pressures without requiring external bracing or blocking.

3) All air used shall pass through a single control panel.

4) Three individual hoses shall be used for the following connections.

a) From control panel to pneumatic plugs for inflation.

b) From control panel to sealed line for introducing the low-pressure air.

c) From sealed line to control panel for continually monitoring the air pressure rise in the sealed line.

b. The following procedure shall be used for low pressure air testing:

1) Clean pipe to be tested by propelling a snug fitting inflated rubber ball through the pipe with water.

2) Plug all pipe outlets with suitable test plugs. Brace each plug securely.

3) If the pipe to be tested is submerged in ground water, inset a pipe probe, by boring or jetting, into the back fill material adjacent to the center of the pipe, and determine the pressure in the probe when air passes slowly through it. This is the back pressure due to ground water submergence over the end of the probe. All gauge pressures in the test should be increased by this amount.

4) Add air slowly to the portion of the pipe installation under test until the internal pressure is raised to 4.0 psig.

5) Check exposed pipe and plugs for abnormal leakage by coating with soap solution. If any leakage is observed, bleed off air and make necessary repairs.

6) After an internal pressure of 4.0 psig is obtained, allow at least two minutes for air temperature to stabilize, adding only the amount of air required to maintain pressure.

7) After the two minute period, disconnect the air supply.

8) When pressure decreases to 3.5 psig, start stopwatch. Determine the time in seconds that is required for the internal air pressure to reach 2.5 psig. The minimum allowable time in seconds shall be based on the diameters and lengths of pipe under the test shown in the following table. If the installation fails to meet this requirement, the Contractor shall, at his own expense,

determine the source of leakage. He shall then repair or replace all defective materials and/or workmanship and perform the air test as many times as necessary to achieve an acceptable test.

SPECIFICATION TIME REQUIRED FOR A 1.0 PSIG PRESSURE DROP FOR SIZE AND LENGTH OF PIPE INDICATED FOR Q = 0.0015

Pipe Diameter (inches)	Min. Time (min sec)	Length for Min. Time (feet)	Time for Longer Length (sec)	Specification Time For Length (L) Shown (min:sec)							
				100 ft	150 ft	200 ft	250 ft	300 ft	350 ft	400 ft	450 ft
4	3:46	597	.380 L	3:46	3:46	3:46	3:46	3:46	3:46	3:46	3:46
6	5:40	398	.385 L	5:40	5:40	5:40	5:40	5:40	5:40	5:42	6:24
8	7:34	298	1.520 L	7:34	7:34	7:34	7:34	7:36	8:52	10:08	11:24
10	9:26	239	2.374 L	9:26	9:26	9:26	9:53	11:52	13:51	15:49	17:48
12	11:20	199	3.418 L	11:20	11:20	11:24	14:15	17:05	19:56	22:47	15:38
15	14:10	159	5.342 L	14:10	14:10	17:48	22:15	26:42	31:09	35:36	40:04
18	17:00	133	7.692 L	17:00	19:13	25:38	32:03	38:27	44:52	51:16	57:41
21	19:50	114	10.470 L	19:50	26:10	34:54	43:37	52:21	61:00	69:48	78:31
24	22:40	99	13.674 L	22:47	34:11	45:34	43:37	52:21	61:00	69:48	78:31
27	25:30	88	17.306 L	28:51	43:16	57:41	72:07	86:32	100:57	115:22	129:48
30	28:20	80	21.366 L	35:37	53:25	71:13	89:02	106:50	124:38	142:26	160:15
33	31:10	72	25.852 L	43:05	64:38	86:10	107:43	129:16	150:43	172:21	193:53
36	34:00	66	30.768 L	51:17	76:55	102:34	128:12	153:50	179:29	205:07	230:46

c. **The air test is dangerous** if, because of ignorance or carelessness, a line is improperly prepared. It is extremely important that the various plugs be installed and braced in such a way as to prevent blowouts. Since a force of 250 lbs. is exerted on an 8-inch plug by an internal pipe pressure of 5 psi, it should be realized that sudden expulsion of a poorly installed plug or of a plug that is partially deflated before the pipe pressure is released could be extremely dangerous.

As a safety precaution, pressurizing equipment should include a regulator set at 10 psi to avoid over-pressurizing and damaging an otherwise acceptable line. No one shall be allowed in the manholes during testing. If the test is not passed in two trials, the leak shall be located and repaired to the satisfaction of the City Engineer and the line shall be retested at the Contractor's expense.

The pressure gage used shall be supplied by the Contractor and shall have minimum divisions of 0.10 psi, and shall have an accuracy of 0.04 psi. Accuracy and calibration of the gauge shall be certified by a reliable testing firm.

3. PVC Deflection Test: After the City Engineer has certified that the air test has been satisfactorily completed, the pipe deflection shall be checked by means of a deflection mandrel, in the presence of the City Engineer. This deflection testing shall not be performed until the pipe has been installed and backfilled for a minimum of 30 days. A

City supplied rigid mandrel with a circular cross section having a diameter, as indicated by the following table, shall be pulled through the pipe by hand. The minimum length of the circular portion of the mandrel shall be equal to the nominal inside diameter of the pipe.

SDR 35 PIPE /3034		
Nominal Diameter (Inches)	Base Inside Diameter (Inches)	Mandrel Diameter (Inches)
6	5.74	5.454
8	7.66	7.28
10	9.56	9.084
12	11.36	10.79

SDR 26 PIPE /3034		
Nominal Diameter (Inches)	Base Inside Diameter (Inches)	Mandrel Diameter (Inches)
6	5.61	5.33
8	7.49	7.11
10	9.34	8.88
12	11.10	10.44

* From the Uni-Bell Plastic Pipe Association Handbook of P.V.C. Pipe, third printing - May 1979.

Any section of PVC pipe that does not permit passage of the deflection mandrel shall not be accepted, and said section shall be properly repaired or replaced. The entire section, from manhole to manhole, shall then be required to be re-air tested successfully prior to re-mandreling.

4. Video Inspection: All main and trunk sewers shall be subject to video inspection by the Contractor following successful completion of the air and mandrel testing, and prior to acceptance. When the sewer is ready to be video inspected, the Contractor shall notify the City in writing as to the scheduled date of the video inspection.

   a. Report information: The Contractor shall provide the City with two sets of typed field logs and one set of media in a video format acceptable to the City Engineer at the completion of the inspection. The field logs shall contain the following information:

      1) The location of the sewer line inspected, the direction of viewing, the date of inspection, the designation of the manholes/cleanouts at the ends of the line, the length of the line, the length of a typical pipe section, the size and type of pipe, and the total amount of infiltration/inflow found in the line during inspection.

      2) The type and location of each service connection. The service connecting shall be classified as to whether the connection was made by cutting into the pipe wall or by use of a manufactured wye. The side of the main the service enters shall also be noted.

      3) The type and location of infiltration/inflow sources and structural defects found

during the inspection shall be noted. The type of infiltration/inflow source and its estimates contribution (in gpm) shall be indicated. Descriptions of structural defects including type and the footage of sewer main involved shall be indicated.

4) Each log sheet shall contain the reference numbers for the video tape recording of the inspection.

5) The video inspection tape shall show full pipe diameter perspective for a minimum distance of 8 feet from the face of the video camera with a properly oriented view, i.e., the top of the pipe shall be at the top of the video. Views characterized by rotated perspective shall not be acceptable.

b. Defects and Re-inspection: The following observations shall be considered defects in the construction of the sewer pipelines and will require corrections prior to acceptance:

1) Off Grade – 0.05 foot or more deviation from grade.

2) Joint Separations – over ½ inch (Joint separations of up to ¾ inches shall be allowed on PVC sewer pipes).

3) Offset joints.

4) Chips in pipe ends – none more than ¼ inch deep.

5) Cracked or damaged pipe or evidence of the presence of an external object bearing upon the pipe (rocks, roots, etc.).

6) Infiltration.

7) Debris or other foreign objects.

8) Other obvious deficiencies when compared to approved plans and specifications.

The Contractor shall be notified in writing of any deficiencies revealed by the video inspection that will require repair, following which the Contractor shall excavate and make the necessary repairs and perform all required re-tests.

B. Manhole Testing: Manholes shall be tested by either of the following methods:

1. Water Testing: This test shall be performed in the presence of the City inspector. After all pipelines have been laid, inspected, cleaned of obstructions, backfilled, and compacted, the manholes shall be tested for leakage. All pipes entering/exiting manholes shall be sealed at a point at least 2 feet outside the manhole walls (if flex couplings are used, the sealing shall be done beyond the flex coupling) to test the pipe-to-manhole joint. The manhole shall be filled with water to a level 2-inches below the top of the cone section. Safety/retrieval lines shall be secured to all plugs utilized. The manhole shall be given a period of not more than one hour to allow the water a chance to stabilize, after which the manhole shall be refilled and the beginning water level established. The water level shall again be re-checked after four hours. If the water level has dropped more than 1.0 inch, then the leakage shall be considered excessive and the

manhole shall be resealed, repaired and re-tested. This test shall be repeated until the water level drops less than 1.0 inch in four hours.

2. Vacuum testing:

a. General: At the Contractor's option, concrete sewer manholes may be tested by the negative air pressure (vacuum) method, in lieu of hydrostatic testing. The vacuum test shall be performed in compliance with ASTM C 1244, except that the duration of the test shall be as modified below. Manholes tested by vacuum testing shall be tested both before backfilling and immediately prior to paving.

b. Summary of Test: All lift holes and any pipes entering the manhole are to be plugged. A vacuum will be drawn and the vacuum drop over a specified time period is used to determine the acceptability of the manhole.

c. Preparation of the Manhole:

1) All lift holes shall be plugged.

2) All pipes entering the manhole shall be temporarily plugged at a point at least 2 feet outside the manhole (if flex couplings are used, the sealing shall be done beyond the flex coupling). Care shall be taken to securely brace the pipes and plugs to prevent them from being drawn into the manhole. Safety/retrieval lines shall be secured to all plugs utilized.

d. Test Procedure:

1) The test head shall be placed at the top of the manhole in accordance with the manufacturer's recommendations.

2) A vacuum of 10 inches of mercury shall be drawn on the manhole, the valve on the vacuum line of the test head closed, and the vacuum pump shut off. The time shall be measured for the vacuum to drop to 9 inches of mercury.

3) The manhole shall pass if the time for the vacuum to drop from 10 inches of mercury to 9 inches of mercury is 80 seconds or more.

4) If the manhole fails the initial test, the necessary repairs shall be made by an approved method. The manhole shall be retested until a satisfactory test is obtained.

SECTION 13

WATER DISTRIBUTION SYSTEM

13.01 DESCRIPTION:
This work shall include the furnishing of all the labor, materials, tools and equipment to construct and complete in an efficient and workmanlike manner the installation of the water lines in accordance with the approved plans, these Specifications and the Public Works Standard Details to insure an operable, reliable, and watertight system.

13.02 MATERIALS:

A. Mains

1. Pipe: All buried mainline pipe shall be Polyvinyl Chloride Pipe (PVC). Pipes from 4 through 12 inch shall conform to the requirements of AWWA Standards C900 class 150, DR 18. Pipes 14 inch and larger shall conform to the requirements of AWWA Standards C905 class 165, DR 25. Outside diameter shall be manufactured to cast iron pipe (CIP) equivalent. Pipe shall be furnished in minimum standard lengths of 20 feet.

   Where the normal mainline static water pressure exceeds 100 psi, class 200, DR14 AWWA Standard C900 PVC is required.

   Where the slope is 15% or greater, all water mains shall be designed with restrained joints. The Consulting Engineer is required to provide adequate drainage measures to protect the trench from erosion.

   All above ground pipe shall be cement lined pressure class 200 ductile iron and shall conform to AWWA standard C151-65, and shall be epoxy coated.

   Other pipe shall be as specified by the City Engineer and shall conform to applicable specifications for the particular pipe.

2. Fittings: Fittings shall be ductile iron with a minimum pressure rating of 250 psi conforming to AWWA standard C110 or C153., Bolts shall be painted with an approved bituminous coating after nuts are tightened. All exposed bolts (including bolts in water meter boxes and vaults) shall conform to ASTM A-276 Type 304 Stainless Steel. Apply "Neverseize" lubricant or approved equal to all exposed bolts. Cast iron fittings shall be cement mortar lined and factory bituminous coated in accordance with AWWA Standard C104. Jointing shall be rubber gasket joints in accordance with AWWA or flanged in accordance with AWWA C110. All above ground fittings, and valves shall be factory painted as required by the City Engineer. No field painting shall be allowed except for minor touch-up.

3. Valves and Valve Boxes:

   a. Valves: All valves, unless otherwise specified, shall be bi-directional flow resilient wedge gate valves, conforming to AWWA Standard C509, and shall be iron body, with a non-rising stem and three O-ring stem seals. All valves shall be rated for a minimum working pressure of 250 psi minimum.

All external ferrous metal surfaces shall be fully coated with a minimum 10 mils thickness of resin epoxy as per AWWA C550 to protect all seating and adjacent surfaces from corrosion and prevent build-up of scale or tuberculation.

Valves shall open left and be provided with 2-inch square wrench nuts which are centered over the pipe. Valves shall have full opening flow-way of equal diameter as the nominal size of connecting pipe. All valves adjacent to tees and crosses shall have a flanged connection to the tee or cross.

Valves shall be designed for ZERO leakage when closed with pressure in either direction, and they shall be suitable for throttling if required.

All valves shall have an internal epoxy resin coating in accordance with AWWA C203.

Valves shall meet the requirements of this section and be Mueller "Superseal" or approved equal.

If distance from top of valve to finish grade is more than 42 inches, factory supplied valve nut extension(s) shall be required to meet a maximum distance of 42 inches from operating nut to finished grade.

b. Valves boxes: All valve boxes shall be Christy Concrete Products No. G-5 marked "WATER", or approved equal.

4. Fire Hydrants

Fire hydrants in residential areas (as defined by the City Engineer) shall have one 4-l/2 inch pumper nozzle and one 2-1/2 inch hose nozzles (Clow 950, Jones No. J-3740 with bronze caps, , or approved equal). Fire hydrant in commercial and industrial areas (as defined by the City Engineer) shall have two 4-l/2 inch pumper nozzles and one 2-1/2 inch hose nozzle (Clow 865, Jones J-3770 with bronze caps, or approved equal). All nozzles shall have "National Standard" threads. All fire hydrants shall be wet barrel type, supplied with factory applied chrome yellow paint, and conform to AWWA C503.

Hydrant risers shall be Clow/Rich No. 100 with localized break-off scoring on the exterior near each flanged end. Only one break-off riser shall be installed per hydrant. Whether or not indicated on the plans, every fire hydrant installation shall have a six-inch gate valve installed on the lateral at the main. A blue reflective marker shall be installed Public Works Standard Details at each hydrant and two for corner hydrants.

B. Water Services:

1. Services: Services shall be installed in conformance with the Public Works Standard Details. The minimum service size shall be 1 inch. Unused services shall be abandoned and all pipes and appurtenances shall be removed from the City right-of-way. The corporation stop shall be closed, the unused service severed and a watertight cap installed. All 1-inch services shall be soft rolled tube type K copper meeting the requirements of ASTM Designation B88.

All 2 inch services shall be hard temper tube type K copper.

Services that are 4 inch, 6 inch and 8 inch shall be PVC C900 or ductile iron pipe and shall comply with the requirements of section 13.02 A of these Specific Provisions.

2. Corporation Stops: Corporation Stops shall be as shown in the applicable Public Works Standard Detail.

3. Service Saddles: Service saddles for PVC pipe shall be bronze or stainless steel and specifically designed for iron pipe o.d. PVC C900 (or C905 where applicable) pipe with female iron pipe threaded outlets. All components shall be bronze and/or stainless steel. Saddles employing a single u-bolt strap or saddles not fully contoured to the pipe o.d. shall not be permitted. The service saddles shown in the applicable Public Works Standard Details are approved for use subject to compliance with the above criteria.

4. Fittings and Meter Stops: All fittings and angle meter stops shall be bronze and conform to AWWA C800. Angle meter stops shall be lockable. All fittings and meter stops shall be as shown in the applicable Public Works Standard Detail subject to compliance with the above criteria.

5. Water Meters: All water meters shall be bronze, Badger Model 70 conforming to AWWA C700 with Itron model 40W electronic radio transmitter (ERT), and shall read in cubic feet.

6. Unions: The use of unions shall be strictly prohibited without prior approval of the City Engineer. If approved, the number, type, and location shall be as approved by the City Engineer.

7. Service Taps: Hot taps are permitted where the service size is equal to or less than half the diameter of the main tapped. Tees shall be used where the service size is greater than one-half the size of the main. No taps shall be permitted within 2 feet of a pipe joint or an adjacent tap (either side of the main). Contractors shall not be permitted to perform taps on existing water mains which have been placed in service unless such work is performed in the presence of the City Engineer or his representative. Contractor shall notify City Engineer a minimum of 48 hours (two working days) prior to tapping to coordinate inspection.

8. Back Flow Prevention Assemblies: All backflow assemblies installed on the City water system shall be tested and certified in place by City approved, AWWA certified personnel at the Contractors expense. Only assemblies which are listed as approved on the most recent list of the U.S.C. Foundation For Cross-Connection Control and Hydraulic Research or Title 22 shall be installed.

13.03 INSTALLATION:

A. Submittals: Contractor shall submit the following to the City Engineer for review and approval prior to construction:

1. Paint Color Charts: Paint color charts shall be submitted to the City Engineer for selection and/or approval for all above ground items.

2. Fabricated Items: Five copies of shop drawings shall be submitted to the City

Engineer for review and approval prior to fabrication. The City Engineer shall have ten working days to review these submittals.

B. Handling of Materials: Water pipe, fittings, hydrants and valves shall be carefully handled at all times. Only safe, suitable and proper equipment and appliances shall be used for the loading, hauling, unloading, handling and placing of materials. Special care shall be exercised so that the coating on pipe, valves and fittings will not be damaged. If such damage should occur, the coating shall be repaired to the satisfaction of the City Engineer. Chain slings will not be permitted. Pipe loaded on trucks or stacked one upon another shall be supported on wooden blocking. Pipe handled on skid ways shall not be skidded or rolled against pipe already on the ground.

C. Laying Pipe: Each section of pipe and each fitting shall be thoroughly cleaned out before it is installed. All pipe, fittings, valves, etc., shall be carefully lowered into the trench by suitable tools or equipment, in such a manner as to prevent damage to the pipe, lining, coating, fitting or other appurtenances. Under no circumstances shall pipe accessories be dropped into the trench.

The pipe shall be laid true to line, with no visible change in alignment at any joint, unless a curved alignment is shown on the plans. When a curved alignment is shown on the plans the maximum deflection at any joint shall not exceed 80 percent of the manufacturer's recommendation for the type of pipe and joint being used.

Thrust blocks of 3000 psi minimum concrete shall be cast-in-place at all bends of 11.25° or greater, behind each tee, or each cross which is valved in such a manner that it can act as a tee, and at the back of fire hydrants. For lines 12 inches and larger, thrust blocks shall be used at all bends. The thrust block shall extend from the fitting to undisturbed soil, shall be kept clear of the joints, and shall be of such bearing area as to assure adequate resistance to the force to be encountered. In addition to the above, movement may be prevented by the additional use of retaining glands and stainless steel rods where necessary. Thrust blocks will be installed in conformance with the Public Works Standard Details. When straps are used to secure thrust blocks, they shall be stainless steel.

Whenever pipe laying is discontinued for short periods, or when work is stopped at the end of the day, the open ends of all mains shall be closed with watertight plugs or bulkheads. The plug or bulkhead shall not be removed unless or until the trench is dry.

Valves shall be set plumb and properly fitted to the adjacent sections of the main. Unless installed above ground or in a vault, a valve box shall be installed over each valve.

D. Installation of Service Lines: The location of water service lines shall be on the centerline of the lot unless otherwise shown on the plans signed by the City Engineer. Water meters shall not be permitted in sidewalks, driveways, or other paved areas without the prior approval of the City Engineer. Refer to Public Works Standard Details for installation. Services shall be run perpendicular to the main. There shall be no fittings between the meter and the main, except as shown on the Public Works Standard Details.

The water service line shall be considered as a part of the main for the purpose of hydrostatic testing.

E. Tracer Wire: Ten gauge insulated, solid copper tracer wire shall be laid along all water mains and non-metallic service laterals. Tracer wire shall also be run to and up the riser of all valves as shown in the standard plans. Tracer wire shall be laid and securely taped directly on top of the pipe and shall be stubbed up inside each valve and meter box. Splices shall be "Burndy" (split bolt) or "Blackburn". After installation, splices shall be taped with two layers of half-lapped rubber electrical tape and two layers of half-lapped vinyl electrical tape.

F. Connection to Existing Mains: The Contractor shall make connections to existing mains where indicated on the plans. The City Engineer shall observe all hot taps. The newly installed facilities shall be kept completely isolated from the City system until properly disinfected and approved by the City Engineer. Testing against existing City valves shall not be allowed prior to water main disinfection.

The City Engineer shall designate 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 shall be at the Contractor's risk. In no circumstances shall connections to existing mains be made until after successful bacteriological testing as specified herein. The City will assume no responsibility for the water tightness of existing valves.

Service in existing mains can be interrupted only upon authorization of the City Engineer who will specify the time and duration of the outage. The Contractor shall notify the City of Healdsburg Fire Department and all affected users in writing at least 24 hours in advance of service interruption, using printed forms provided by the City Engineer. The Contractor shall also, a minimum of 2 working days in advance of the requested shut down, make a request to the City Engineer to notify the water department personnel to coordinate the required valve closing for service interruption.

Valves shall only be operated by City of Healdsburg personnel.

G. Air Reliefs and Blow offs: Air relief and blow off assemblies shall be located as shown on the plans and installed in accordance with the Public Works Standard Details.

13.04 ABANDONMENT:

All unused water system facilities within the public-right-of-way are required to be abandoned and shown in the construction plans with the appropriate notation as follows:

A. Services: Water services (including dedicated fire and irrigation services) shall be abandoned by closing the corporation stop valve, installing a water tight cap at the end of the corporation stop and removing all piping and appurtenances within the right-of-way. For larger services with flanged valves, the valve shall be left in place (box and riser removed) and a blind flange shall be installed on the downstream side of the valve.

B. Mains: Water mains and all portions of associated structures (valve, air release valve, blow off, box and riser, etc.) less than 4 feet deep shall be removed. Water mains and portions of associated structures (valve, air release valve, blow off, box and riser, etc.) more than 4 feet deep shall be removed or filled with a 2 sack cement and sand slurry.

13.05 TESTING:

A. Hydrostatic and Leak Testing of Water Mains: After the street basement material has been

placed, rolled, and is ready for paving each section of the pipe to be tested shall be slowly filled with water and all air shall be expelled from the pipe. Only one fill point shall be used to minimize the risk of contamination. Air may be released by opening hydrants and service line cocks at the high points of the system and the blow offs at the dead ends. The valve controlling the admission of water into the section of pipe to be tested shall be opened wide before shutting the hydrants or blow offs. After the system has been filled with water and all air expelled, the fill valve shall be closed.

The pipe shall then be refilled, if necessary, and subjected to a pressure of not less than 150 psi or the service pressure plus 50 psi, whichever is greater for a period of 2 hours.

No leakage shall be allowed during the 2-hour hydrostatic test.

Once successfully tested and approved, the mains shall be left fully charged.

B. Disinfection of Mains and Services: All lines, mains, and branches shall be disinfected by chlorination in accordance with AWWA Standard C651-92 "Disinfecting Water Mains" and as herein specified. Sufficient chlorine or other disinfectant shall be added and flushing performed such that the water in all main and services meets the applicable Federal, State, and Local drinking water standards prior to paving the street and prior to acceptance of the Project. The Contractor shall obtain, at no cost to the City, all NPDES and other permits required by other agencies prior to flushing water mains.

The required concentration of chlorine in the mains may be obtained by the use of HTH tablets as produced by Olin Mathieson in the following quantities:

HTH 5 gram TABLET - (65 percent available chlorine)
Number of tablets per length of pipe

Length of Section	Diameter of Pipe					
	6"	8"	10"	12"	16"	20"
13'	1	2	3	3	6	9
18'	2	2	3	5	8	13
20'	2	3	4	5	9	14
30'	2	4	5	7	13	14
36'	3	5	6	9	16	25
40'	3	5	7	10	18	28
100'	7	13	17	25	45	70

HTH tablets are to be fastened to the inside top surface of each length of pipe using food grade adhesives such as "Permatex No. 2" at time of pipe laying. The tablets are potentially dangerous and shall be safely locked/secured by the Contractor at all times. The new facilities shall be slowly filled with water. Air shall be exhausted from each dead end, branch run, hydrant run and installed service. After filling and exhausting all air, the chlorinated water in the system being tested shall be retained for a minimum period of 96 hours, after which each service, hydrant branch run and dead end shall be thoroughly flushed to clear foreign matter. The flushing shall be continued until the residual chlorine concentration is less than 0.1 mg/l above the source supply and a minimum of 0.2 mg/l.

The water system shall then be allowed to rest an additional 24 hours prior to the collection of samples for bacteriological analysis. The Contractor shall contact the City of Healdsburg Public Works Inspector to coordinate the collection of samples for bacteriologic contamination. All samples shall meet or exceed the current Federal, State, and Local water quality standards for bacteriologic contamination prior approval of the water system installation and its use. The Contractor, at his sole expense, shall be responsible to repeat flushing and disinfecting in accordance with the above requirements, or take any and all other remedial actions necessary and acceptable to the City Engineer until all samples tested meet the required standards. Flushing of chlorinated water into the storm drain system or any creeks or streams shall not be allowed.

Flushing Table

Pipe Diameter Inches	2.5 fps gpm	Number of 2" Taps (Blowoff)	Number of 2-1/2" Fire Hydrant Outlets
4	100	1	1
6	200	1	1
8	400	2	1
12	900	2	2
16	1600	4	2

SECTION 14

PLANTING

14.01 DESCRIPTION:
This work shall consist of furnishing all labor, materials, plant materials, tools and equipment required to grade, prepare soil, fertilize, plant, seed and otherwise complete the landscape as shown on the approved plans, these Specifications and the Public Works Standard Details.

14.02 PRESERVATION OF PROPERTY:
The planting operations shall be conducted in such a manner that no damage shall result to existing site improvements and plantings. The contractor shall be responsible for any damage resulting from his operations, and shall repair or replace such damage at his own expense. Vehicles of any kind shall not be allowed to pass over curbs, sidewalk, planting areas, etc, unless proper protection is provided.

14.03 SOILS TESTING:
The Contractor shall obtain agronomic soils tests for all planting areas after completion of finish grading and prior to the start of soil preparation work. Tests shall be performed by an approved agronomic soils testing laboratory and shall include a fertility and suitability analysis with written recommendations for soil preparation, amendments, compaction relief, and post planting fertilization program. The Contractor shall instruct the soils laboratory as to the type of irrigation being used and that the City prefers humus based amendments, such as fully composted chicken manure. The soils report recommendations shall take precedence over the minimum amendment and fertilizer application rates specified herein only when they exceed the specified minimums.

14.04 PERSONNEL:
Planting and seeding operations shall be performed by personnel familiar with planting procedures and under supervision of an experienced landscape horticulturist who is acceptable to the City Engineer.

14.05 WEATHER:
No planting shall occur during weather conditions which will adversely affect materials or when soil is in a non-friable condition, as determined by the City Engineer.

14.06 INSPECTIONS:
Inspections of planting operations will be required. The Contractor shall contact the City of Healdsburg at least 48 hours (two working days) in advance of an anticipated inspection. As a minimum, inspection will be required at each of the steps listed below, and as directed by the Engineer:

A. Upon completion of finish grade and prior to commencement of soil preparation, for acceptance of finish grades and collection of soils samples for analysis by the Contractor under the supervision of the City Engineer. The number and locations of the sample(s) shall be determined by the City Engineer based on site soil conditions.

B. During amendment spreading, incorporation and compaction relief work.

C. When major plants are spotted for planting, but before planting holes are dug.

D. When planting and all other indicated or specified work has been completed.

E. During application of pre-emergent chemical.

F. At start of plant establishment and maintenance period.

G. At the end of maintenance, prior to acceptance of the project for maintenance by the City. This acceptance for maintenance will be confirmed in writing by the City Engineer after all punch list items, for the entire Project, including non-landscape items, have been completed. On projects which involve more than landscape, no partial acceptances will be made by the City, and the entire Project will be accepted at one time. In this instance, the final inspection will not be made until all Project punch-list items have been completed, including the required maintenance period for landscaping.

14.07 SUBMITTALS:

The following written certifications are required to be submitted to the Inspector upon delivery of the respective materials to the job site:

A. Total Quantity of commercial fertilizer by type
B. Total Quantity of soil amendments and conditioners by type
C. Total Quantity of seed
D. Total Quantity of Mulch
E. Total Quantity of iron sulfate

14.08 MATERIALS:

A. Imported Topsoil: Topsoil shall be an imported friable soil of loamy character containing a normal amount of organic matter. It shall be obtained from well-drained arable land and shall be free of refuse, roots, heavy and stiff clay and stones larger than one inch in size. Soil shall, by particle examination, contain the following percentages: Sand - between 25 and 40 percent, Silt - between 10 and 35 percent, and Clay - between 10 and 35 percent. Sand shall be defined as ranging in size from 2 to 0.05 mm in diameter: silt from 0.05 to 0.002 mm and clay less than 0.002 millimeters.

B. Soil Amendment:

1. Soil amendment shall be delivered to the job site bearing the warranty of the producer for the grade furnished and shall be uniform in composition and free flowing. Grade of particles shall be 0 to 1/4 inch with 15 percent maximum proportion of 1/4-inch particles. All composted soil amendment products shall be fully composted and 100 percent free of deleterious material. The City prefers amendments based on high humus content. Composted or humus based products shall have a carbon/nitrogen ratio of at least 15:1 with a moisture content of less than 24 percent by weight. Amendment quantities shall be as per soils reports, however, the following shall be used as a base line for quantities: 2 cubic yards (cu. yds.) per 1000/sq.ft. composted chicken manure or 4 cu. yds. per 1000/sq.ft nitrolized material (fir bark, etc).

2. Soil amendment shall be nitrogen stabilized (1-0-0) (if required by analysis), and shall be Composted Chicken Manure, as distributed by Fosters Farms, (Livingston, CA., (209).394-6339) or Nursery Mix, as distributed by Sun-up Forest Products Inc., Sacramento, CA or City approved equal. Supply sample of proposed substitutes to the

City Engineer within two weeks of award of contract with laboratory organic amendment analysis.

3. Soil conditioners shall be agricultural grade gypsum, soil sulfur and iron sulfate.

C. Fertilizer: Fertilizer shall be a commercial inorganic fertilizer in the granular or pellet form, time release. Fertilizer shall be delivered to the site in containers labeled in accordance with the applicable State of California regulations, bearing the warranty of the producer for the grade furnished, and shall be uniform in composition, dry and free-flowing. Material, which becomes caked or otherwise damaged, shall not be used. Fertilizer quantities shall be as per soils reports, however, the following shall be used as a base line for quantities:

1. Turf areas and Planting Areas: Prill type with analysis of 6-20-20 (6 percent Nitrogen, 20 percent Phosphorus, and 20 percent Potassium), 15-lbs/1000 sq. ft. for soil preparation and/or 10-lbs/1000 sq. ft. of 16-6-8 for plant maintenance.

D. Herbicide: Submit written chemical weed control program prepared by a licensed Pest Control advisor within two weeks of the award of the contract for approval by the City Engineer.

E. Seed: Seed mixture shall be 98 percent pure and noxious weed free, with a minimum of 88 percent germination. Seed variety or mix shall be as specified on the plans or in the Special Provisions. All turf seed shall be re-cleaned Grade A "new crop" seed, delivered in the original unopened containers, and shall bear a guaranteed analysis and dealer's label. The dealer may mix the seed provided a guaranteed statement of composition of mixture and percentages of purity and germination of each variety is attached to the sealed container. The seed shall be pre-treated with a pre-emergent fungus preventative such as 'Thiram', or other City approved equal, in accordance with manufacturer's specifications. The seed containers shall be stored immediately in a dry, weather and damp proof structure. Any seed which has become wet, moldy or is otherwise damaged in transit or storage will not be acceptable. Supplier shall be approved by the City Engineer prior to delivery.

F. Hydro seeding Materials:

1. Seed : As specified on the plans or in the Special Conditions.

2. Fertilizer: Per soils report(s).

3. Cellulose: The mulch shall be a green colored, fibrous wood cellulose mulch containing no growth or germination inhibiting factors. It shall be manufactured in such a manner that after addition and agitation in the slurry tanks with fertilizer, seed, water and other approved additives, the fibers in the material will become uniformly suspended to form a homogeneous slurry; and that when hydraulically sprayed on the ground, the material will form a blotter-like groundcover impregnated uniformly with seed. After application the mulch will allow the absorption of moisture and allow rainfall to percolate to the underlying soil without causing erosion. Cellulose shall be certified to indicate that laboratory and field-testing of the product has been accomplished and that it meets all of the foregoing requirements. Weight specifications of this material from suppliers and for all applications shall refer only to air-dry weight on the fiber material. Each package of the cellulose fiber shall be marked by the manufacturer to show the air-dry weight content. Mulch shall be applied at 1800 lbs per acre.

4. Binding Agent: Dry powder organic concentrate, such as Ecology Controls M-binder or City approved equal.

5. Water: Water for hydro mulching shall be clean potable water added to the slurry mixture in sufficient amount to spread uniformly the required quantity of hydro mulch solids (approximately 3,000 gallons per acre).

6. Equipment : Hydro mulching equipment used for the application of the seed, fertilizer and slurry of prepared wood pulp shall be of the type normally used in such operations and shall be approved by the City Engineer. This equipment shall have a built-in agitation system and operating capacity sufficient to agitate, suspend and homogeneously mix a slurry containing up to 40 pounds of fiber plus a combined total of 70 pounds of fertilizer solids and seeds for each 100 gallons of water. The slurry distribution lines shall be large enough to prevent stoppage. This discharge line shall be equipped with a set of hydraulic spray nozzles which will provide a continuous nonfluctuating discharge and delivery of the slurry in the prescribed quantities uniformly, without misses, waste, or erosion. The slurry tank shall have a minimum capacity of 1,000 gallons and shall be mounted on a traveling unit which may be either self propelled or drawn.

G. Plant Stock: Plants shall be the variety, quantity and size indicated on the drawings. When total quantities are tabulated, they shall be considered approximate and are furnished for convenience only. Quality and size shall conform to the State of California Grading Code of nursery stock, No. 1 grade. Nursery grown stock only shall be used unless otherwise specified, and it shall be free from insect pests and diseases.

All plants shall comply with Federal and State laws requiring inspection for plant diseases and infestations. Inspection certificates required by law shall accompany each shipment of plants, and certificates shall be delivered to the City Engineer. All plants shall be true to species and size indicated, and shall be tagged in accordance with the standard practice recommended by the American Association of Nurserymen; however, determination of plant species or variety will be made by the City Engineer and his decision shall be final.

Plants shall be healthy, shapely, and well rooted, and roots shall show no evidence of having been root bound, restricted or deformed. Root condition of plants in containers will be inspected by the City Engineer and condition determined by removal of earth from the roots of not less than two plants of each species or variety from each source. If the sample plants are found to be defective, the City Engineer reserves the right to reject the entire lot or lots of plants represented by the defective samples. All plants rendered unsuitable for planting because of this inspection shall immediately be removed from the site.

Each plant shall be handled and packed in the approved manner for that species or variety, and all necessary precautions shall be taken to ensure that the plants will arrive at the work site in proper condition for successful growth without scarred or broken branches. Trucks used for transporting plants shall be equipped with covers to protect plants from windburn.

Substitutions will not be permitted, unless proof is submitted to the City Engineer that any plant specified is not available. The City will then consider the use of the nearest equivalent size or variety. Such proof shall be substantiated and submitted in writing by the Contractor within 35 days after the effective date of the Notice to Proceed.

Plants shall have straight trunks with the leader intact, undamaged and uncut. At no time will the contractor prune the leader without the prior written approval of the Public Works landscape inspector. Trees shall be well tapered in the trunk so that they will stand alone without the support of the nursery stake. Branching on the main leader shall be in alternate locations and well spaced apart with no severe crossing of the branches. All old abrasions and cuts shall be completely calloused over. All plants shall be measured when their branches are in their normal position. Height and spread dimensions indicated refer to the main body of the plant and not from branch to branch or root tip to tip. Indicated sizes shown are before pruning. Plants shall not be pruned prior to delivery except upon approval of the City Engineer.

Groundcover shall be rooted plants from flats unless otherwise approved by the City Engineer.

H. Mulch: Mulch shall be shredded redwood bark as available from Redigrow of Sacramento, Walk-On Bark as distributed by Cement Hill Ready-Mix, or approved equal. This product shall only be used where the area is under overhead spray irrigation (as opposed to drip irrigation). In other areas use 3/4" to 1 ½" graded chipped redwood bark or approved equal.

I. Backfill: Soil used for backfill of plant pits shall be enriched using the previously amended on site soil.

J. Tree Stakes and Ties: Tree stakes shall be 2" by 10' (or as required) straight, close-grained lodge pole pine, pointed at one end. Stakes shall be free from knots, checks, splits or disfigurements. Point the stakes prior to treatment with Copper Napthanate which shall penetrate stake surfaces to a minimum depth of 1/4 inch.

Tree ties shall be 'Gro-strait' or City approved equal.

Earth anchors for specimen trees shall be equal to the 'Duckbill' as supplied by Landscape Supply, Inc., Santa Clara, CA. The size of the trees to be supported shall determine the necessary holding capacity of the anchors used. The anchor holding capacity shall be approved by the City Engineer.

K. Deep Rooting Barriers: All concrete pavement, including curbs and gutters, which are within eight feet of a tree shall be protected with deep root barriers. Such barriers shall be a minimum of 18 inches deep and located parallel to, and within six inches to one foot of, the concrete paving. All barriers shall be installed per manufacturer's recommendations.

14.09 PLANTING:

A. Soil Preparation and Fine Grading: Prior to any planting bed preparation or planting, finish grade all planting areas, fill as needed or remove excess dirt. Install all irrigation (except equipment that would be damaged by amendment/compaction relief efforts). Float all areas to a smooth uniform grade as indicated on the Grading plans. Slope all planting areas to drain. Roll, scarify, rake and level as necessary to obtain true, even planting surfaces. Finish grades shall be approved by the City Engineer and all soils testing and amendment completed prior to any planting work.

Finish grades shown on the plans are given in feet and decimals of feet. Slope uniformly

between given spot elevations. Grades not otherwise indicated shall be uniform levels or slopes between points established by pavings, curbs or catch basins. Minor adjustments of finish grade shall be made at the direction of the City Engineer if required. All grades shall provide for natural runoff of water without undrained low spots or pockets. Flow line grades shall be accurately set and shall not be less than 2 percent gradient unless otherwise indicated. Connective tops and toes of all slopes shall be rounded to produce a natural appearing transition between various levels. Unless otherwise shown on the plans, all planting areas shall be graded so as to have a minimum slope of 2 percent in all directions, and all areas. This grading shall be accomplished to the satisfaction of the Engineer with a minimum of wash boarding.

On island or curbed planters the grades shall be 20 percent on those planters that are between three to eight feet in width and 10 percent on those planters that are between eight feet to 20 feet in width. Island planters shall have all compacted efforts removed to six inches below native compaction, and may need dry wells or positive drains installed, at the discretion of the City Engineer.

After approval of finish grade but before the installation of irrigation, thoroughly cross rip, with chisel or disc (four times minimum), the soil to a depth of 12 inches, minimum. This shall be done in two stages, adding half of the amendments and fertilizer outlined below to each lift. Soil amendment and fertilizers shall be spread at the rates designated by the agronomic soils lab but at no less than the rates per section 14.08.B.C.

After approval of amendment and fertilizer applications by the City Engineer, thoroughly incorporate into the top 12 inches of soil by disking or rotary-hoe cultivation. Be careful not to over till to the point of destroying the soils' texture and structure.

All planting areas shall be thoroughly wet down and sprinkler/emitter coverage and operation inspected and approved prior to planting. Allow soil to dry so as to be workable.

Finish grade of all tree, shrub, annual and groundcover areas shall be 1½ inches below the top of adjacent pavement, headers, curbs or walls before the installation of the mulch, unless otherwise indicated on the drawings. Finish grade of turf areas shall be ½ inch below top of adjacent pavement, sidewalks, curbs, and headers.

B. Tree, Shrub, and Groundcover Planting

Mark tree and major shrub locations on site using stakes or similar means. Locations shall be approved in the field by the City Engineer before plant holes are dug. Adjustments will be made as required.

Dig pits circular in outline with vertical sides as shown on the Public Works Standard Detail. Holes shall be a minimum diameter of twice the container diameter and the minimum depth shall be 24 inches or 12 inches deeper than the root ball in enclosed planter areas, whichever is greater. After pits are dug, roughen sides of the pit and loosen soil in the bottom of the pit to a depth of 3". Construct foot-tamped mound in the bottom of the pit to support the plant at the proper level.

Do not handle container plants by the tops, stems or trunks at any time. Lift all plants so that the root ball is supported from the underside. Plants that do not have a satisfactory root system will be rejected. If plants do not have young feeder roots showing at the edge of the

container, score the root ball with ½ inch deep vertical lines at three places around the root ball to encourage new feeder root development.

Bare root stock backfill shall consist of on-site soil with organic amendment, fertilizer and any soil conditioners as listed above. Should the agronomic soils test call for additional fertilizer or soil amendments, it shall take precedence.

Soil surrounding the planting pit shall be in a friable condition. Place plant in hole in an upright position. Crown of tree should be 1 ½ inch above finish grade. Crown of shrubs shall be 1 inch above finish grade. Backfill using the on site soil, fill ½ hole. Thoroughly water and complete the backfill. Place a 3-inch high berm outside the excavated area to create a watering basin and fill the watering basin with water (not necessary if drip irrigated). The crown of the plant after settlement shall be ½ to 1 inch above finish grade and all roots shall be covered by soil.

After any pruning that has been approved by the Public Works landscape inspector, place the tree stakes along side but not piercing the root ball. Stakes shall extend a minimum of 1 foot into undisturbed soil. Attach trees to the stakes with tree ties as shown on the Public Works Standard Detail. Mulch the inside of each watering basin with 3 inches of bark mulch.

All trees shall be staked. Specimen trees shall be guyed as shown on the Public Works Standard Details. When trees are planted in public areas, install a 24" by ½" piece of white pvc pipe on each guy wire for visibility as directed by the City Engineer.

All plants shall be planted immediately after the containers are cut or broken. Containers shall be immediately removed from the site to prevent a hazard to persons using the area. No containers shall be left on site overnight.

In groundcover areas, apply fertilizer at the recommended rate. Groundcover shall be installed at spacings indicated on the drawings, evenly spaced and in triangulated pattern. Place each plant in its pit so that the root system lies freely without doubling and so that the plant is vertical to the ground. Firm the soil around each plant making sure that the crown is ½ to 1 inch above finish grade. All roots shall be below the soil. Provide a small watering basin as shown on the Public Works Standard Details and water the plant in thoroughly.

After all plants are installed, pre-emergent herbicide shall be applied to all Groundcover and shrub areas including plant basins. Chemicals used are to be as shown on the written chemical weed control program prepared by a licensed Pest Control Advisor and approved by the City Engineer. Application to be made prior to any mulching.

After the application of the pre-emergent, all Groundcover, shrub, and tree areas shall be mulched. All groundcover and shrub areas shall receive a two-inch layer of the approved mulch, taking care not to cover the crown of any plant. Mulch shall not be installed under low growing groundcover but shall be placed up to the edges, and not covering, the newly installed plants. All tree basins shall receive a 3-inch layer of mulch.

C. Hydro mulch Seeding: The slurry preparation shall take place on the site. The preparation shall begin by adding water to the tank when the engine is at half throttle. When the water level has reached the height of the agitator shaft, good recirculation shall be established. At this time, the seed shall be added followed by the fertilizer and then the cellulose mulch. The mulch shall only be added to the mixture after the seed and when the tank is at least one-

third filled with water. The engine throttle shall be opened to full speed when the tank is half filled with water. All of the mulch shall be added by the time the tank is two-third to three-fourths full. Spraying shall commence immediately when the tank is full.

All areas to receive hydro mulch shall be sprayed with a uniform visible coat using the green color of the mulch as a guide. The slurry shall be applied in a sweeping motion, in an arching stream, so as to fall like rain allowing the fibers to build on each other until a good coat is achieved and the specified amount of materials are applied. The nozzle shall not be pointed at the ground nor shall the pressure be allowed to roll the mulch, forming ridges along the ground. Such areas shall be immediately re-sprayed.

Any slurry mixture which has not been applied to the designated areas within four hours of mixing shall be rejected by the City Engineer and shall be removed from the project at the Contractor's expense.

The slurry shall not be sprayed on undesignated areas. It shall not be allowed to fall onto groundcover or shrub areas nor onto trees that are within the designated areas. Any slurry spilled or sprayed into areas other than those designated to receive spray or onto objects such as trees, posts, fences, poles, vaults, walks, etc. shall be cleaned up to the satisfaction of the City at the Contractor's expense.

The Contractor shall reseed all bare spots at 10-day intervals at the Contractor's expense. The Contractor shall be responsible for all seeded or reseeded area until acceptable germination and establishment is realized and approved by the City.

D. Seeding: Installation of plants shall have been completed before seeding operations are begun. Just prior to sowing, the areas to be seeded shall be made sufficiently loose and friable to receive the seed.

The seed shall be sown evenly using a mechanical spreader at the rates specified on the plans or in the Special Provisions. One-half of the seed shall be sown in one direction and the second half sown at 90 degrees to the first during a time when weather will not disturb the seeding process. Apply fertilizer the agronomic soils lab but at no less than the rates per section 15.08.B.C. uniformly over the seeded areas. Lightly rake the surface to cover the seed and to mix with the fertilizer, then compact the surface with a 200 lb. roller or similar device to ensure proper contact between soil and seed. Soil shall be kept moist but not saturated until the seed is germinated.

