PROPOSAL, SPECIFICATIONS, BOND AND AFFIDAVIT
FOR THE CONSTRUCTION OF THE
NORTH TORRANCE WELL FIELD PROJECT, CIP No. I-108, PHASE I
B2013-25

REGISTERED PROFESSIONAL ENGINEER
TOUFIC SEMAAN
No. 59226
Exp. 06/30/13
CIVIL
STATE OF CALIFORNIA

TOUFIC J. SEMAAN, P.E.

ACTING CITY ENGINEER

MAY 2013

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SECTION A

NOTICE INVITING BIDS

CITY OF TORRANCE, CALIFORNIA

NOTICE INVITING BIDS

Notice is hereby given that sealed bids for performing the following described work will be received at the Office of the City Clerk of the City of Torrance, California, **until 2:00 p.m. on May 30, 2013,** after which time they will be publicly opened and read at 2:15 p.m. in the Council Chambers of said City:

THE CONSTRUCTION OF THE NORTH TORRANCE WELL FIELD PROJECT, CIP No. I-108, PHASE I

Plans, Bid Schedule and Specifications are available for viewing and printing by prospective bidders and subcontractors on the City's website at *(http://www. torranceca.gov/3239.htm)*

Those who only view and/or print the Plans, Bid Schedule and Specifications from the City's website will not be added to the City's Plan Holder list for this project.

The official and required form of Proposal must be obtained at the Office of the City Clerk (310) 618-2870, City Hall, 3031 Torrance Boulevard, Torrance, California. There is no cost if picked up at City Hall. A payment of $5 is required if requested by mail. The amount includes tax and is not refundable. A prospective bidder must provide to the City Clerk the firm's name, address, telephone and fax numbers, a contact person and a valid email address. This will ensure that your firm is listed as a "Plan Holder" and that you will be informed of any and all information issued subsequent to obtaining the official form of Proposal. Addenda will be issued only by email and only to those that provide the required information to the City Clerk. Receipt of any Addendum must be acknowledged by a bidder in its submitted form of Proposal.

Full-size 24" x 36" Plans and a bound Specifications booklet may also be obtained at the Office of the City Clerk (310) 618-2870, City Hall, 3031 Torrance Boulevard, Torrance, California upon payment of **$50** if picked up at City Hall, or payment of **$70** if requested by mail. Both amounts include tax. Neither amount is refundable. The payment includes a copy of the official form of Proposal.

If requesting any item(s) by mail, please send check to the following:

CITY OF TORRANCE
OFFICE OF THE CITY CLERK
3031 TORRANCE BLVD
TORRANCE, CA 90509
ATTN: B2013-25

The Engineer's estimate for the Construction of the North Torrance Well Field Project, CIP No. I-108, Phase I is between **$1,300,000 and $1,500,000**.
Bidders shall furnish references of three previous underground utility projects costing a minimum of 1.5 million dollars constructed in the last 5 years.

Notice to Proceed (NTP) will be provided by June 17, 2013. All work shall be completed by August 31, 2013

Per Division 2, Chapter 2 of the Torrance Municipal Code, the Torrance City Council may reject any and all bids, waive any informality or irregularity in such bids, and determine the lowest responsible bidder. No facsimile bids shall be accepted by the City.

Bidders are advised that, as required by federal law, the State has established a statewide overall Disadvantaged Business Enterprise (DBE) goal. To provide assistance in meeting the statewide goal, the Agency is including a DBE availability Advisory of 9% in this contract. Although bidders need not achieve this DBE Availability Advisory as a condition of award, they are encouraged to solicit bids from DBE subcontractors and suppliers.

Substitution of securities for withheld funds is permitted per Section 22300 of the Public Contract Code.

The City has determined that a Class **A** Contractor's license is necessary to bid this project, but reserves the right to accept another Class at the sole discretion of either the Public Works Director or Engineer.

This project is not subject to state or federal prevailing wages.