Protect the grass areas with temporary fencing as necessary. Barriers shall be maintained by the Contractor and kept in orderly condition at all times until the City has accepted the work. The Contractor at his own expense shall repair any damage to the turf. If for some reason the maintenance period does not start immediately, refer to Section 15.12 B following for the care and maintenance of seeded areas.

E. Installation of Sod: Sod area should be prepared by stripping all plant material from the area. If there is existing turf to match, the edge shall be lowered approximately one inch so that the new turf will meet existing grade. All rocks and uneven areas shall be removed and the area rolled smooth. Sod area shall then be loosed to a depth of a minimum of one inch to ensure a tight contact with the new sod. Care should be given to prevent heel or footprints in the grade as the sod is installed. Unroll the sod, fitting each strip tightly on all sides to the preceding strips or the existing turf. Do not stretch or deform the sod. Force each strip

together as tightly as possible. Stagger the strips of sod as bricklayer places bricks to prevent the seams from matching.

As soon as the sod is placed roll with a light roller, making certain that no airspace is left under the sod. After the first rolling, moisten the sod lightly, and then allow the sod to dry off before the second rolling. The second rolling should be at right angles to the first rolling. Care should be taken to leave no footprints in the sod. Upon completion of the rolling, apply sufficient water to wet the sod and soil to a depth of six inches. At the end of 10 days, mow to a height as recommended by the sod producer.

14.10 CLEANING UP:

The Contractor shall at all times keep the premises free from the accumulation of waste material or rubbish. At the completion of the work, he shall remove all rubbish from and about the site and all of his and his sub-contractors tools, scaffolding, surplus materials, etc.

14.11 WATERING:

It shall be the Contractor's responsibility to maintain a balanced watering program to ensure proper growth until final acceptance of the work. Apply water in sufficient quantities and as often as seasonal conditions require in order keeping the planted area moist at all times, well below the root system of the plants. The Contractor shall not, however, water so much that the area floods or that insufficient oxygen is allowed to the plant roots.

14.12 MAINTENANCE PERIOD:

A. Preliminary Inspection: Upon completion of all construction and planting work, the Contractor shall notify the City in writing that the landscape work is ready for preliminary inspection for start of maintenance. The approval of the completed work will establish the beginning of the maintenance period. No partial approvals will be given.

B. Maintenance: The maintenance period shall be a minimum of 90 calendar days after the approval of the landscape for start of maintenance by the City Engineer. A longer period may be required if the plant material is not acceptably maintained during the 90-day maintenance period, if replacements are required during the maintenance period, or due to other circumstances described herein. The maintenance period may be suspended at any time upon written notice to the Contractor/Developer that the Landscape is not being acceptably maintained, and the day count suspended until the landscape is brought up to City standards.

Permanent electrical power connections to remote controller shall be provided prior to the start of maintenance.

Maintenance shall include, but is not limited to all watering, weeding, fertilizing, cultivation, spraying, and pruning necessary to keep the plant material in a healthy growing condition and to keep the area neat throughout the maintenance period. However, the Contractor shall not prune any trees without the express written consent of the City. All plants shall be watered not less than twice a week. Each watering shall be of sufficient quantity as to provide optimum growth conditions. The Contractor shall provide the equipment and means for its proper application. During the maintenance period, should the appearance of any plant indicate weakness and the probability of dying in the opinion of the City Engineer, that plant shall be replaced immediately by the Contractor at his own expense. Replacements shall be made in the same manner as specified for the original planting. At the end of the

maintenance period, all plant material shall be in a healthy growing condition and free of physical injury of any kind.

Lawn shall be mowed as specified herein. Clippings and debris shall be removed from the site. Lawn shall be trimmed at the edges of curbs, paving, drains, and headers. Lawn areas which fail to germinate shall be re-seeded at maximum 10-day intervals until a vigorous, even stand of turf is established. Lawn areas shall be kept free from weeds by hand pulling or by spraying with the approved selective chemical herbicide before they exceed 2 inches in height. Lawn shall be mowed for the first time after the turf has reached a uniform height of 3 inches. Turf shall be mowed for the second time when it again reaches a height of 3 inches. This second mowing shall be no sooner than 10 days after the first mowing. Mowing thereafter shall take place at 7-day intervals until final acceptance.

After the second mowing of the turf, apply a second application of (16-6-8) fertilizer at a rate of 6 lbs. per 1000 square feet. Fertilizer shall be spread uniformly over the turf area. Apply fertilizer at the same rates at 30-day intervals thereafter until final acceptance of the project.

The final application of pre-emergent (as indicated in the approved herbicide program) in shrub and groundcover areas and fertilizer in all areas shall take place immediately preceding the final inspection. A minimum of 3 applications of fertilizer shall have been applied prior to acceptance by the City.

The Contractor shall apply commercial fertilizer to all areas at a 1/3 the rate recommended by the soils at 30-day intervals for 3 applications as a minimum during the 90-day maintenance period above and beyond the original soils preparation application. After planting and during the maintenance period, in the event that any plants or turf areas exhibit iron chlorosis symptoms, apply FE 138 Geigy or City approved equal at the manufacturer's recommended rates.

Any plantings that do not show a prompt establishment of plant material shall have defective plant material replaced at 10-day intervals until accepted by the City Engineer. If a good rate of growth has not been demonstrated within 30 days of the first planting/Hydro seeding, the Contractor shall be responsible for determining the appropriate horticultural practices necessary to obtain good growth. The Contractor shall obtain agronomic soils testing and/or plant pathology reports from a City approved source for all areas not showing good growth and shall provide copies of the test results to the City to verify the appropriateness of all plant establishment work performed. If, in the opinion of the City Engineer, remedial action is necessary based on these reports, such remedial action shall be taken by the Contractor at no additional cost to the City. The Contractor is also responsible for providing the appropriate fungicides or other chemical control to provide healthy plants at the end of the maintenance period.

During the maintenance period, all flow lines shall be maintained to allow for free flow of surface water without causing erosion. Displaced materials which interfere with drainage shall be removed and/or relocated as directed. Low spots and pockets shall be regraded to drain properly and plant material replaced. Jute netting shall be installed at flow lines and other locations where erosion is evident as directed by the inspector. Work under this Section shall include complete responsibility for maintaining adequate protection for all areas. Any damaged areas shall be repaired at no additional cost to the City.

During the maintenance period, any turf areas or plants which are vandalized, diseased,

dead, or in an unhealthy condition, shall be replaced by the Contractor at his expense within two weeks after notification from the City Engineer or his inspectors. The Contractor at his expense shall replace any plant damaged by herbicide. Maintenance shall also include treatments for fungus, diseases, rodents and insects with requirements for approvals of chemicals being the same as for herbicides. Weed all areas at no less than 7-day intervals. Maintenance is to include all items installed under the contract. All mechanical items shall be maintained in optimum working condition. The site shall be kept free of trash and debris by means of a general clean-up once a week.

14.13 FINAL INSPECTION AND ACCEPTANCE:

Final inspection will be conducted at the end of the maintenance period. Notice requesting final inspection shall be submitted by the Contractor to the City Engineer at least 7 days prior to the anticipated date. Acceptance by the City will be contingent upon proper maintenance and the establishment of a vigorous, uniform stand of turf over all areas seeded. Any portion thereof which does not show a vigorous, uniform stand shall make all areas subject to continued maintenance at the contractor's expense.

Just prior to the final inspection, the Contractor shall have performed weeding, repair or touch-up of pavement, repair of equipment and structures, and a thorough cleaning of the site. Apply pre-emergent to all tree basins, shrub and groundcover areas per program and apply fertilizer per recommendations.

Fertilizer shall be spread around the base of the plants and thoroughly watered. The Contractor shall supply the City with three copies of the Material Safety Data Sheets (M.S.D.S.) on all materials used in the course of construction and maintenance prior to the Final inspection.

At the final inspection, the City Engineer will determine the condition of improvements, planting and turf. Plants, which are missing, vandalized, dead or unhealthy, shall be replaced by the Contractor at his expense with the same species and sizes originally specified. The Contractor shall make such replacements within two weeks after the final inspection and maintain the areas for an additional 30 days before calling for another Final Inspection. If project improvements, corrective work, and maintenance have not been performed as specified to the satisfaction of the City Engineer, the maintenance period shall continue at the Contractor's expense until such time as the work has been successfully completed and maintained successfully for 30 days. When the work has been performed as specified to the satisfaction of the City Engineer, and the maintenance period has been successfully completed to the satisfaction of the City Engineer, and all other Project related punch list items (including non-landscaping items) have been completed to the satisfaction of the City Engineer, the Project will be referred to the City Council for acceptance at the next available meeting. Upon acceptance of the Project by the City Council, the City will assume the maintenance responsibilities.

14.14 GUARANTEE:

A. All plant materials installed under the contract shall be guaranteed against any and all poor, inadequate or inferior materials and/or workmanship for a period of one year following final acceptance.

B. Any trees or other plant material that die back and lose the form and size originally specified shall be replaced, even if they have taken root and are growing after the dieback.

C. During the guarantee period, any material found to be dead missing or in poor condition

by the City shall be replaced by the Contractor within 10 (ten) working days of written notification. The City of Healdsburg Public Works Department shall be the sole judge as to the condition of the material.

D. Replacement shall be made in accordance with City of Healdsburg Standards. Material and labor involved in replacing the plant material shall be provided by the Contractor at no additional cost to the City.

E. Replacement material shall be installed to the same specifications as required for the original installation and shall carry the same guarantee from the time they are replaced.

SECTION 15

IRRIGATION SYSTEM

15.01 DESCRIPTION:

This work shall consist of furnishing all the labor, materials, tools, and equipment necessary to construct and complete in an efficient and workmanlike manner the installation of an irrigation system in accordance with the approved plans and these Specifications.

15.02 GENERAL

A. Purpose: It is the intention of these Specifications to accomplish the work of installing an irrigation system, which will operate in an efficient manner and provide adequate coverage. The plans indicate the general arrangement of piping and equipment, and do not necessarily indicate all offsets, fittings and accessories that may be required. The Contractor shall furnish incidental materials and labor not specifically called for but required to complete work as intended.

B. Type of Irrigation: Because of the high wind conditions typical to the Healdsburg area and the problems with run off onto paved areas, irrigation for median islands and parkway strips shall be a drip or approved underground system. The system shall be designed in such a way as to minimize runoff onto sidewalks, streets, curbs and gutters, and to effectively water the potential root zone(s). Overhead spray systems may be used for large turf or Groundcover areas that cannot be efficiently irrigated with a drip or underground system. All overhead spray irrigation systems shall utilize low angle, short radius, closely spaced heads that produce a uniform application of water under extremely windy conditions.

C. Details: The irrigation plan and the piping details are diagrammatic. Pipe lines shown parallel on the drawing may be placed in a common trench, providing that a minimum horizontal distance of 6 inches is maintained between buried lines. Sprinkler heads and quick-coupler valves are shown schematically. Discrepancies in dimensions or sizes of areas to be irrigated shall be brought to the attention of the City, prior to submission of bid. After such time, intent of City will govern all discrepancies.

D. Damage by Leaks: The Contractor shall be responsible for damages to any property or work caused by leaks in the piping systems being installed. He shall repair, at his expense, all damages so caused. All repair work shall be done as directed, and in a manner satisfactory to the City.

E. Protection: The contractor shall be responsible for any damage to this work which occurs before final acceptance. He shall securely cover all openings into the systems and protect all apparatus, equipment and appliances, both before and after being set in place, to prevent obstructions in the pipes and breakage, misuse or disfigurement of the apparatus, equipment of appliance. Contractor shall be responsible for damage to all existing utilities and existing facilities (buildings, turf, and landscape areas, paving, etc.), whether or not they are indicated on drawings.

F. Equipment List and Drawings: Within 15 days following notification of award of the contract, the Contractor shall submit to the City Engineer for approval a list of equipment and material, which he proposes to furnish and install. The list shall be complete as to

name of manufacturer, size and catalog number of unit, and shall be supplemented by such other data as may be required, including detailed scale drawings, plumbing, and writing diagrams. All of the above data shall be submitted in duplicate for checking. Following checking, correcting and approval, three complete sets shall be submitted to the City Engineer.

Materials list shall be submitted using the following format:

Item	Description	Manufacturer	Model No.
1	Pressure Supply Line	Lasco	Sch.40
2	Lawn Head	Rainbird	2400

G. "Record" Prints

1. Record accurately on one set of blue-line prints all changes in the work constituting departures from the original contract drawings, including changes in pressure and non-pressure line locations, and a complete schematic circuit diagram.

2. The changes and dimensions shall be recorded in a legible and workmanlike manner to the satisfaction of the City. Prior to final inspection of work, and prior to transferring the information to Mylars, submit record prints to the City Inspector for approval.

3. Dimension from two permanent points of reference (buildings, monuments, sidewalks, curbs, pavement, etc.). Data to be shown on record prints shall be recorded day-to-day as the project is being installed.

4. Show locations and depths of the following items:

a. Point of connection.

b. Routing of sprinkler pressure lines (dimension maximum 100 feet along routing).

c. Gate valves.

d. Sprinkler control valves.

e. Quick coupling valves.

f. Routing of control wires.

g. Related equipment (as may be directed).

5. Maintain record prints on-site at all times.

6. Upon completion of work, transfer all as-built information and dimensions to reproducible sepia Mylars. The changes and dimensions shall be recorded in a legible and workmanlike manner, to the satisfaction of the City of Healdsburg Public Works Department.

H. Standard of Installation: Material and workmanship shall be in accordance with local codes and ordinances of legally constituted authorities, except where provisions of these Specifications exceed such requirements, these Specifications shall govern. All installations shall be completed in a professional manner in accordance with generally accepted industry standards and these Specifications. In addition, all pipe shall be laid with the factory applied pipe markings facing up.

I. Personnel: All layout, installation, and work relating to the irrigation system shall be performed by personnel experienced in the trade and under the supervision of a certified landscape technician acceptable to the City Engineer.

15.03 MATERIALS:

A. Pipe and Fittings

1. Mains

a. PVC - Polyvinyl Chloride for 2 inch up to 6 inch shall be type 2, SDR21 1120-200 class 200 solvent weld or rubber gasket type PVC. Solvent weld and ring type pipe shall not be used together on the same pressurized supply line. Pipe shall be marked continuously and permanently with manufacturer's quality control identification.

b. Copper shall be soft rolled tube Type K conforming to ASTM Designation B88.

2. Main or Sub-Main

a. PVC -Polyvinyl Chloride for all pipe 1 ½ inch or under shall be Schedule 40 - ASTM 1785 - Type I PVC 1120. Fittings shall be Type I/II, Schedule 40 NSF PVC, Solvent Weld.

b. Copper shall be soft rolled tube Type K conforming to ASTM Designation B88.

3. Laterals: Lateral lines on the discharge side of valves less than 2" diameter shall be Schedule 40 PVC.; greater that 2" shall be class 200. Fittings shall be TypeI/II Schedule 40, Solvent Weld.

Separate conduit shall be installed to carry water pipe and control wires under all existing and proposed Portland cement concrete and asphalt concrete surfaces. Conduit shall be as per main line schedule (PVC) size as required. Conduit shall be bored under existing paving and shall extend 12 inches beyond paving edge. A separate sleeve shall be provided for each water line and for the electrical control wires.

B. PVC Pipe Cements

1. Primer shall be IPS P-70 PVC, or equal, for all sizes of PVC pipe and fittings.

2. Cement shall be IPS 711 heavy bodied gray cement, or equal, for all sizes of PVC pipe and fittings over 1 ½ inch. Applicator shall be a minimum of one-half the diameter of the pipe or fittings.

C. Sprinkler Heads: Sprinkler heads shall be of the types and sizes with the radius of throw, pressure, discharge and any other designations necessary to determine the types and

sizes, as indicated on the plans.

All heads of a particular type of function in the system shall be of the same manufacture and shall be marked with the manufacturer's name and identification in such a position that they can be identified without being removed from the system. Any substitutions for items specified on the plans must be submitted for approval in writing. Subsequent approval or rejection will be given in writing.

D. Sprinkler Risers: All ½ inch riser nipples shall be threaded Schedule 80 PVC and swing joints shall be Schedule 40 Marlex threaded street ells.

All 1-inch riser assemblies shall consist of swing joints rated at 200 psi and 2 Class 200 PVC nipples and 1 Schedule 80 nipple or approved equal.

E. Check Valves: In line check valves shall be installed in the risers (or the bodies) of all heads that are 12 inch or more below the grade of the valve.

F. Emitters: Emitters shall be of the types and sizes as indicated on the plans. They shall be pre-emergence treated for root intrusion.

All emitters of a particular type of function in the system shall be of the same manufacture and shall be marked with the manufacturer's name and identification in such a position that they can be identified without being removed from the system. Any substitutions for items specified on the plans must be submitted for approval in writing. Subsequent approval or rejection will be given in writing.

G. Underground Dripper Line: Underground dripper (emitter) lines shall be of a type that will provide an even coverage of water over the entire area where they are used. The dripper line (or emitter line) shall consist of linear low-density polyethylene tubing, with turbulent flow, drip emitters bonded to the inside or outside will. The pressure compensating emitters shall be molded from virgin polyethylene resin with a silicone rubber diaphragm. The pressure compensating emitters shall have nominal discharge rates of 1.0 or 0.5 gallons per hour (G.P.H.). The dripper line shall be available in 12, 18 or 24 inch spacing between emitters. The emitters shall be impregnated with Treflan (trade mark) to inhibit root intrusion for a minimum period of ten years and shall be guaranteed by the manufacturer to inhibit root intrusion for this period. Drip line and accessories shall be as manufactured by Geoflow, Inc., San Francisco, CA. Polyethylene products shall conform to ASTM D-1248 Type 1 Cl. C., ASTM D-1598, ASTM D-2609, or a City approved equal.

H. Flush End: All emitter and drip systems shall be provided with a ball type, faucet handle flush valve at the end of each emitter line or approved equal. Install in a round valve box.

I. Fertilizer Injector Kit: All underground and drip emitter systems shall be provided with a fertilizer injector kit to allow for the use of water-soluble fertilizers on the site. Install in a plastic or concrete valve box.

J. Pressure Gauge: Underground and drip emitter systems shall be provided with pressure gauges as necessary to ensure the proper operation of the system. Pressure gauge as manufactured by Irrometer or City approved equal. Install in a plastic valve box.

K. Screen Filter: A primary screen filter such as that manufactured by Amiad or City approved

equal shall be provided after the fertilizer injector and/or for each underground or drip emitter zone. Install in its own plastic valve box so as to be easily serviceable.

L. Valves:

1. Remote Control Valves (R.C.V.), Electric Solenoid Type For Uses Other Than Drip Systems: The remote control valve shall be 24 volts, normally closed, spring loaded and diaphragm actuated. It shall be self-cleaning, self-purging, contamination resistant, have flow control, 150 PSI operating pressure, internal manual bleed, rubber or fabric reinforced diaphragm, have self-cleaning main seat and will operate under low flow conditions. It will be capable of angle or globe installation. It should be easily flushed if a foreign object becomes lodged in the internal control mechanism. It should have no screens, filters, or small orifices in the control mechanism which are subject to clogging. It will have a manual internal bleed system. It shall be completely serviceable in the field without removing the valve body from the system. The diaphragm shall carry a 5-year warranty; the valve shall carry a 2-year warranty.

   Remote Control Valves shall be identified with permanently attached plastic or metal tags identifying the station number.

2. Remote Control Valves (R.C.V.), Electric Solenoid Type For Use With Drip Irrigation Systems: The remote control valve shall be 24 volts, normally closed, spring loaded and diaphragm actuated. The remote control valve shall be 24 volts, normally closed, spring loaded and diaphragm actuated. It shall be self-cleaning, self-purging, contamination resistant, have flow control, 150 PSI operating pressure, internal manual bleed, rubber or fabric reinforced diaphragm, have self-cleaning main seat and will operate under low flow conditions. It will have a regulating range of 5 to 100 PSI. Upstream pressure can vary from 5 to 200 psi, while controlling a steady downstream pressure. Downstream pressure can be regulated when manually opened. It will be capable of angle or globe installation. It should be easily flushed if a foreign object becomes lodged in the internal control mechanism. It should have no screens, filters, or small orifices in the control mechanism which are subject to clogging. It will have a manual internal bleed system. It shall be completely serviceable in the field without removing the valve body from the system. The diaphragm shall carry a 5-year warranty; the valve shall carry a 2-year warranty. Locate a permanent pressure gauge immediately downstream of the valve located so as to be easily read from above.

   Remote Control Valves shall be identified with permanently attached plastic or metal tags identifying the station number.

3. Gate Valves: Gate valves 2 ½" and above shall be iron body, bronze mounted, double disc, parallel seat with non-rising stem and with a 2 inch square operating nut, opening counterclockwise. Gate valves 2 ½" and below shall be brass 150 PSI rated body, bronze mounted, double disc, parallel seat with non-rising stem and with a operating wheel, opening counterclockwise. Valves shall have double "O" ring seals and have hubs suitable for use with the main distribution pipe furnished for the sprinkler system. All internal ferrous metal surfaces shall be fully coated with epoxy as per AWWA C550 to protect all seating and adjacent surfaces from corrosion and prevent build-up of scale of tuberculation. Size shall be as indicated on the drawings. Valve boxes shall be plastic with lock bolt cover, green, with the word "Irrigation" embossed on the cover, Carson Model 910-12B or equal.

4. Quick Coupling Valves: Quick coupling valves shall be two-piece, single slot, 1-inch diameter Buckner No. 14 or approved equal. Quick coupling valves to be installed in plastic box with green lock bolt cover marked "Irrigation", Carson Model 910-12B or equal. Location as shown on the plans.

M. Backflow Prevention Assemblies: A Reduce Pressure Principle Backflow Prevention Assembly shall be used. The assembly shall be U.S.C. approved and shall be installed at the locations indicated on the plans. It shall be installed above grade and housed in a Le Meur backflow enclosure or City approved equal. After the assembly is installed, it shall be tested and certified in place by an AWWA certified Backflow Assembly Tester and the test report given to the City.

Reduced pressure assemblies shall be installed per applicable State Laws, the manufacturer's recommendation, and in accordance with the Public Works Standard Details.

N. Irrigation Controller: The irrigation system controller shall be a U.L. approved, micro-processor based, electro-mechanical unit capable of fully automatic or manual operation of the system. It shall be housed in an approved exterior weatherproof pedestal mounted locking case as required by these Specifications. It shall operate on 117 volts AC, 50/60 Hz power input and be capable of operating 24-volt AC electric control valves. In addition, the controller shall be equipped with or shall be capable of the following:

The controller shall have 3 independent programs minimum, with eight start times watering in no less than one-minute increments and percentage function. It shall have a non-volatile memory, a station test program, master valve circuit, pump start circuit and a master sensor station. Each station shall have the capability of being individually programmed to operate from one minute to nine hours and 59 minutes in one-minute increments. Each program shall be capable of being set on either a seven day weekly repeat cycle where the active days are displayed all at once or on a skip day basis where the user may select the number of days skipped, from one to thirty, between waterings with the starting data selectable. The controller shall have a review program function which will sequentially bring all its programmed information to the displays at a readable rate. The recall display shall be interruptible at any time for changing the program. Each program shall provide a total duration watering time in hours and minutes.

The controller shall allow for setting in a "rain mode" for up to seven days after which, it will revert to the "automatic mode." Controller shall be capable of being operated manually at any time without affecting the original program. The controller shall have a rechargeable battery back-up to maintain time and the user's program. The controller shall have the capability of responding to external remote control signals when coupled to a master remote control system. The controller shall be Rain Bird ESP-C, Hardy Total Control or approved equal.

The controller shall be housed in a Le Meur Controller Enclosure Model A series or City approved equal, installed on a Class B Portland cement concrete foundation as recommended by the manufacturer of the controller. Enclosure shall be a weatherproof, 3/16-inch plate, foliage green painted metal locking case to which two keys shall be provided. The enclosure and accessories shall be installed in conformance with the manufacturer's instructions and recommendations. Foundation to be minimum of 6 inches

deep and sufficient width to prevent tipping. Each controller shall be protected by a GFI receptacle (15 amp min.) with the controller wired to the protected side and installed in the cabinet.

Each park or maintenance district shall provide a compatible master remote control unit with the controller. If the project is completed in phases, the remote control unit shall be provided with the acceptance of the first phase.

O. Electrical:

1. Control Wire: All wiring to be used for connecting the automatic controller to the electric solenoid actuated remote control valve shall be type UF-600V, solid copper, PVC insulation, single conductor, UL approved underground feeder cable. All pilot or "hot" wires are to be of one color and all "common" wires are to be white. Connecting and splicing of wire at the valves or in the field shall be made as follows: The wire shall be connected by twist connectors applied. The splice shall then be insulated with a Spears pre-filled dri-spliced connector with crimp sleeves splice kit or equal. Field splices between the controller and valves will not be allowed without special written permission from the landscape inspector/City Engineer.

2. Pull Boxes: Pull boxes shall be installed at the locations shown on the plans or at locations designated by the City Engineer at site of work. Contractor may, at his own expense, install such additional pull boxes as may be approved by the City Engineer to facilitate the work.

   Reinforced concrete covers shall be inscribed "Irrigation 24 Volt." Covers shall be provided with two 3/8-inch brass hold down bolts with brass washers and nuts. Nuts shall be recessed below the surface of the cover. If pull boxes are set in an area subject to vehicle traffic load, they shall have a steel cover of suitable design to withstand such loads.

3. Service Unit and Meter Socket: The combination City of Healdsburg Electric service and termination point for metered service shall be Tesco Class 26-000 service pedestal State of California Type 3 or equal rated at 120 volts.

4. PVC Conduit: All poly-vinyl-chloride (coded "PVC" on the Drawings) conduit shall be heavy-wall, Schedule 40, with factory made bends, couplings, and fittings; where permitted by NEC.

15.04 INSTALLATION:

A. General: Prior to all work of this section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence. Verify that irrigation system may be installed in strict accordance with all pertinent codes and regulations, the original design, the referenced standards, and the manufacturer's recommendations.

In the event any equipment or methods indicated on the drawings or in the specifications is in conflict with local codes, immediately notify the inspector prior to installing. If this notification is not provided, the Contractor shall assume full responsibility for the cost of all revisions necessary to comply with code.

1. Grades: Before starting work, carefully check grades to determine that work may safely proceed, keeping within the specified material depths with respect to finish grade.

2. Coordination with work of other trades: Make all necessary measurements in the field to ensure precise fit of items in accordance with the original design. Contractor shall coordinate the installation of all irrigation materials with all other work. Special attention shall be given to coordination of piping locations and tree locations to avoid conflicts.

B. Water Supply: Connections to or the installation of the water supply shall be at the locations shown on the drawings. Minor changes caused by actual site conditions shall be made at no additional cost to the City.

C. Electrical Service: Contractor shall provide the electrical meter, if necessary, and make 120V connection to the irrigation controllers, all as necessary for a complete and operational system.

D. Trenching: No trenching shall commence until rough grading work has been completed and accepted by the inspector. Excavation shall be open vertical construction sufficiently wide to provide free working space around the work installed and to provide ample space for backfilling and compacting. Trenches for pipe shall be cut to required grade lines, and trench bottom shall be compacted to provide an accurate grade and uniform bearing for the full length of the line. When two pipes are to be placed in the same trench, it is required that a minimum of 6 inches be maintained between the pipes.

The excavation required for the installation of conduit, foundations, and other appurtenances shall be performed in such a manner as to cause the least possible injury to the streets, sidewalks and other improvements. The Contractor to the satisfaction of the City Engineer shall repair all damage so caused. All lawns or improvements disturbed in excavating shall be replaced or reconstructed with the same kind of material as that damaged or with materials of equal quality. The material from the excavation shall be placed in a position that will not cause damage or obstruction to vehicular and pedestrian traffic nor interfere with surface drainage.

The depth of trench shall provide a minimum cover above the conduit or wiring as follows:

1. 12 to 18 inches over nonpressure lateral lines.

2. 18 to 24 inches over mainline under pressure.

3. 24 inches over pipe crossing under paving.

E. Control Wiring

1. Connections between the automatic controllers and the electric control valves shall be made with direct burial copper wire AWG-U.F. 600 volt. Pilot wires shall be a different color wire for each automatic controller. Common wires shall be white with

a different color stripe for each automatic controller. Install in accordance with valve manufacturer's specifications and wire chart. In no case shall wire size be less than #14.

2. Wiring shall occupy the same trench and shall be installed along the same route as pressure supply or lateral lines wherever possible. All wiring shall be located beneath the lowest pipe in a trench.

3. Where more than one wire is placed in a trench, the wiring shall be taped together at intervals of 10 feet.

4. Wires installed in conduits shall not be taped together to facilitate replacement of individual wires.

5. An expansion curl should be provided within 3 feet of each wire connection and at least every 100 feet of wire length on runs more than 100 feet in length. Expansion curls shall be formed by wrapping at least 5 turns of wire around a 1 inch in diameter pipe, then withdrawing the pipe.

6. Field splices between the automatic controller and electric control valves will not be allowed without prior approval of the City Engineer.

F. Backfilling: Backfill material shall be of native material free from lumps or stones and placed in 4 inch layers thoroughly compacted by mechanical tamping until the relative compaction is not less than 90 percent except under pavement. Provide sand backfill a minimum of 6 inches over and under all piping under paved areas. Flooding in lieu of tamping is not allowed.

G. Water Service and Meter: The water service shall be installed by the Contractor with an approved jumper for the meter. The meter shall be installed by the City at the location shown on the plans.

H. PVC Pipe: Pipe shall be cut with a fine tooth hacksaw or approved PVC cutting tool and any burrs shall be removed. The outside surface of the pipe and the inside surface of the fittings shall be wiped with a clean cloth saturated with methyl isobutyl ketone (MIBK) to remove all dirt and moisture before the cement solution is applied. The cement solution shall be applied to the pipe and fitting socket with a brush having a width approximately one-half the diameter of pipe. The cement solution shall be applied freely with a light wiping action to spread the cement uniformly over the surfaces. The pipe surface or fitting socket shall not be rubbed with a brush any more than is necessary to spread the cement. If the cement thickens, it shall be discarded.

Immediately after the cement has been applied to the surface to be joined, the pipe shall be inserted into the fitting with a twisting motion to the full depth of the fitting socket. Immediately after joining is completed, any excess cement shall be thoroughly wiped from the pipe and fitting. The joined members shall be allowed to cure for at least 5 minutes before they are handled. In cold or damp weather, the curing period shall be increased due to slower evaporation of the solvent. An additional fitting or pipe section may be added to the completed joint within 3 minutes if care is exercised in handling so that a strain is not placed on the previous joint. The male and female pipe threads of all threaded connections on PVC pipe shall be coated with Permatex #51, or

equal, pipe joint compound. Tighten fittings finger tight plus no more than one or two turns.

For plastic to metal connections, work the metal connections first. Use a non-hardening pipe dope on all threaded plastic to metal connections, except where noted otherwise.

Except as shown on the plans, PVC pipe placed in a trench shall be laid on level, undisturbed, or well-compacted earth and solvent-weld pipe shall be snaked from side to side in the trench at intervals of approximately 50 feet. Pipe shall be held down between joints with small mounds of earth to prevent movement. After completing the pressure tests on the pipelines and before any backfill is placed, water shall be run through the entire line until the pipe has been cooled to the supply water temperature. The trench shall be immediately backfilled, covering the pipe with soft earth to prevent damage to the pipe from rocks or clods.

I. Emitters

a. Multi-outlet emitters: Spaghetti tubing shall be installed after distribution emitters are in place, if used. Run 4 tubes to each tree, spacing them equally around the tree, with one emitter in the root ball and the other three emitters along the root ball/soil interface as directed by the City Engineer. Run two tubes to each shrub. Tubing shall be held off the ground with plastic stakes and each tube shall have a bug cap. All emitter openings not used shall be capped. Emitters shall be set perpendicular to finished grade and shall be installed as indicated on the plans and shown in the details. Tubing or emitter lines shall be stapled/staked as necessary to hold the lines in place under the bark.

b. Dripper line, Emitter line, In Line Tubing:

1. Handle P.E. Dripper line as per manufacturer's directions.

2. Install P.V.C. to P.E. distribution manifold as shown on the details and in the locations shown on the plans. If Distribution is shown as a butterfly (split) do not install as an end feed.

3. Install P.E. dripper line in straight runs (or as shown on the plans) at centers shown on the plans, ± 3"on center. Start the grid or the first line about 3" to 6" from the nearest sidewalk or curb, or 12" from the bottom of slope(s). Bury dripper line 4" deep, or as called, (±1") maximum below finish grade (not including mulch). Use jute-netting staples as necessary to hold tubing at depth while backfilling. Note that the emission holes in the tubing are in no instance to be further than 18" apart, including the perimeter P.E. dripper line header (emitter, not line spacing).

4. The systems shall be a 'LOOPED GRID' system in that all ends are joined and the emitter lines are placed in a rigid grid pattern. Join all ends of the Dripper line using Tee's and Ell's using compression fittings only. Compression fittings must be U.V. inhibited with a pressure rating of 70 psi minimum. Submit sample of compression fittings to the City Engineer or his Representative for approval.

5. Install flushing apparatus in areas easily accessible for future maintenance. Activate the system and thoroughly flush the entire grid (at least 10 minutes) before

allowing the system to come to fully closed pressurization.

6. Scarify the large tree root balls or drive rods thru the root ball and insert dripper lines thru the root balls to ensure proper watering.

c. Adjusting Drip Irrigation System

1. With the system fully flushed and pressurized and before shrub, hedge, Groundcover or sod planting operations test the system for operation.

2. On steep slopes it may be necessary to adjust some lines or portion thereof. This can be accomplished be closing off some of the lines after installation. This action will be indicated visually by the presence of free water at the bottom of the slope (or at the edge of the planter) with the top or adjoining slope being relatively dry after a very short period of time (5 to 10 min. or less).

3. Additional costs associated with these changes or adjustments are to be born by the Contractor.

4. The entire system shall be operating properly before any area is to be sodded or planted.

5. The Contractor is responsible for periodically checking operation of the system and adjusting it as necessary for the duration of the Contract, including the maintenance period.

J. Sprinkler Heads: Nozzles on stationary sprinklers shall be tightened after installation and sprinklers having an adjustment stem shall be adjusted on a lateral line for the proper radius, diameter, and/or gallonage. They shall be set perpendicular to finished grade and shall be installed as indicated on the plans and shown in the details.

K. Valves: Provide each assembly with its own outlet; no multiple assemblies will be allowed. Each valve shall be installed with approved unions installed on each side of the valve to aid in maintenance and replacements. Each valve is to be housed in its own valve box. Quick couplers and valves shall not be installed in the same boxes. There shall be a minimum three-foot clear distance between valves.

Remote control valves shall be adjusted so the most remote sprinkler heads operate at the pressure recommended by the head manufacturer and so a uniform distribution of water is applied by the sprinkler heads to the planting areas for each individual valve system.

All valves shall be installed as shown in the details and in accordance with manufacturer's recommendations.

L. Valve Boxes: All remote control valves, gage valves, and manual angle, or globe valves shall be installed in a plastic valve box as shown in details, or stated in Section 16.03 G complete with cover, unless otherwise specified on the plans. All plastic valve boxes shall be Ametec or Carson with locking lid installed as shown in the Public Works Standard Details.

All valve boxes shall be set to finish grade in lawn areas and 2 inches above finish grade in Groundcover areas. Under no circumstances shall more than one remote control valve be installed in one valve box. Valve boxes shall not rest on lines. A minimum of 2 inches clear distance shall be left between the box wall with 10 inches clearance between the lid and the valve.

Valve boxes located near walks, curbs, header boards, and paving shall be installed in such a way as to allow for valve boxes to abut those items with top surface matching plane of items listed above.

M. Irrigation Controller: All controller locations are essentially diagrammatic, and shall be specifically located by the Designated Authority.

All local and applicable codes shall take precedence in furnishing of 120-volt electrical service to the controller. This service will be provided by others. The Contractor shall provide and install the service unit and meter socket and make the connection between the power source and the controller.

Adequate coverage and protection of the 24-volt service wire leading from the controller shall be maintained from the bottom of the controller.

15.05 TESTING:

A. Record Prints: No inspection will commence without "record" prints. In the event the Contractor calls for an inspection without up–to-date "record" prints, without completing previously noted corrections, or without preparing the system for inspection, the inspection will be canceled and the Contractor back charged for the direct costs of all City personnel's time and consultant's time lost. Inspection will be required for:

1. Pressure test of irrigation main line.

2. Coverage test.

3. Final inspection/start of maintenance.

4. Final acceptance.

B. Testing of Service Lines and Irrigation Main: Service lines and irrigation main shall be tested in accordance with applicable provisions of the Water Distribution Specifications.

C. Hydrostatic Test

1. Prior to the installation of any valves, all pressure lines shall be tested under a hydrostatic pressure of 150 psi for a period of not less than 2 hours, with all ends of lines capped and the line fully charged with water after all air has been expelled from the line.

2. All hydrostatic tests shall be made in the presence of the City. No pressure line shall be backfilled until it has been inspected, tested, and approved in writing.

3. Contractor shall furnish necessary force and all other test equipment.

D. Flushing Plastic Pipe: After all new sprinkler piping and risers are in place and connected, and all necessary division work has been completed and prior to the installation of sprinkler heads, control valves shall be opened and a full head of water used to flush out the system.

E. Closing in Uninspected Work: Do not allow any of the work of this section to be covered up or enclosed until it has been inspected, tested, and approved by the City.

F. Coverage Test: When the irrigation system is completed, Contractor shall perform a coverage test in the presence of the City Engineer to determine if the water coverage for planting areas is complete and adequate. This test and any corrective work shall be accomplished before any planting.

G. Testing of Electrical System: Prior to acceptance of the work the Contractor shall cause the following tests to be made:

1. For continuity of each circuit.

2. For grounds in each circuit.

3. A functional test in which it is demonstrated that each and every part of the system functions as specified or intended herein.

15.06 COMPLETION CLEANING:

Upon completion of the work, Contractor shall smooth all ground surfaces; remove excess materials, rubbish, debris, etc.; sweep adjacent streets, curbs, gutters and trails and remove construction equipment from the premises.

15.07 MAINTENANCE:

Contractor shall properly and complete maintain the irrigation system. A balanced water program shall be maintained to ensure proper germination and growth until final acceptance of the work. Plants, which cannot be watered sufficiently with the irrigation system, shall be watered by means of a hose until such time as the deficiencies in the irrigation system are corrected to the satisfaction of the City Engineer. All such corrective work shall be performed by the Contractor at his sole expense.

All controllers are to have each station individually adjusted on a weekly basis. System shall be set considering the application rate each area is capable of receiving. The system shall operate on short intervals, with the cycle repeating at a later time to reduce runoff.

15.08 GUARANTEE:

A. The entire sprinkler system shall be unconditionally guaranteed by the Contractor as to material and workmanship, including settling of backfilled areas below grade for a minimum period of one year following the date of final acceptance of the work.

B. If, within one year following acceptance of the work, settlement occurs and adjustments in pipes, valves and sprinkler heads, sod or paving is necessary to bring the system, sod or paving to the proper level of the permanent grades, the Contractor, as part of the work under this Contract, shall make all adjustments without extra cost to the City, including

the complete restoration of all damaged planting, paving or other improvements of any kind.

C. Should any operational difficulties in connection with the sprinkler system develop within the specified guarantee period which in the opinion of the City may be due to inferior material and/or workmanship, said difficulties shall be immediately corrected by the Contractor to the satisfaction of the City at no additional cost to the City, including any and all other damage caused by such defects.

D. After work has been completed, the Contractor shall instruct the City in the operation and maintenance of the system and shall furnish a complete set of operating instructions.

15.09 TURNOVER ITEMS:

A. Controller Charts:

1. Record prints must be approved by City before charts are prepared.

2. Provide one controller chart (of the maximum size controller door will allow) for each automatic controller. Chart shall show the area covered by controller.

3. The chart is to be a reduced copy of the actual "record" print. In the event the controller sequence is not legible when the print is reduced, it shall be enlarged to a readable size.

4. Chart shall be marked with a different color to show the area of coverage for each station.

5. When completed and approved, the chart shall be hermetically sealed between two pieces of plastic, each piece being minimum 20 mils in thickness. Chart shall be installed in the controller enclosure using Velcro fasteners.

6. Controller charts shall be completed prior to final inspection.

B. Operation and Maintenance Manuals: Within 10 calendar days prior to acceptance of construction, prepare and deliver to the City all required descriptive materials, properly prepared in two individually bound copies of the operation and maintenance manual. The manual shall describe the material installed and shall be in sufficient detail to permit operating personnel to understand, operate, and maintain all equipment. Spare parts list and related manufacturer's information shall be included for each equipment item installed. Each complete, bound manual shall include the following information:

1. Index sheet stating Contractor's address and telephone, including names and addresses of local manufacturer's representatives.

2. Complete operating and maintenance instructions on all major equipment.

C. Materials to be furnished:

1. Supply as part of the contract the following spare parts:

a. Four percent additional sprinkler heads of each type and spray pattern shown and/or 4 percent additional emitters and/or tubing of each type shown.

b. Two wrenches for disassembly and adjustment of each type sprinkler head installed.

c. Two keys for each automatic controller.

d. Two couplers with a 3/4 inch bronze hose bib, bent nose type with hand wheel and two coupler keys.

e. One valve box cover key.

f. "As-built" black line Xerox Mylars from "record" prints.

g. Backflow assemblies valve handles and Water Department inspection documentation.

h. Test reports on Reduced Pressure Backflow Prevention Assemblies.

i. Gate valve key

2. The above spare parts shall be turned over to the City at the final inspection.

STREETS DETAILS

ST06 & ST07 – Curb Ramp

1) Detectable Warning Surface:
    a. Armor-Tile ADA-C-3648-YW (federal yellow), sized to fit

ST09 – Survey Monument

1) Cast Iron Monument Ring and Cover:
    a. D&L Foundry K6001
    b. Southbay Foundry B1000

ST12 – Street Sign (street name)

1) Sign Bracket:
    a. 2” Pipe Cap - Hawkins V14F(HD)SL-105-90
    b. 90 degree crosspiece – Hawkins V14F(HD)SL-107

ST14 – Street Sign (mast arm mounted)

1) Sign Bracket:
    a. Hawkins MIOJ-OCB250

STORM DRAIN SYSTEM DETAILS

SD01 – Curb Inlet

1) Curb Inlet:
    a. US Concrete Group model 4AC hood with CP3648 base

2) Access Cover:
    a. US Concrete Group concrete cover with NPDES cast iron logo and pick hole

SD02 – Storm Drain Manhole

1) Manhole Structure:
    a. Pipe smaller than 18" - US Concrete Group 20-48C
    b. 18" to 48" pipe - US Concrete Group 20-60CC

2) Frame and Cover (marked "STORM DRAIN" with open or closed pick hole):
    a. South Bay Foundry 1900
    b. D&L Supply A-1024

3) Gasket for barrel section joints:
    a. Ram-nek

SD05 – Storm Drain Outfall

1) Field Drain:
    a. US Concrete Group 3K with 2 side openings and heavy locking grate

SEWER SYSTEM DETAILS

SS01 – Sewer Lateral

1) Pipe and Fittings:
    a. Up to 8' deep – SDR35 PVC
    b. Greater than 8' deep – SDR26 PVC

2) Cleanout Box:
    a. Non-traffic bearing - Christy F8 box with F8D lid marked "SEWER"
    b. Traffic bearing - Christy G5 box with G5C lid marked "SEWER"

3) Plastic Mechanical Gripper Plug:
    a. Cherne Industries end of pipe series, sized to fit (peen end of bolt to prevent wingnut removal)

4) Wye (sized to fit sewer main):
    a. Plastic Trends
    b. Multifittings

5) Coupling (for adding cleanout to existing lateral only):
    a. Shear band coupling with stainless steel sleeve

SS02 – Sewer Manhole

1) Manhole Structure:
    a. Pipe smaller than 18" - US Concrete Group 20-48C
    b. 18" to 48" pipe - US Concrete Group 20-60CC

2) Frame and Cover (marked "SANITARY SEWER" with closed pick hole):
    a. South Bay Foundry 1900 CPH
    b. D&L Supply A-1024 CPH

3) Gasket for barrel section joints:
    a. Ram-nek

4) Interior Coating:
    a. Thoroseal and Waterplug mixture

SS03 – Temporary Mainline Cleanout

1) Pipe and Fittings:
    a. All pipe and fittings shall match size (8" MAX) and type of sewer main

2) Cleanout Box:
    a. Christy G5 box with G5C lid marked "SEWER"

3) Plastic Mechanical Gripper Plug:
    a. Cherne Industries (end of pipe series) with end of bolt peened to prevent wingnut removal, sized to fit

WATER SYSTEM DETAILS

WL01 – Water Service (1" meter)

1) Water Meter:
   a. 1" model 70 Badger meter with model 60WP Itron electronic radio transmitter (ERT)

2) Meter Box:
   a. Non-traffic bearing – Christy B30 with B30E reading lid marked "WATER"
   b. Traffic bearing – Christy B1324 with B61GH reading lid marked "WATER"

3) 1½" Polyethylene Service Pipe:
   a. Service Pipe:
      - 1½" High density polyethylene pipe, class 200, 3408, SDR 9, ASTM D-2737, AWWA C901
   b. Stainless Steel Insert:
      - Ford 54
      - Jones J2805
      - McDonald 6133
      - Mueller 506139

4) 1½" Tapping Service Saddle (IP thread):

   a. C-900 Pipe:
      1. Ford S91
      2. Jones J996
      3. McDonald 3846
      4. Mueller H134

   b. Ductile Iron & A.C. Pipe:
      1. Ford 202B
      2. Jones J979
      3. McDonald 3826
      4. Mueller BR2B

5) 1½" Corporation Stop Brass Ball Valve (MIP by CTS compression):
   a. Ford FB1100Q
   b. Jones J1935-SG
   c. McDonald 4704BQ
   d. Mueller B25008

6) 1½" Angle Meter Brass Ball Valve – CITY SIDE:
   a. Angle Valve (CTS compression by flange):
      - Ford BFA43-666WQ
      - Jones J1975-WSG
      - McDonald 4602BQ-1½
      - Mueller B24276
   b. 1½" to 1" Meter Adapter (flange by meter nut):
      - Ford A46
      - McDonald 10J46

7) 1" Meter Brass Ball Valve with Customer Handle – PROPERTY OWNER SIDE (meter swivel nut by FIP):
   a. Angle Valve:
      - Ford BA13-444W
      - Jones J1966W
      - McDonald 4604 B1
      - Mueller B24265

   b. Straight Valve:
      - Ford B13-444W
      - Jones J1925W
      - McDonald 6101MW-1
      - Mueller B20200

   c. Customer Handle:
      - Ford HB34
      - Jones J2815
      - McDonald 6102
      - Mueller B20298

WL02 – Water Service (1½" and 2" meters)

1) Water Meter:
   a. 1½" model 120 Badger meter with model 60WP Itron electronic radio transmitter (ERT)
   b. 2" model 170 Badger meter with model 60WP Itron electronic radio transmitter (ERT)

2) Meter Box:
   a. Non-traffic bearing – Christy B36 with B36E lid marked "WATER"
   b. Traffic bearing – Christy B1730 with B51GH lid marked "WATER"

3) Cathodic Protection:
   a. Anode - high potential magnesium anode, bagged in burlap sack with gypsum/bentonite/sodium powder and 10' long 10 gauge solid copper cable with black THHN insulation. Anode shall be sized as specified in Standard Detail.

4) 2" Copper Service Pipe:
   a. Type "K" hard temper copper pipe per ASTM Designation B88
   b. 2" coupling (if service longer than 20'):
      - Ford C4477Q
      - Jones J2609
      - McDonald 4758Q-2
      - Mueller H15403

5) 2" Tapping Service Saddle (IP thread):
   a. C-900 Pipe:
      - Ford 202BS
      - Jones J996
      - McDonald 3846
      - Mueller H134

   b. Ductile Iron & A.C. Pipe:
      - Ford 202B
      - Jones J979
      - McDonald 3826
      - Mueller BR2B

6) 2" Brass Ball Valve at Main with 2" Square Nut Adaptor:
   a. per Standard Detail WL07

7) Valve Box and Riser at main:
    a. per Standard Detail WL07

8) 2" Angle Meter Brass Ball Valve – CITY SIDE (CTS compression by flange):
    a. Ford BFA43-777WQ
    b. McDonald 4602BQ-2
    c. Jones J1963W-SG
    d. Mueller B24276

9) 2" Meter Brass Ball Valve – PROPERTY OWNER SIDE (flange by FIP):
    a. Angle Valve:
        - Ford BFA13-777W
        - Jones J1975W
        - McDonald 4604B2
        - Mueller B24286

    b. Straight Valve:
        - Ford BF13-777W
        - Jones J1912W
        - McDonald 6101MW2
        - Mueller B24337

    c. Customer Handle:
        - Ford HB67
        - Jones J2815
        - McDonald 6120
        - Mueller B20298

WL03 – Water Service (4", 6" and 8" meters)

1) Water Meter:
    a. 4", 6" or 8" Badger compound series meter with bronze plate strainer and two model 60WP Itron electronic radio transmitters (ERT). Summators for the Itron ERT's are prohibited.
    b. Turbo style Badger meters may be considered for dedicated irrigation services on a case-by-case basis.

2) Meter Box:
    a. Non-traffic bearing – Christy concrete box with reading lid marked "WATER", sized to fit
    b. Traffic bearing – Christy concrete H20 loading box with reading lid marked "WATER", sized to fit

3) Cathodic Protection:
    a. Anode – 17 lb high potential magnesium anode, bagged in burlap sack with gypsum/bentonite/sodium powder and 10' long 10 gauge solid copper cable with black THHN insulation.

4) 4", 6" and 8" PVC Service Pipe:
    a. Static Main pressure of 100 psi or less - Class 150, DR 18 per AWWA C900 standard
    b. Static Main pressure greater than 100 psi - Class 200, DR 14 per AWWA C900 standard

5) Tapping Sleeves, stainless steel (IP thread):
    a. Ford FTSS
    b. JCM 415 & 432
    c. Powerseal 3490
    d. Romac SST3

6) Resilient Wedge Gate Valve at main with 2" Square Nut Adaptor:
    a. per Standard Detail WL07

7) Valve Box and Riser at main:
    a. per Standard Detail WL07

8) 4", 6", 8" and 12" Gate Valve at meter - PROPERTY OWNER SIDE:
    a. Clow
    b. US Pipe

WL04 – Water Service (manifold multiple meters off 2" service)

1) Water Meter:
    a. 1" model 70 Badger meter with model 60WP Itron electronic radio transmitter (ERT)

2) Meter Box:
    a. Non-traffic bearing – Christy B30 with B30E reading lid marked "WATER"
    b. Traffic bearing – Christy B1324 with B61GH reading lid marked "WATER"

3) Cathodic Protection:
    a. Anode – high potential magnesium anode, bagged in burlap sack with gypsum/bentonite/sodium powder and 10' long 10 gauge solid copper cable with black THHN insulation. Anode shall be sized as specified in Standard Detail WL02.

4) 2" Copper Service Pipe:
    a. Type "K" hard temper copper pipe per ASTM Designation B88
    b. 2" coupling (if service longer than 20'):
        - Ford C4477Q
        - Jones J2609
        - McDonald 4758Q-2
        - Mueller H15403

5) 2" Tapping Service Saddle (IP thread):
    a. C-900 Pipe:
        - Ford 202BS
        - Jones J996
        - McDonald 3846
        - Mueller H134
    b. Ductile Iron & A.C. Pipe:
        - Ford 202B
        - Jones J979
        - McDonald 3826
        - Mueller BR2B

6) 2" Brass Ball Valve at Main with 2" Square Nut Adaptor:
    a. per Standard Detail WL07

7) Valve Box and Riser at main:
    a. per Standard Detail WL07

8) 2” Angle Meter Brass Ball Valve – CITY SIDE (CTS compression by flange):
    a. Ford BFA43-777WQ
    b. McDonald 4602BQ-2
    c. Jones J1963W-SG
    d. Mueller B24276

9) 1” Meter Brass Ball Valve with Customer Handle – PROPERTY OWNER SIDE (meter swivel nut by FIP):
    a. Angle Valve:
        - Ford BA13-444W
        - Jones J1966W
        - McDonald 4604 B1
        - Mueller B24265

    b. Straight Valve:
        - Ford B13-444W
        - Jones J1925W
        - McDonald 6101MW-1
        - Mueller B20200

    c. Customer Handle:
        - Ford HB34
        - Jones J2815
        - McDonald 6102
        - Mueller B20298

WL05 –Backflow Assembly (reduced pressure)

1) Backflow Assembly:
    a. Approved reduced pressure backflow assembly appearing on "List of Approved Backflow Prevention Devices" (of latest edition) by the University of Southern California Foundation for Cross Connection Control and Hydraulic Research.

2) Freeze Protection:
    a. Commercially available insulated blanket with green weather resistant outer covering locked in place over the backflow assembly.

3) Pipe and Fittings:
    a. 3” and smaller assemblies – Threaded brass, type “K” hard tempered copper or galvanized
    b. 4” and larger assemblies – Flanged ductile iron

WL06 – Backflow Assembly (fire service double detector check)

1) Backflow Assembly:
    a. Approved double detector check backflow assembly (unit includes paired bypass water meter with separate double check backflow assembly) appearing on "List of Approved Backflow Prevention Devices" (latest edition) by the University of Southern California Foundation for Cross Connection Control and Hydraulic Research.
        *** If chemical additives used in fire system, a reduced pressure detector check backflow assembly is required.**

2) Freeze Protection:
    a. Commercially available insulated blanket with green weather resistant outer covering locked in place over the backflow assembly and bypass meter assembly.

3) 4", 6", 8" and 12" PVC Service Piping:
    a. Static Main pressure of 100 psi or less - Class 150, DR 18 per AWWA C900 standard
    b. Static Main pressure greater than 100 psi - Class 200, DR 14 per AWWA C900 standard

4) Resilient Wedge Gate Valve at main:
    a. per Standard Detail WL07

5) Valve Box and Riser at main:
    a. per Standard Detail WL07

6) Cathodic Protection Anode:
    a. Anode – 17 lb high potential magnesium anode, bagged in burlap sack with gypsum/bentonite/sodium powder and 10' long 10 gauge solid copper cable with black THHN insulation.

WL07 – Valve

1) Valve:
    a. 2" Brass Ball Valve (FIP by FIP):
        - Ford B11-777W
        - Jones 4604B
        - McDonald 6107W
        - Mueller B20200
    b. 4", 6", 8" and 12" Resilient Wedge Gate Valve:
        - Clow
        - Mueller
        - US Pipe

2) 2" Square Nut Adaptor:
    a. Ford QT67
    b. McDonald 6122
    c. Mueller B20299

3) Valve Box:
    a. Christy G5 box with G5C lid marked "WATER"

4) Cathodic Protection:
    Anode - high potential magnesium anode, bagged in burlap sack with gypsum/bentonite/sodium powder and 10' long 10 gauge solid copper cable with black THHN insulation. Anode shall be sized as specified in applicable Standard Detail WL07.

WL09 & WL10 – Water Main Crossing

1) Cathodic Protection:
    a. Anode - high potential magnesium anode, bagged in burlap sack with gypsum/bentonite/sodium powder and 10' long 10 gauge solid copper cable with black THHN insulation. Anode shall be sized as specified in Standard Detail WL07.

2) Air Release Valve:
    a. per Standard Detail WL13

3) Resilient Wedge Gate Valve:
    a. per Standard Detail WL07

4) Valve Box and Riser at main:
    a. per Standard Detail WL07

WL11 – Fire Hydrant

1) Hydrant:
    a. Residential Area (two 2.5" and one 4.5" outlet):
        - Clow 960
        - Jones J4060
    b. Non-Residential Area (one 2.5" and two 4.5" outlets):
        - Clow 865
        - Jones J4065
    c. Color - Benjamin Moore safety orange (cm22.65)

2) 4", 6", 8" and 12" PVC Service Piping:
    a. Static Main pressure of 100 psi or less - Class 150, DR 18 per AWWA C900 standard
    b. Static Main pressure greater than 100 psi - Class 200, DR 14 per AWWA C900 standard

3) Resilient Wedge Gate Valve at main:
    a. per Standard Detail WL07

4) Valve Box and Riser at main:
    a. per Standard Detail WL07

5) Cathodic Protection:
    a. Anode – 17 lb high potential magnesium anode, bagged in burlap sack with gypsum/bentonite/sodium powder and 10' long 10 gauge solid copper cable with black THHN insulation.

WL12 – Blow Off

1) 2" Brass Ball Valve at main with 2" Square Nut Adaptor:
    a. per Standard Detail WL07

2) Pipe and Fittings:
    a. Threaded brass

3) Brass Fire Hose Adapter (2½" male national standard thread, MHT by 2" FIP)

4) Box Enclosure:
    a. Christy B1324 with B61JH lid with "BLOW OFF" welded on face

5) Cathodic Protection:
    a. Anode – 17 lb high potential magnesium anode, bagged in burlap sack with gypsum/bentonite/sodium powder and 10' long 10 gauge solid copper cable with black THHN insulation.

WL13 – Air Release Valve

1) Air Release Valve:
    a. APCO Model 143C
    b. Crispen UL10
    c. Valmatic 201C

2) Box Enclosure:
    a. Box - Christy B36
    b. Lid - Christy B36D marked "WATER"
    c. Box Extension - Christy B36X12

3) Pedestal Cabinet:
    a. Marconi TV80SB

4) Suction Screen:
    a. Flow Ezy Filters Inc.

5) 1" Polyethylene Service Pipe:
    a. Service Pipe:
        - 1" High density polyethylene pipe, class 200, 3408, SDR 9, ASTM D-2737, AWWA C901
    b. Stainless Steel Insert:
        - Ford 52
        - Jones J2805
        - McDonald 6133
        - Mueller 504385

6) Tapping Service Saddle:
    a. C-900 Pipe:
        - Ford S90 and 202BS
        - Jones J996
        - McDonald 3806-1 and 3846-1
        - Mueller H134
    b. Ductile Iron & A.C. Pipe:
        - Ford 202B
        - Jones J979
        - McDonald 3826-1
        - Mueller BR2B

7) 1" 90° Elbow (CTS compression by MIP):
    a. Ford L84-44Q
    b. McDonald 4779MQ
    c. Mueller H15526

8) 1" Corporation Stop Brass Ball Valve (MIP by FIP):
    a. Ford FB1700
    b. Jones J3401-SG
    c. McDonald 3149B
    d. Mueller B25008

9) 1" Ball Valve Curb Stop:
    a. Ford B11-444W
    b. Jones J1900W
    c. McDonald 6101W
    d. Mueller B20200

WL14 – Water Sample Station

1) Sample Station Cabinet:
    a. Kupferle model 88 (cabinet only)

2) Tapping Service Saddle:
    a. C-900 Pipe:
        - Ford S90 and 202BS
        - Jones J996
        - McDonald 3806-1 and 3846-1
        - Mueller H134
    b. Ductile Iron & A.C. Pipe:
        - Ford 202B
        - Jones J979
        - McDonald 3826-1
        - Mueller BR2B

3) 1" Corporation Stop Brass Ball Valve (MIP by FIP):
    a. Ford FB1700
    b. McDonald 3149B
    c. Jones J3401-SG
    d. Mueller B25008

4) Cathodic Protection:
    a. Anode – 9 lb high potential magnesium anode, bagged in burlap sack with gypsum/bentonite/sodium powder and 10' long 10 gauge solid copper cable with black THHN insulation.

MISCELLANEOUS DETAILS

MS01 – Street Tree (planting)

1) Root Barrier:
    a. Century Products 24” diameter by 12” or approved equal

MS02 – Street Tree (streetscape)

1) Root Barrier:
    a. Century Products 24” diameter by 12” or approved equal

2) Bubbler:
    a. Toro 570570-FB-25-PC

3) Tree Grate:
    a. 48” by 48” tree well – Neenah R9002
    b. 64” by 32” tree well – Neenah R9105

APPENDIX H

Public Works Details - Water-Misc

WATER MAIN INSTALLATION

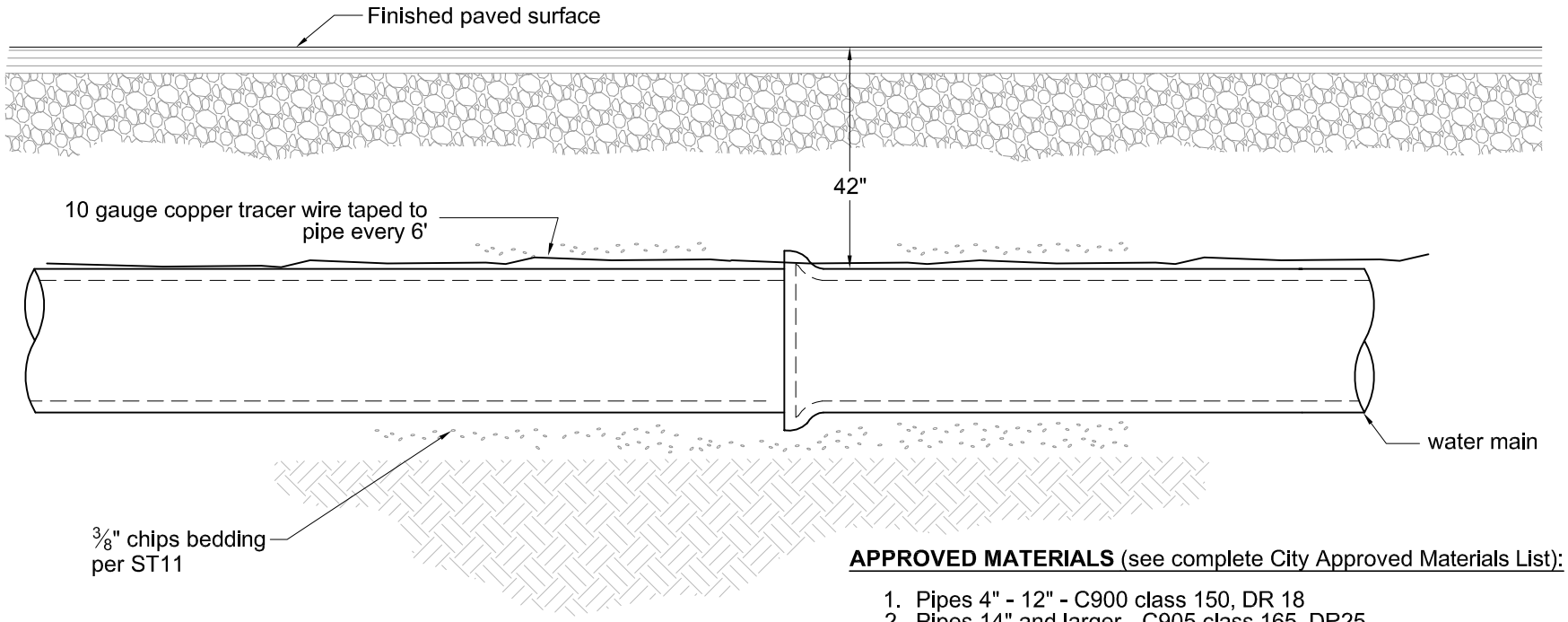
SCALE: NONE

APPROVED:

DATE: March 2016

WL01

STANDARD DETAIL



APPROVED MATERIALS (see complete City Approved Materials List):

1. Pipes 4" - 12" - C900 class 150, DR 18
2. Pipes 14" and larger - C905 class 165, DR25
3. Above Ground - Ductile Iron Pipe - Class 200 epoxy coated
   a. 8 mil polyethylene wrap (polywrap)
4. Valves and Fittings - Ductile Iron with 250 psi pressure rating

NOTES:

1. Water mains shall be parallel with and run 6' on the North or East side of the road centerline.
2. Water mains shall be seperated from sewer mains a minimum of 10 feet and from all other utilites a minimum of 5 feet.
3. Maximum spacing between isolation valves is 500'.
4. Valves shall be provided on all legs of an intersection of mains (i.e. 3 valves for "T" intersection and 4 valves for cross intersection).
5. A mainline valve shall be installed on each side of services to hospitals, schools, and major commercial/industrial sites.
6. Pipes Copper tracer wire (10 gauge insulated solid wire) shall be taped to pipe at 4' intervals and run continuous along all water mains.
7. After backfilling, the water system will be inspected by the City Inspector and shall be leak free under pressure. Any portion of the service line or fittings that have not been inspected or is damaged will not be accepted.
8. Entire water service line is required to be leak free under pressure.
9. Furnish and install 8-mil polyethylenepoly-wrap on all metallic pipe in accordance with AWWA C-105. Epoxy coatings are also an acceptable alternative type of coating system for the pipe subject to the approval of the City Engineer.
10. Where the City Engineer has identified that the water system requires cathodic protection, contractor shall furnish and install cathodic protection system on all metallic components of the water system. Cathodic protection system designs shall be in accordance with NACE Standard RP0169-02 submitted to the City for review and approval prior to installation.

WATER SERVICE

3/4" and 1" Meters

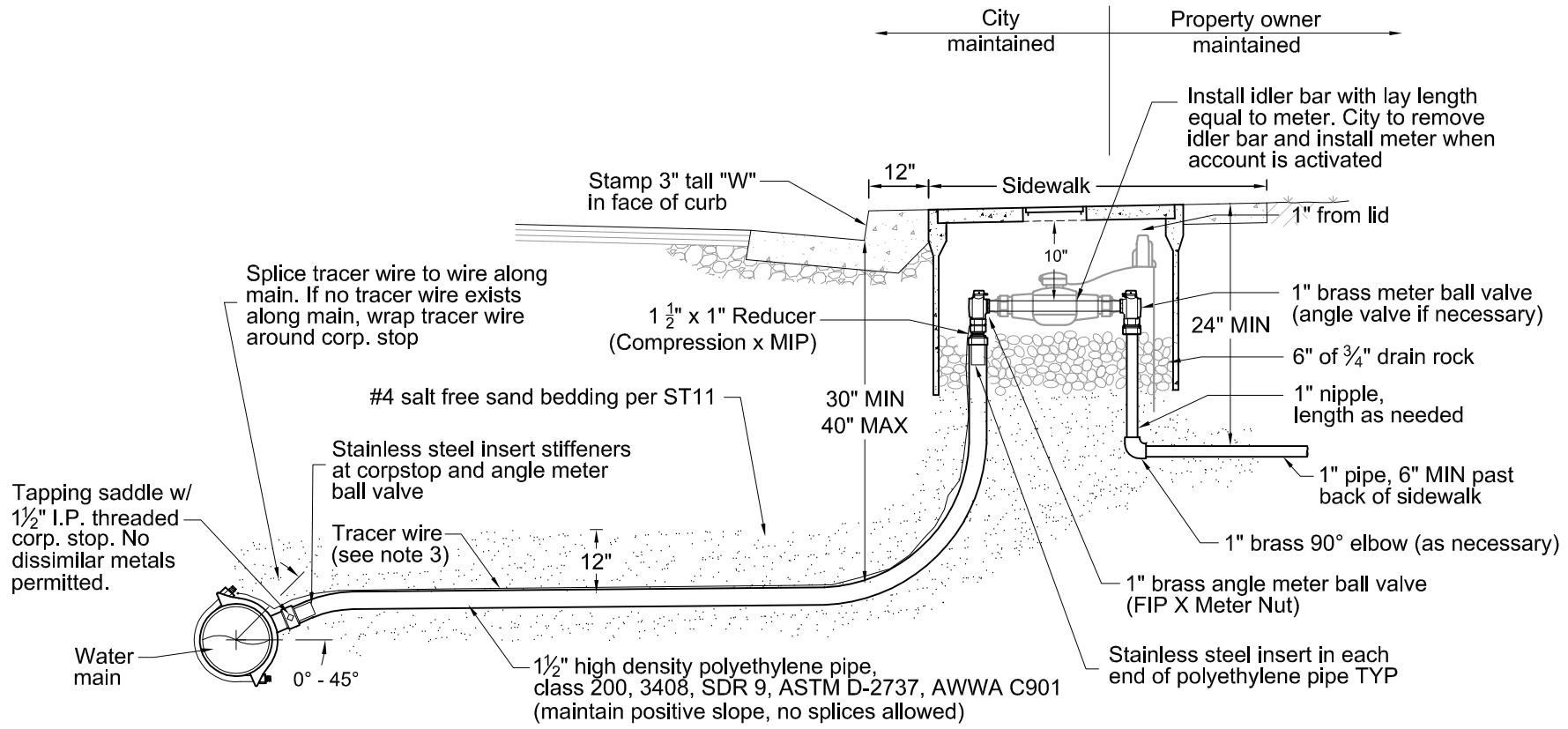
SCALE: NONE

APPROVED:

DATE: March 2016

WL02

STANDARD DETAIL



NOTES:

1. Connections to the water main:
   a. 5' MIN horizontal separation from sewer laterals.
   b. 2' MIN separation from an adjacent tap or mainline joint.
2. Boring or trenching under curb, gutter, or sidewalk for installation or repair is prohibited.
3. Copper tracer wire (10 gauge insulated solid wire) shall be taped to pipe at 4' intervals and run continuous from the water main and terminate in the meter box. Do not wrap tracer wire around pipe.
4. Prior to backfilling, the entire water service line will be inspected by the City Inspector and shall be leak free under pressure. Any portion of the service line or fittings that have not been inspected or are damaged will not be accepted.
5. Water meter and ERT to be furnished and installed by City.
6. Tape coating shall be applied to all buried brass and steel pipe, fittings, connections and sections in accordance with ANSI/AWWA C214-95 and C209-95.

APPROVED MATERIALS (see complete City Approved Materials List):

1. Water Meter: 1" Badger model 70 with model 100W Itron ERT and HR-E Encoder
2. Meter Box:
   a. Box - Armorcast 13"x24"x12" Polymer Concrete Box A6001946PCX12
   b. Lid - Armorcast 13"x24"x2" Polymer Concrete Cover with AMR/AMI Top Mount A6001969-TH (20K - ANSI Tier 22) - lid marked "WATER"
3. Tapping Saddle: IP Thread Tapping Service Saddle
   a. C-900 Pipe - Ford S91
   b. DIP - Ford 202B

WATER SERVICE
1½" and 2" Meters

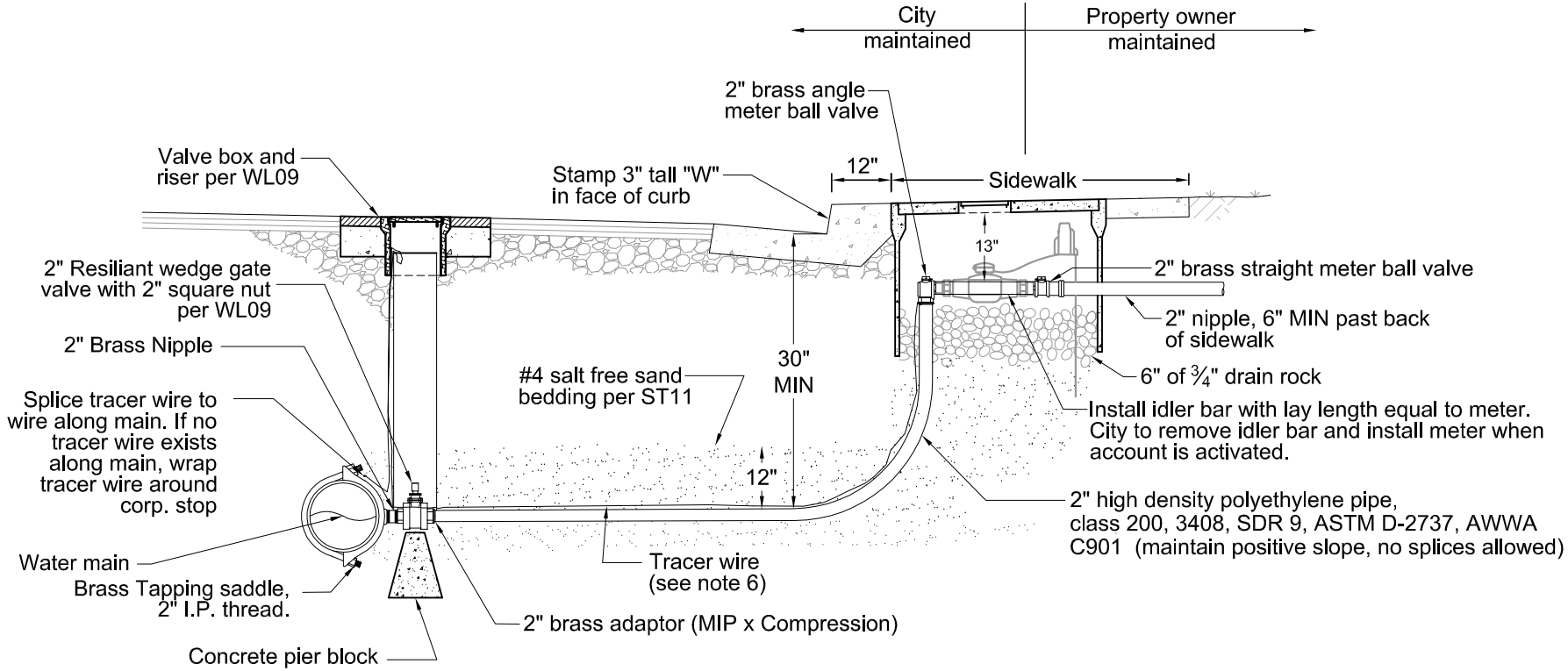
SCALE: NONE

APPROVED:

DATE: March 2016

WL03

STANDARD DETAIL



NOTES:

1. Connections to the water main:
   a. 5' MIN horizontal separation from sewer laterals.
   b. 2' MIN separation from an adjacent tap or mainline joint.
2. Boring or trenching under curb, gutter, or sidewalk for installation or repair is prohibited.
3. If more than a full length of pipe is required, a compression coupling shall be used.
4. Prior to backfilling, the entire water service line is required to be inspected by the City Inspector and shall be leak free under pressure. Any portion of the service line or fittings not have not been inspected or are damaged will not be accepted.
5. Copper tracer wire (10 gauge insulated solid wire) shall be taped to pipe at 4' intervals and run continuous from the water main and terminate in the meter box. Do not wrap tracer wire around pipe.
6. Water meter and ERT to be furnished and installed by City.
7. Tape coating shall be applied to all buried brass and steel pipe, fittings, connections and sections in accordance with ANSI/AWWA C214-95 and C209-95.

APPROVED MATERIALS (see complete City Approved Materials List):

1. Water Meter:
   a. 1½" model 120 Badger with Itron model 100W ERT and HR-E Encoder
   b. 2" model 170 Badger with Itron model 100W ERT and HR-E Encoder
2. Box - Armorcast 17"x30"x12" Polymer Concrete Box A6001640PCX12

   Lid - Armorcast 17"x30"x2" Polymer Concrete Cover with AMR/AMI Top Mount A6001647HD (20K - ANSI Tier22) - lid marked "Water"
3. Tapping Saddle: IP Thread Brass Tapping Service Saddle
   a. C-900 Pipe - Ford 202BS
   b. DIP - Ford 202B

WATER SERVICE
4", 6" and 8" Meters

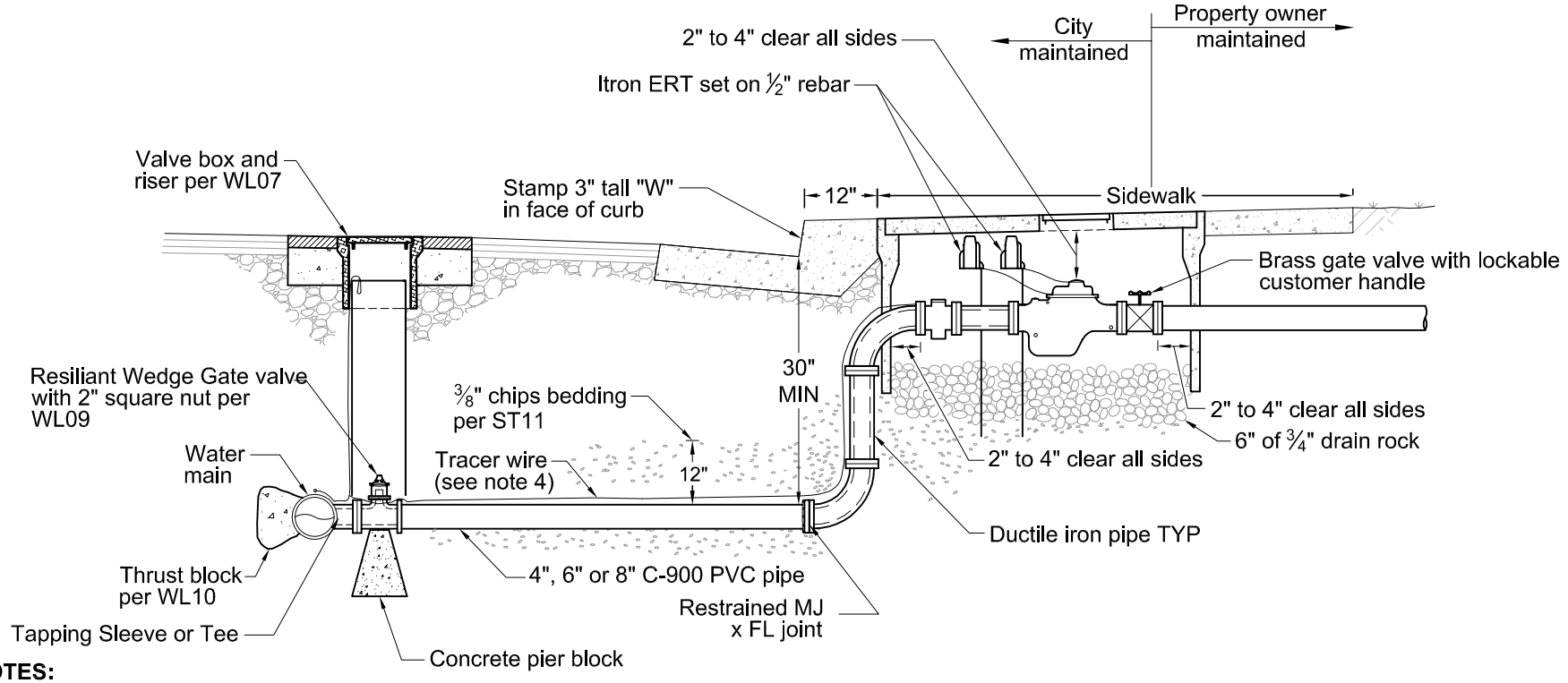
SCALE: NONE

APPROVED:

DATE: March 2016

WL04

STANDARD DETAIL

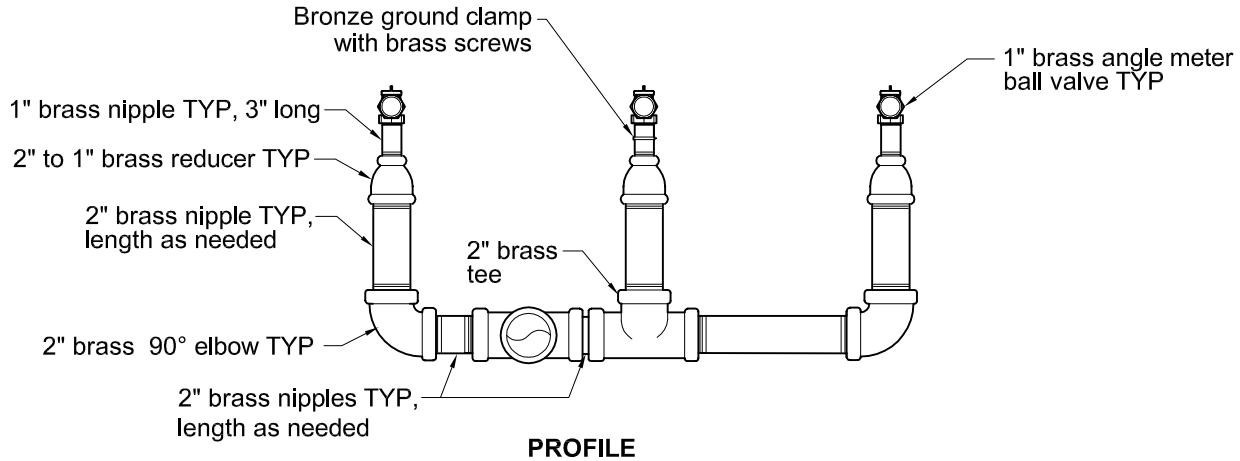


NOTES:

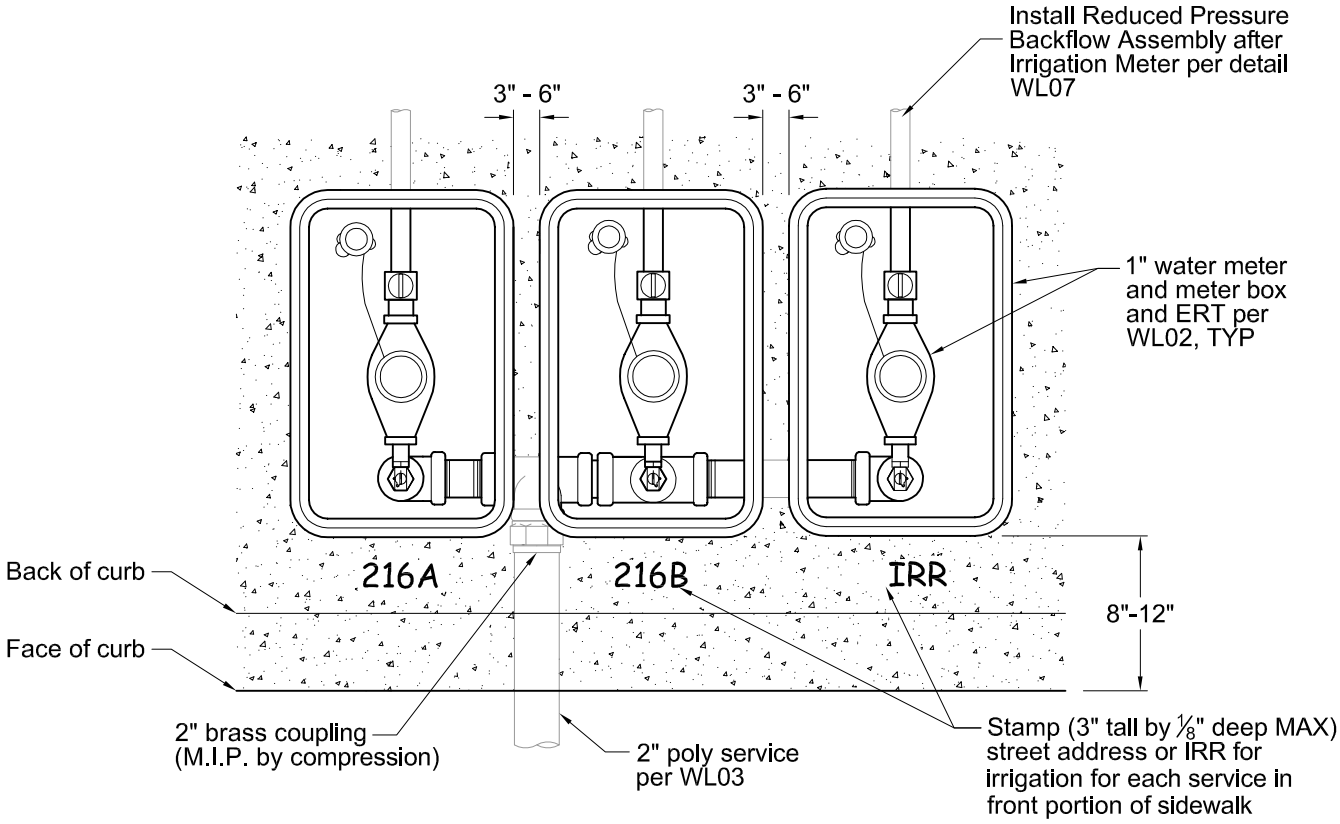
1. Connections to the water main:
   a. 5' MIN horizontal separation from sewer laterals.
   b. 2' MIN separation from an adjacent tap or mainline joint.
   c. Connection to water main shall be with a flanged tee, except where the service size is not more than half the diameter of the main, a tapping saddle may be used.
2. Boring or trenching under curb, gutter or sidewalk for installation or repair is prohibited.
3. Copper tracer wire (10 gauge insulated solid wire) shall be taped to pipe at 4' intervals and run continuous from the water main and terminate in the meter box.
4. Bypass line may be required by the City Engineer for critical facilities.
5. After backfilling, the entire water service line will be inspected by the City Inspector and shall be leak free under pressure. Any portion of the service line or fittings that have not been inspected or are damaged will not be accepted.
6. Water meter, plate strainer and Itron ERT to be furnished and installed by contractor.
7. All Ductile Iron pipe and fittings shall be provided with a bituminous coating from the factory and encased in an 8-mil polyethylene bag in the field in accordance with AWWA C-105. All bolts, restraining rods, etc. shall be coated with bitumastic prior to encasement in the polyethylene bag.
8. Tape coating shall be applied to all buried brass and steel pipe, fittings, connections and sections in accordance with ANSI/AWWA C214-95 and C209-95

APPROVED MATERIALS (see complete City Approved Materials List):

1. Water Meter: 4", 6", or 8" Badger compound series meter with bronze plate strainer, (2) Itron model 100W ERT's and HR-E Encoders
2. Meter Box:
   a. Armorcast Polymer Concrete Box, sized to fit, with AMR/AMI Top Mount (20K -ANSI Tier 22) - Lid marked "Water"
3. Tapping Sleeve - Stainless Steel, IP Thread, Ford FTSS



PROFILE

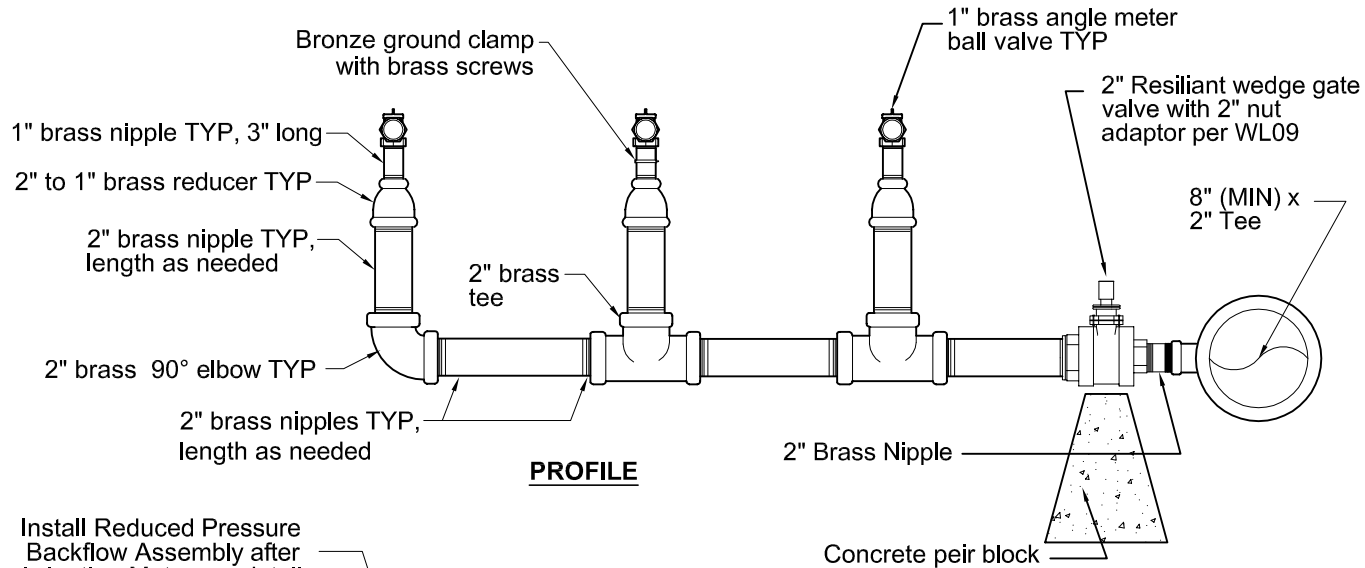


PLAN VIEW

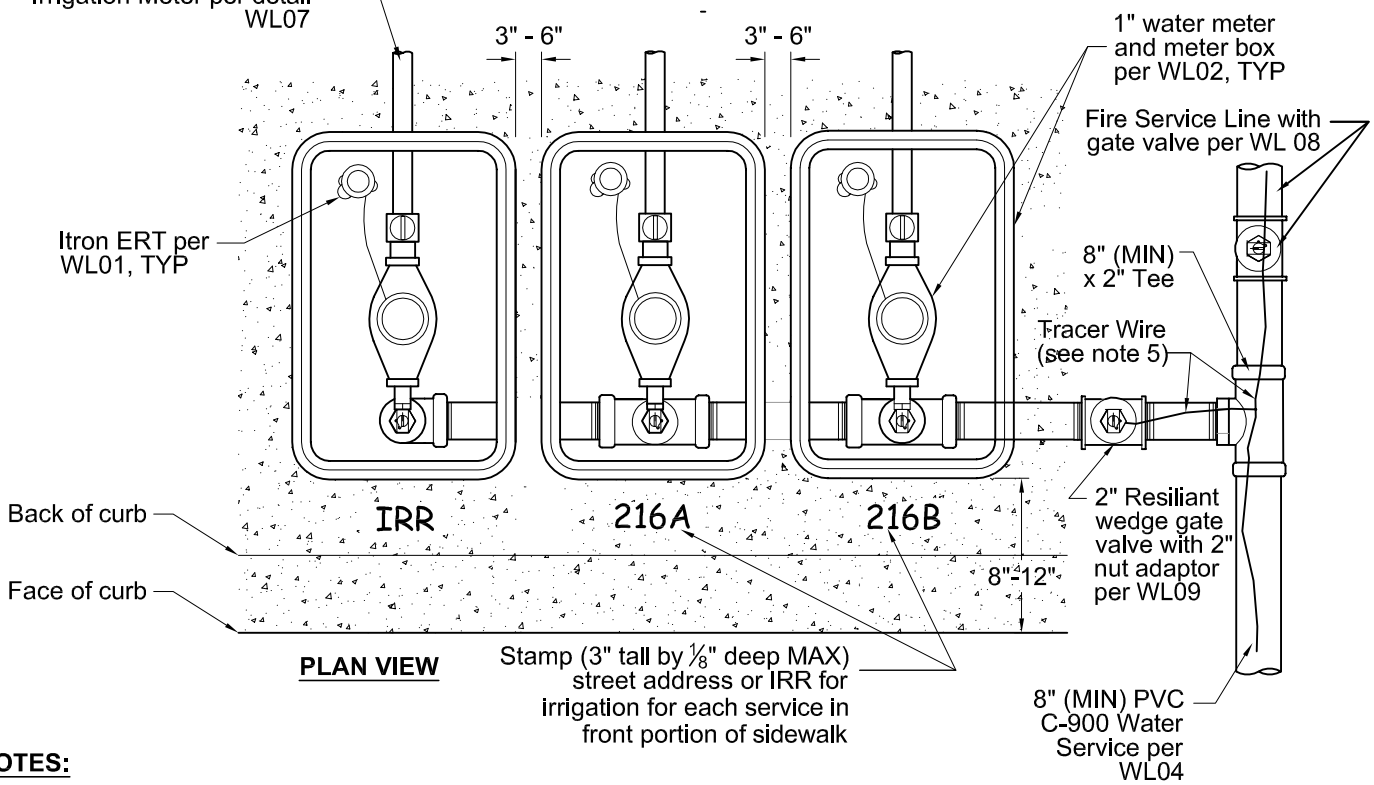
NOTES:

1. Up to four 1" meters may be manifolded off of a 2" poly service line.
2. Manifolds larger than 2" require written approval by the City Engineer.
3. Fittings used in the manifold assembly shall be solid brass, no copper fittings shall be used.
4. Prior to backfilling, the entire water service line and manifold will be inspected by the City Inspector and shall be leak free under pressure. Any portion of the service line, manifold or fittings that have not been inspected or are damaged will not be accepted.
5. Brass manifold shall be bedded in #4 salt free sand per Trench Detail.
7. Tape coating shall be applied to all buried brass and steel pipe, fittings, connections and sections in accordance with ANSI/AWWA C214-95 and C209-95.