The U.S. Department of Transportation (DOT) provides a toll-free "hotline" service to report bid rigging activities. Bid rigging activities can be reported Mondays through Fridays, between 8:00 a.m. and 5:00 p.m., eastern time, Telephone No. 1-800-424-9071. Anyone with knowledge of possible bid rigging, bidder collusion, or other fraudulent activities should use the "hotline" to report these activities. The "hotline" is part of the DOT's continuing effort to identify and investigate highway construction contract fraud and abuse and is operated under the direction of the DOT Inspector General. All information will be treated confidentially and caller anonymity will be respected.

By order of the City Council of the City of Torrance, California.

For further information, please contact Emmanuel Martin, Associate Engineer, in the Public Works Department at 310 618-3069, emartin@TorranceCA.Gov or John Dettle, Engineering Manager, at (310) 618-3059, jdettle@TorranceCA.Gov or via the main office at (310) 781-6900.

SECTION B

INSTRUCTIONS TO BIDDERS

CITY OF TORRANCE, CALIFORNIA

INSTRUCTIONS TO BIDDERS

A. QUALIFICATION OF BIDDERS

1. Competency of Bidders

The Bidder shall be thoroughly competent and capable of satisfactorily performing the Work covered by the Bid. As specified in the Bid Documents, the Bidder shall furnish references for of three previous underground utility projects costing a minumun of 1.5 million dollars and constructed in the last 5 years. When requested, the Bidder shall also furnish the plan of procedure proposed; the organization, machinery, plant and other equipment available for the Work; evidence of its financial condition and resources; and any other such documentation as may be required by the City to determine if the Bidder is responsible.

2. Contractor's License

At the time of submitting the Bid, the Bidder shall be licensed as a contractor in accordance with the provisions of Chapter 9, Division 3, of the California Business and Professions Code. The required prime contractor license class for the Work is shown in the project Notice Inviting Bids. However, the City reserves the right to award the Contract to a contractor with another class if the City determines that the license is proper for the work.

B. BIDDER RESPONSIBILITY

A responsible Bidder is a Bidder who has demonstrated the attribute of trustworthiness, as well as ability, fitness, capacity and experience to satisfactorily perform the work.

Bidders are notified that, in accordance with Division 2, Chapter 2 of the Torrance Municipal Code, the City Council may determine whether the Bidder is responsible based on a review of the Bidder's performance on other contracts.

If, based on the provision and criteria in Division 2, Chapter 2 of the Torrance Municipal Code, the Public Works Director proposes not to recommend the award of contract to the apparent low bidder, the Director shall notify the Bidder in writing of its intention to recommend to the City Council that the Council award the contract to the 2nd lowest responsible bidder. If the Bidder presents evidence in rebuttal to the recommendation, the Director shall evaluate the merits of such evidence, and based on that evaluation, make a recommendation to the City Council.

C. ADDENDA TO THE CONTRACT DOCUMENTS

The City may issue Addenda to the Contract Documents during the period of advertising for any reason. The Bidder shall acknowledge the receipt of the Addenda in their Bid. Failure of the Bidder to do so may result in the rejection of the Bid as non-responsive.

D. PREPARATION OF THE BID

1. Examination of Site, Plans and Specifications

Prior to submitting a Bid, the Bidder shall examine the Plans and the Work site, carefully read the Specifications, and satisfy itself that it has the abilities and resources to complete the Work. The Bidder agrees that if it is awarded the Contract, no claim will be made against the City based on ignorance or misunderstanding of the provisions of the Contract Documents, the nature and amount of the work, and the physical and climatic conditions of the work site.

2. Estimated Quantities

The quantities shown in the Bid are approximate only. The Contractor will be paid for the actual quantities of work based on field measurements as provided for in these Specifications. The City reserves the right to increase or decrease the amount of any item or portion of work to be performed or materials furnished, or to delete any item, in accordance with the Specifications.

3. Bid Instructions and Submissions

The Bid shall be submitted on the Bid Proposal forms included with the Specifications. All Bid Documents listed below must be completed, executed and submitted with the Bid by the Bidder.