	# WATER SERVICE ## Manifold Multiple Meters off 2" Service	STANDARD DETAIL WL05
SCALE: NONE	APPROVED:	DATE: March 2016



PROFILE



PLAN VIEW

NOTES:

1. Calculations must be provided to show fire service line is of sufficient size to meet both the fire flow and domestic peak demands including irrigation.
2. Permitted only in locations where approved by City Engineer due to difficulty in tapping City water main for domestic service. Tap from Fire Service Line shall occur prior to the backflow assembly.
3. Fittings used in the manifold assembly shall be solid brass, no copper fittings shall be used.
4. After backfilling, the entire water service line and manifold is required to be inspected by the City Inspector and to be leak free under pressure. Any portion of the service line, manifold or fittings not inspected or damaged will not be accepted.
5. The brass manifold shall be tied to the existing tracer wire on the Fire Service Line where available.
6. Brass manifold shall be bedded in #4 salt free sand per Trench Detail.
7. Tape coating shall be applied to all buried brass and steel pipe, fittings, connections and sections in accordance with ANSI/AWWA C214-95 and C209-95.

CITY OF TEALDOBLING	# WATER SERVICE ## Manifold Meters and Fire Line off Single Lateral	STANDARD DETAIL WL06
SCALE: NONE	APPROVED:	DATE: March 2016

BACKFLOW ASSEMBLY

Reduced Pressure

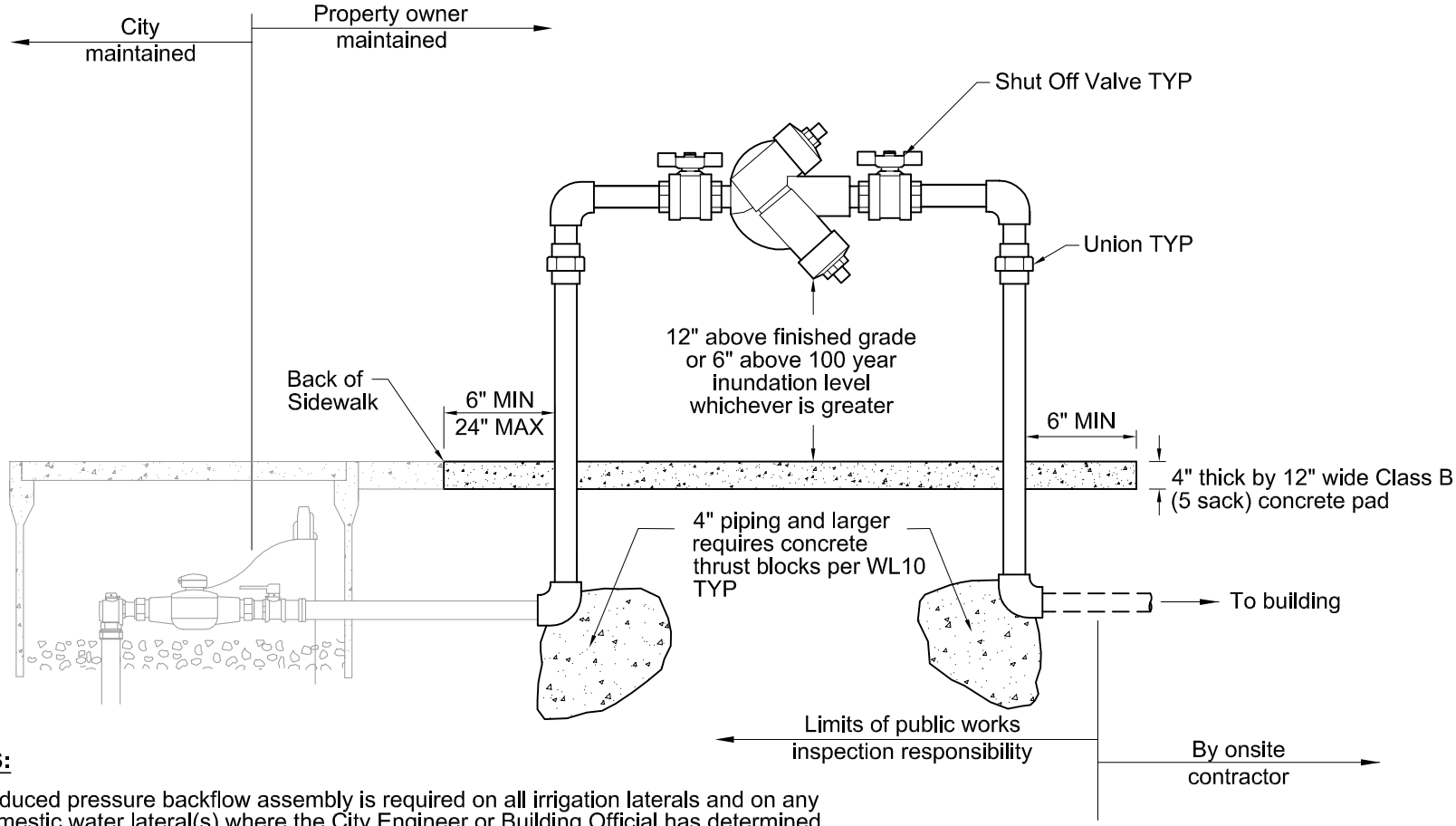
SCALE: NONE

APPROVED:

DATE: March 2016

STANDARD DETAIL

WL07

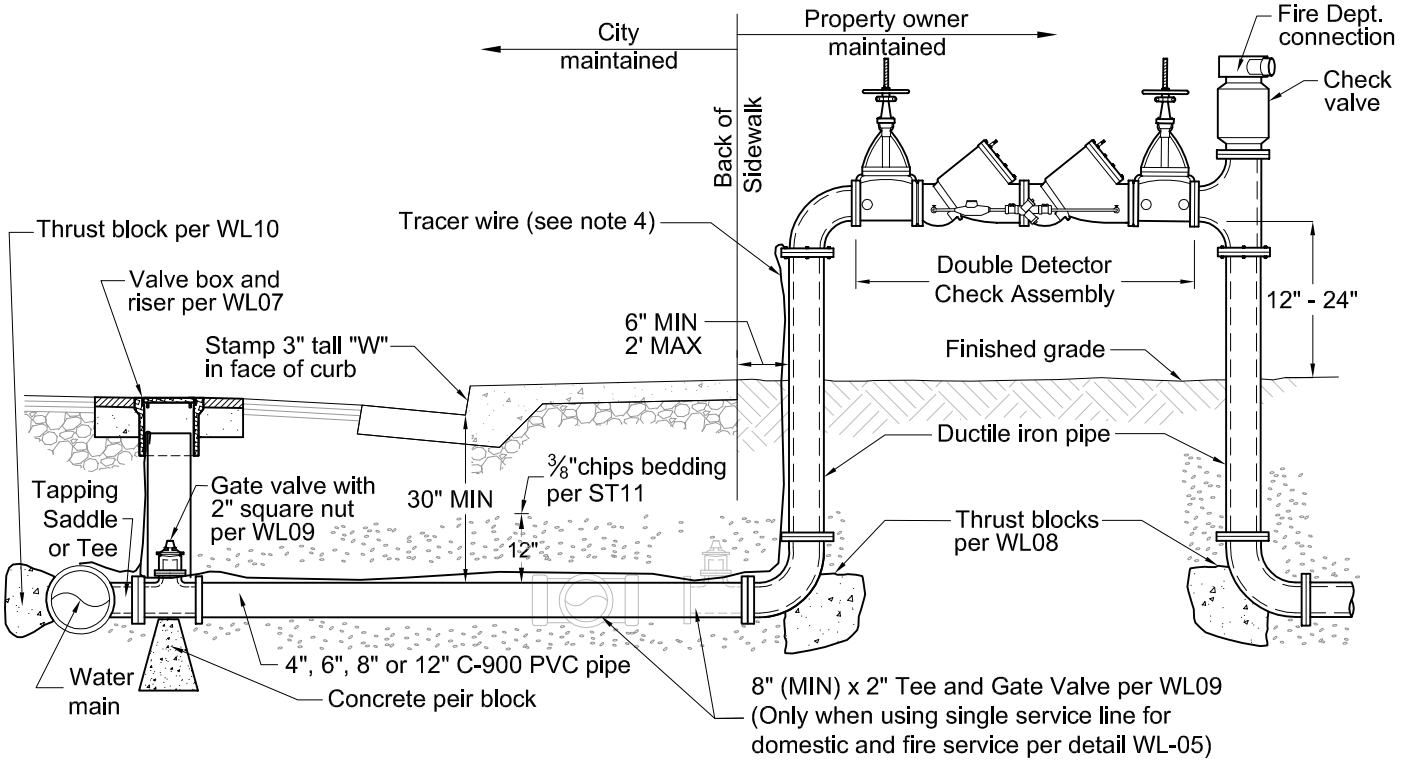


NOTES:

1. Reduced pressure backflow assembly is required on all irrigation laterals and on any domestic water lateral(s) where the City Engineer or Building Official has determined there is a risk of cross contamination such as at an industrial or manufacturing sites.
2. Connections or tees between the water meter and the backflow assembly are prohibited.
3. Backflow assemblies shall not be closer than 5' to a driveway, parking space, etc. and shall allow sufficient room for maintenance and testing of the backflow assembly.
4. Backflow assemblies shall be tested in place for the initial installation and on an annual basis thereafter. Test report shall be provided to the Public Works Department prior to acceptance. A list of recognized testers is available from the Public Works Department.
5. All Ductile Iron pipe and fittings shall be provided with a bituminous coating from the factory and encased in an 8-mil polyethylene bag in the field in accordance with AWWA C-105. All bolts, restraining rods, etc. shall be coated with bitumastic prior to encasement in the polyethylene bag.
7. Tape coating shall be applied to all buried brass and steel pipe, fittings, connections and sections in accordance with ANSI/AWWA C214-95 and C209-95.

APPROVED MATERIALS (see complete list)**:**

1. Piping and fittings:
   a. 3" and smaller assemblies - threaded brass, type "K" hard-tempered copper or galvanized pipe
   b. 4" and larger assemblies - flanged ductile iron
2. Reduced pressure backflow assemblies appearing on "List of Approved Backflow Prevention Devices" (latest edition) by the University of Southern California Foundation for Cross Connection Control and Hydraulic Research.
3. Freeze protection is required and shall be a commercially available insulated blanket with green weather resistant outer covering locked in place.



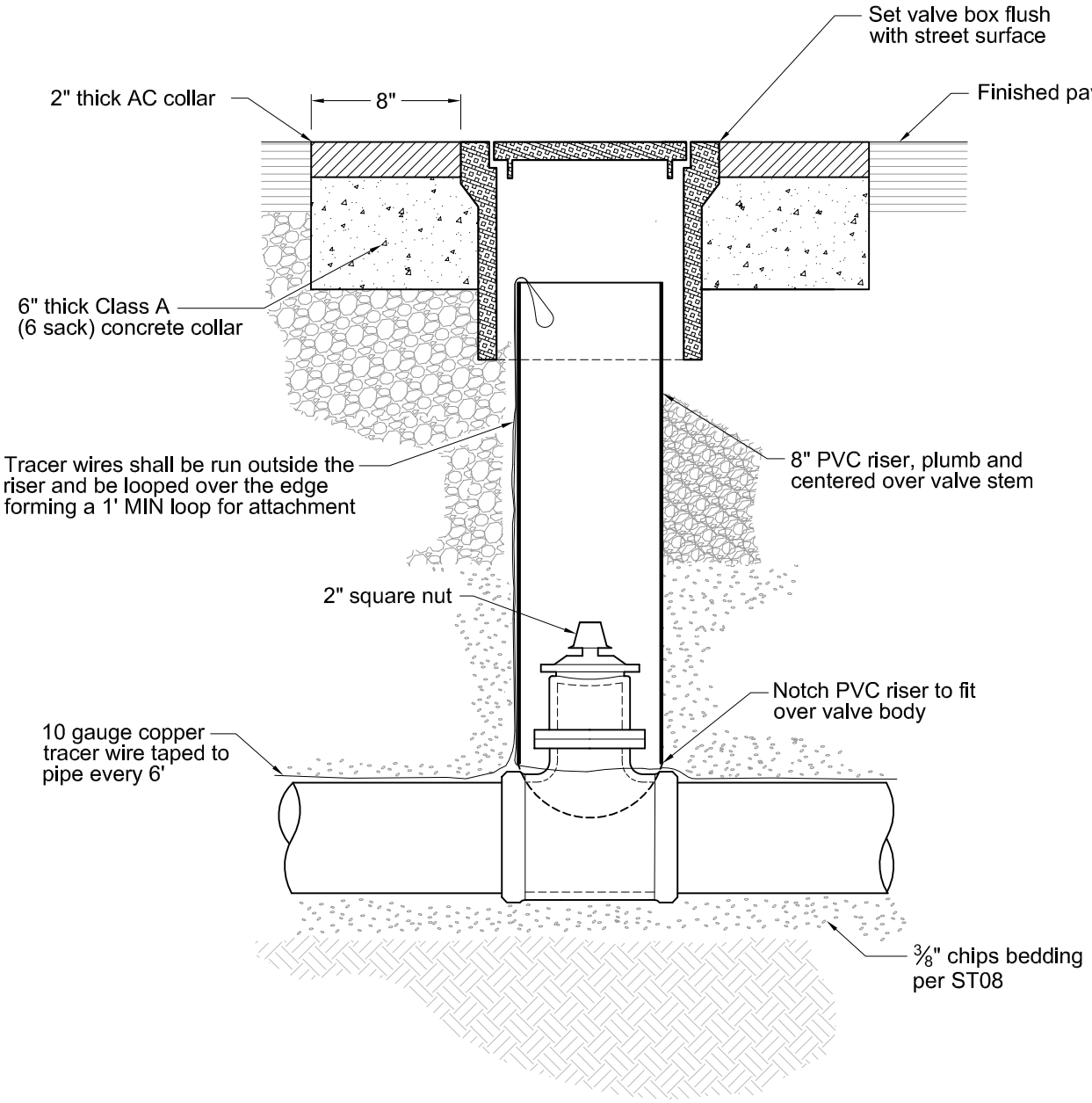
NOTES:

1. Backflow Assembly Requirements:
   a. Located no closer than 5' to a driveway, parking space, etc. and allow sufficient room for maintenance and testing.
   b. Tested in place for the initial installation and on an annual basis thereafter. Test report shall be provided to the Public Works Department prior to acceptance. A list of approved testers is available from the Public Works Department.
   c. Tamper switches, freeze protection and similar objects shall be installed to allow for access to test cocks for testing and maintenance of the assembly.
   d. Valve handles on bypass assembly shall be removed.
2. Connection Requirements:
   a. Connection to water main shall be with a flanged tee, except where the service size is not more than half the diameter of the main, a tapping saddle may be used.
   b. Connections or tees between the water main and the backflow assembly are prohibited.
3. Copper tracer wire (10 gauge insulated solid wire) shall run continuous from the water main, loop up into the valve box and terminate above grade at a bolted connection on the backflow assembly.
4. Fire Department Requirements:
   a. Fire Dept. connection shall be easily accessible without interference from shut off valves or adjacent objects.
   b. Shut off valves shall be resilient wedge OS&Y, pad locked in open position with tamper switches and monitoring station as approved by the City Fire Department.
5. All Ductile Iron Pipe and fittings shall be provided with a bituminous coating from the factory and encased in an 8-mil polyethylene bag in the field in accordance with AWWA C-105. All bolts, restraining rods, etc. shall be coated with bitumastic prior to encasement in the polyethylene bag.
7. Tape coating shall be applied to all buried brass and steel pipe, fittings, connections and sections in accordance with ANSI/AWWA C214-95 and C209-95.

APPROVED MATERIALS (See complete City Approved Materials List):

1. Backflow Assembly (unit includes paired Badger bypass meter with separate double check backflow assembly):
   a.Backflow assemblies for use in fire services appearing on "List of Approved Back Flow Prevention Devices" (latest edition) by the University of Southern California Foundation for Cross Connection Control and Hydraulic Research.
2. Tapping Sleeve - Stainless Steel, IP Thread, Ford FTSS
3. Freeze protection is required (most critically over the bypass meter and double check assembly) and shall be a commercially available insulated blanket with green weather resistant outer covering locked in place. Other covers or screening require written approval of the City Engineer.

CITY OF MEADOWVIEW	# Fire Service Line ## With Double Detector Check Backflow Assembly	STANDARD DETAIL WL08
SCALE: NONE	APPROVED:	DATE: March 2016



NOTES:

1. All metallic valves shall be epoxy coated from the factory and all bolts shall be coated with bitumastic in the field and the entire valve shall be encased in an 8-mil polyethylene bag in accordance with AWWA C-105.

APPROVED MATERIALS (see complete City Approved Materials List)**:**

1. Valve:

   a. 2", 4", 6", 8", and 12" resilient wedge gate valve

2. Valve Box: Christy G05 box with G05C lid marked "WATER"

City Of Healdsburg	VALVE	STANDARD DETAIL WL09
SCALE: NONE	APPROVED:	DATE: March 2016

THRUST BLOCKING

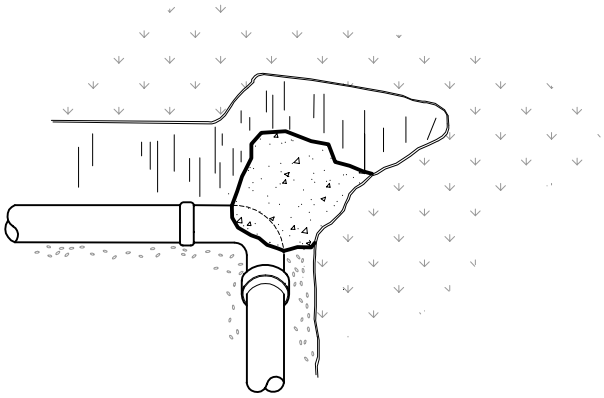
SCALE: NONE

APPROVED:

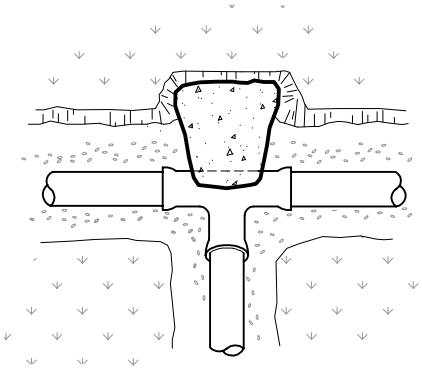
DATE: March 2016

WL10

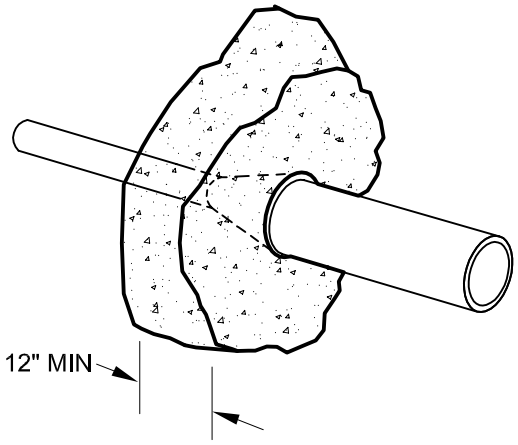
STANDARD DETAIL



BEND



TEE



REDUCER

NOTES:

1. Table of thrust block dimensions at right are calculated for soil bearing capacity of 2,000 lbs. per sq-ft. The Consulting Engineer shall specify thrust blocking requirements for all other soil bearing conditions.
2. Safe bearing load of soil for horizontal thrust shall not be exceeded. Concrete blocking, cast in place, shall extend from bells of pipe to undisturbed ground. Concrete shall not be placed on or around nuts and bolts.
3. For plugged leg(s) of tee or cross use concrete blocking indicated in table to the right. Other additional concrete thrust blocking may be required by City Engineer.
4. All Ductile Iron pipe and fittings shall be provided with a bituminous coating from the factory and encased in an 8-mil polyethylene bag in the field in accordance with AWWA C-105. All bolts, restraining rods, etc. shall be coated with bitumastic prior to encasement in the polyethylene bag.

APPROVED MATERIALS (see complete City Approved Materials List):

1. Concrete shall be Class B (5 sack). For small amounts a U-cart with rotating drum from a certified plant may be used (no hand mix).

Pipe Diameter	Minimum bearing area required (see note 1)				
	90° Bend	45° Bend	22 ½° Bend	Tee	Reducer
4"	3 sq-ft	2 sq-ft	1 sq-ft	2 sq-ft	2 sq-ft
6"	6 sq-ft	3 sq-ft	2 sq-ft	4 sq-ft	3 sq-ft
8"	9 sq-ft	5 sq-ft	3 sq-ft	7 sq-ft	4.5 sq-ft
10"	15 sq-ft	8 sq-ft	4 sq-ft	11 sq-ft	8 sq-ft
12"	22 sq-ft	10 sq-ft	6 sq-ft	15 sq-ft	11 sq-ft

WATER MAIN CROSSING
Over A Structure

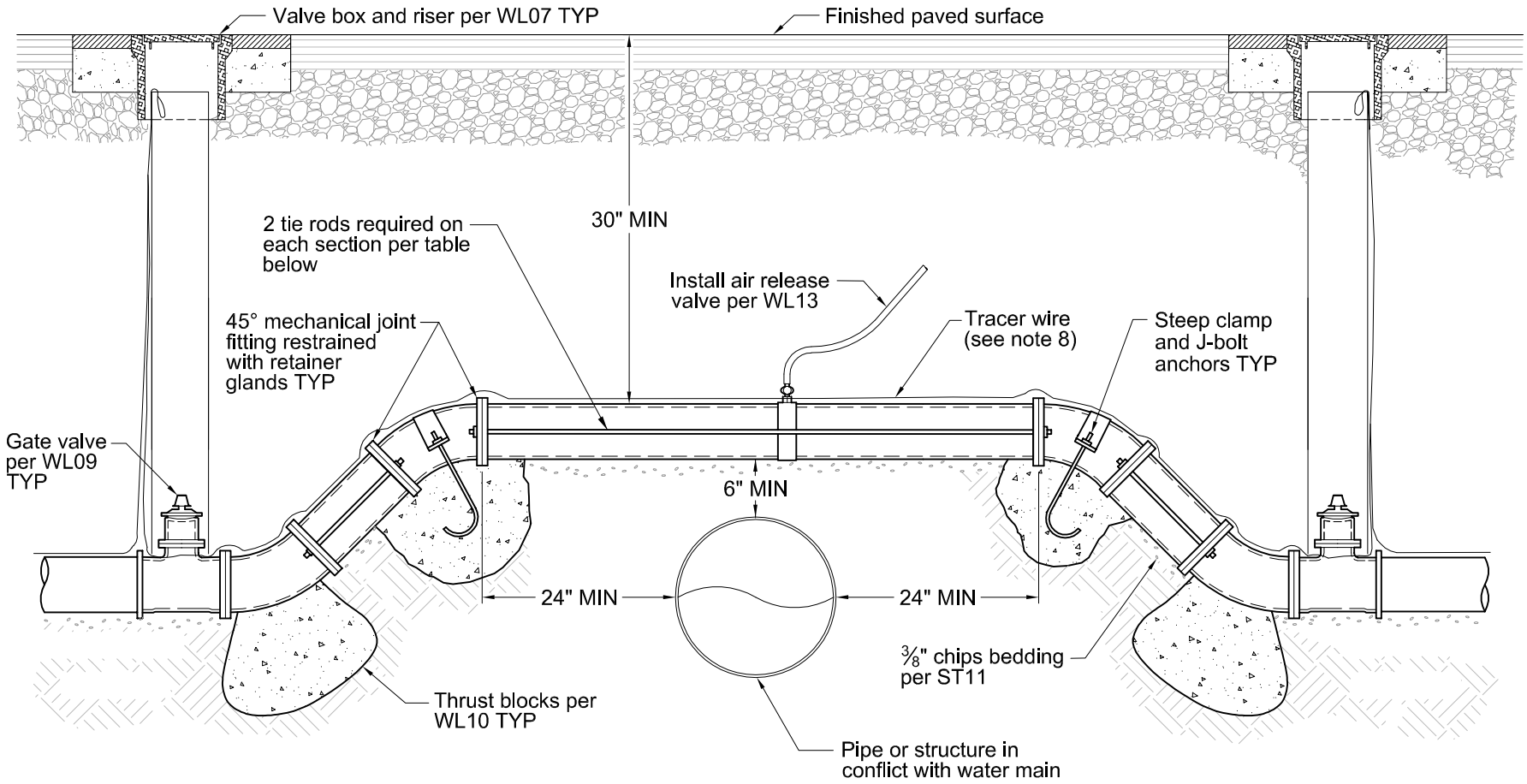
SCALE: NONE

APPROVED:

DATE: March 2016

WL11

STANDARD DETAIL



NOTES:

1. To be used only with written approval of the City Engineer.
2. All pipe and fittings in the crossing shall be ductile iron.
3. All hardware (nuts, bolts, tie rods, etc.) on underground fittings shall be stainless steel.
4. All joints shall be flanged or mechanical joint restrained.
5. All bends shall be 45° or less (90° bends prohibited).
6. All bolts shall be painted with an approved bituminous coating after nuts are tightened.
7. Copper tracer wire (10 gauge insulated solid wire) shall be taped to pipe at 4' intervals and run continuous along the water main crossing.
8. All ductile iron pipe and fittings shall be provided with a bituminous coating from the factory and encased in an 8-mil polyethylene bag in the field in accordance with AWWA C-105. All bolts, restraining rods, etc. shall be coated with bitumastic prior to encasement in the polyethylene bag.

Pipe Diameter	Tie Rod Diameter
6"	5/8"
8"	3/4"
12"	1 1/8"

WATER MAIN CROSSING
Under A Structure

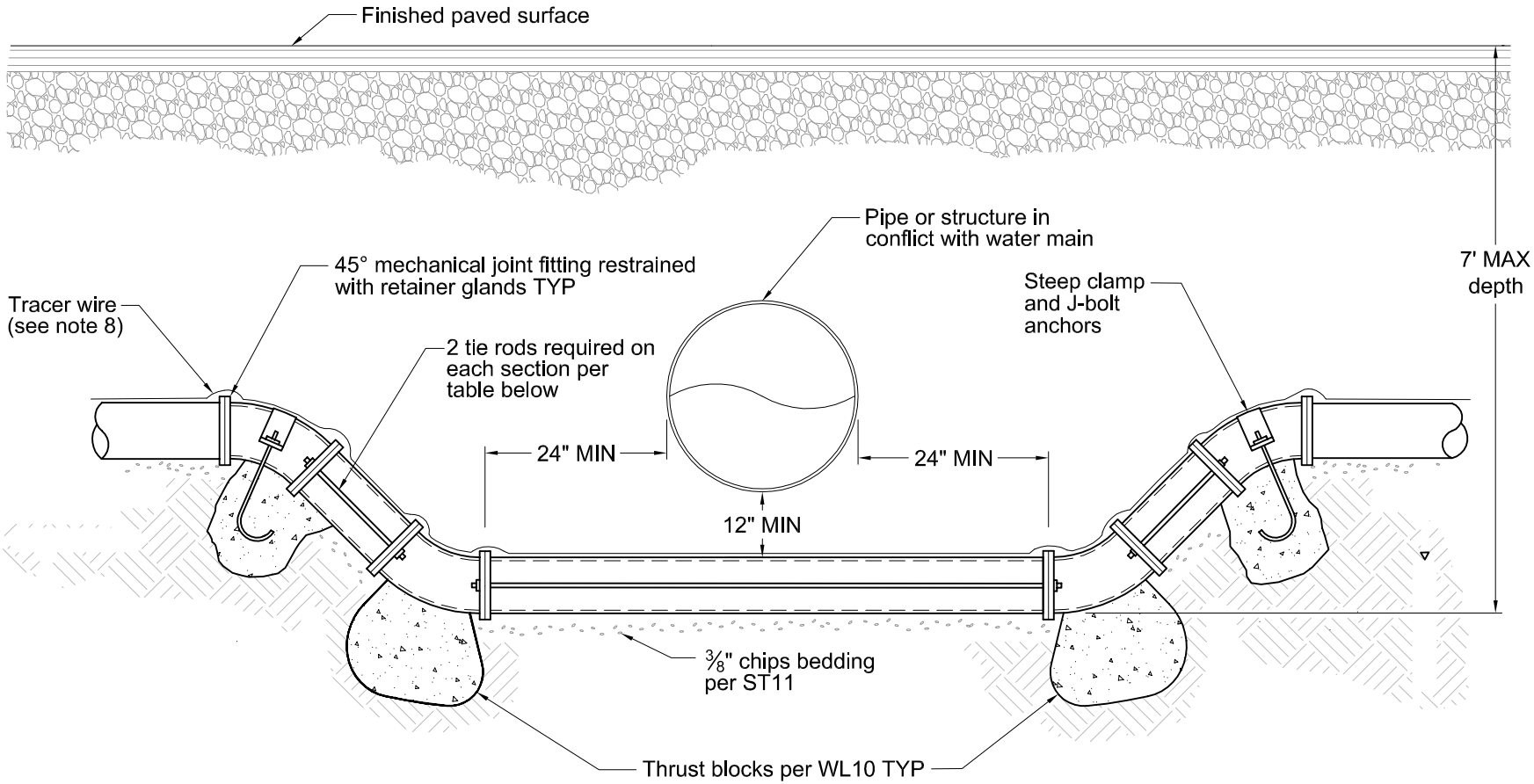
SCALE: NONE

APPROVED:

DATE: March 2016

WL12

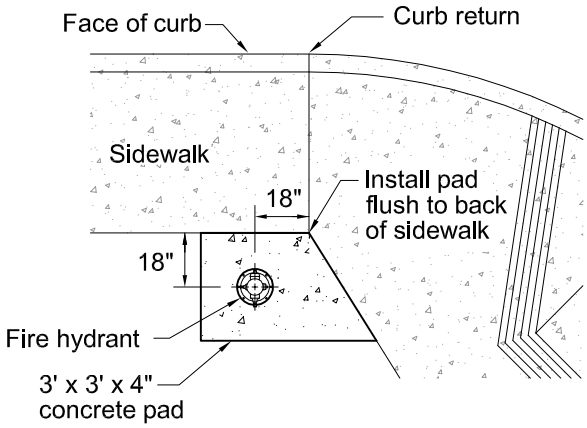
STANDARD DETAIL



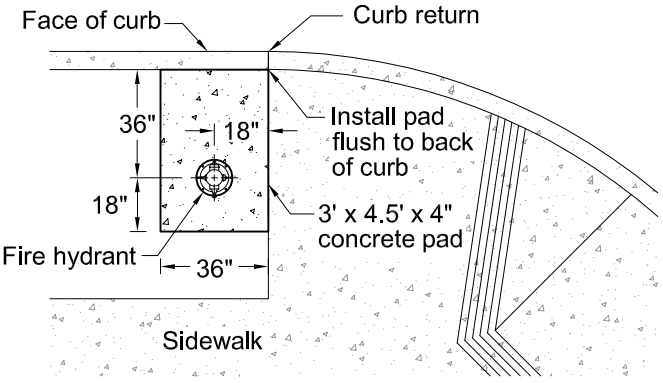
NOTES:

1. To be used only with written approval of the City Engineer.
2. All pipe and fittings in the crossing shall be ductile iron.
3. All hardware (nuts, bolts, tie rods, etc.) on underground fittings shall be stainless steel. All joints shall be flanged or mechanical joint fittings with retainer glands.
4. All bends shall be 45° or less (90° bends prohibited).
5. All bolts shall be painted with an approved bituminous coating after nuts are tightened.
6. Copper tracer wire (10 gauge insulated solid wire) shall be taped to pipe at 4' intervals and run continuous along the water main crossing and loop up into the valve boxes.
7. All ductile iron pipe and fittings shall be provided with a bituminous coating from the factory and encased in an 8-mil polyethylene bag in the field in accordance with AWWA C-105. All bolts, restraining rods, etc. shall be coated with bitumastic prior to encasement in the polyethylene bag.

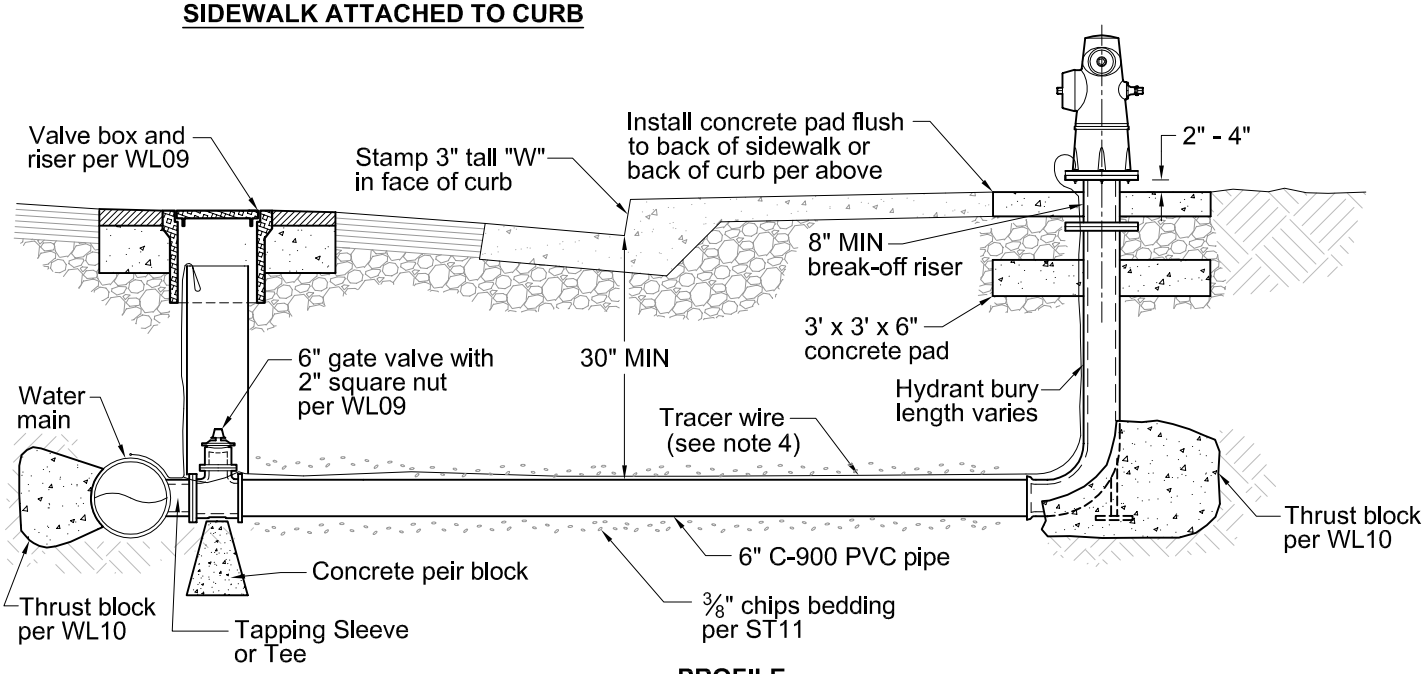
Pipe Diameter	Tie Rod Diameter
6"	5/8"
8"	3/4"
12"	1 ⅛"



PARK STRIP-
SIDEWALK ATTACHED TO CURB



SIDEWALK NOT ATTACHED TO CURB



PROFILE

APPROVED MATERIALS (see complete list)**:**

1. Concrete pads shall be Class B (5 sack)
2. Hydrants:
   a. Residental: Clow 960 or Jones J-4060
   b. Non-Residential: Clow 865 or Jones J-4065
3. Fire Hydrant Color: Benjamin & Moore safety orange (Z22-65 or P22-65)
4. Tapping Sleeve - Stainless Steel, IP Thread, Ford FTSS

NOTES:

1. Hydrants shall not be closer than 5' to a driveway (as measured from top of transition), parking lot space, etc.
2. Where a bollard, retaining wall, fence, etc. is located near a hydrant, maintain 3' clearance between hydrant and obstruction.
3. Copper tracer wire (10 gauge insulated solid wire) shall be taped every 4' and run continuous from the water main, loop up into the valve box and terminate at fire hydrant. Connect wire to hydrant by flange bolt.
4. Fire hydrant shall be installed so that 4½" outlet is at right angle to the street.
5. Place blue-colored reflectorized raised pavement marker, at centerline of street, perpendicular to hydrant. When hydrant is located on a corner, reflectorized markers shall be placed at centerline of both streets, perpendicular to hydrant.
6. All ductile iron pipe and fittings shall be provided with a bituminous coating from the factory and encased in an 8-mil polyethylene bag in the field in accordance with AWWA C-105. All bolts, restraining rods, etc. shall be coated with bitumastic prior to encasement in the polyethylene bag.

	# FIRE HYDRANT	STANDARD DETAIL WL13
SCALE: NONE	APPROVED:	DATE: March 2016

BLOW OFF

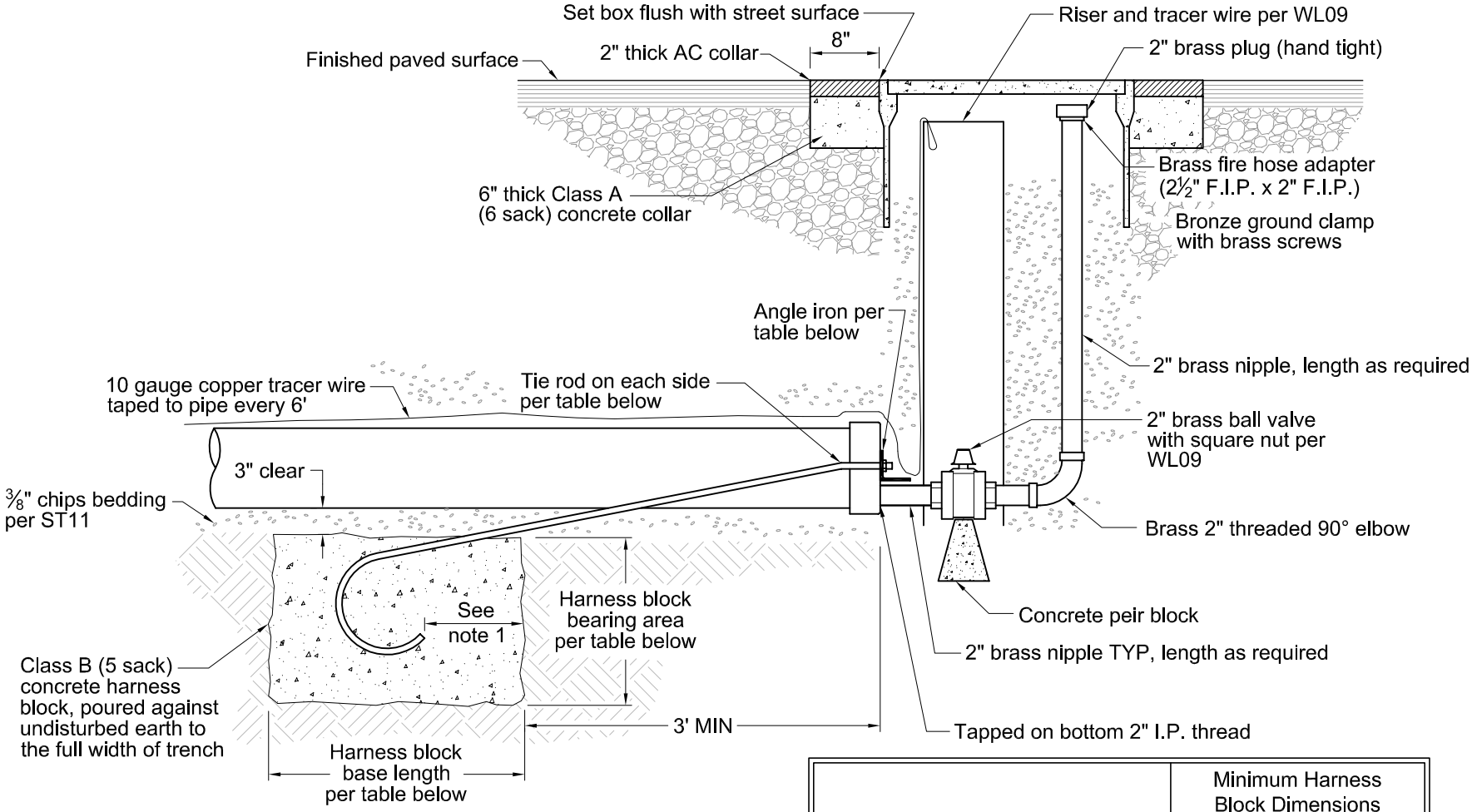
SCALE: NONE

APPROVED:

DATE: March 2016

WL14

STANDARD DETAIL



NOTES:

1. Tie rods shall have 6" MIN of concrete cover on all sides.
2. All exposed threads shall be painted with an approved bituminous coating after nuts are tightened.
3. Tape coating shall be applied to all buried brass and steel pipe, fittings, connections and sections in accordance with ANSI/AWWA C214-95 and C209-95.

APPROVED MATERIALS (see complete City Approved Materials List):

1. Box: Christy B1324 box with 61JH lid with "BLOW OFF" welded on face

			Minimum Harness Block Dimensions	
Pipe Diameter	Tie Rods	Angle Iron	Base Length	*Bearing Area
4"	½"	2½" x 2" x ¼"	2'	2 sq-ft
6"	⅝"	3" x 3" x ¼"	2'	4 sq-ft
8"	¾"	3" x 3" x ¼"	3'	7 sq-ft
10"	1"	4" x 3" x 5/16"	3'	11 sq-ft
12"	1⅛"	4" x 3" x ½"	3'	15 sq-ft
Pipe over 12" diameter - sizes specified by City Engineer				

*Bearing area is the height multiplied by the width of the face of the concrete harness block.

AIR RELEASE VALVE

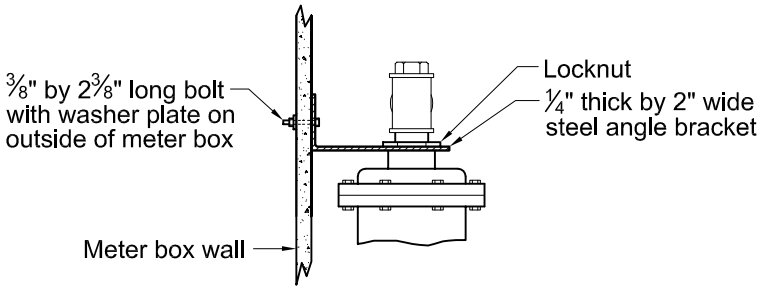
SCALE: NONE

APPROVED:

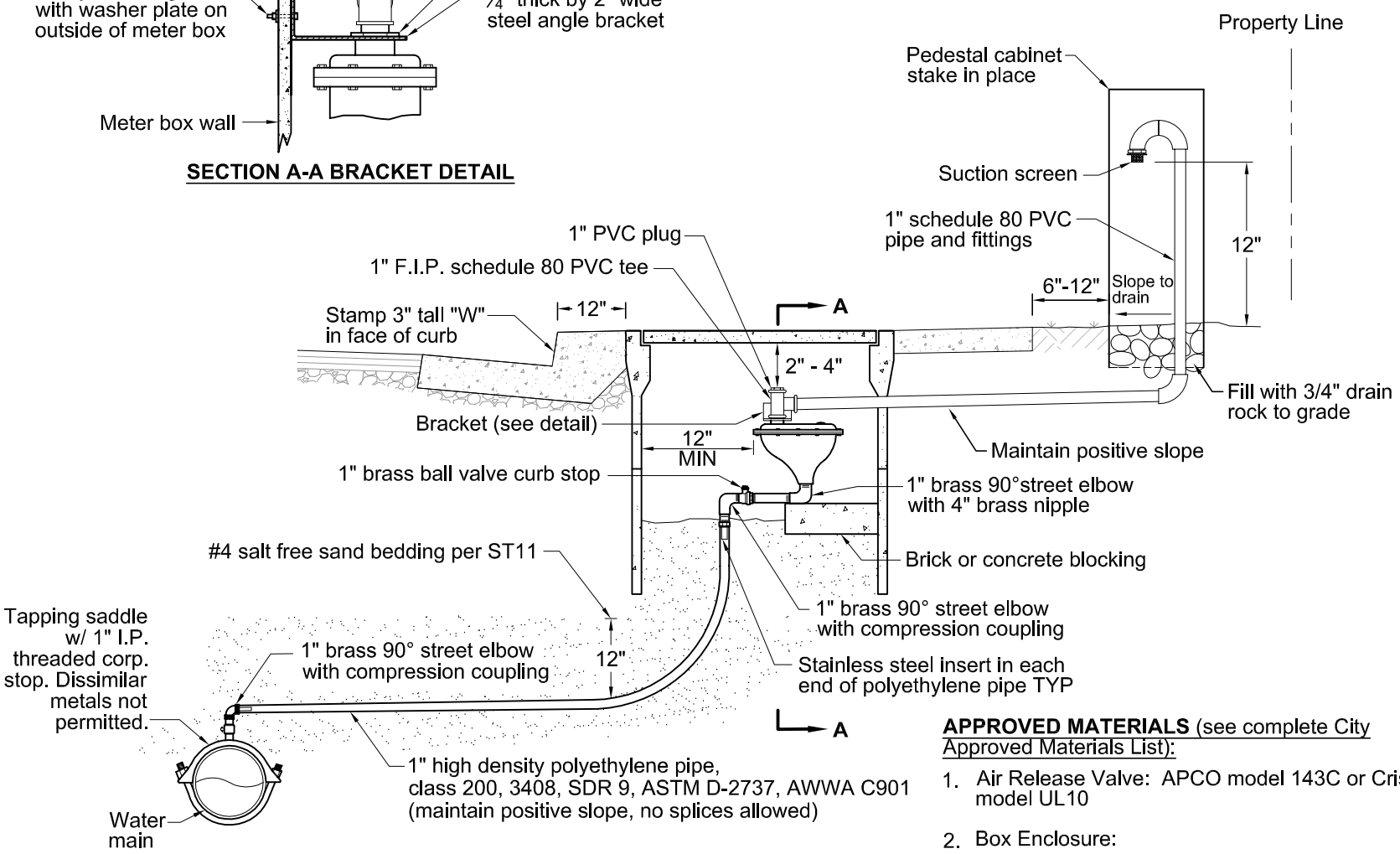
DATE: March 2016

WL15

STANDARD DETAIL



SECTION A-A BRACKET DETAIL



NOTES:

1. All exposed threads shall be painted with an approved bituminous coating after nuts are tightened.
2. Tape coating shall be applied to all buried brass and steel pipe, fittings, connections and sections in accordance with ANSI/AWWA C214-95 and C209-95.

APPROVED MATERIALS (see complete City Approved Materials List):

1. Air Release Valve: APCO model 143C or Crispen model UL10
2. Box Enclosure:
   a. Christy B36 with B36D lid marked "WATER"
   b. Box Extension - B36x12 extension
3. Pedestal Cabinet: Marconi TV80SB
4. Suction Screen: Flow Ezy Filters Inc.
5. Tapping Saddle: IP Thread Tapping Service Saddle
   a. C-900 Pipe - Ford S90 and 202BS
   b. DIP - Ford 202B

WATER SAMPLE STATION

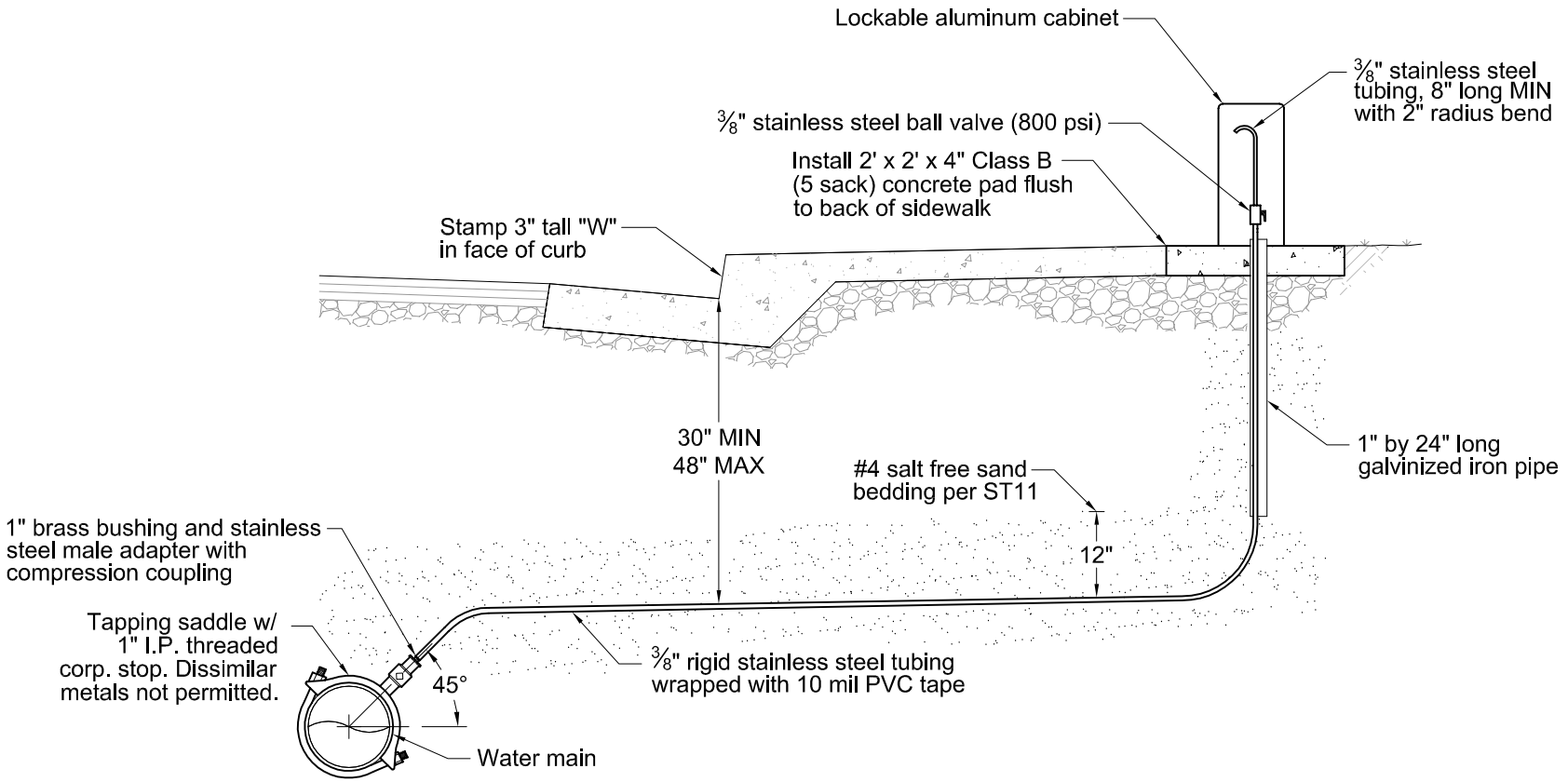
SCALE: NONE

APPROVED:

DATE: March 2016

WL16

STANDARD DETAIL



NOTES:

1. If more than one length of 3/8" stainless steel tubing is required, stainless steel compression couplings shall be used.
2. Tape coating shall be applied to all buried brass and steel pipe, fittings, connections and sections in accordance with ANSI/AWWA C214-95 and C209-95.

APPROVED MATERIALS (see complete City Approved Materials List):

1. Sample Station Cabinet: Kupferle model 88 (cabinet only)
2. Tapping Saddle: IP Thread Tapping Service Saddle
   a. C-900 Pipe - Ford S90 and 202BS
   b. DIP - Ford 202B

Recycled Water Service

All Meter Sizes

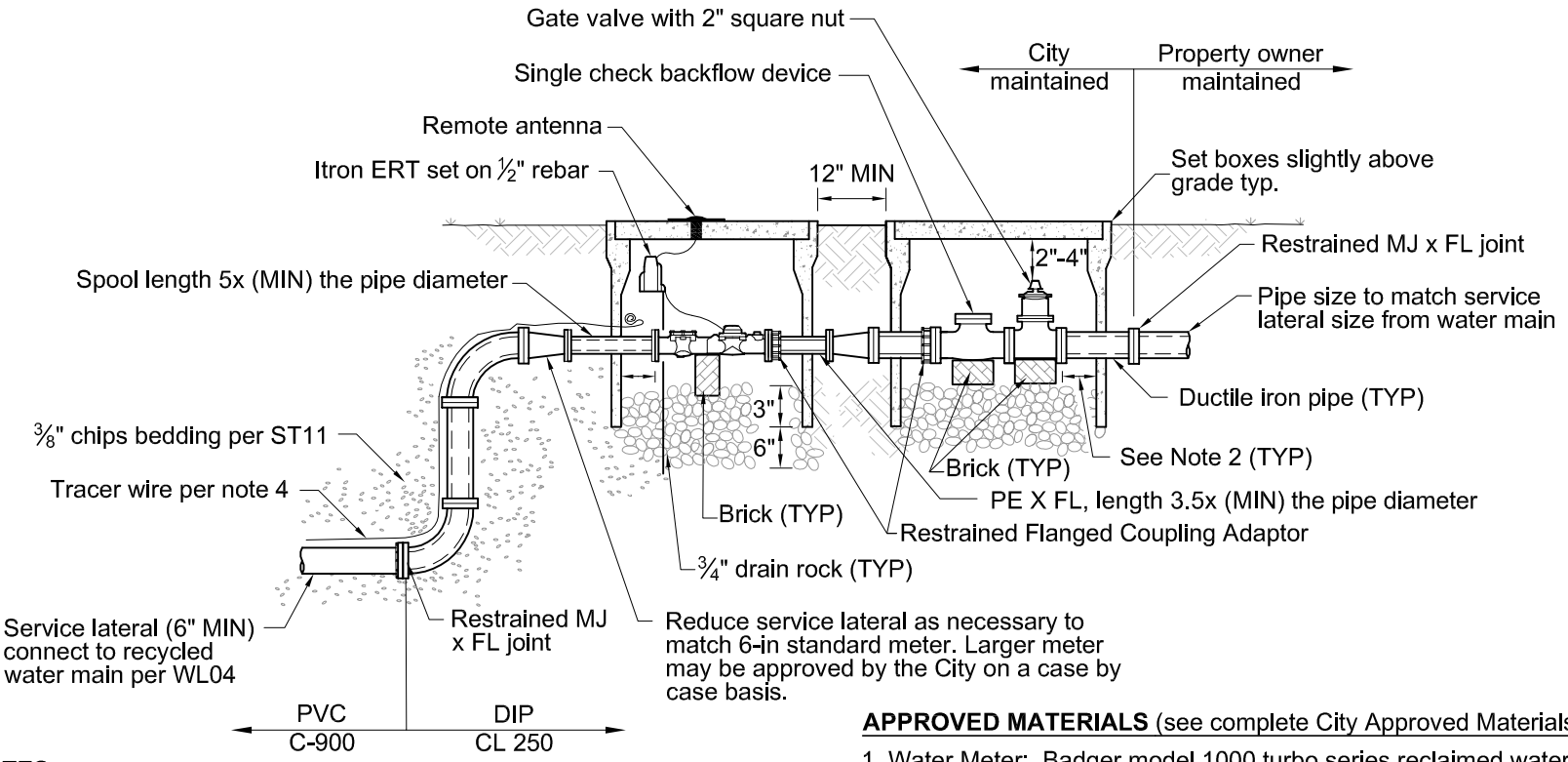
SCALE: NONE

APPROVED:

DATE: March 2016

RW01

STANDARD DETAIL



NOTES:

1. Meter and backflow devices shall be located in a non-paved area where boxes are not subject to traffic loading.
2. Maintain 2"-4" clearance between box wall and pipe fitting (TYP all sides).
3. All Ductile Iron pipe and fittings shall be provided with a bituminous coating from the factory and encased in an 8-mil polyethylene bag in the field in accordance with AWWA C-105. All bolts, restraining rods, etc. shall be coated with bitumastic prior to encasement in the polyethylene bag.
4. Use City approved restrained joints or flanged spools.
5. Copper tracer wire (10 gauge insulated solid wire) shall be taped to pipe at 4' intervals and run continuous from the water main and terminate with 2' MIN length coil exposed in meter box.
6. Water meter and ERT shall be purchased through the City. Purchase includes installation.
7. Prior to backfilling, the entire water service line will be inspected by the City Inspector. Entire water line is shall be leak free under pressure. Any portion of the service line or fittings not inspected or damaged will not be accepted.

APPROVED MATERIALS (see complete City Approved Materials List):

1. Water Meter: Badger model 1000 turbo series reclaimed water meter with integral strainer and Itron model 100WP ERT with HR-e Encoder and with ERW-1300-212 remote antenna.

2. Single Check Backflow Device:

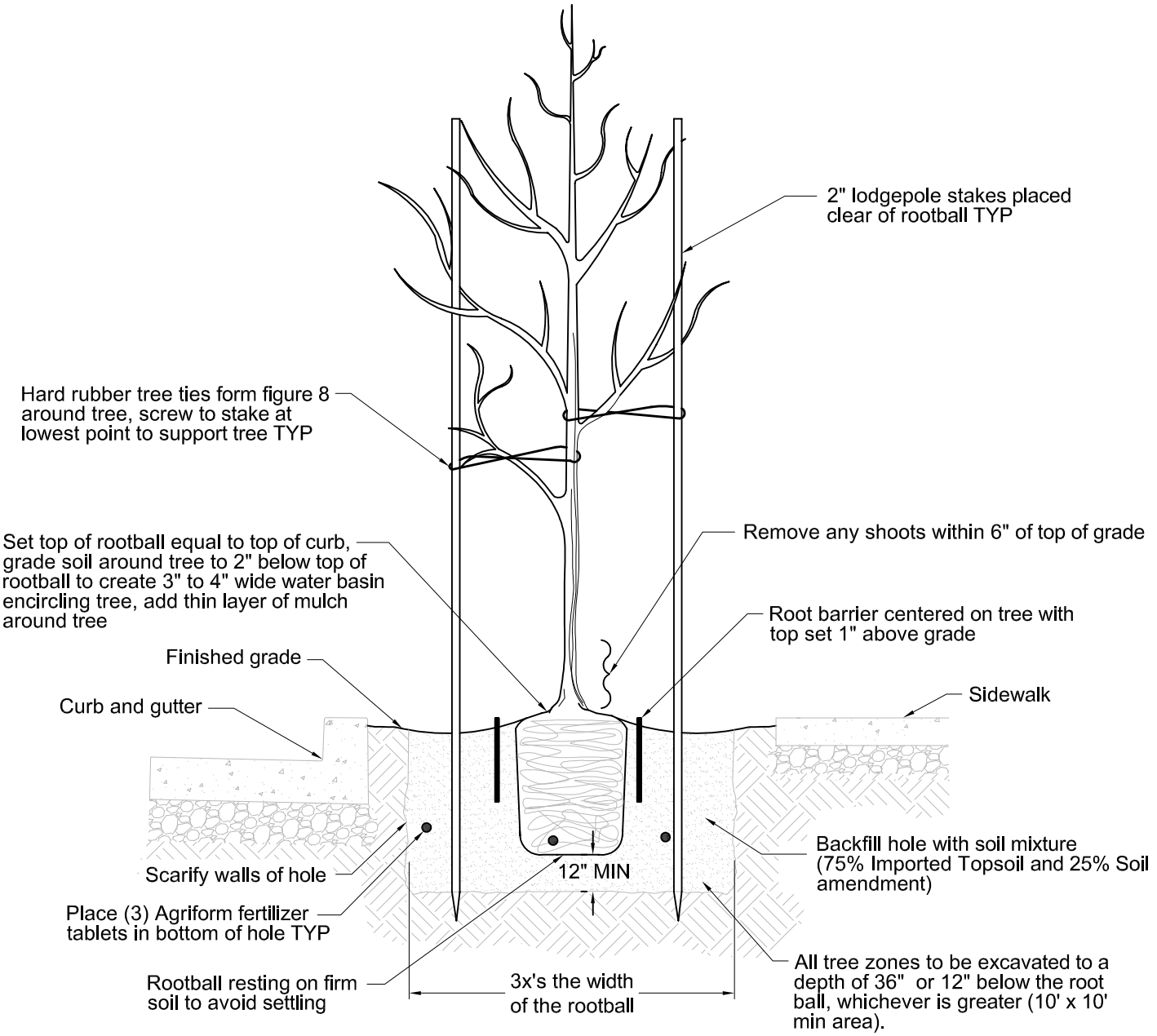
   a. Ames 1000SS (stainless)
   b. Matco-Norca 120F (epoxy)

3. Utility Boxes: 20k lbs. rated Armorcast polymer concrete box with purple colored cover labeled "RECLAIMED WATER".

   a. Meter box shall be A6001640TAPCX18 with A6001947T-H-PUR cover with nominal dimensions required to meet minimum clearances indicated on detail. Cover includes hole for future single top mount AMR/AMI. Meters larger than 6-inch may require a larger box.

   b. Single check box shall be A6001430TAPCX18 box with two piece A6001470T-PUR cover colored with nominal dimensions required to meet minimum clearances indicated on detail. 8" and larger services may require a larger box size.

   c. Use box extensions as needed.



NOTES:

1. 15 gallon MIN tree shall be used and nursery stake removed prior to planting.
2. Trees shall be located a minimum of 3' from walls, overheads, walks, headers, and other trees unless otherwise approved by the City Engineer.

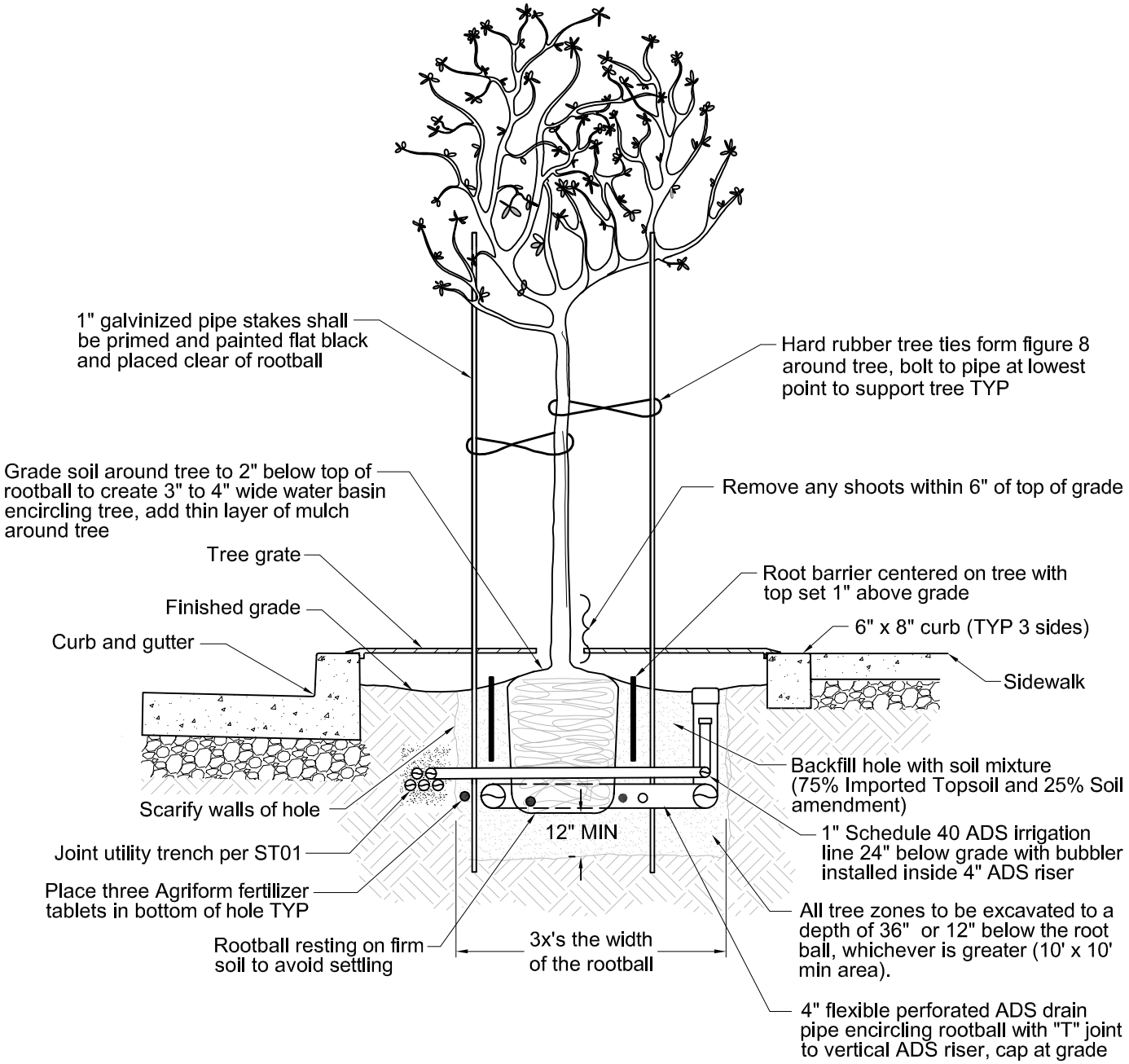
APPROVED MATERIALS (see complete list)**:**

1. Root barrier: Century Products 24" diameter by 12" or approved equal

	STREET TREE Planting		STANDARD DETAIL MS01
	SCALE: NONE	APPROVED:	DATE: March 2016

APPENDIX I

Public Works Details - Street, Storm Drain, Sewer



NOTES:

1. Top of concrete shall conform to top of existing curb within a single plane.
2. Tree wells shall be perpendicular to back of curb.
3. 15 gallon MIN tree shall be used and nursery stake removed prior to planting.

APPROVED MATERIALS (see complete list)**:**

1. Root barrier: Century Products 24" diameter by 12" or approved equal
2. Bubbler: Toro Bubbler 570-FB-25-PC
3. Tree grate:
   a. 48" x 48" tree well opening - Neenah R9002
   b. 68" x 32" tree well opening - Neenah R9105

STREET TREE

Streetscape

STANDARD DETAIL

MS02

SCALE:	APPROVED:	DATE:
NONE		March 2016

PUBLIC UTILITIES

Typical Location

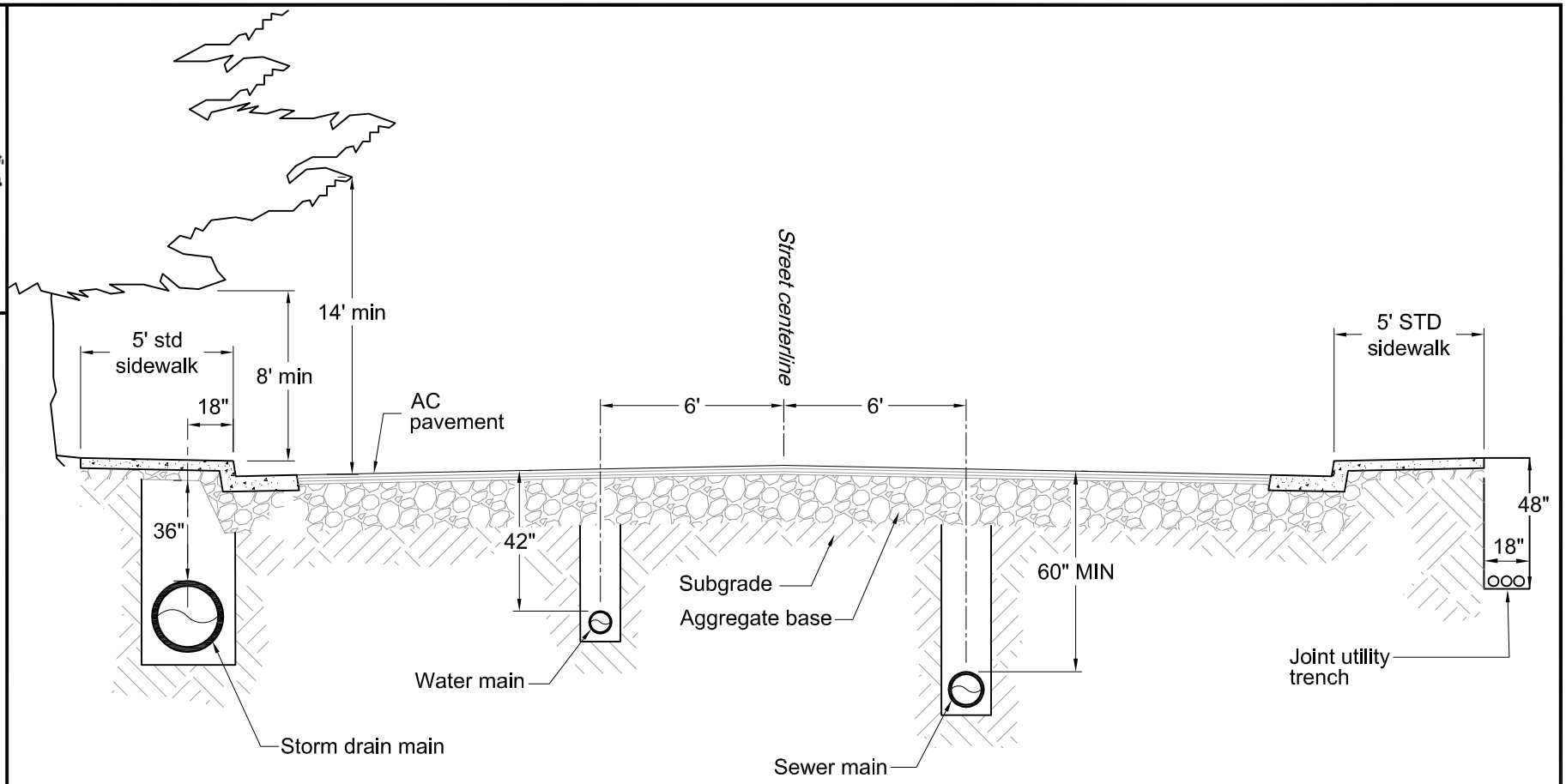
SCALE: NONE

APPROVED:

DATE: March 2016

ST01

STANDARD DETAIL



NOTES:

1. Minimum separation between crossing utilities (sewer, water, storm drain & joint utility trench) shall be 6" except, 12" separation shall be maintained where RCP storm drain mains cross over water or sewer mains.
2. Trim trees and other vegetation a minimum of 8-ft above sidewalks and 14-ft above streets or as directed by City Engineer
3. When installing utilites behind existing sidewalks, trench shall be offset from back of walk a minimum of 1-ft.

STREET
Typical Cross Section

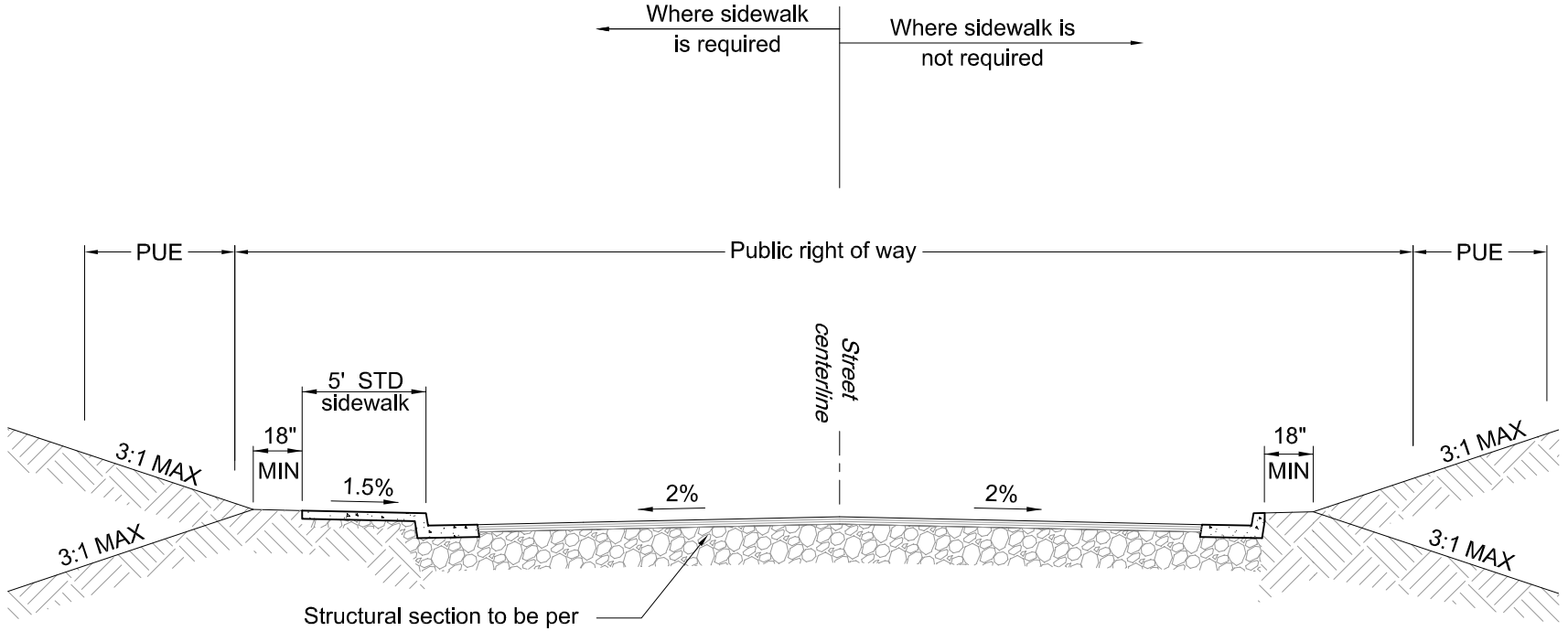
SCALE: NONE

APPROVED:

DATE: March 2016

ST02

STANDARD DETAIL

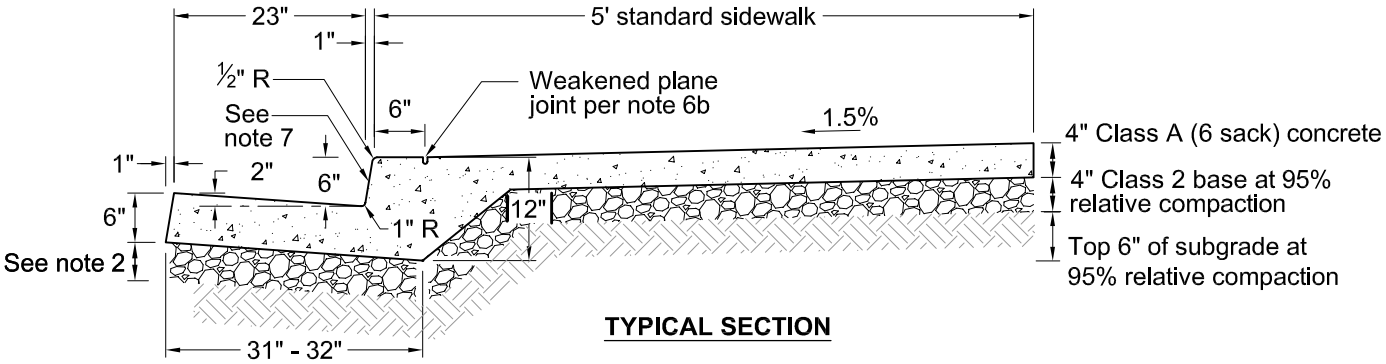


ROADWAY STRUCTURAL SECTIONS

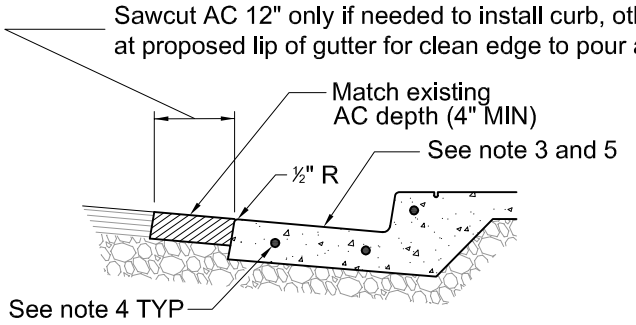
Road Class	Traffic Index	Standard Pavement Section
Arterial	9	0.45 AC / 1.9 AB
Collector	8	0.4 AC / 1.7 AB
Residential	7	0.35 AC / 1.5 AB
Industrial	9	0.45 AC / 1.9 AB
Hillside	7	0.35 AC / 1.5 AB
Road Classifications can be found in the Transportation Element of the Healdsburg General Plan		

NOTES

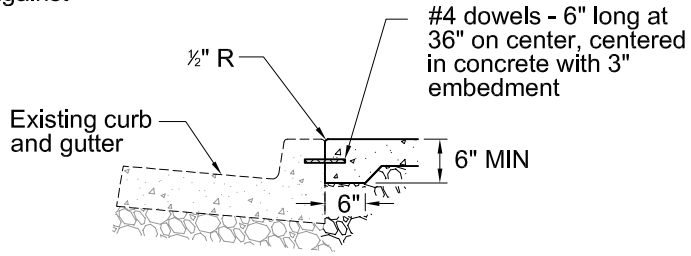
1. Street, public right of way and public utility easement (PUE) widths shall be as specified in the general plan, specific plan or approved tentative map.
2. The structural section on this detail and provided in section 3 of the Engineering Design Standards represents the minimum structural section allowed. A thicker structural section will be required if specified in the geotechnical study.



TYPICAL SECTION



REPLACEMENT - OVERCUT AC

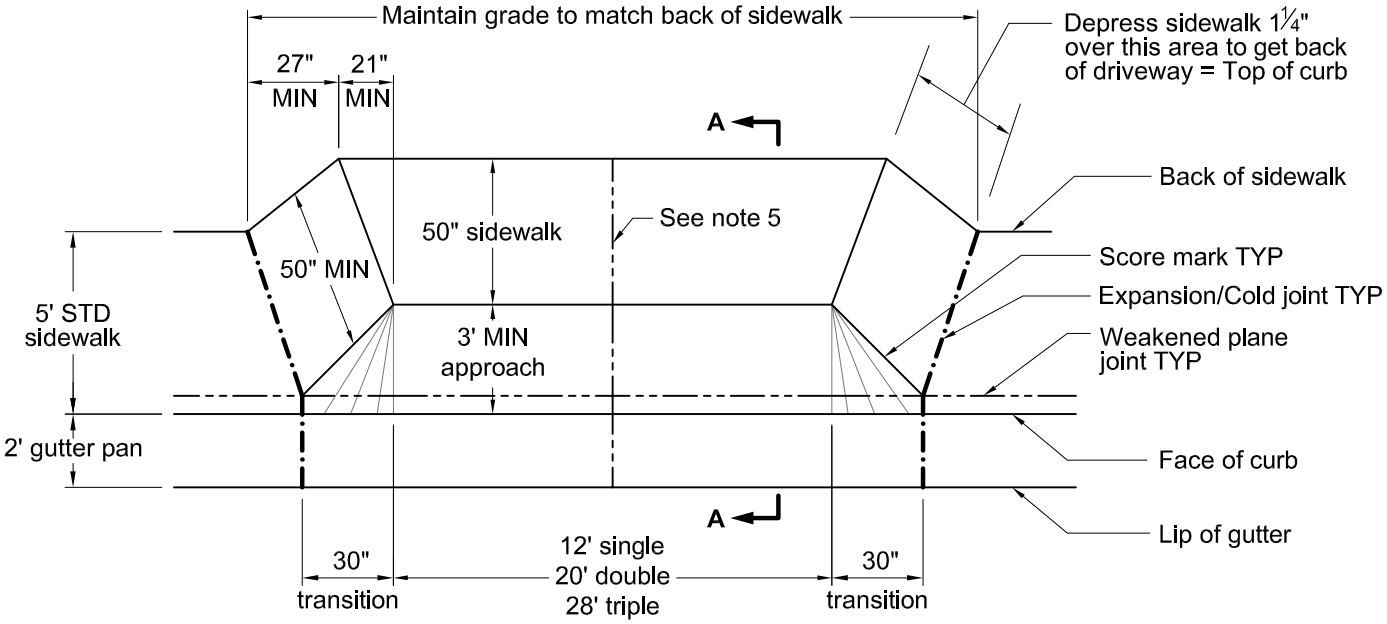


STAGED CONSTRUCTION OF SIDEWALK
*may only be used with written permission of City Engineer

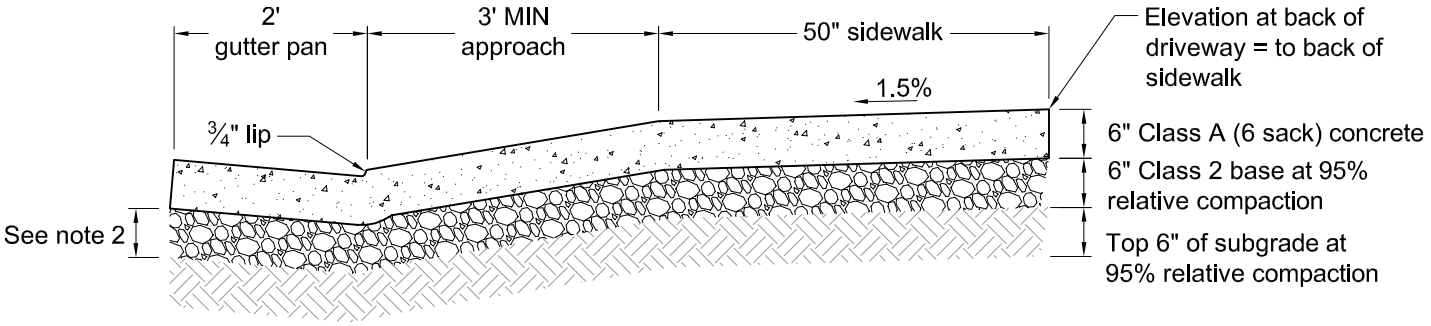
NOTES:

1. Curb, gutter and sidewalk shall be poured monolithically.
2. Class 2 aggregate base at 95% compaction. a minimum of 6-inches thick, shall extend under curb and gutter.
3. Where sidewalk and/or curb and gutter are to be removed or repaired, the concrete shall be removed by saw cutting its full depth at the nearest score mark or joint. When the area of work is less than 5 feet from any joint or crack, the removal shall be extended to nearest joint or crack.
4. Install three #4 dowels - 6" long, centered in concrete curb and gutter with 3" embedment to secure to adjacent curb and gutter.
5. Where the existing AC pavement surface covers the gutter pan, the replacement curb and gutter shall be installed and broom finished to match the adjacent curb and gutter, and the AC shall be re-installed over the gutter pan to preserve the flow line.
6. Jointing:
   a. All joints shall be straight and perpendicular to the longitudinal axis of the sidewalk and/or curb.
   b. Weakened plane joints shall be ⅛" wide and 1" deep in sidewalks and ⅛" wide and 1½" deep in curb and gutter, spaced 10' on center and at back of curb. Weakened plane joints in sidewalks shall match joints in the curb and gutter.
   c. Expansion joint material shall be ½" thick premolded joint filler placed through the full thickness of the concrete every 30'. Where pouring up against a cold joint or saw cut, no joint fill shall be used.
   d. Score marks on sidewalks shall be installed to match adjacent sidewalk with a MAX spacing of every 5'.
   e. Sidewalks wider than 5 feet shall have a longitudinal score mark installed along the center of the sidewalk.
7. Where new curb crosses water and/or sewer laterals or lines, the face of the curb shall be impresses with a 3" tall "W" or "S" symbol, respectively. The "W" and "S" symbols may be checked out from Public Works at the CDC.
8. All exposed surfaces shall have a medium broom finish. Sidewalks and driveways shall be broom finished perpendicular to the longitudinal axis of the sidewalk.
9. Contractor shall be responsible for protecting fresh concrete from damage, regardless of the source. Patching of damaged concrete is not permitted.

CITY OF HEALDSBURG	CURB, GUTTER and SIDEWALK			STANDARD DETAIL ST03
	SCALE: NONE	APPROVED:	DATE: March 2016	



PLAN VIEW



SECTION A-A

NOTES:

1. Driveways shall be located a MIN of 2.5' from a property line and a MIN of 5' from a water meter, sewer cleanout, or other utility box, adjacent driveway, sign post, power pole, fire hydrant, etc. (as measured from the top of the driveway transition).
2. Class 2 aggregate base at 95% compaction, a minimum of 6-inches thick, shall extend under curb and gutter.
3. The driveway shall be poured monolithically with the curb and gutter.
4. Jointing (between expansion joints):
   a. Weakened plane joints shall be installed at 10' MAX spacing and run continuous through the sidewalk, approach and gutter pan.
   b. Score marks through 50" sidewalk section shall be installed to match adjacent sidewalk with a 5' MAX spacing.
5. All exposed surfaces shall have a medium broom finish. Sidewalks and driveways shall be broom finished perpendicular to the longitudinal axis of the sidewalk.
6. Driveways shall be installed perpendicular to the curbline unless otherwise approved by the City Engineer.
7. See ST03 for additional information.

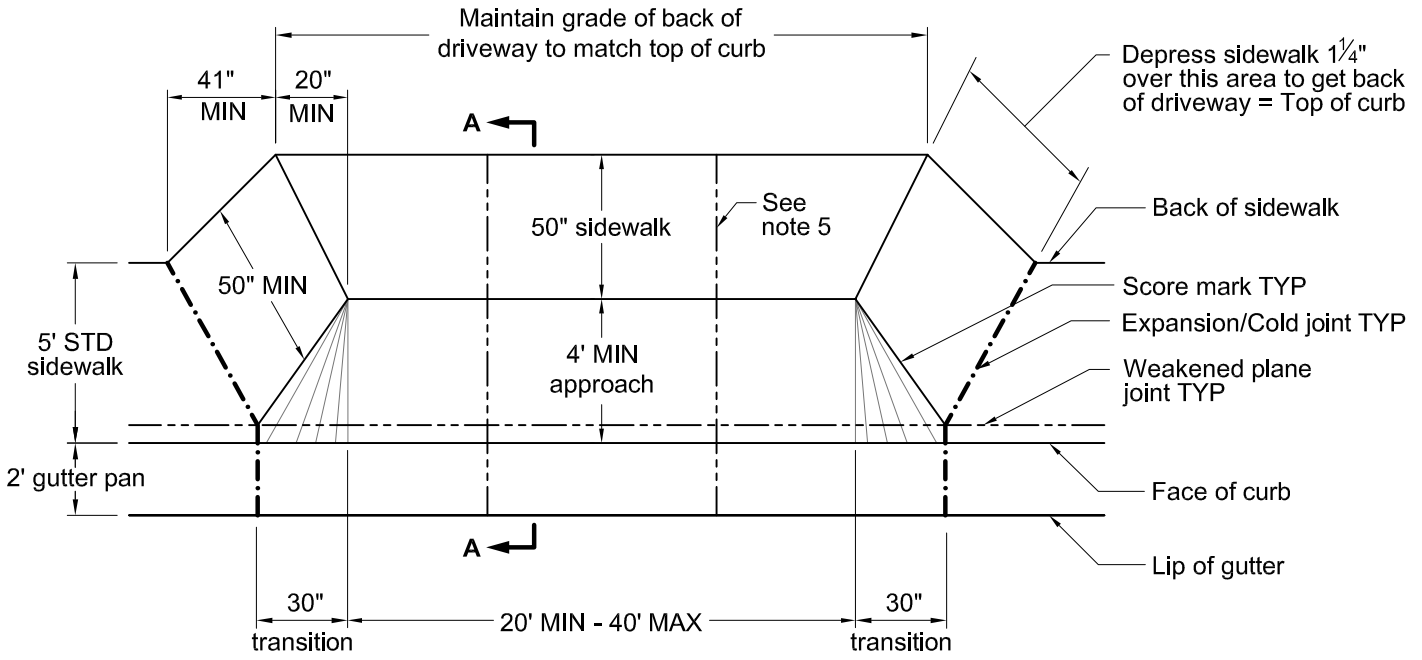
RESIDENTIAL DRIVE APPROACH

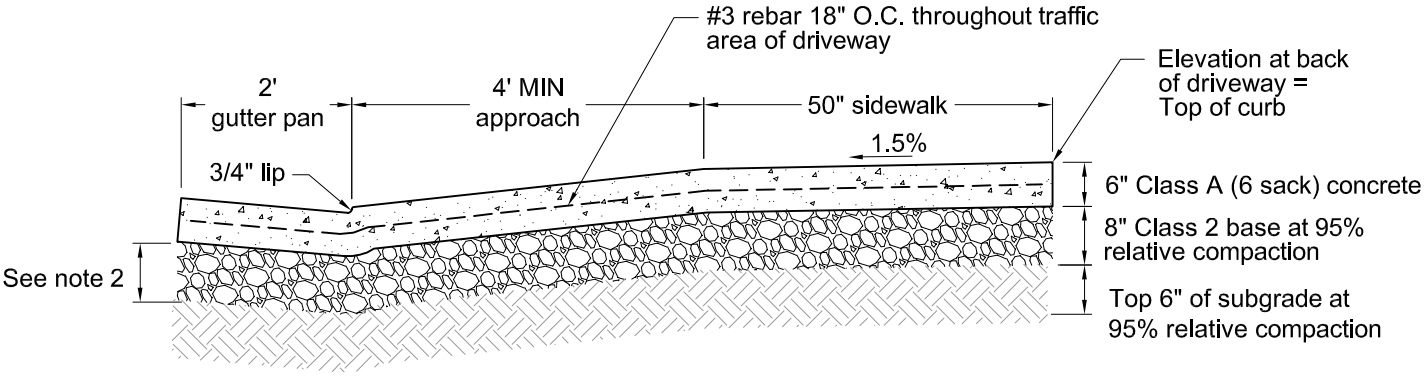
on Low Speed/Volume Road

STANDARD DETAIL

ST04

SCALE:	APPROVED:	DATE:
NONE		March 2016





SECTION A-A

NOTES:

1. Driveways shall be located a MIN of 2.5' from a property line and a MIN of 5' from a water meter, sewer cleanout, or other utility box, adjacent driveway, sign post, power pole, fire hydrant, etc. (as measured from the top of the driveway transition).
2. Class 2 aggregate base at 95% compaction, a minimum of 6-inches thick, shall extend under curb and gutter.
3. The driveway shall be poured monolithically with the curb and gutter.
4. Jointing (between expansion joints):
   a. Weakened plane joints shall be installed at 10' MAX spacing and run continuous through the sidewalk, approach and gutter pan.
   b. Score marks through 50" sidewalk section shall be installed to match adjacent sidewalk with a 5' MAX spacing.
5. All exposed surfaces shall have a medium broom finish. Sidewalks and driveways shall be broom finished perpendicular to th longitudinal axis of the sidewalk.
6. Driveways shall be installed perpendicular to the curbline unless otherwise approved by the City Engineer.
7. See ST03 for additional information.