Required fifteen 9 Bid Proposal Documents:

1) Bidder's Proposal
2) Addenda Acknowledgment Of Addenda Received
3) Contractor's Affidavit
4) Bid Bond (10%)
5) List of Subcontractors
6) References (2 pages)
7) Violations of Federal or State Law
8) Disqualification or Debarment

All prices submitted will be considered as including any and all sales or use taxes.

In the case of discrepancy between unit bid price and total bid, the unit price shall prevail.

4. Disadvantaged Business Enterprise (DBE) Requirements

This project has no DBE requirements.

E. BID BOND

The Bid must be accompanied by either cash, a certified or cashier's check or a surety bond (bid bond) payable to the City of Torrance. Bids must be submitted on the proposal forms furnished by the Public Works Department. The Bid Guaranty shall be in an amount equivalent to at least 10% of the Total Contract Bid Price.

F. NONRESPONSIVE BIDS AND BID REJECTION

1. A Bid in which any one (1) of the required sixteen (9) Bid proposal documents are not completed, executed and submitted may be considered non-responsive and be rejected.

2. A Bid in which the Contract Unit Prices are unbalanced, which is incomplete or which shows alteration of form or irregularities of any kind, or which contains any additions or conditional or alternate Bids that are not called for, may be considered non-responsive and be rejected.

G. AWARD OF CONTRACT

In accordance with Division 2, Chapter 2 of the Torrance Municipal Code, the City Council reserves the right to reject any and all bids received, to take all bids under advisement for a period not-to-exceed sixty (60) days after date of opening thereof, to waive any informality or irregularity in the Bid, and to be the sole judge of the merits of material included in the respective bids received.

H. EXECUTION OF CONTRACT

After the Contract is awarded, the awardee shall execute the following eight (8) documents:

1) Performance Bond (100% of Bid)
2) Labor and Material Bond (100% of Bid)
3) Contract - Public Works Agreement
4) Verification of Insurance Coverage (Certificates and Endorsements)
5) Construction or Service Contract Endorsement
6) Workers' Compensation Insurance Certificate
7) Construction Permit Application Form
8) Business License Application Form

I. APPRENTICESHIP EMPLOYMENT STANDARDS

The Contractor is directed to the provisions in Sections 1776, 1777.5 and 1777.6 of the California Labor Code concerning the employment of apprentices by the contractor or any subcontractor under them.

J. PERMITS, LICENSES AND PUBLIC WORKS AGREEMENT

The Contractor shall procure and execute all permits, licenses, pay all charges and fees, and give all notices necessary and incidental to the completion of the Work. The Contractor shall execute a Public Works Agreement. No fee is charged for a Construction-Excavation Permit issued by the City of Torrance for a public works project. The Contractor shall obtain a City of Torrance Business License.

The Contractor shall be required to obtain a rider to the City of Torrance's encroachment permit from the State.

K. INSURANCE

The Contractor shall maintain Automobile Liability, General Liability and Workers' Compensation Insurance as specified in the Public Works Agreement included in the Project Specifications.

L. PRE-BID INQUIRIES

A Bidder with a Pre-Bid Inquiry must submit their question(s) in writing to the Torrance Public Works Department. You may email it to Emmanuel Martin, Associate Engineer at emartin@TorranceCA.Gov. All questions must be received no later than 5:00 p.m. on the Monday prior to the date for opening the bids. Questions received after this date may not be considered. For questions of a general nature, a bidder may call Emmanuel Martin directly at (310) 618-3069.

SECTION C

BID DOCUMENTS

BIDDER'S PROPOSAL

Company: ________________________
Total Bid:

**PROPOSAL, SPECIFICATIONS, BOND AND AFFIDAVIT
FOR THE CONSTRUCTION OF THE
NORTH TORRANCE WELLFIELD PROJECT,
CIP No. I-108, PHASE I
B2013-25**

Honorable Mayor and Members
of the Torrance City Council
Torrance, California

Members of the Council:

In accordance with the Notice Inviting Bids pertaining to the receiving of sealed proposals by the City Clerk of the City of Torrance for the above titled improvement, the undersigned hereby proposes to furnish all Work to be performed in accordance with the Plans, Specifications, Standard Drawings, and the Contract Documents, for the unit price or lump sum set forth in the following schedule.