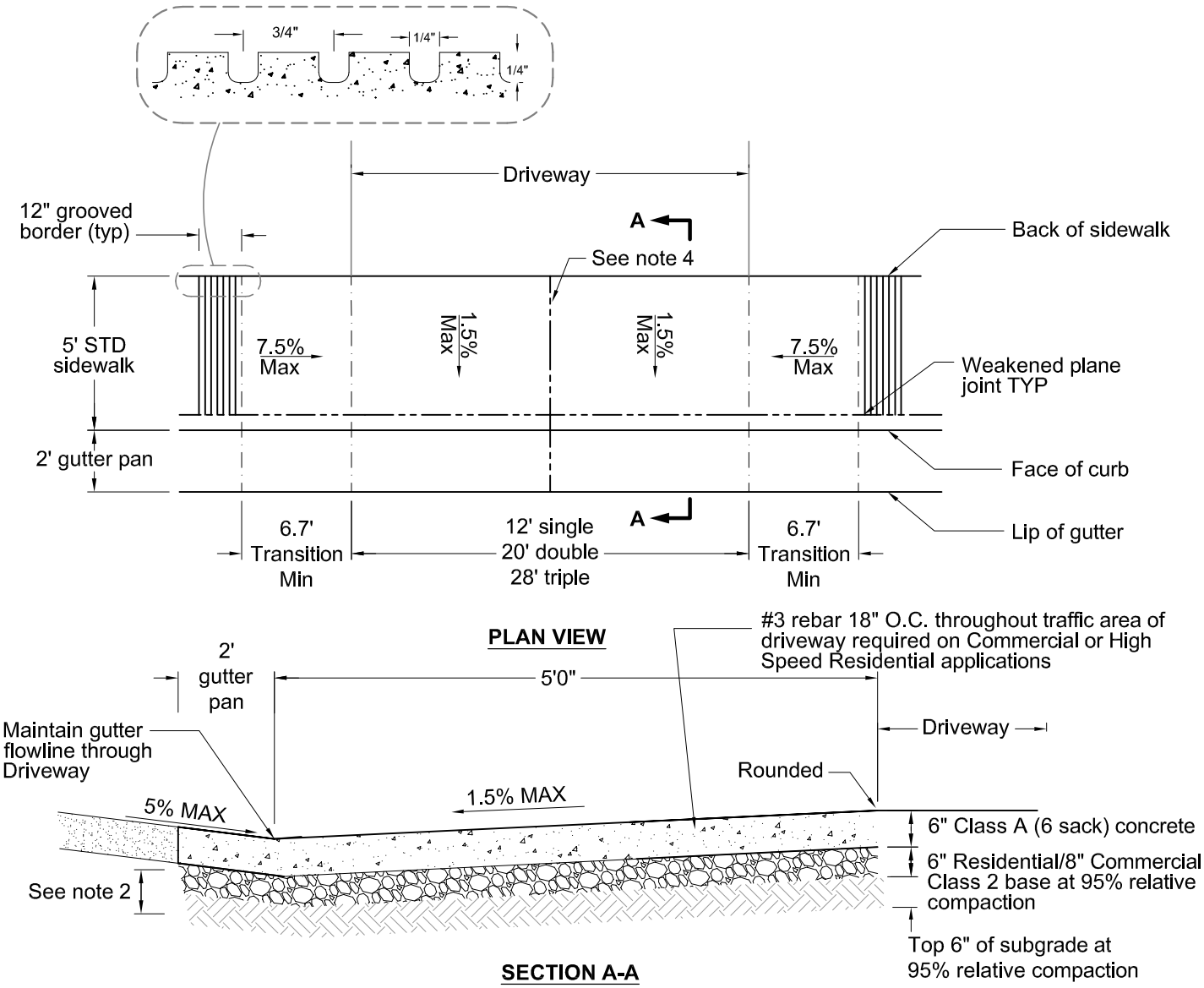
COMMERCIAL DRIVE APPROACH

and Residential Driveway on High Speed/Volume Road

STANDARD DETAIL

ST05

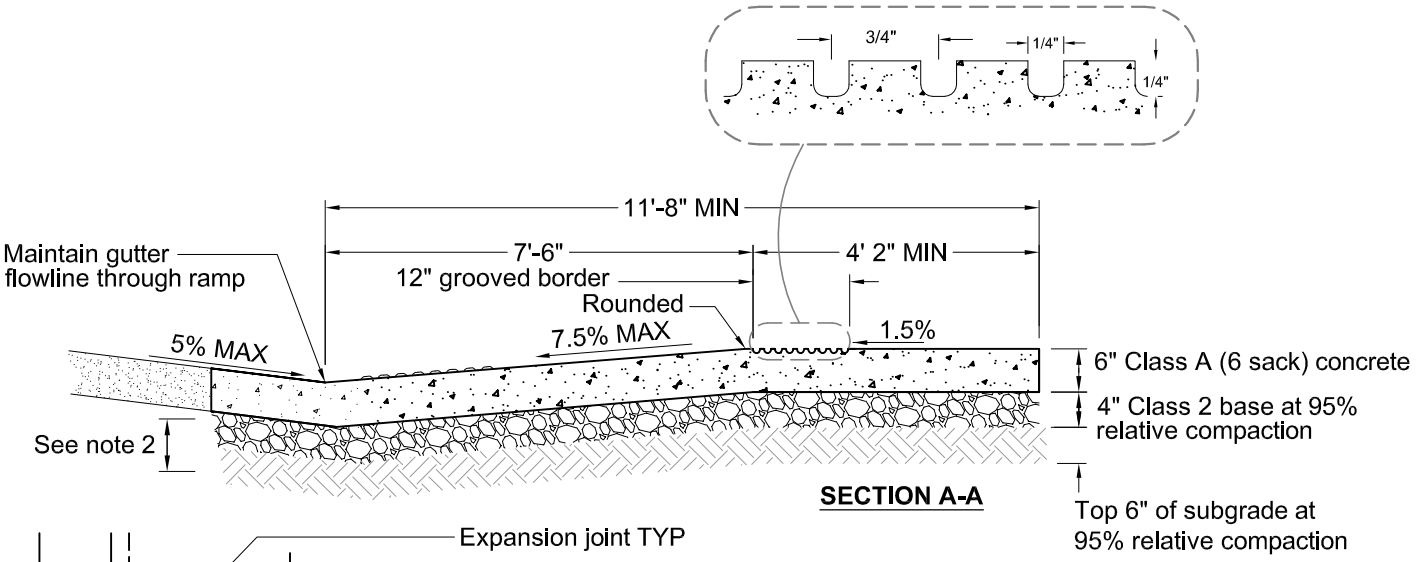
SCALE:	APPROVED:	DATE:
NONE		March 2016



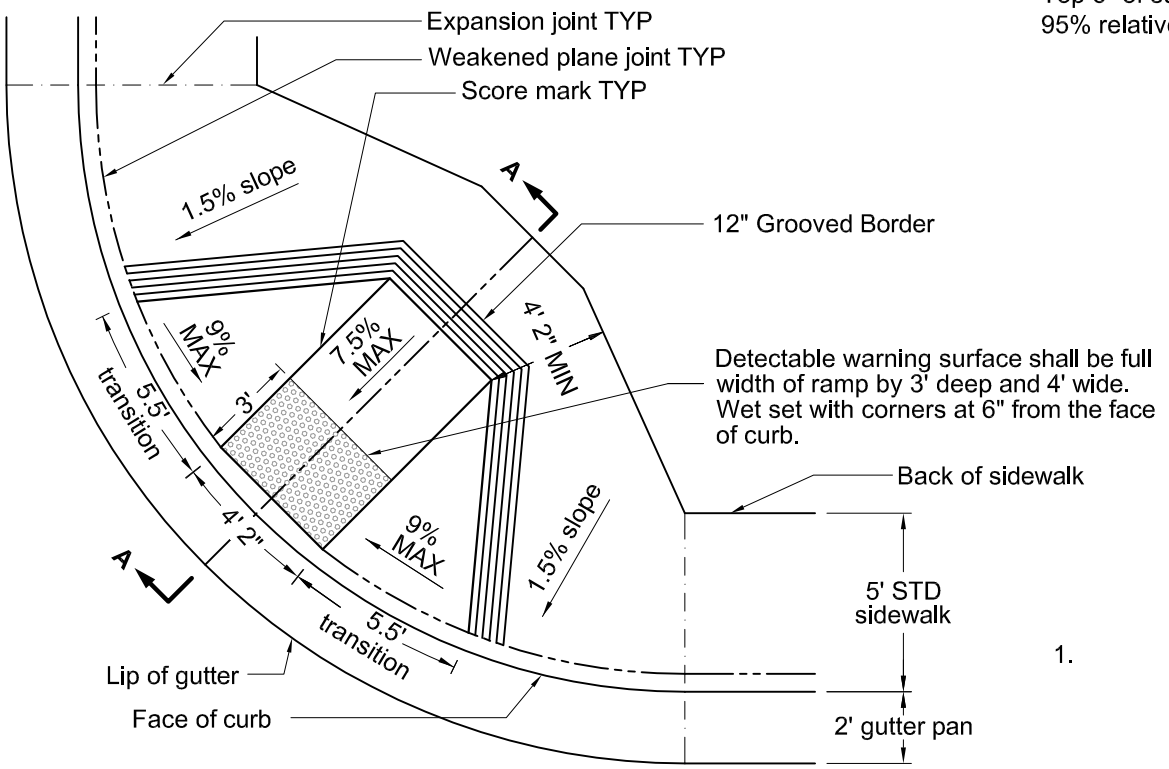
NOTES:

1. Driveways shall be located a MIN of 2.5' from a property line and a MIN of 5' from a water meter, sewer cleanout, or other utility box, adjacent driveway, sign post, power pole, fire hydrant, etc. (as measured from the top of the driveway transition).
2. Class 2 aggregate base at 95% compaction, a minimum of 6-inches thick, shall extend under curb and gutter.
3. The driveway shall be poured monolithically with the curb and gutter.
4. Jointing (between expansion joints):
   a. Weakened plane joints shall be installed at 10' MAX spacing and run continuous through the sidewalk, approach and gutter pan.
   b. Score marks through 50" sidewalk section shall be installed to match adjacent sidewalk with a 5' MAX spacing.
5. All exposed surfaces shall have a medium broom finish. Sidewalks and driveways shall be broom finished perpendicular to the longitudinal axis of the sidewalk.
6. Driveways shall be installed perpendicular to the curbline unless otherwise approved by the City Engineer.
7. See ST03 for additional information.

City of Healdsburg	**DRIVE APPROACH** Alternative Design for Residential/Commercial	STANDARD DETAIL **ST06**
SCALE: NONE	APPROVED:	DATE: March 2016



SECTION A-A



PLAN VIEW

1.

APPROVED MATERIALS
(see complete list):

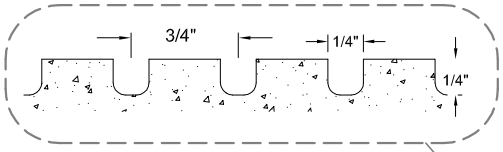
Detectable Warning Surface:

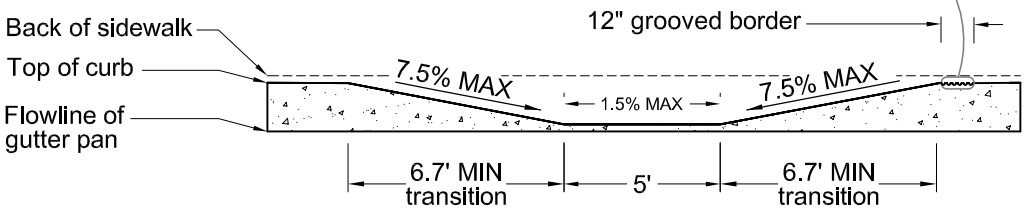
a. Armor-Tile ADA-C-3648-YW (federal yellow), sized to fit

NOTES:

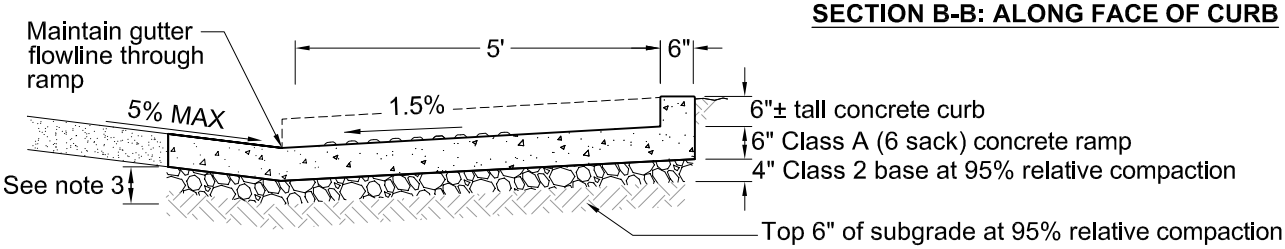
1. All poles, boxes, cabinets and other utilities shall be relocated out of the curb ramp.
2. Class 2 aggregate base at 95% compaction. a minimum of 6-inches thick, shall extend under curb and gutter.
3. The ramp shall be poured monolithically with the curb and gutter.
4. Joint spacing (expansion, weakened plane and score marks) shall be 5' MAX in any direction.
5. Dimensions shown are based on a 6" standard curb height.
6. Transitions from ramps and landing to walks, gutters, or streets shall be flush and free of abrupt changes.
7. All exposed surfaces shall have a medium broom finish. Sidewalks and driveways shall be broom finished perpendicular to the longitudinal axis of the sidewalk.

City Of Healdsburg	CURB RAMP Type "A"	STANDARD DETAIL ST07
SCALE: NONE	APPROVED:	DATE: March 2016

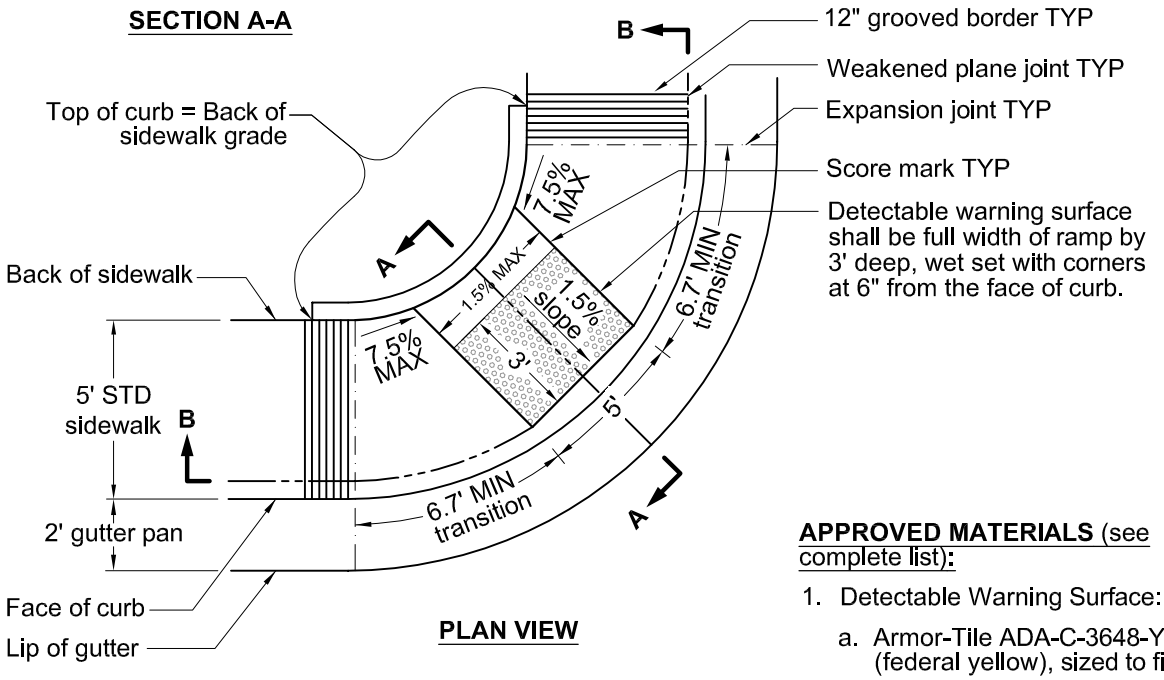




SECTION B-B: ALONG FACE OF CURB



SECTION A-A



PLAN VIEW

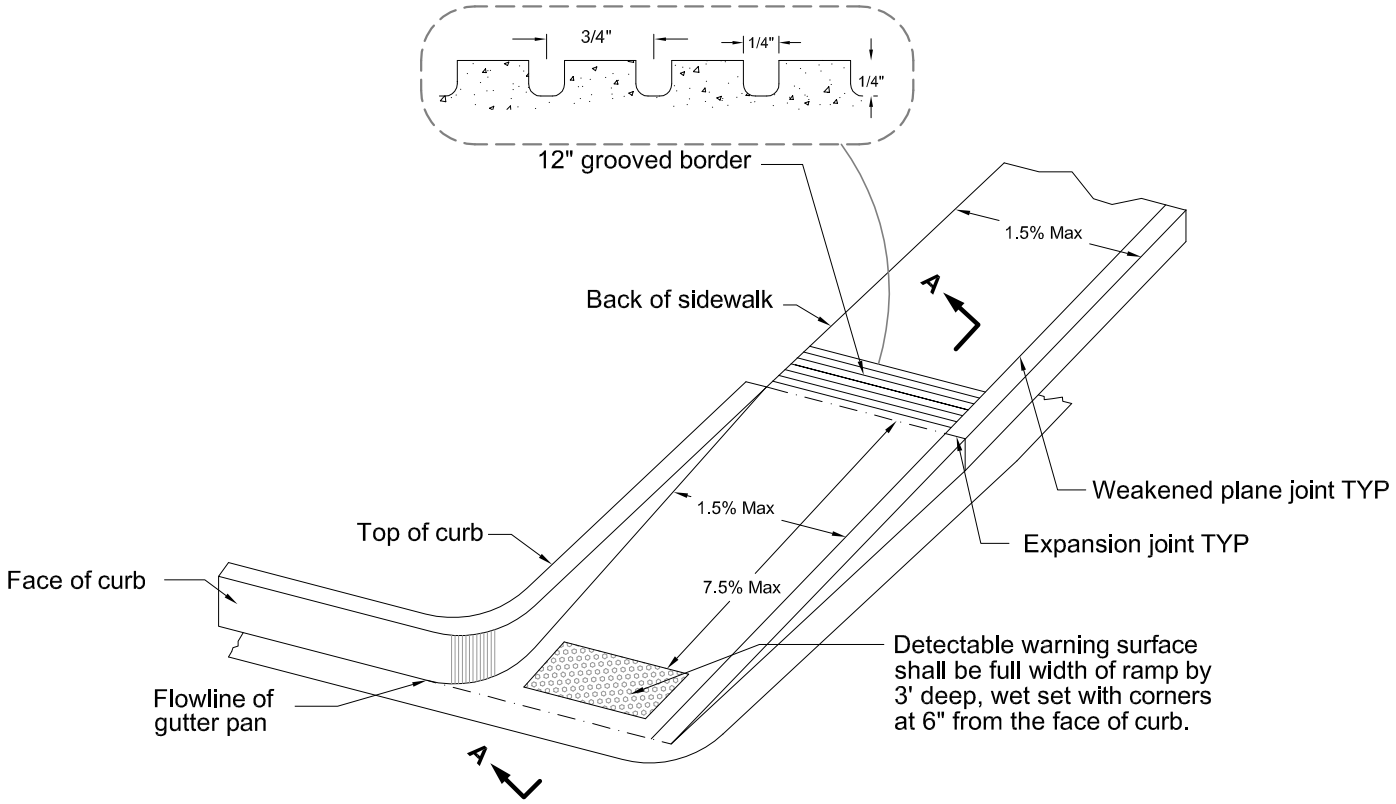
APPROVED MATERIALS (see complete list):

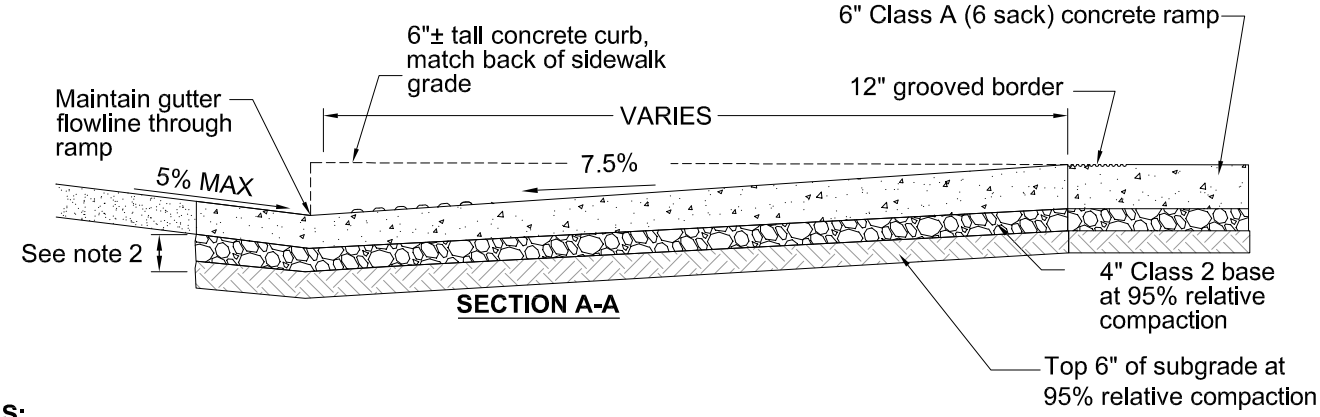
1. Detectable Warning Surface:
   a. Armor-Tile ADA-C-3648-YW (federal yellow), sized to fit

NOTES:

1. Type "B" ramps may only be used in situations where a 4' sidewalk cannot be obtained behind the back of the ramp.
2. All poles, boxes, cabinets and other utilities shall be relocated out of the curb ramp.
3. Class 2 aggregate base at 95% compaction. a minimum of 6-inches thick, shall extend under curb and gutter.
4. The ramp shall be poured monolithically with the curb and gutter.
5. Joint spacing (expansion, weakened plane and score marks) shall be 5' MAX in any direction.
6. Dimensions shown are based on a 6" standard curb height.
7. All exposed surfaces shall have a medium broom finish. Sidewalks and driveways shall be broom finished perpendicular to the longitudinal axis of the sidewalk.

City Of Healdsburg	# CURB RAMP Type "B"	STANDARD DETAIL ST08
SCALE: NONE	APPROVED:	DATE: March 2016





SECTION A-A

NOTES:

1. All poles, boxes, cabinets and other utilities shall be relocated out of the curb ramp.
2. Class 2 aggregate base at 95% compaction. a minimum of 6-inches thick, shall extend under curb and gutter.
3. The ramp shall be poured monolithically with the curb and gutter.
4. Joint spacing (expansion, weakened plane and score marks) shall be 5' MAX in any direction.
5. Dimensions shown are based on a 6" standard curb height.
6. Transitions from ramps and landing to walks, gutters, or streets shall be flush and free of abrupt changes.
7. All exposed surfaces shall have a medium broom finish. Sidewalks and driveways shall be broom finished perpendicular to the longitudinal axis of the sidewalk.

APPROVED MATERIALS
(see complete list):

1. Detectable Warning Surface:
   a. Armor-Tile ADA-C-3648-YW (federal yellow), sized to fit

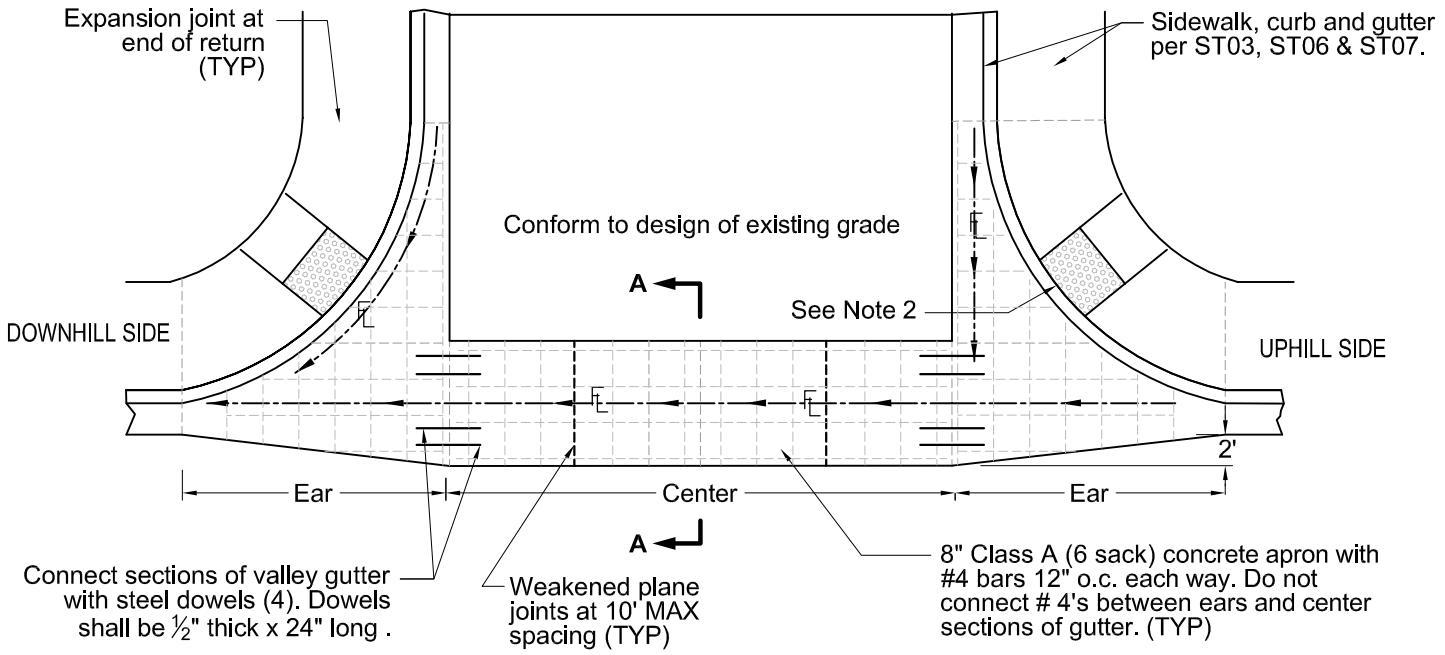
CURB RAMP

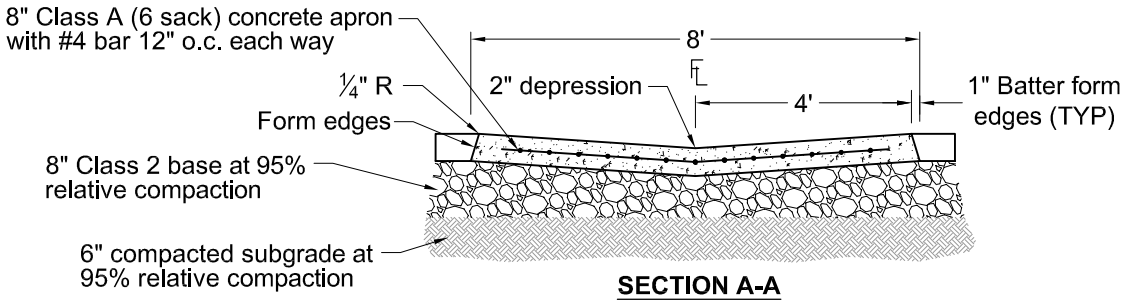
Type "C"

STANDARD DETAIL

ST09

SCALE:	APPROVED:	DATE:
NONE		March 2016





SECTION A-A

NOTES:

1. Asphalt concrete shall be held $\frac{1}{4}$" high at edge of concrete
2. Flowline at bottom of uphill ramp shall be raised 1 $\frac{1}{2}$" at midpoint to create highpoint
3. Class 2 aggregate base at 95% compaction. a minimum of 8-inches thick, shall extend under valley gutter.
4. Install three #4 dowels - 6" long, centered invalley gutter with 3" embedment to secure to adjacent curb and gutter.
5. Jointing:
   a. All joints shall be straight and perpendicular to the longitudinal axis of the gutter.
   b. Weakened plane joints shall be $\frac{1}{8}$" wide and 1 1/2" deep spaced 10' on center. spacing shall match adjacent curb and gutter.
6. All exposed surfaces shall have a medium broom finish. Sidewalks and driveways shall be broom finished perpendicular to the longitudinal axis of the sidewalk.
7. Contractor shall be responsible for protecting fresh concrete from damage of any kind, regardless of the source.

CITY OF HEALDSBURG	VALLEY GUTTER	STANDARD DETAIL ST10
SCALE: NONE	APPROVED:	DATE: March 2016

TRENCH

Backfill and Resurfacing

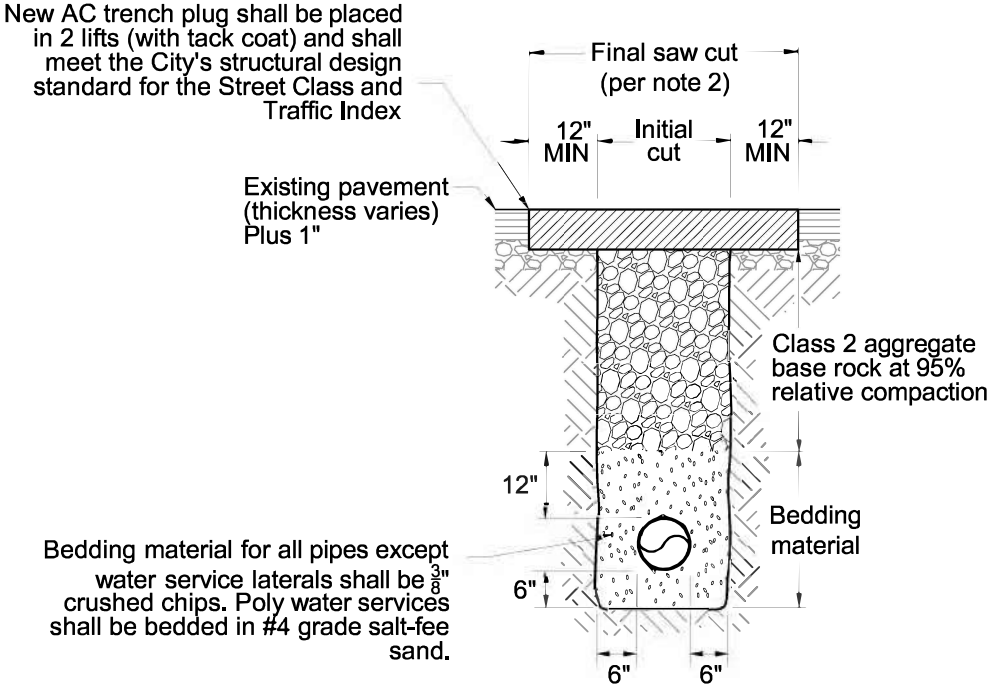
SCALE: NONE

APPROVED:

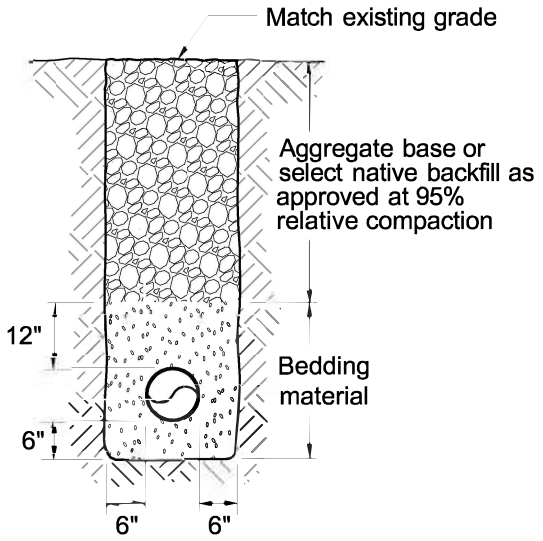
DATE: March 2016

DRAWN DETAIL

ST11



ROADWAYS / SIDEWALKS



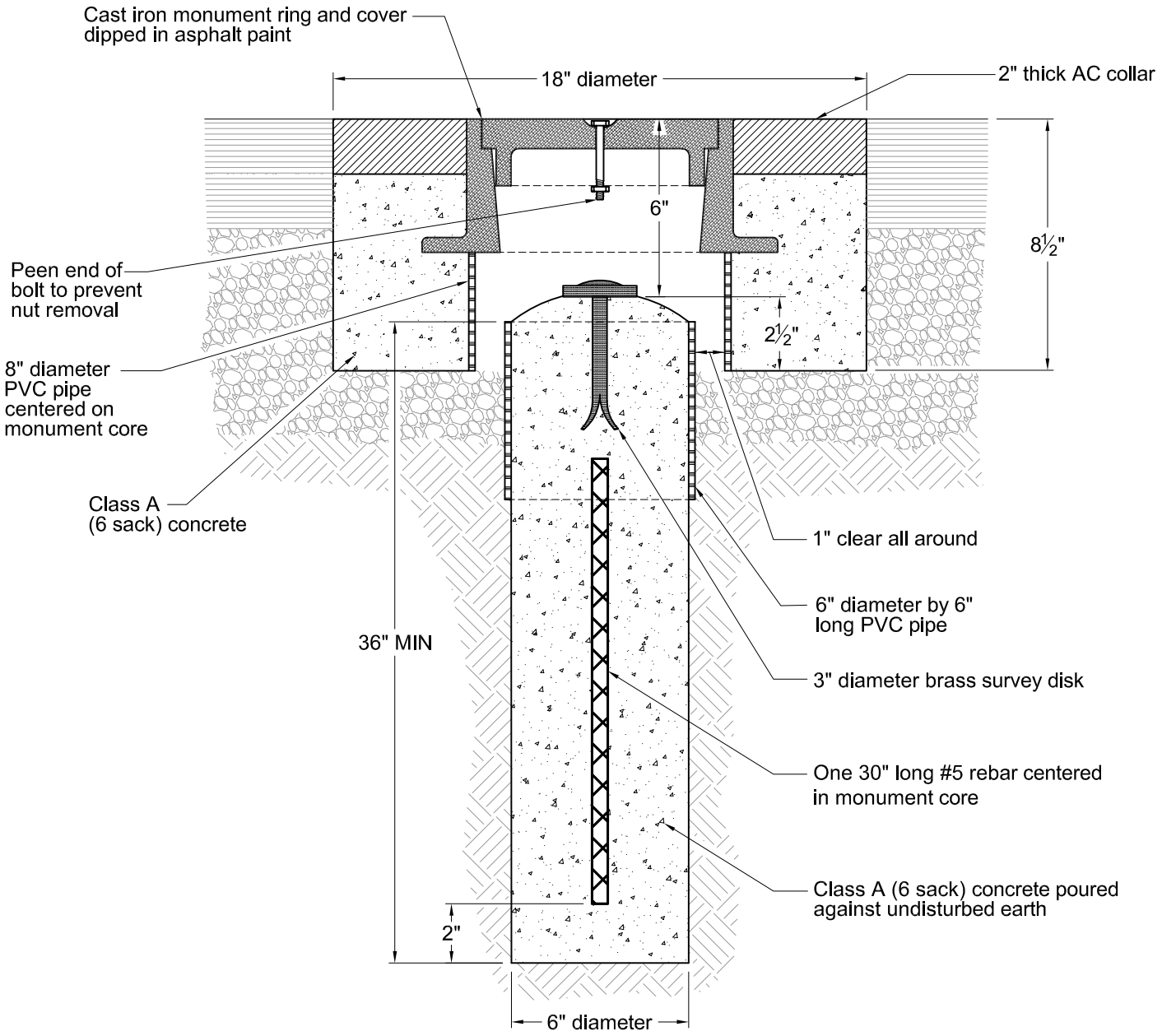
NON-PAVED AREAS

NOTES:

1. Where existing street is concrete overlaid with AC, the concrete section removed by trenching shall be replaced with AC to the required structural section.
2. Final trench paving is required to be expanded to a painted lane stripe, existing pavement patch, the lip of gutter or edge of pavement where such street feature is within 3 feet of the final saw cut. If existing pavement adjacent to trench is cracked or damaged, final trench paving shall be extended to a location where a clean, smooth edge can be established.
3. Permanent paving must be completed within 30 days. AC or cutback (1" thick) may be placed as a temporary surface in roadway areas and shall be maintained until permanent paving is completed. Where warranted and at the discretion of the Public Works Inspector, trench plates may be used for up to 2 weeks. Trench plates shall have a skid resistant surface, secured with 24" wide collar of cutback around all sides of plate, and tapered to provide smooth transitions. Temporary surface and material shall be completely removed prior to placement of permanent pavement.
4. Contractor shall be responsible to provide adequate shoring to keep adjacent material from running into trench. Voids under pavement sections adjacent to the trench shall be filled with a 2 sack slurry or the pavement over such voids shall be removed and the area backfilled with Class 2 aggregate and compacted to 95% relative compaction.

ROADWAY STRUCTURAL SECTIONS

Road Class	Traffic Index	Standard Pavement Section
Arterial	9	0.45 AC / 1.9 AB
Collector	8	0.4 AC / 1.7 AB
Residential	7	0.35 AC / 1.5 AB
Industrial	9	0.45 AC / 1.9 AB
Hillside	7	0.35 AC / 1.5 AB
Road Classifications can be found in the Transportation Element of the Healdsburg General Plan		



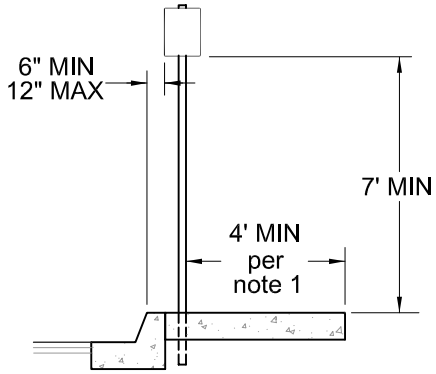
NOTES:

1. Finished top of monument core smooth and round with no concrete above edge of brass survey disk.

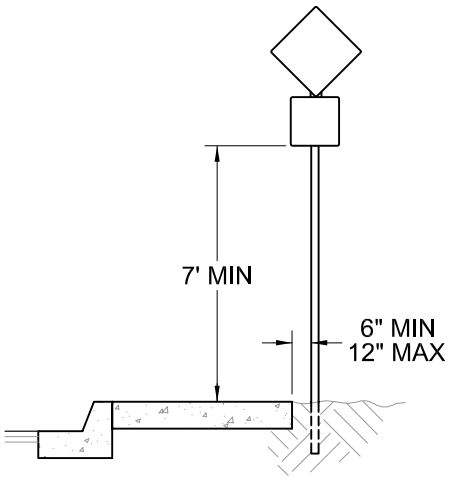
APPROVED MATERIALS (see complete list)**:**

1. Cast Iron Monument Ring and Cover:
   a. D&L Foundry K6001
   b. Southbay Foundry B1000

CITY OF TEALOUSLAND	SURVEY MONUMENT		STANDARD DETAIL ST12
SCALE: NONE	APPROVED:	DATE: March 2016	

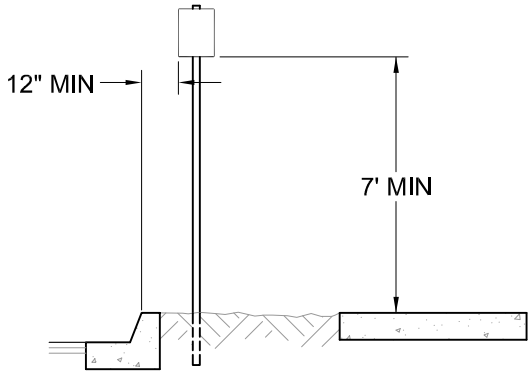


REGULATORY AND WARNING SIGNS



GUIDE SIGNS

SIDEWALK ATTACHED TO CURB



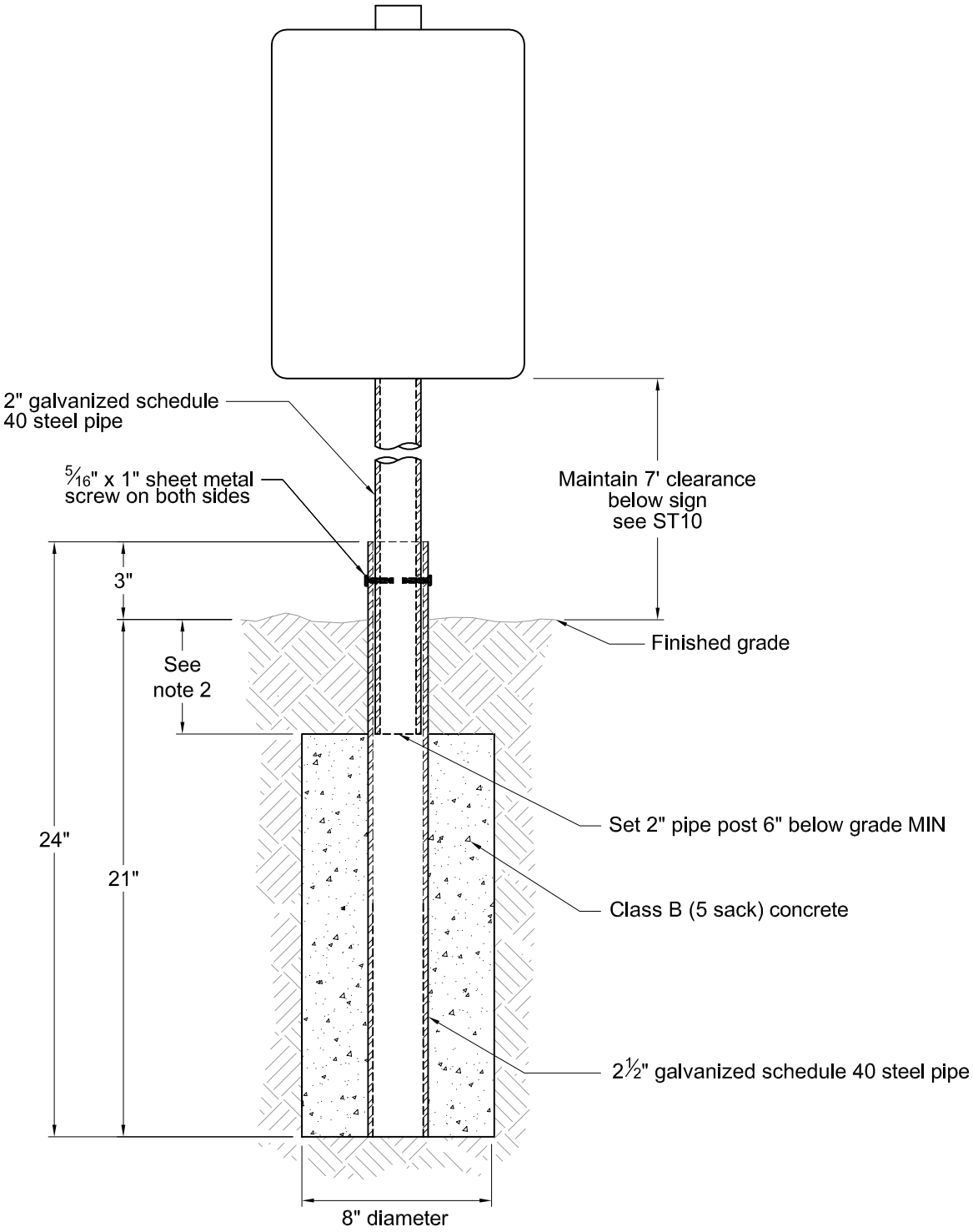
ALL SIGNS

SIDEWALK SEPARATED FROM CURB OR NO SIDEWALK

NOTES:

1. Extend sidewalk around sign post per ST16 when necessary to maintain 4' clear sidewalk.
2. Signs shall conform to Caltrans requirements (size, format, color & 0.080" aluminum panels).
3. Signs shall be centered and bolted directly to the post.
4. Sign posts shall be installed per ST11.

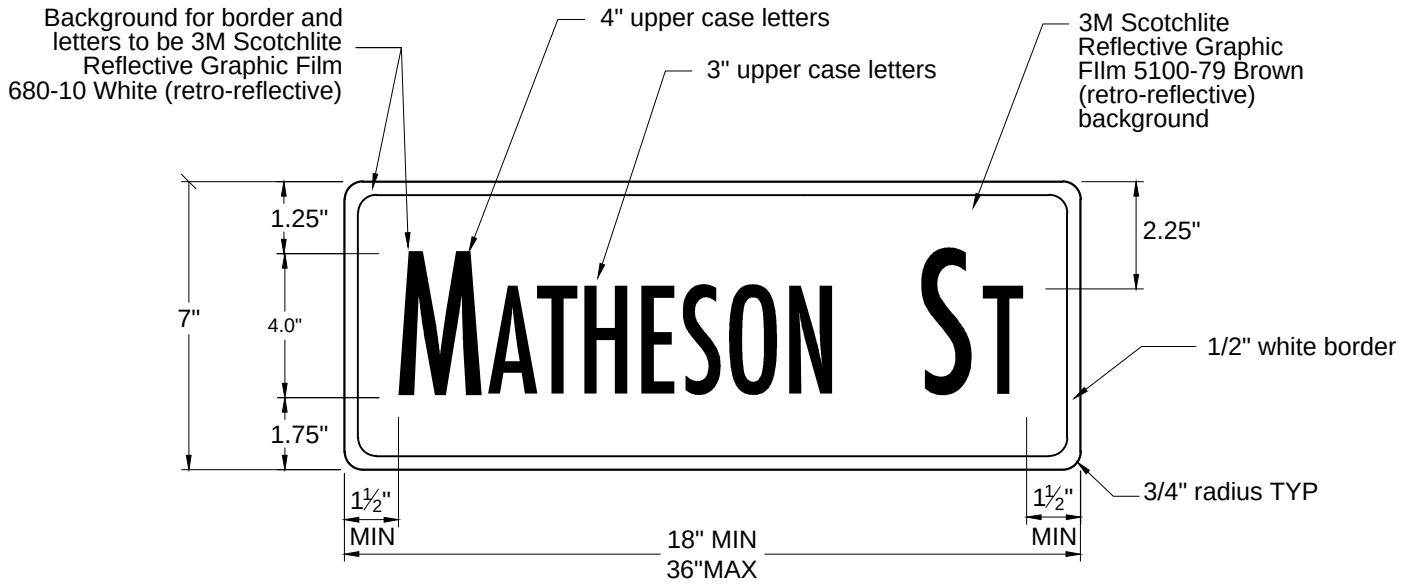
	STREET SIGN Typical Location	STANDARD DETAIL ST13
SCALE: NONE	APPROVED:	DATE: March 2016



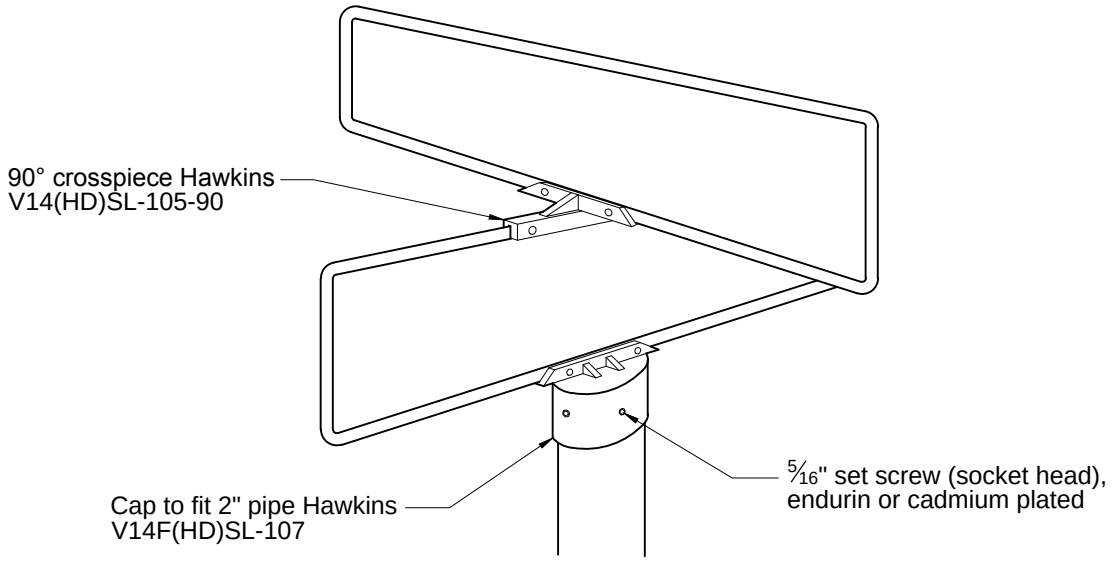
NOTES:

1. Post hole shall be hand excavated if underground utilities are present.
2. Cover shall be 6" of soil or 4" concrete sidewalk.