BID SCHEDULE

Item No.	Approx. Qty	Unit of Measure	Item Description	Unit Price	Total Bid
1	1	LS	Mobilization/Demobilization (maximum 5% OF BID ITEMS 2 through 20).	$	$
2	1	LS	Prepare SWPPP-WPC Manual 2011, Erosion and Sedimentation Control Plan, submit NOI and NOT to meet NPDES Compliance and BMPs	$	$
3	1	LS	Remove existing and relocate school irrigation system in accordance with plans and specifications	$	$
4	268	LF	Furnish and install 8 ft high CMU wall Type 2 per SPPWC Standard 601-3, color to match Well No. 9(coordinate with City) in accordance with plans, specifications and standard details.	$	$
5	1,157	LF	Furnish and install 6 inch diameter extra strength vitrified clay pipe, including shoring, trenching (excavation), bedding, backfill, compaction, restoration of surface features, laying and testing and all appurtenances for a complete sewer line system in accordance with plans, specifications and standard details	$	$

Item No.	Approx. Qty	Unit of Measure	Item Description	Unit Price	Total Bid
6	7	EA	Furnish and install new pre-cast concrete sewer manholes complete in place, including shoring, trenching (excavation), bedding, backfill, compaction, laying, and testing in accordance with plans, specifications and per SPPWC standard details 200-3	$	$
7	675	LF	Furnish and install 30 inch diameter RCP or HDPE drain including trenching (excavation), bedding, backfill, compaction, laying, restoration of surface features, testing and all appurtenances for a complete Storm Drain line system in accordance with plans, specifications and standard details	$	$
8	1	EA	Furnish and install Storm drain manholes complete in place, including shoring, trenching (excavation), bedding, backfill, compaction, laying, restoration of surface features, and testing in accordance with plans, specifications and SPPWC standard details 321-2	$	$
9	438	LF	Furnish and install 12 inch diameter DIP, Class 350, blend line including shoring, trenching (excavation), bedding, backfill, compaction, laying, restoration of surface features, testing and all appurtenances in accordance with plans, specifications and standard details	$	$
10	233	LF	Furnish and install 16 inch diameter CMLCSP inlet line including shoring, trenching (excavation), bedding, backfill, compaction, laying, restoration of surface features, testing and all appurtenances in accordance with plans, specifications and standard details	$	$
11	740	LF	Furnish and install 20" diameter CMLCSP inlet line including shoring, trenching (excavation), bedding, backfill, compaction, laying, restoration of surface features, testing and all appurtenances in accordance with plans, specifications and standard details	$	$
12	683	LF	Furnish and install 24" diameter CMLCSP outlet line including shoring, trenching (excavation), bedding, backfill, compaction, laying, restoration of surface features, testing and all appurtenances in accordance with plans, specifications and standard details	$	$
13	1	LS	Furnish and install concrete valve vault in accordance with plans, specifications and standard details	$	$
14	740	LF	Furnish and install Electrical conduits and pull boxes in accordance with plans, specifications and standard details	$	$
15	740	LF	Furnish and install Telephone conduit in accordance with plans, specifications and standard details	$	$

Item No.	Approx. Qty	Unit of Measure	Item Description	Unit Price	Total Bid
16	1	LS	Construct Parking lot improvements including concrete swale, striping, curb and gutter, AC pavement and removal of existing AC pavement, in accordance with plans, specifications and standard details	$	$
17	1	LS	Furnish and install gates and temporary fencing in accordance with plans, specifications and standard details	$	$
18	1	LS	Furnish and install electrical conduits for future school electronic sign board in accordance with plans, specifications and standard details		
19	1	LS	Construct paved AC access road and concrete gutter in accordance with plans, specifications and standard details		
20	1	LS	Provide traffic control plans, furnish and install Traffic Control measures including install Temporary Pavement markers and delineation, install delineators, cones, signs, restoration of striping, steel plating, in accordance with plans, specifications and standard details	$	$

TOTAL BID PRICE $______________________________
(Figures)*

TOTAL BID PRICE: ______________________________
(Words)*

____

***BID MAY BE REJECTED IF TOTAL IS NOT SHOWN IN FIGURES AND WORDS.**

The undersigned furthermore agrees to enter into and execute a contract, with necessary bonds, at the unit prices set forth herein and in case of default in executing such contract, with necessary bonds, the check or bond accompanying this bid and the money payable thereon shall be forfeited thereby to and remain the property of the City of Torrance.

The above unit prices include all work appurtenant to the various items as outlined in the Specifications and all work or expense required for the satisfactory completion of said items. In case of discrepancies between unit prices and totals, the unit prices shall govern.

The undersigned declares that it has carefully examined the Plans, Specifications, and Contract Documents, and has investigated the site of the work and is familiar with the conditions thereon.

Contractor:____

Date: ____________________ By:______________________________

Contractor's State License No. __________________ Class_________

Address:____

Phone: ____________________

Fax: ______________________

ACKNOWLEDGMENT OF ADDENDA RECEIVED – B2013-25

The Bidder shall acknowledge the receipt of addenda by placing an "X" by each addendum received.

Addendum No. 1 ____

Addendum No. 2 ____

Addendum No. 3 ____

Addendum No. 4 ____

Addendum No. 5 ____

Addendum No. 6 ____

Addendum No. 7 ____

Addendum No. 8 ____

If an addendum or addenda have been issued by the City and not noted above as being received by the Bidder, the Bid Proposal may be rejected.

______________________________ ____________________
Bidder's Signature Date

CONTRACTOR'S AFFIDAVIT

STATE OF CALIFORNIA }
}
COUNTY OF ____________}

Construction of the North Torrance Well Field Project, CIP No. I-108, Phase I

______________________________, being first duly sworn, deposes and says:

1. That he is the

____
Title

of ____
(Name of Partnership, Corporation, or Sole Proprietorship)

hereinafter called "Contractor," who has submitted to the City of Torrance a proposal for the **Construction of the North Torrance Well Field Project, CIP No. I-108, Phase**

2. That said proposal is genuine; that the same is not sham; that all statement of facts therein are true;

3. That such proposal was not made in the interest or behalf of any person, partnership, company, association, organization or corporation not named or disclosed;

4. That the Contractor did not, directly or indirectly, induce, solicit or agree with anyone else to submit a false or sham bid, to refrain from bidding, or to withdraw the bid, to raise or fix the bid price of the Contractor or anyone else, or to raise or fix any overhead, profit or cost element of the Contractor's price or the price of anyone else; and did not attempt to induce action prejudicial to the interest of the City of Torrance, or of any other bidder, or anyone else interested in the proposed contract;

5. That the Contractor has not in any manner sought by collusion to secure for itself an advantage over any other bidder or to induce action prejudicial to the interests of the City of Torrance, or of any other bidder or of anyone else interested in the proposed contract;

6. That the Contractor has not accepted any bid from any subcontractor or materialman through any bid depository, the bylaws, rules or regulations of which prohibit or prevent the Contractor from considering any bid from any subcontractor or materialman, which is not processed through said bid depository, or which

prevent any subcontractor or materialman from bidding to any contractor who does not use the facilities of or accept bids from or through such bid depository;

7. That the Contractor did not, directly or indirectly, submit the Contractor's bid price or any breakdown thereof, or the contents thereof, or divulge information or data relative thereto, to any corporation, partnership, company, association, organization, bid depository, or to any member or agent thereof, or to any individual or group of Individuals, except to the City of Torrance, or to any person or persons who have a partnership or other financial interest with said Contractor in its business.

Dated this _________ day of _______________________________, 2013.

Subscribed and Sworn to
before me this _________ day
of ______________________, 2012.