	STREET SIGN Post and Sleeve Installation		STANDARD DETAIL ST14
SCALE: NONE	APPROVED:	DATE: March 2016	



TYPICAL STREET NAME SIGN

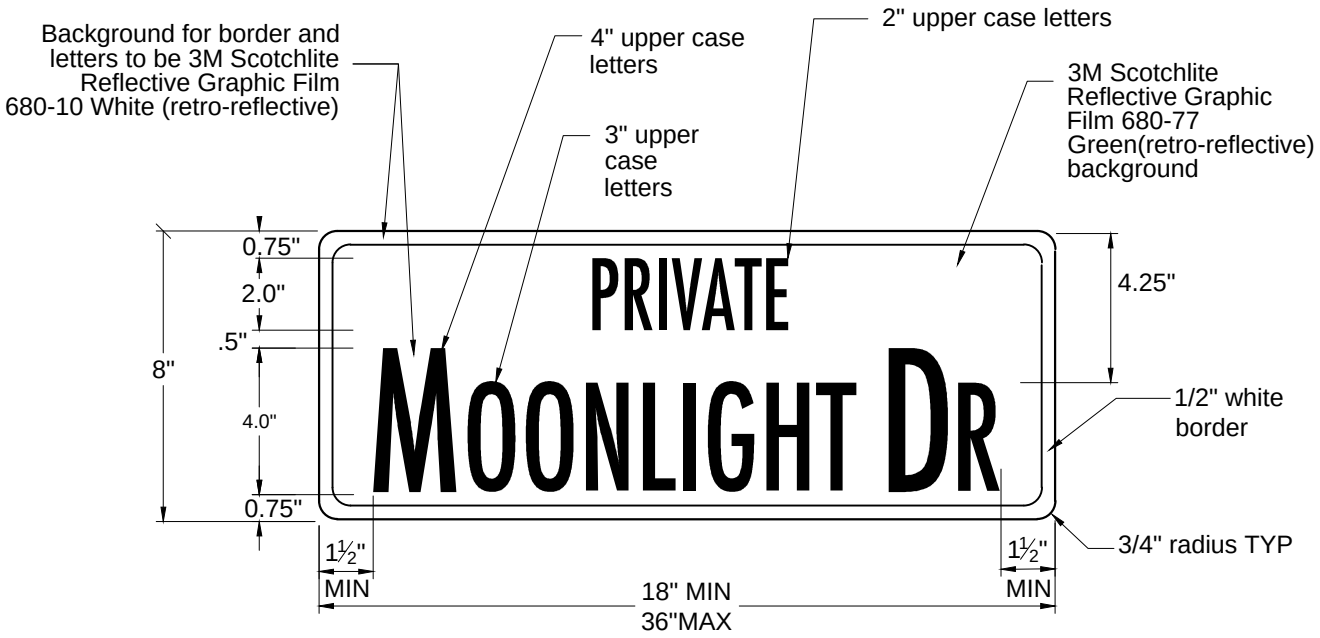


POLE MOUNTING HARDWARE

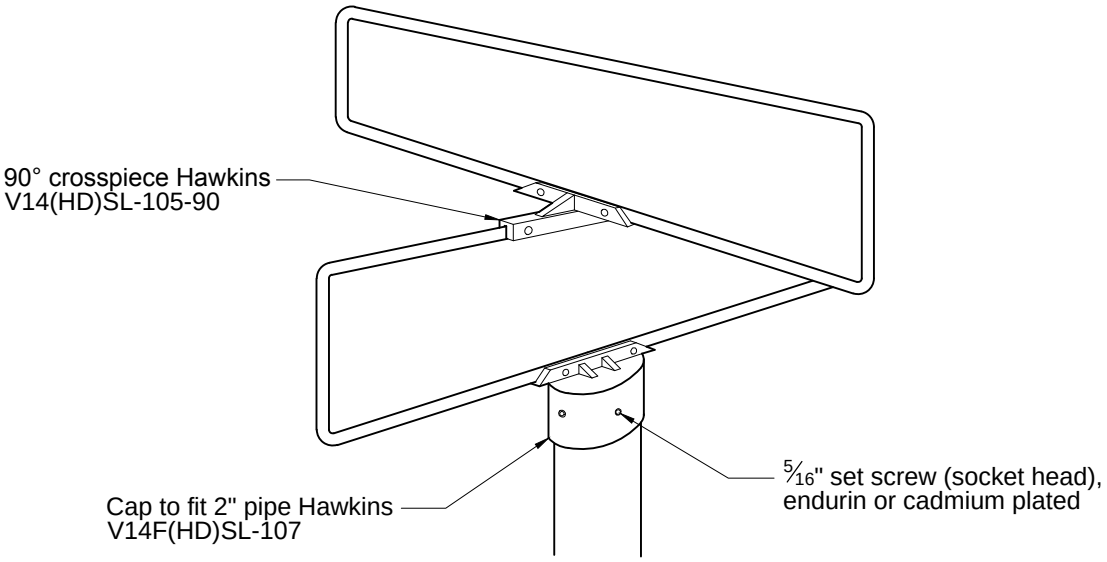
NOTES:

1. Sign blanks shall be 0.080" aluminum per Caltrans specifications.
2. Font shall be Futura Medium Condensed.
3. Spacing of letters, words, and abbreviations per Caltrans specifications.
4. Signs shall be double faced.
5. Sign posts shall be installed per ST11.
6. All signs shall be centered on pole and level at time of installation.

CITY OF HEALDSBURG CALIFORNIA SINCE 1867	STREET SIGN Street Name		STANDARD DETAIL ST12
	SCALE: NONE	APPROVED:	DATE: Jan 2016



TYPICAL STREET NAME SIGN

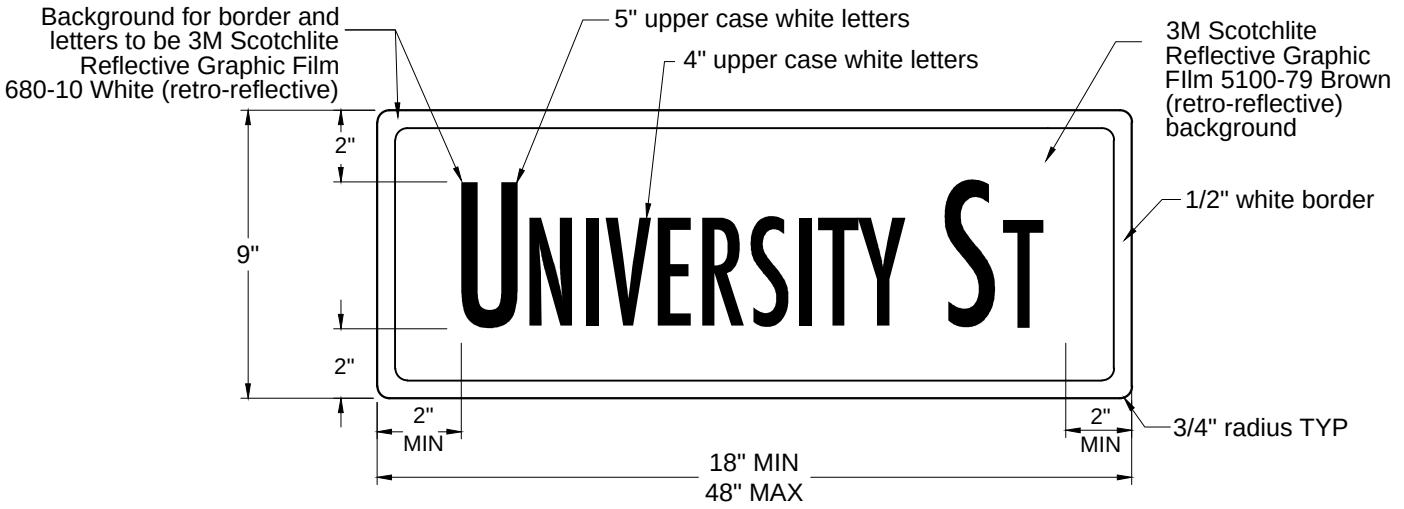


POLE MOUNTING HARDWARE

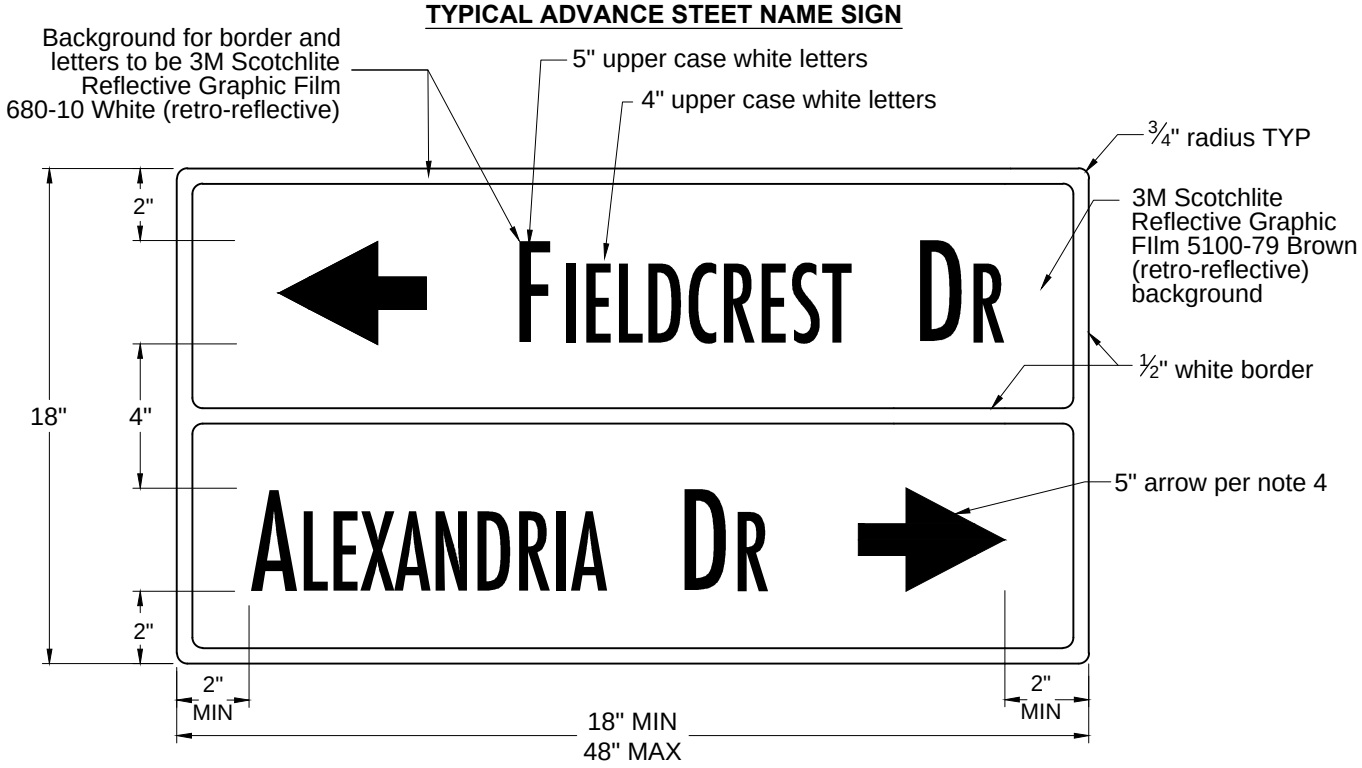
NOTES:

1. Sign blanks shall be 0.080" aluminum per Caltrans specifications.
2. Font shall be Futura Medium Condensed.
3. Spacing of letters, words, and abbreviations per Caltrans specifications.
4. Signs shall be double faced.
5. Sign posts shall be installed per ST11.
6. All signs shall be centered on pole and level at time of installation.

CITY OF HEALDSBURG CALIFORNIA SINCE 1867	PRIVATE STREET SIGN Street Name	STANDARD DETAIL ST12A
SCALE: NONE	APPROVED:	DATE: Jan 2016



TYPICAL ADVANCE STEET NAME SIGN

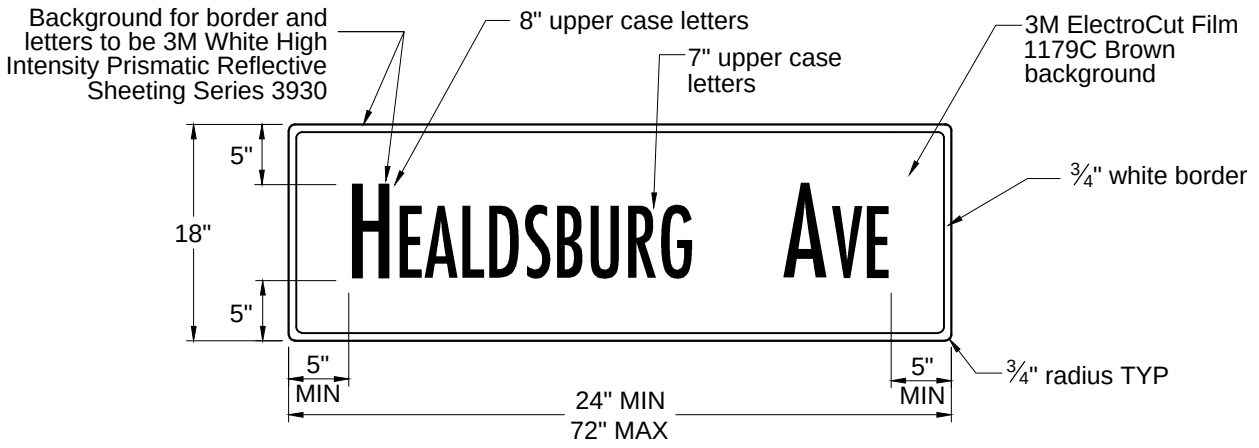


STREET NAME CHANGE

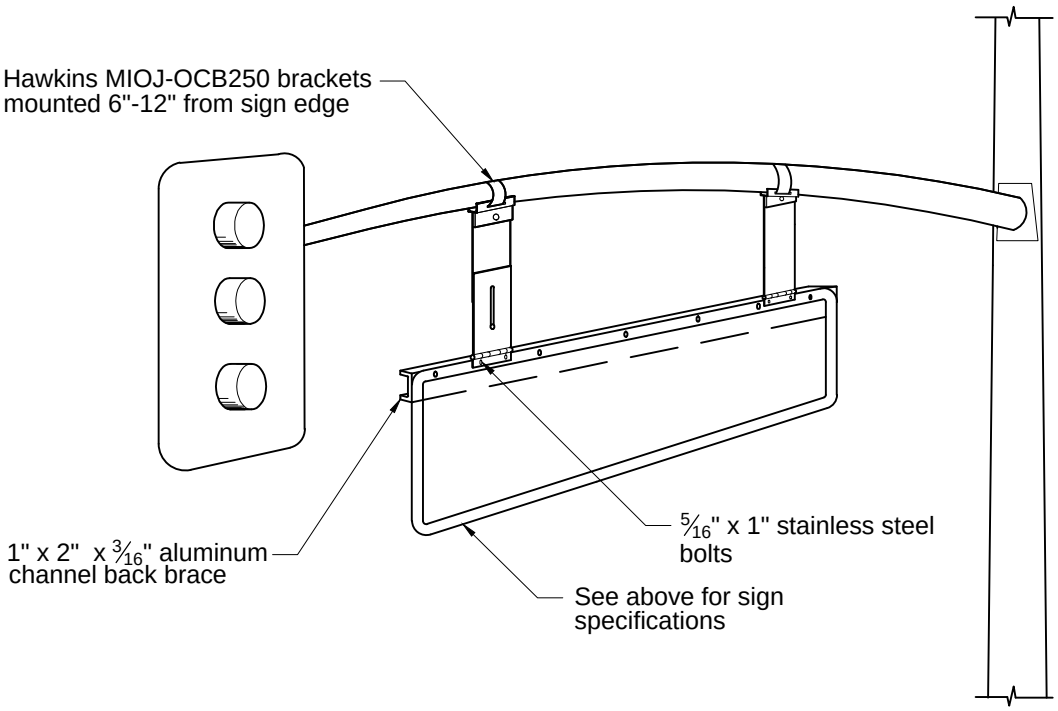
NOTES:

1. Sign blanks shall be 0.080" aluminum per Caltrans specifications.
2. Font shall be Futura Medium Condensed
3. Spacing of letters, words, and abbreviations per Caltrans specifications.
4. At “T" intersections or intersections where a street name changes, a 5” arrow shall be added to the sign. The arrow shall be solid white high intensity reflective material and shall point in the direction of the associated street as shown in the above detail.
5. Sign posts shall be installed per ST11.
6. All signs shall be centered on pole and level at time of installation. Signs over 36" long shall be mounted with U-post brace.

CITY OF HEALDSBURG CALIFORNIA SINCE 1867	STREET SIGN Advance Street Name	STANDARD DETAIL ST13
SCALE: NONE	APPROVED:	DATE: Jan 2016



TYPICAL MAST-ARM STREET NAME SIGN



TYPICAL MAST-ARM STREET NAME SIGN INSTALLATION

NOTES:

1. Sign blanks shall be 0.125" aluminum per Caltrans specifications.
2. Font shall be Future Medium Condensed
3. Signs shall be double-faced.
4. Spacing of letters, words, and abbreviations per Caltrans specifications.
5. At “T" intersections or intersections where the street name changes, a 8” arrow shall be added to the sign. The arrow shall be solid white high intensity reflective material and shall point in the direction of the associated street similar to ST13.
6. Location of sign mounting on the mast arm shall be determined by the City Engineer during the plan check process.

CITY OF HEALDSBURG CALIFORNIA SINCE 1867	STREET SIGN Mast Arm Mounted	STANDARD DETAIL ST14
SCALE: NONE	APPROVED:	DATE: Jan 2016

STREET BARRICADE

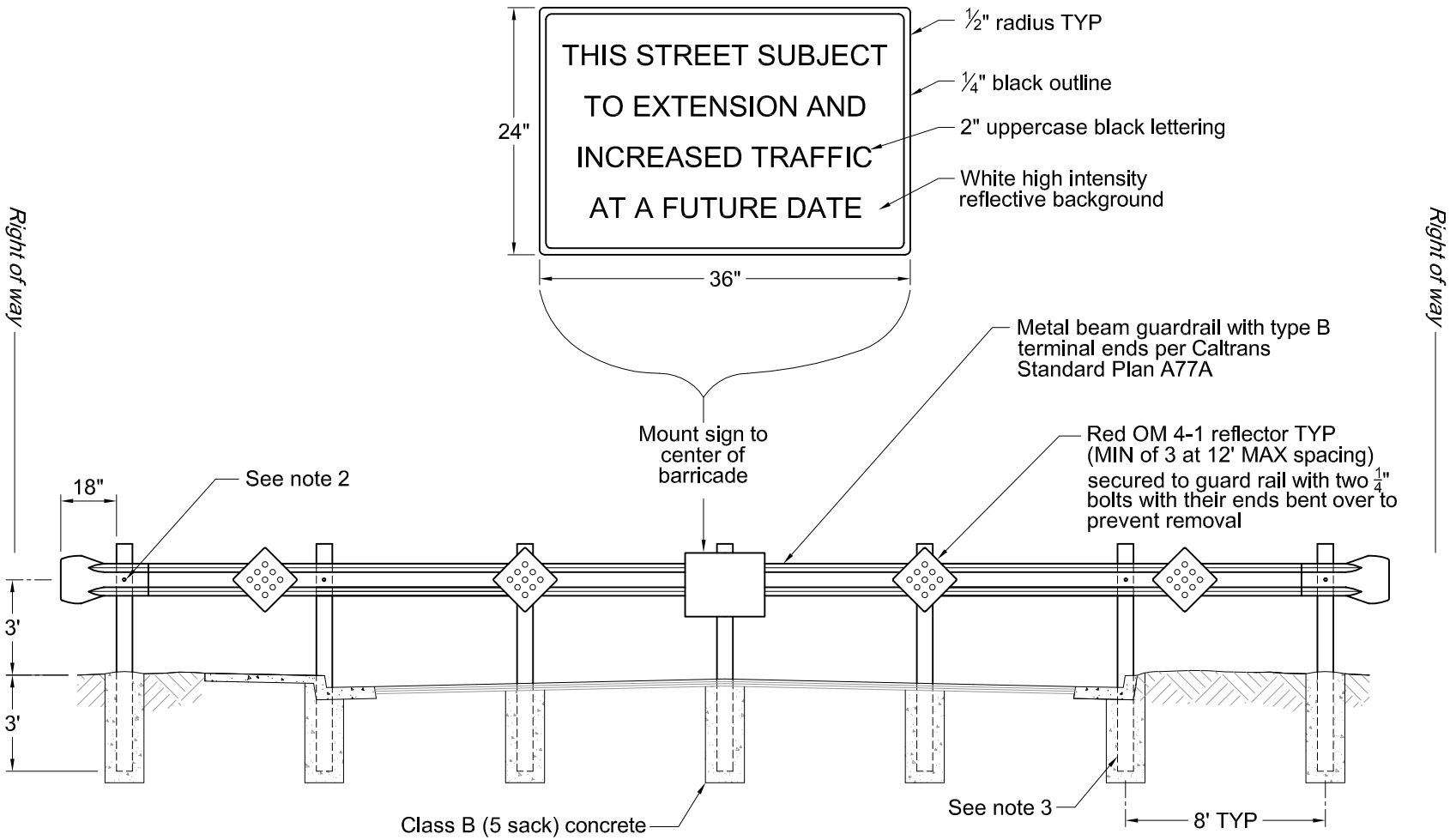
SCALE: NONE

APPROVED:

DATE: March 2016

ST19

STANDARD DETAIL



NOTES:

1. The barricade shall be placed immediatly behind the end of the street improvements and extend across the entire right-of-way.
2. ½" carriage bolt with cut washer and hex nut shall be used to attach guardrail to each post. Bolts shall be bent over to prevent removal.
3. Posts shall be 7' long: W 4 x 6 steel posts or 6" x 6" pressure treated wood posts.
4. All steel components shall be hot dipped galvanized and all wood components shall be pressure treated per Caltrans Specification Section 83.
5. Sign blanks shall be 0.080" aluminum per Caltrans specifications.
6. Signs shall be single faced.

SIDEWALK BARRICADE

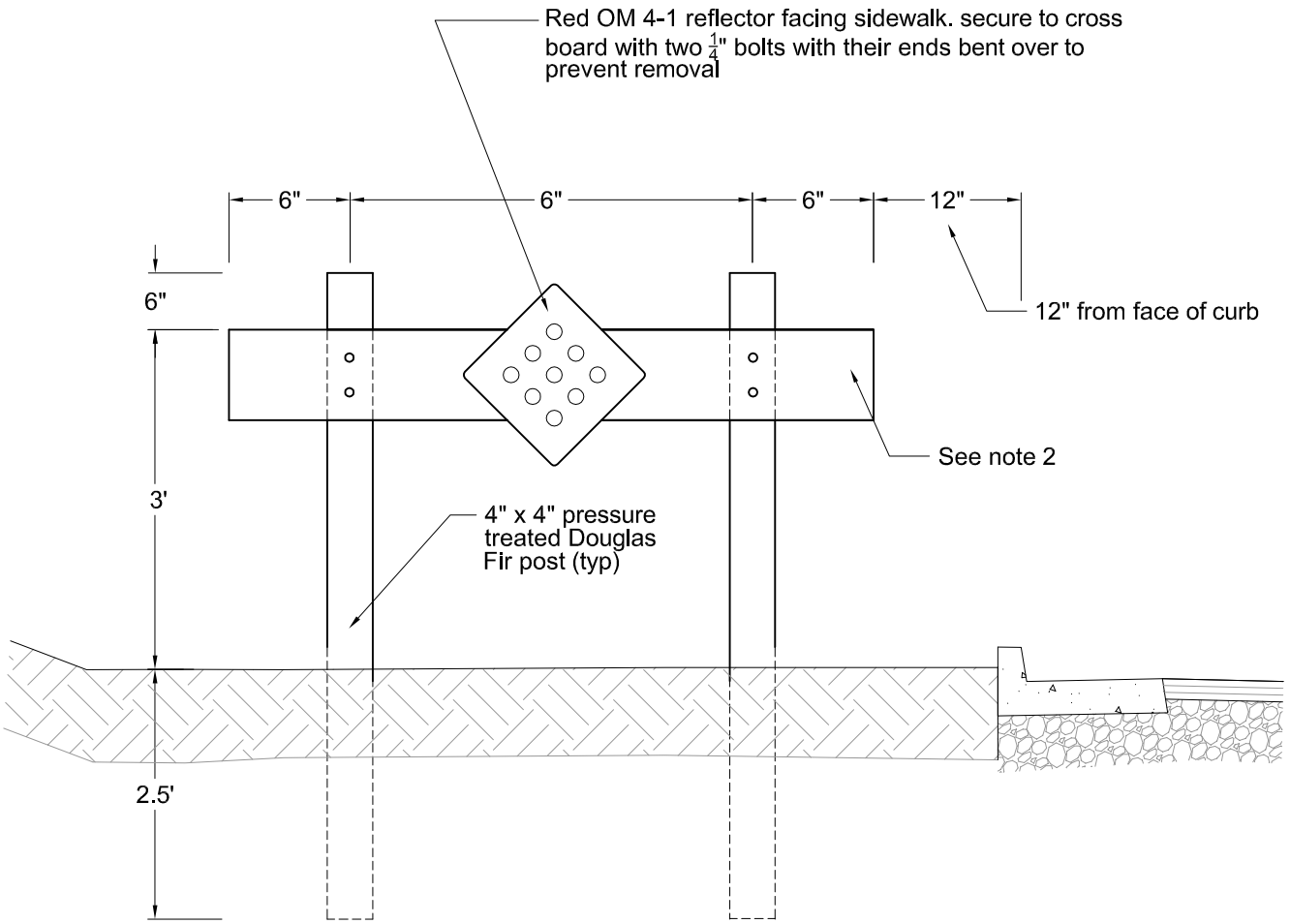
SCALE: NONE

APPROVED:

DATE: March 2016

ST20

STANDARD DETAIL



NOTES:

1. The barricade shall be placed immediately behind the end of the sidewalk
2. Posts shall be backfilled with compacted earth
3. 2" x 6" cross board shall be pressure treated Douglas FIr fastened to posts with ½" galvanized bolts, washers, and nuts countersunk at both ends.
4. Barricade shall be painted white (1 coat prime and 2 coats enamel after erection.
5. All steel components shall be hot dipped galvanized and all wood components shall be pressure treated per Caltrans Specification Section 83.
6. Sign blanks shall be 0.080" aluminum per Caltrans specifications.
7. Signs shall be single faced.

SIDEWALK OBSTRUCTION

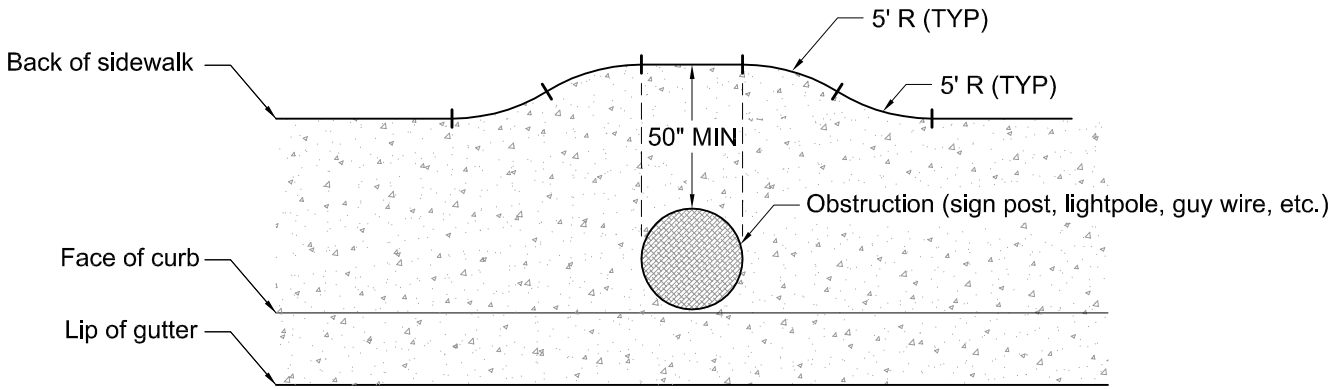
SCALE: NONE

APPROVED:

DATE: March 2016

ST21

STANDARD DETAIL



NOTES:

1. 50" MIN clearance shall be maintained around obstruction.

BOLLARD

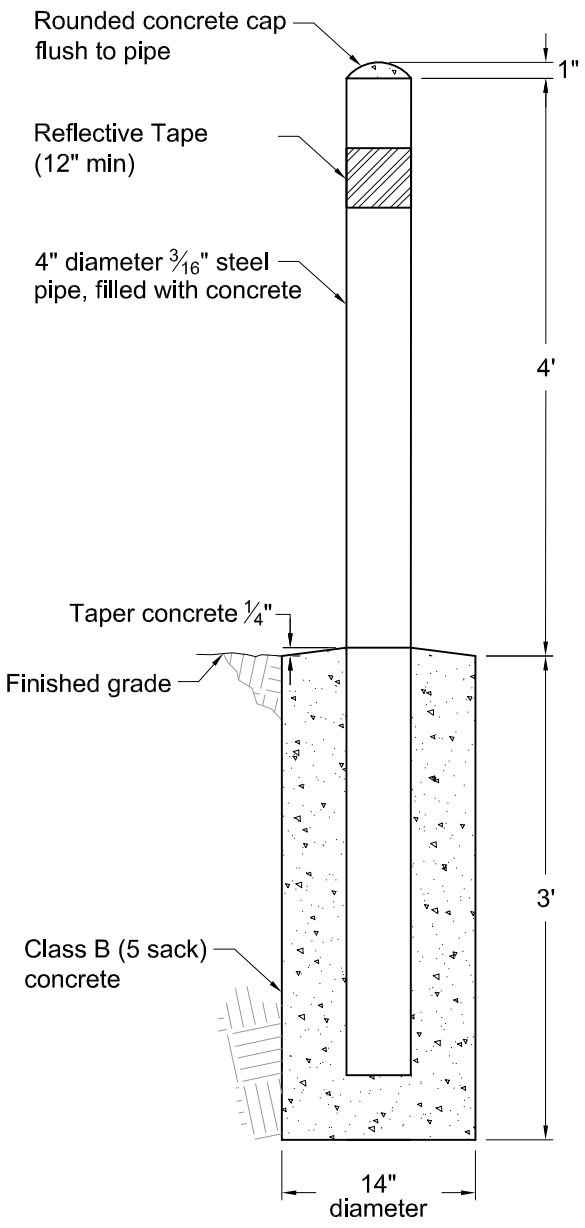
SCALE: NONE

APPROVED:

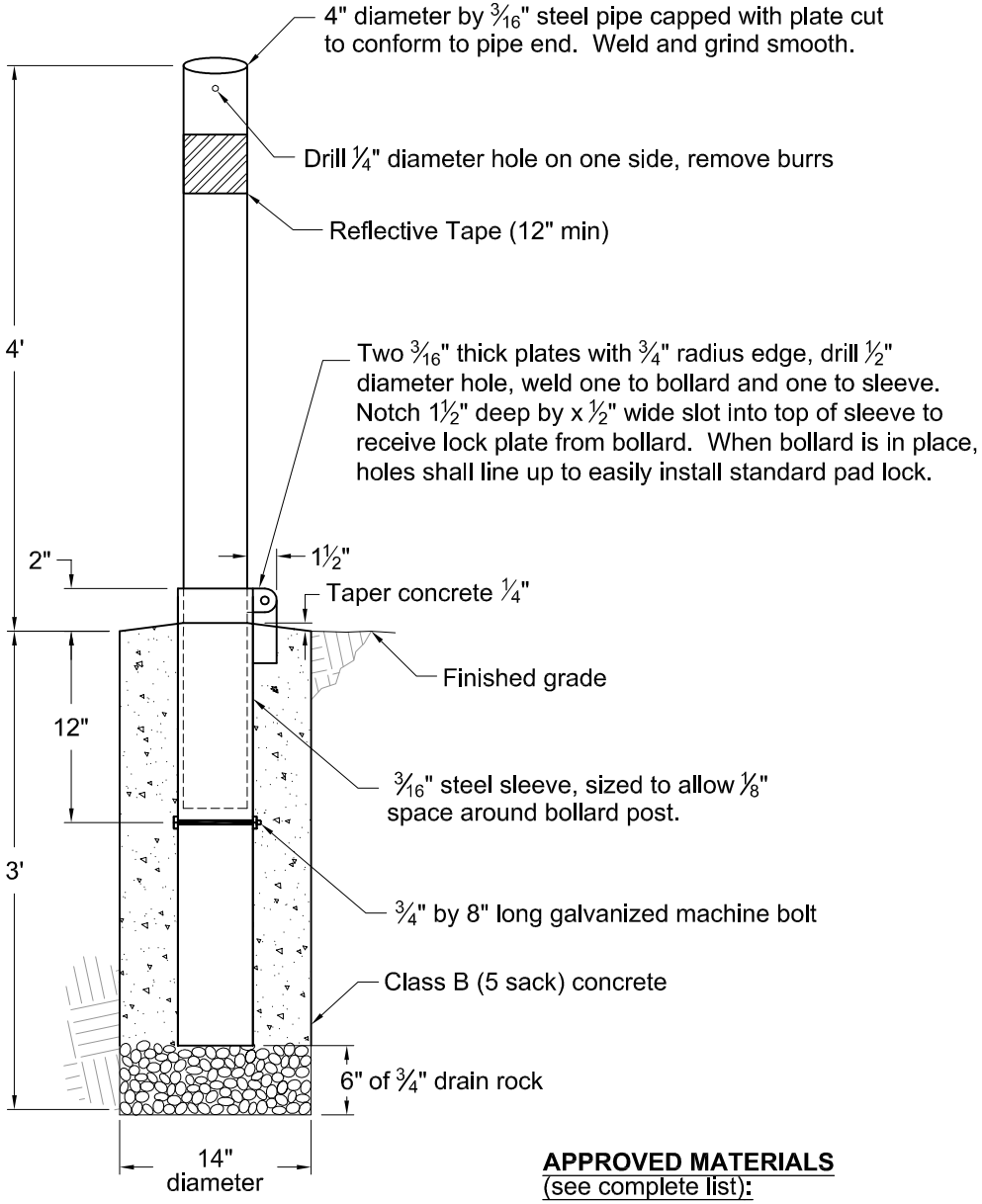
DATE: March 2016

ST22

STANDARD DETAIL



NON-REMOVABLE BOLLARD



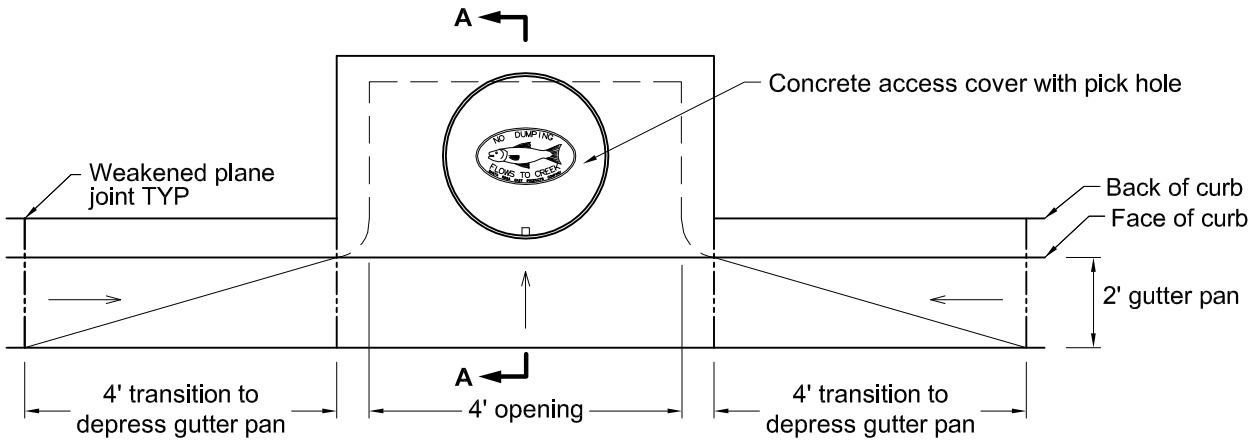
REMOVABLE / LOCKABLE BOLLARD

APPROVED MATERIALS
(see complete list):

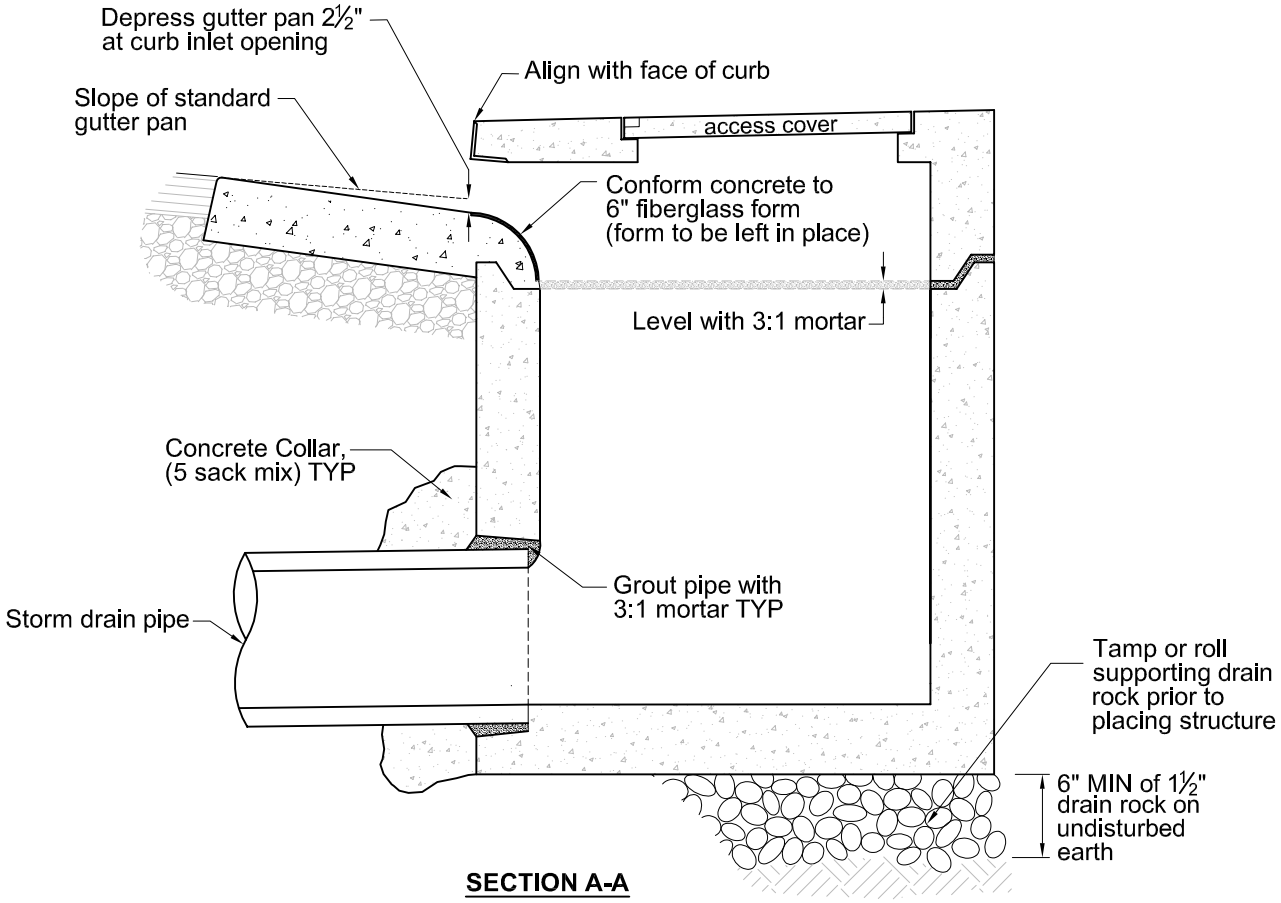
a. All parts of bollard shall be hot dip galvanized steel per Caltrans Std Specification 75-1.05

NOTES:

1. Post hole shall be hand excavated if underground utilities are present.



PLAN VIEW



SECTION A-A

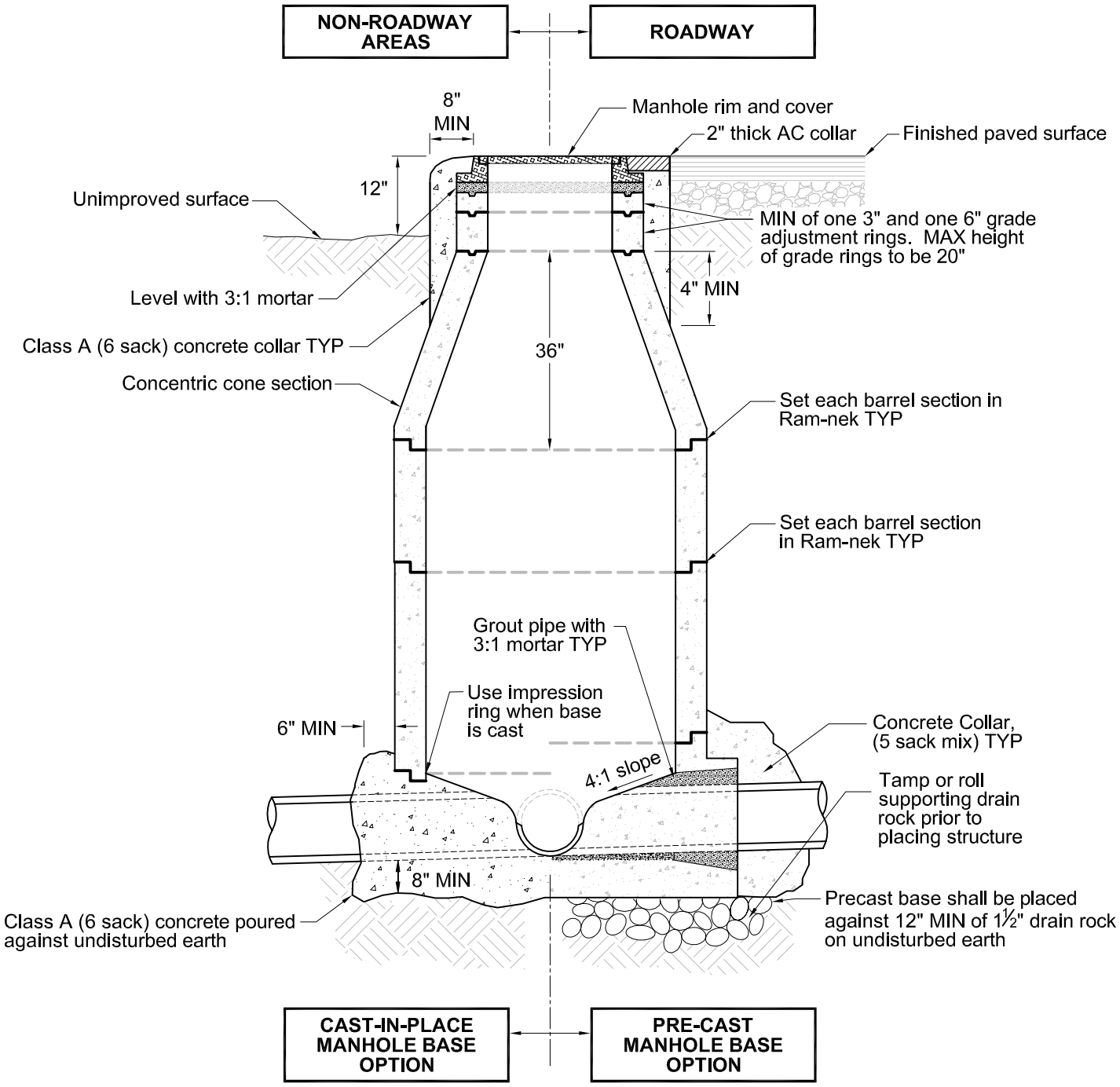
NOTES:

1. Where a cast-in-place box is used:
   a. Wall Thickness - 6" for boxes up to 8' deep and 8" for boxes deeper than 8'.
   b. Rebar - #4 at 12" on center
   c. Concrete - Class A (6 sack)
2. No steps permitted in curb inlet.