____
(Contractor)

____
(Title)

____
Notary Public in and for said
County and State.
(Seal)

BID BOND (10%)

Construction of the North Torrance Well Field Project, CIPI-108, Phase I
B2013-25

KNOW ALL MEN BY THESE PRESENTS: That we, ______________________________

____

as principal, and ____

as sureties, are held and firmly bound unto the City of Torrance, State of California, in the penal sum of __________________________ dollars ($______________), for the payment whereof we hereby bind ourselves, our successors, heirs, executors or administrators jointly and severally, firmly by these presents.

The condition of this obligation is such that, whereas the above bounded principal is about to file with and submit to the City of Torrance a bid or proposal for the performance of certain work as required in the City of Torrance, Project No. B2012-01, said work being: **Construction of the North Torrance Well Field Project, CIPI-108, Phase I** and in compliance with the Specifications therefore under an invitation of said City contained in a notice or advertisement for bids or proposals; now if the bid or proposal of the said principal shall be accepted and if the said work be thereupon awarded to the principal by said City and if the said principal shall enter into a contract with the said City in accordance with said bid or proposal, or if the bid or proposal of the said principal is rejected, then this bond shall be void and of no effect and otherwise in full force and effect.

WITNESS our hands this ______ day of _______________, 2013.

____
Principal

____
Surety/Attorney-in-Fact

____
Signature

Name: ______________________________
Local Address: ______________________________
____
Phone No.: ______________________________
Fax No.: ______________________________

LIST OF SUBCONTRACTORS
B2013-25

The Bidder is required to fill in the following blanks in accordance with the provisions of the Subletting and Subcontracting Fair Practices Act (Chapter 2 of Division 5, Title 1 of the Government Code of the State of California). The contractor, sub recipient or subcontractor shall not discriminate on the basis of race, color, national origin, or sex in the performance of this contract. The contractor shall carry out applicable requirements of Title 49 CFR (Code of Federal Regulations) part 26 in the award and administration of US DOT assisted contracts. Failure by the contractor to carry out these requirements is a material breach of this contract, which may result in the termination of this contract or such other remedy, as the recipient deems appropriate. Each subcontract signed by the bidder must include this assurance.
Failure of the bidder to fulfill the requirements of the Special Provisions for submittals required to be furnished after bid opening, including but not limited to escrowed bid documents, where applicable, may subject the bidder to a determination of the bidder's responsibility in the event it is the apparent low bidder on a future public works contracts.

Name Under Which Subcontractor is Licensed: ______________________________

Subcontractor's Address: ______________________________

Specific Description of Sub-Contract: ______________________________

License Number: ______________ CA License Classification/Type: ______________

Name Under Which Subcontractor is Licensed: ______________________________

Subcontractor's Address: ______________________________

Specific Description of Sub-Contract: ______________________________

License Number: ______________ CA License Classification/Type: ______________

Name Under Which Subcontractor is Licensed: ______________________________

Subcontractor's Address: ______________________________

Specific Description of Sub-Contract: ______________________________

License Number: ______________ CA License Classification/Type: ______________

Subcontractors listed must be properly licensed under the laws of the State of California for the type of work which they are to perform. Do not list alternate subcontractors for the same work.

REFERENCES (Page 1 of 2)
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List work similar in magnitude and degree of difficulty completed by the Contractor within the past three (3) years.

1. Name (Firm/Agency): ______________________
   Address: ______________________
   Contact Person: ______________ Telephone No.: ______________
   Title of Project: ______________________
   Project Location: ______________________
   Date of Completion: ______________ Contract Amount: $ ______________

2. Name (Firm/Agency): ______________________
   Address: ______________________
   Contact Person: ______________ Telephone No.: ______________
   Title of Project: ______________________
   Project Location: ______________________
   Date of Completion: ______________ Contract Amount: $ ______________

3. Name (Firm/Agency): ______________________
   Address: ______________________
   Contact Person: ______________ Telephone No.: ______________
   Title of Project: ______________________
   Project Location: ______________________
   Date of Completion: ______________ Contract Amount: $ ______________