APPROVED MATERIALS (see complete list)**:**

1. Curb Inlet: US Concrete Group 4AC hood with CP3648 base
2. Access Cover: US Concrete Group concrete cover with NPDES cast iron logo and pick hole

	CURB INLET	STANDARD DETAIL SD01
SCALE: NONE	APPROVED:	DATE: March 2016



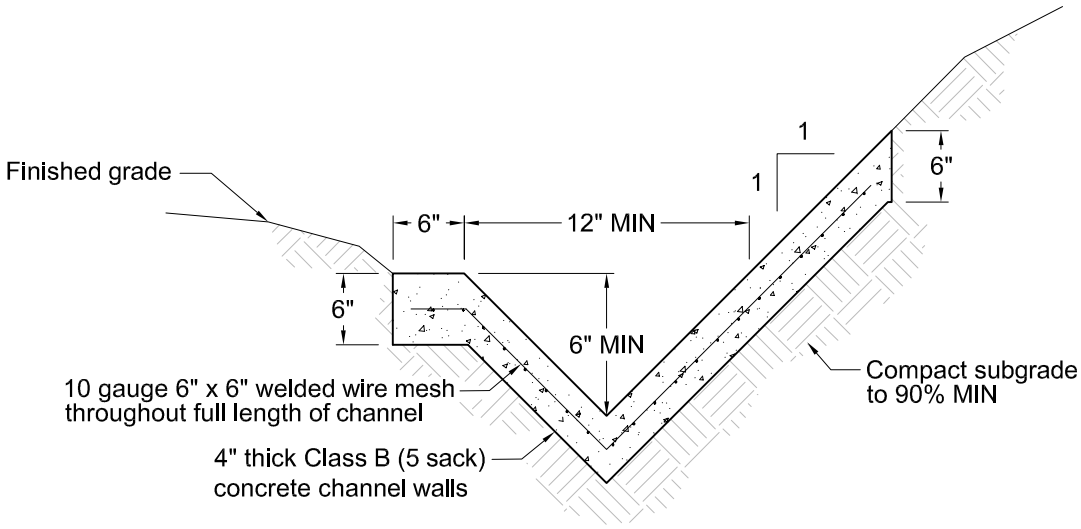
NOTES:

1. After lower ring section is set, break out top half of pipe (leave lower half of pipe in place) flush with inside face of manhole wall and construct shelf and U-shaped channel. Make elevation changes gradual and directional changes with smooth curves. Slope and size of channels shall match upstream and downstream pipes.
2. No steps are permitted in the manhole.

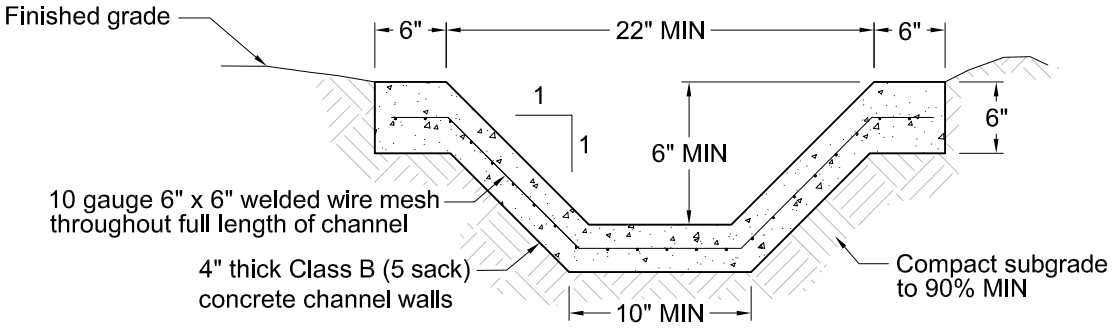
APPROVED MATERIALS (see complete list):

1. Manhole Structure:
   a. Pipe smaller than 18" - US Concrete Group 20-48C
   b. 18" to 48" pipe - US Concrete Group 20-60CC
2. Frame and Cover (marked "STORM DRAIN" with open or closed pick hole):
   a. South Bay Foundry 1900
   b. D&L Supply A-1024

CITY OF HEALDSBURG	STORM DRAIN MANHOLE		STANDARD DETAIL SD02
SCALE: NONE	APPROVED:	DATE: March 2016	



TYPE "A"



TYPE "B"

NOTES:

1. Forms shall be inspected by Public Works Inspector prior to placing concrete.
2. No ditch shall be constructed on filled ground prior to certification of the fill by the Soils Engineer.
3. Weakened plane joints shall be installed every 10', no expansion joints required.

APPROVED MATERIALS (see complete City Approved Materials List)**:**

1. Concrete shall be Class B (5 sack).

CITY OF HEALDSBURG	DITCHES Concrete Lined	STANDARD DETAIL SD03
SCALE: NONE	APPROVED:	DATE: March 2016

STORM DRAIN OUTFALL

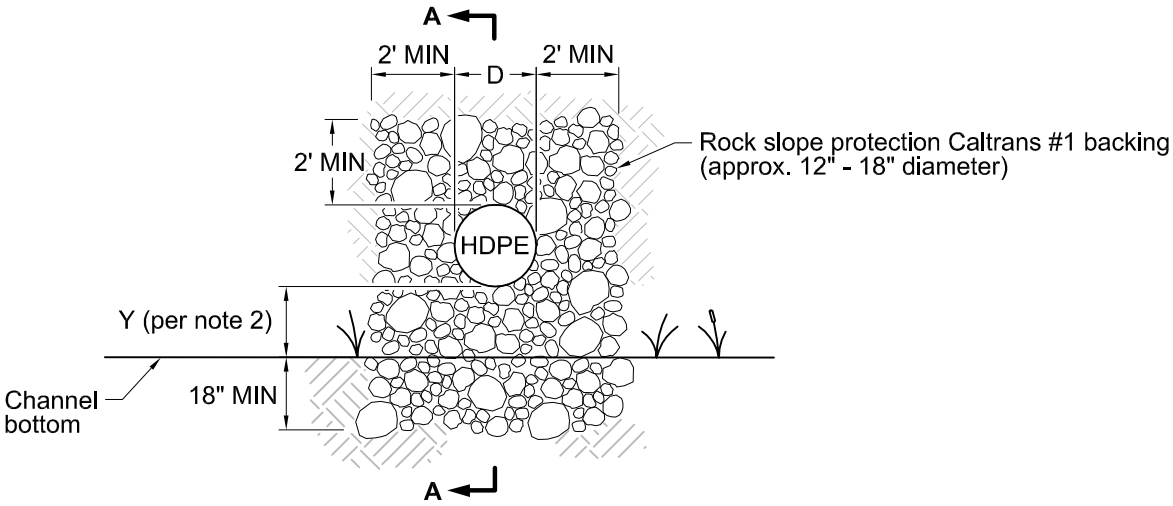
SCALE: NONE

APPROVED:

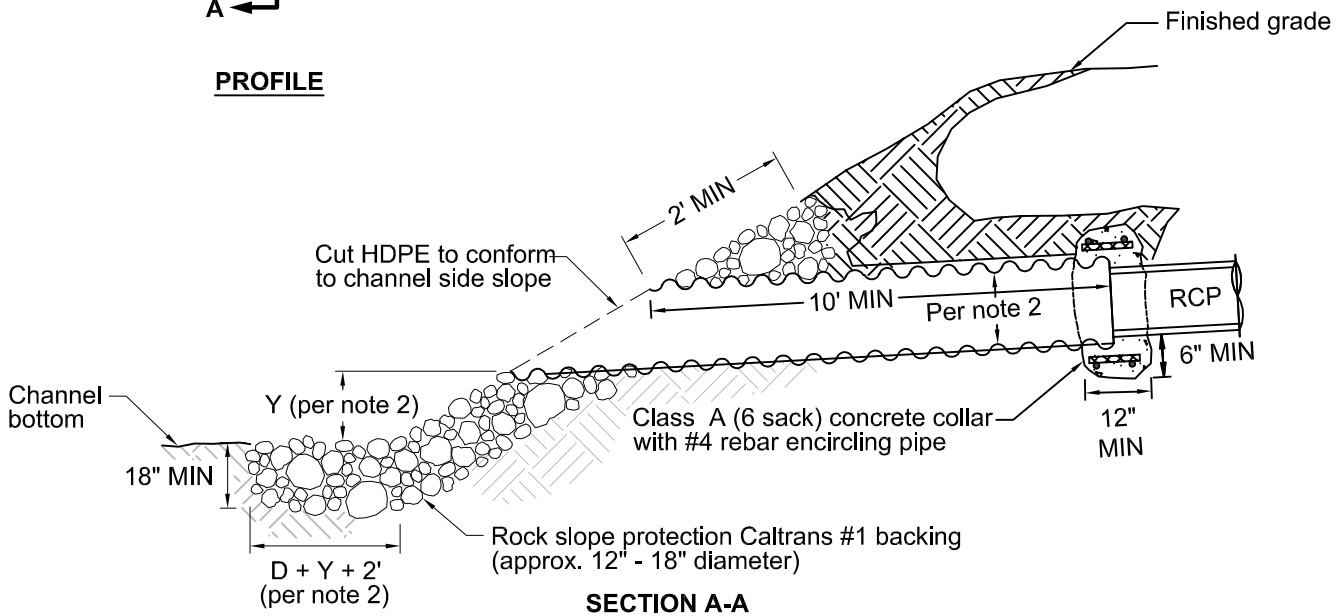
DATE: March 2016

SD04

STANDARD DETAIL



PROFILE



SECTION A-A

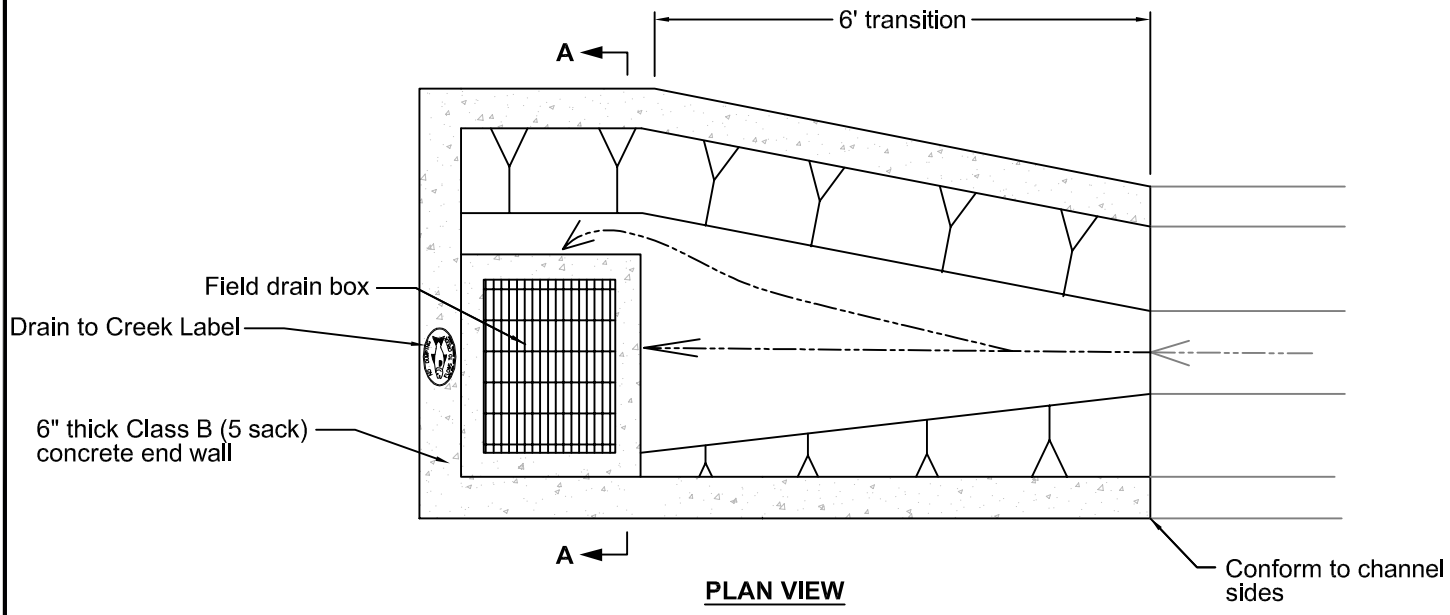
NOTES:

1. The last section of any storm drain that empties into a creek, stream, river or other waterway shall be High Density Polyethylene (HDPE) sized one standard pipe size larger (i.e., use 24" HDPE for 18" RCP).

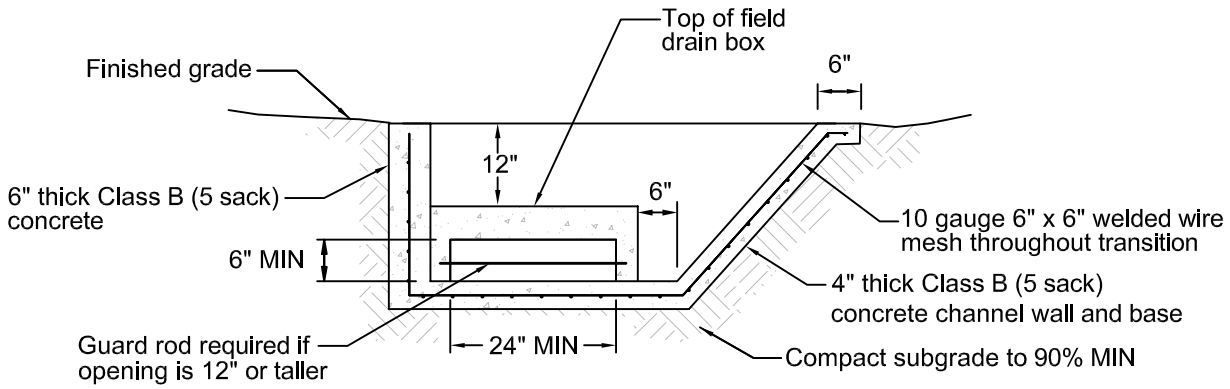
2. Rock slope protection based on CMP pipe diameter (D):

   When D is 24" or larger, Y= 2'

   When D is smaller than 24", Y = 1'



PLAN VIEW



SECTION A-A

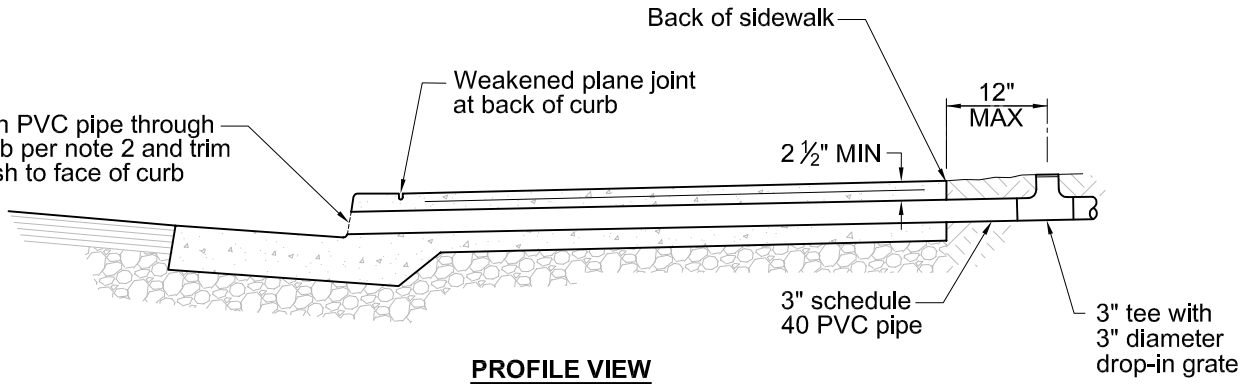
NOTES:

1. No structure shall be constructed on filled ground prior to certification of the fill by the Soils Engineer.
2. Forms shall be inspected by Public Works Inspector prior to placing concrete.
3. All sections shall be at least 4" thick.
4. Concrete finish shall conform to section 51-18A of the latest Caltrans specifications.

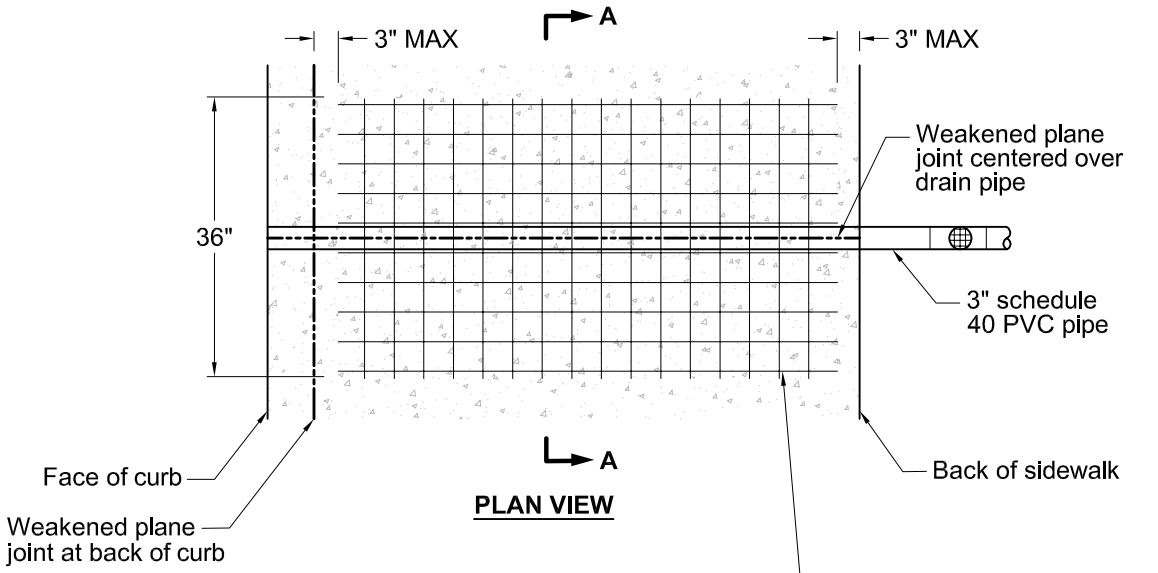
APPROVED MATERIALS (see complete list)**:**

1. Concrete shall be Class B (5 sack).
2. Field Drain: US Concrete Group 3K with two side openings and heavy locking grate.
3. Drain to Creek Label (Public and Private)

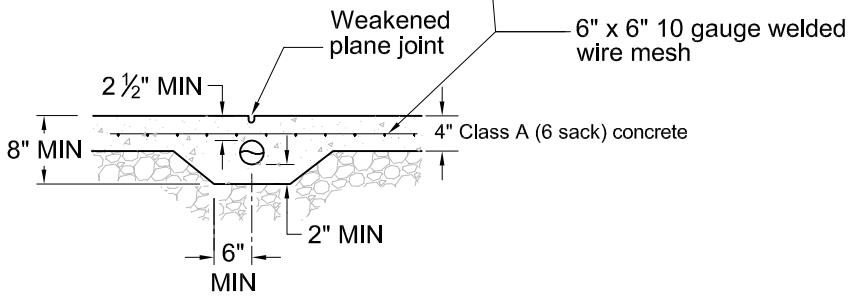
CITY OF HOLLISTER	# FIELD DRAIN Redundant Inlets		STANDARD DETAIL SD05
	SCALE: NONE	APPROVED:	DATE: March 2016



PROFILE VIEW



PLAN VIEW

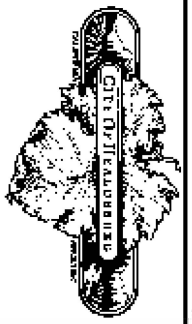


SECTION A-A

NOTES:

1. Sidewalk drains are required for all new construction (2 per lot recommended).
2. Sidewalk drains shall be incorporated into site drainage plan to prevent storm water concentrated by a device such as a roof downspout, ditch, swales, or pipe from running across the public sidewalk. Devices that collect and convey storm water such as pipes and downspouts should incorporate water quality Best Management Practices (BMP's) such as rain gardens, bio-retention swales, or infiltrations trenches whenever possible prior to discharging to a sidewalk drain. More information on storm water BMP's and BMP details can be found in the City of Santa Rosa Storm Water LID Manual available online at http://srcity.org/departments/utilities/stormwatercreeks/swpermit/Pages/swLIDtechManual.aspx.
3. Core drilling of curb is required unless curb and gutter is replaced.

CITY OF SANTA ROSA	SIDEWALK DRAIN		STANDARD DETAIL SD06
	SCALE: NONE	APPROVED:	DATE: March 2016



SCALE: NONE

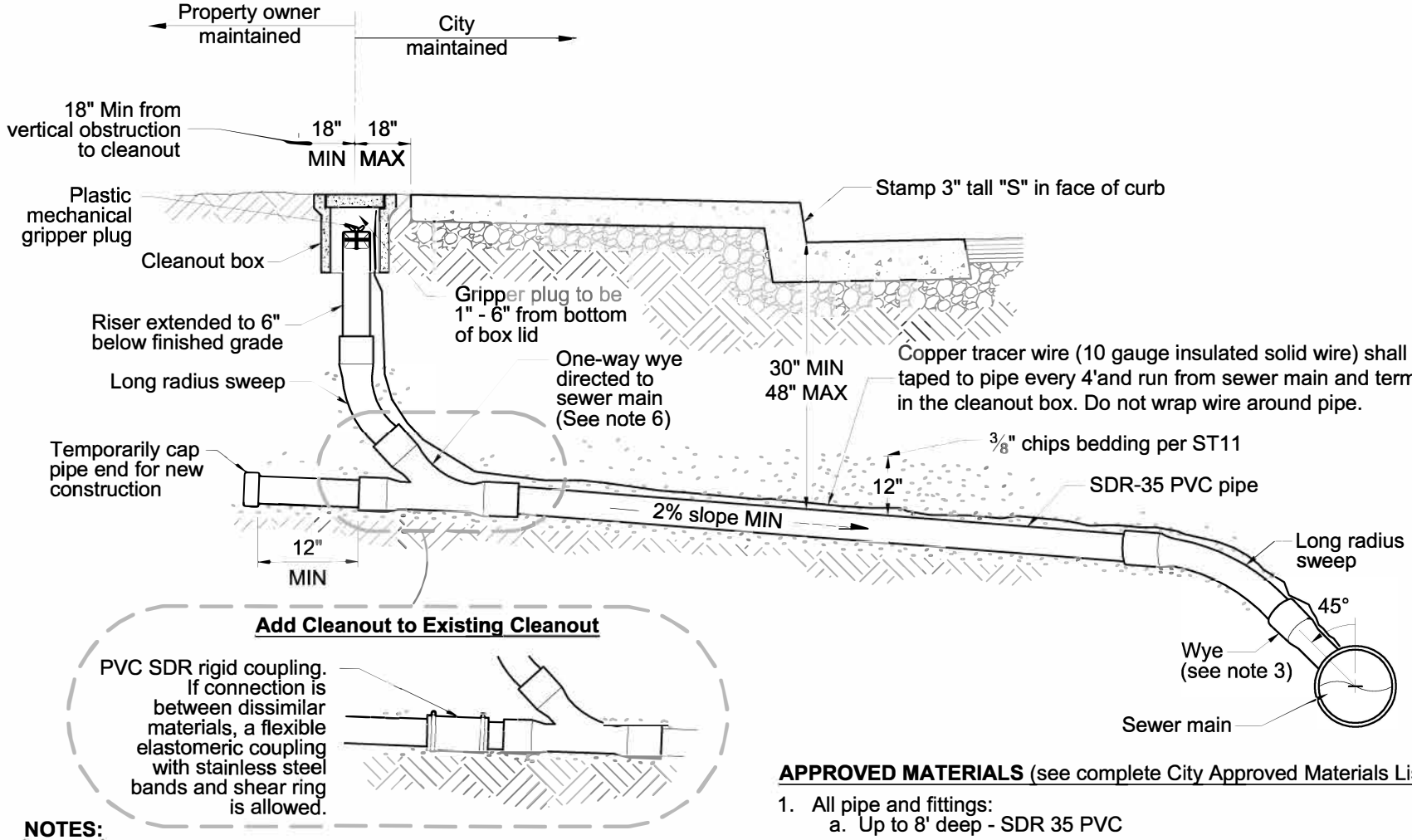
APPROVED:

DATE: March 2016

SEWER LATERAL

SS01

STANDARD DETAIL



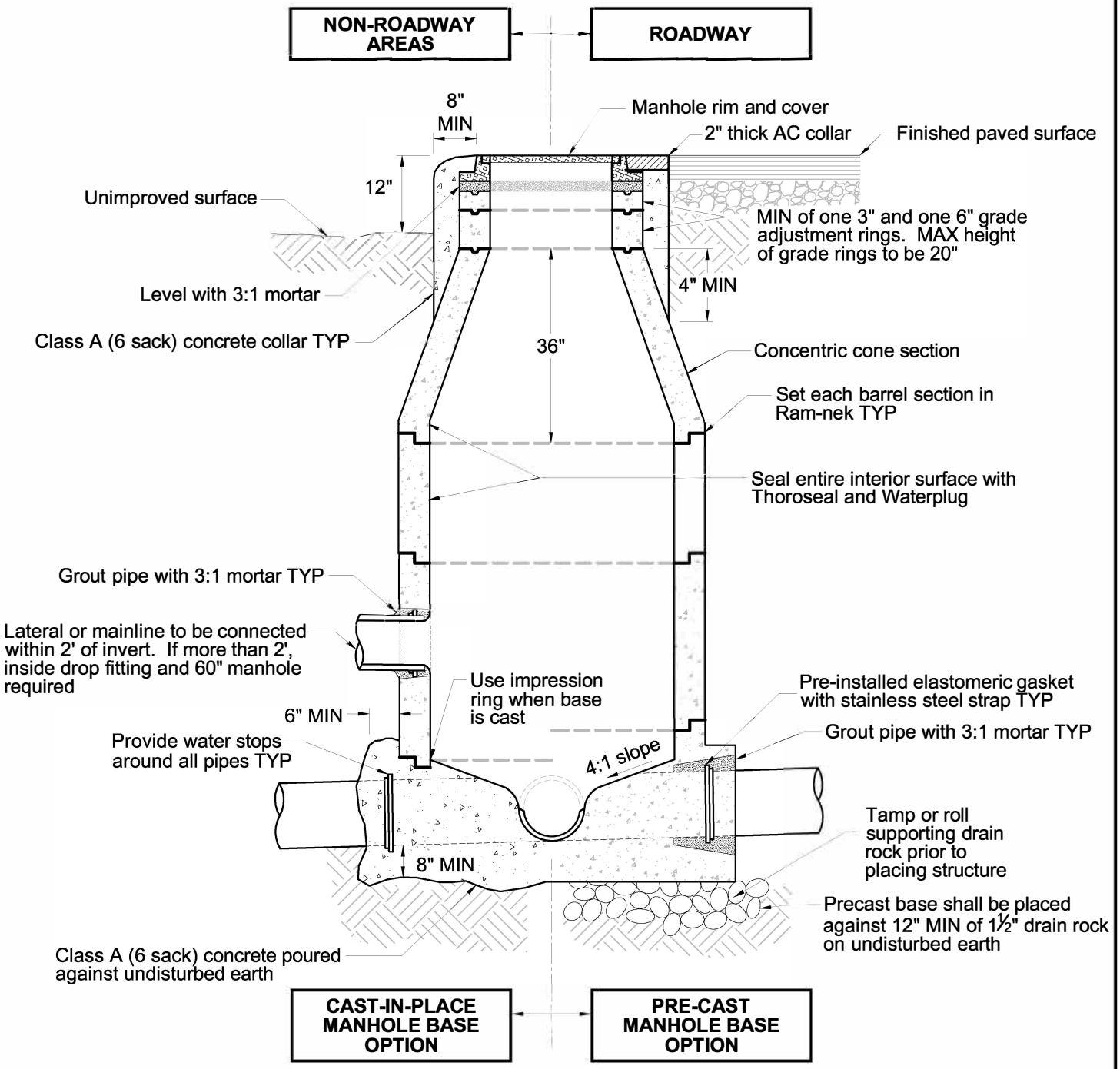
Add Cleanout to Existing Cleanout

NOTES:

1. 5' MIN horizontal separation is required between sewer laterals and water services, water mains or fire hydrant lines.
2. 6" or larger laterals are required to be connected to the public sewer main at a manhole.
3. New laterals installed on existing public mains shall connect with a wye branch saddle with stainless steel band (tee is not allowed).
4. Cleanout components shall be the same size as the lateral.
5. Tracer wire (10 guage insulated solid copper wire) required on all non-perpendicular installations
6. Two-way cleanouts may be permitted by the City Engineer where access is limited between building and cleanout at Property Line.

APPROVED MATERIALS (see complete City Approved Materials List):

1. All pipe and fittings:
   a. Up to 8' deep - SDR 35 PVC
   b. Greater than 8' deep - SDR 26 PVC
2. Cleanout Box:
   a. Non-traffic bearing - Christy F8 box with F8D lid marked "SEWER"
   b. Traffic bearing - Christy G5 box with G5C lid marked "SEWER"
3. Plastic mechanical gripper plug:
   a. Cherne Industries end of pipe series, sized to fit
4. Coupling (for adding cleanout to existing lateral only):
   a. PVC to PVC - Rigid SDR PVC Coupling
   b. PVC to Other - Fernco Elastomeric coupling with stainless steel bands and shear ring
5. Saddle for new lateral on existing main - Fernco Flexible Tap Saddle



NOTES:

1. After lower ring section is set, break out top half of pipe (leave lower half of pipe in place) flush with inside face of manhole wall and construct shelf and U-shaped channel. Make elevation changes gradual and directional changes with smooth curves. Slope and size of channels shall match upstream and downstream pipes.
2. No steps are permitted in the manhole.
3. Bolt down lids with water tight gasket are required for manholes within 100' of a waterway where an overflow could discharge directly into the waterway.

APPROVED MATERIALS (see complete list):

1. Manhole Structure:
   a. Pipe smaller than 18" - US Concrete Group 20-48C
   b. 18" to 48" pipe - US Concrete Group 20-60CC
2. Frame and Cover (24" marked "SANITARY SEWER" with closed pick hole):
   a. South Bay Foundry 1900 CPH
   b. D&L Supply A-1024 CPH

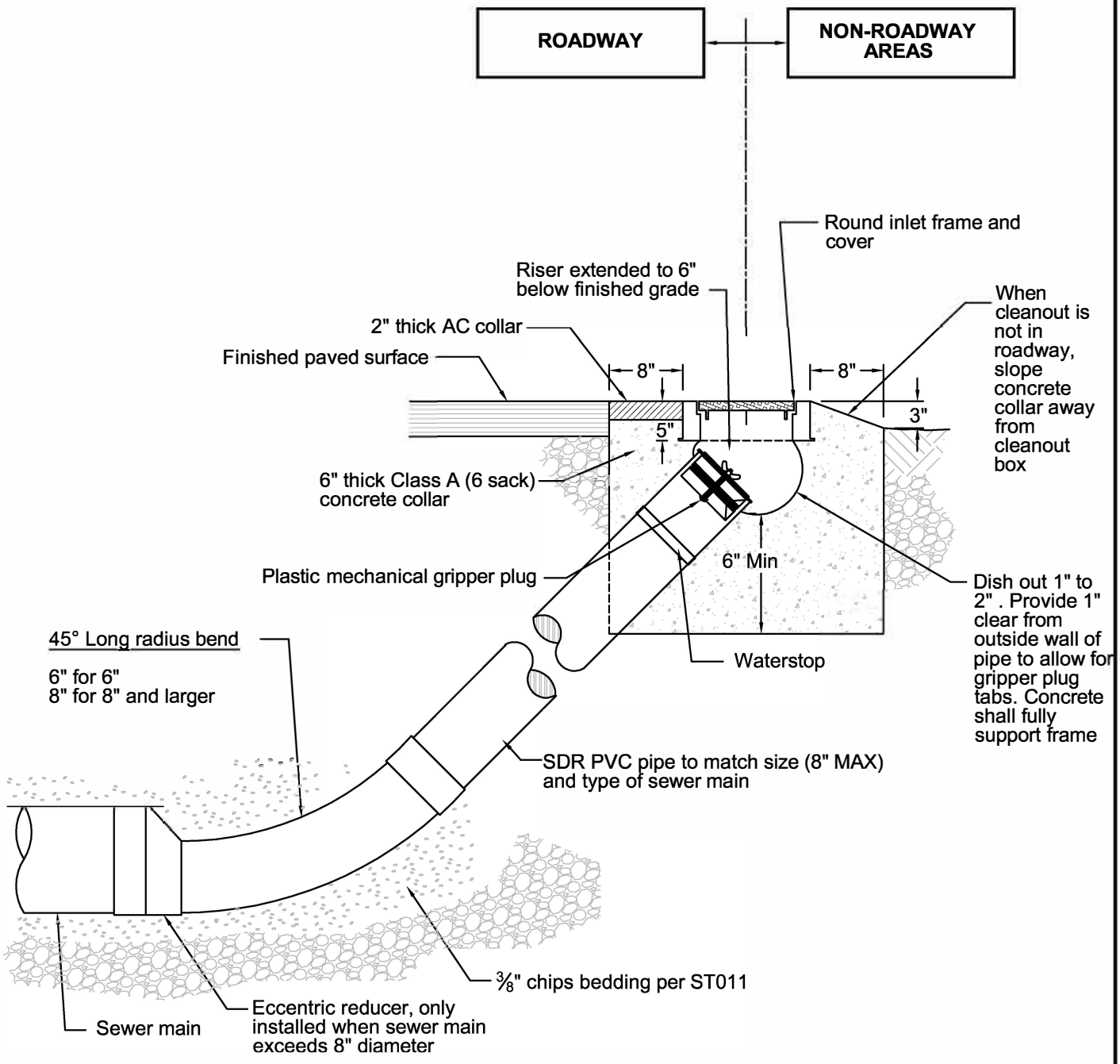
CITY OF HEALDSBURG

SEWER MANHOLE

STANDARD DETAIL

SS02

SCALE:	APPROVED:	DATE:
NONE		March 2016



NOTES:

1. Mainline cleanout is allowed only where the sewer main is subject to future extension and as approved by the City Engineer.

APPROVED MATERIALS (see complete list):

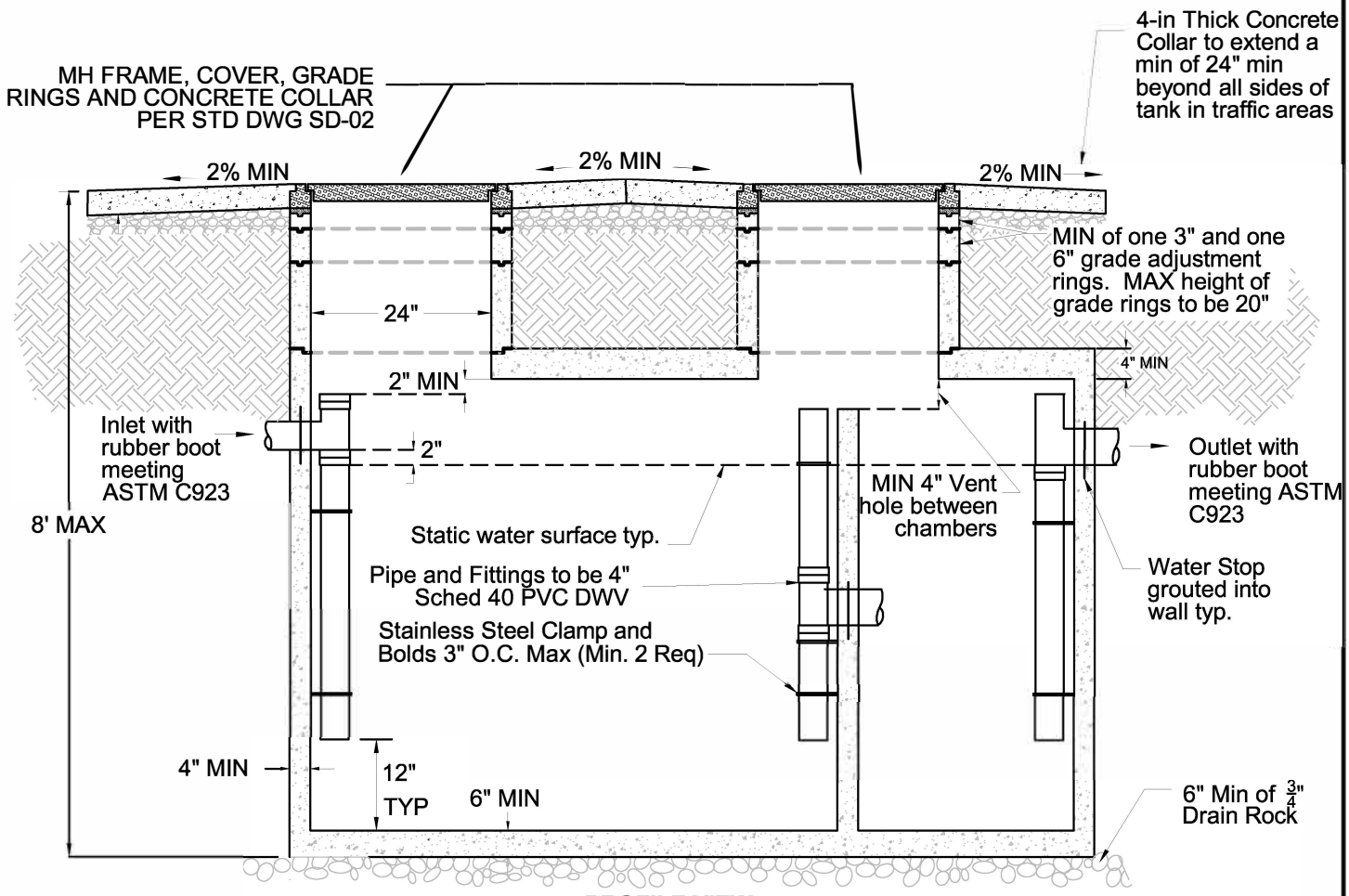
1. All pipe and fittings shall match the size and type of sewer main
2. Cleanout Rim and Cover: D&L H-8026 CPH with lid marked "SEWER"
3. Plastic mechanical gripper plug:
   a. Cherne Industries end of pipe series, sized to fit

Temporary Mainline Cleanout

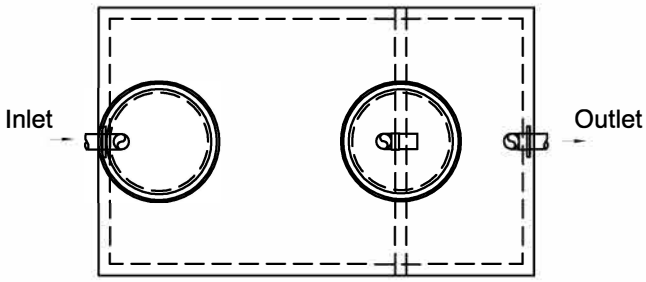
STANDARD DETAIL

SS03

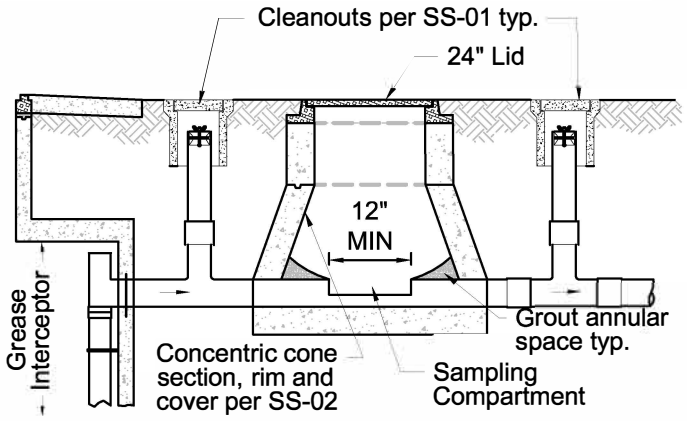
SCALE:	APPROVED:	DATE:
NONE		March 2016



PROFILE VIEW



PLAN VIEW



SAMPLING MANHOLE

NOTES:

1. Tank to be precast and sized to fit application with a minimum retention time of 30 minutes (1000 gallon minimum).

2. Grease interceptors must be located outside of building in location accessible to hauler and outside of public right of way.

3. Protective coasting shall cover all internal surfaces and meet the criteria of ASTM D-4541 and C-882

4. Invert grades of inlet and outlet pipes to be provided by design engineer.

5. Wall thicknesses shown are minimum, Grease Interceptor shall be designed for AASHTO H-20 surface loading plus active soil pressure loading and conform to ASTM C1613

APPROVED MATERIALS (see complete list):

1. Pre Manufactured tank meeting the requirements of this detail
2. Frame and Cover (24" marked "SANITARY SEWER" with closed pick hole):
   a. South Bay Foundry 1900 CPH
   b. D&L Supply A-1024 CPH

CITY OF HEALDSBURG	Two Stage Grease Interceptor with Sampling Manhole		STANDARD DETAIL SS04
	SCALE: NONE	APPROVED:	DATE: March 2016

Overflow Protection Device

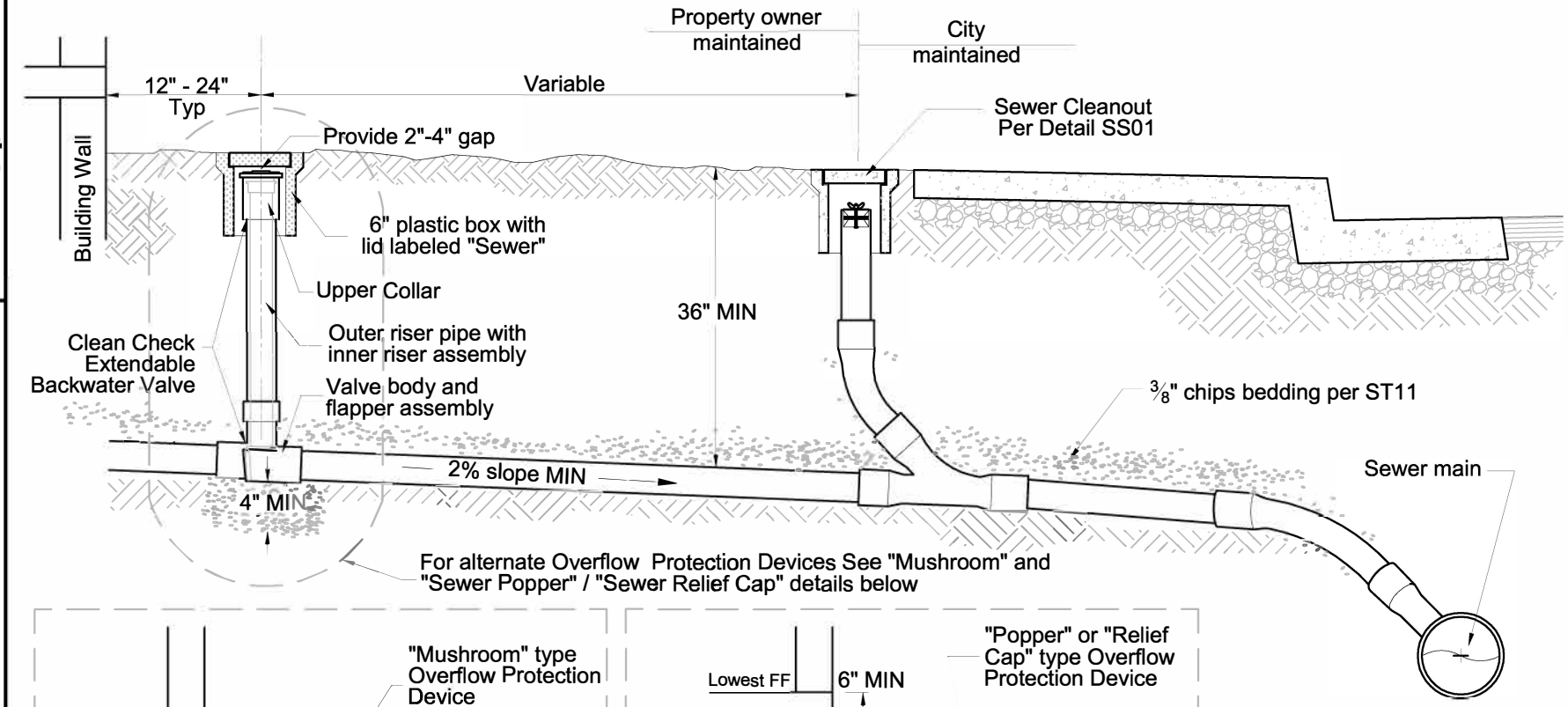
SCALE: NONE

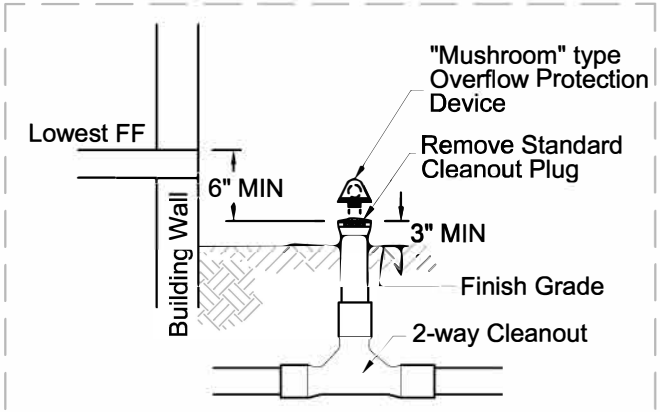
APPROVED:

DATE: March 2016

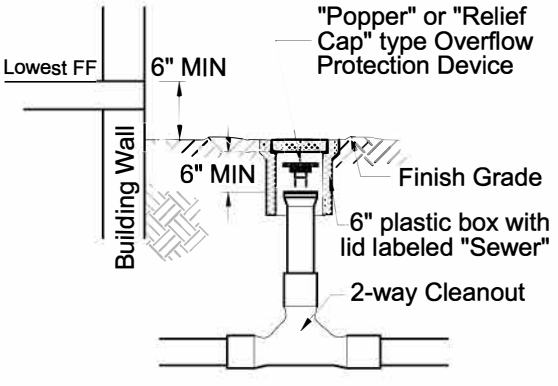
SS05

STANDARD DETAIL





Overflow Protection Device - "Mushroom"



Overflow Protection Device - "Popper" or "Relief Cap"

NOTES:

1. A Sewage Backwater Valve assembly or Overflow Device is required to be installed on all sewer laterals. Specific location shall be determined by the contractor and the property owner.
2. The property owner is responsible for the installation and maintenance of the sewage backwater valve assembly or overflow device.
3. If the device is subject to vehicular traffic, use precast box and lid designed for H-20 traffic loadings.
4. Overflow Protection Devices located within 5-ft of the building may be used in lieu of a standard clean-out subject to the approval of the Building Official.

APPROVED MATERIALS (see complete City Approved Materials List):

1. Overflow Protection Device:
   a. Backwater Valve - Clean Check extendable backwater valve by Rectorseal
   b. Mushroom - Kelly Backwater Device (No-Hub & IPS) by Genplex
   c. Sewer Popper - Sewer Popper Model S62-304 by Stephens Corp
   d. Relief Cap - Sewer Relief Cap by Unlimited Home Solutions LLC