4. Name (Firm/Agency): ______________________
   Address: ______________________
   Contact Person: ______________ Telephone No.: ______________
   Title of Project: ______________________
   Project Location: ______________________
   Date of Completion: ______________ Contract Amount: $ ______________

REFERENCES (PAGE 2 OF 2)
B2013-25

If Contractor has not performed work for the City of Torrance within the last five (5) years, list all work done within said five years (attach additional sheets if necessary). Note if work was done as subcontractor [include only subcontract amount]:

Work Description & Contract Amount	Agency	Date Completed

Contractor's License No.: ______________________ Class: ______________________

a. Date first obtained: ______________________ Expiration: ____________________

b. Has License ever been suspended or revoked? ________________

If yes, describe when and why: ____

c. Any current claims against License or Bond? __________________

If yes, describe claims: ____

Principals in Company (List all – attach additional sheets if necessary):

NAME	TITLE	LICENSE NO. (If Applicable)
______________________	______________________	______________________
______________________	______________________	______________________
______________________	______________________	______________________

DBE

BIDDERS LIST

Construction of North Torrance Well Field Project, CIP I-108, Phase I

B2013-25

All bidders/proposers are required to provide the following information for all DBE and non-DBE contractors or consultants who provided a proposal, bid quote, or were contacted by the proposed prime. This information is also required from the proposed prime contractor/consultant and must be submitted with their bid/proposal. The City of Torrance will use this information to maintain and update a "Bidders" List to assist in the overall annual DBE goal-setting process.

Firm Name:_______________________________ Phone:____________________

Address:_________________________________ Fax:______________________

Contact Person:___________________________ No. of Years in Business:_____

Is the firm currently certified as a DBE under 49 CFR Part 26: YES:_____ NO:______

Type of work/services/materials provided by firm?_______________________________

____

What was your firm's Gross Annual receipt for last year?

Less than $1 Million
Less than $5 Million
Less than $10 Million
Less than $15 Million
More than $15 Million

*This form can be duplicated if necessary to report all bidders (DBEs and non-DBEs) information

VIOLATIONS OF FEDERAL, STATE OR LOCAL LAWS
B2013-25

1. Has your firm or its officers been assessed any penalties by an agency for noncompliance or violations of Federal, State or Local labor laws and/or business or licensing regulations within the past five (5) years relating to your construction projects?

   Yes/No: ____________________ Federal/State: ____________________

   If "yes," identify and describe, (including agency and status): ________________

   ____

   ____

   ____

   Have the penalties been paid? Yes/No: ________________________________

2. Does your firm or its officers have any ongoing investigations by any public agency regarding violations of the State Labor Code, California Business and Professions Code or State Licensing Laws?

   Yes/No: ______ Code/Laws: ____________ Section/Article: ________________

   If "yes," identify and describe, (including agency and status): ________________

   ____

   ____

   ____

DISQUALIFICATION OR DEBARMENT

Has your firm, any officer of your firm, or any employee who has a proprietary interest in your firm ever been disqualified, removed, or otherwise prevented from bidding on, performing work on, or completing a federal, state or local project because of a violation of law or a safety regulation? Yes/No: _______________. If yes, provide the following information (if more than once, use separate sheets):

Date: _______________ Entity: ____

Location: ____

Reason: ____

____

____

____

____

Provide Status and any Supplemental Statement: ______________________________

____

____

____

____

Has your firm been reinstated by this entity? Yes/No: ___________________________

SECTION D

DOCUMENTS TO BE COMPLETED AND DELIVERED TO CITY PRIOR TO AWARD OF CONTRACT

PERFORMANCE BOND

KNOW ALL MEN BY THESE PRESENTS:

That we, ______________________________as Principal(s) and ________________a corporation, incorporated, organized, and existing under the laws of the State of _____________, and authorized to execute bonds and undertakings and to do a general surety business in the State of California, as Surety, are jointly and severally held and firmly bound unto the City of Torrance, a municipal corporation, located in the County of Los Angeles, State of California, in the full and just sum of: __________________________ Dollars ($__________________), lawful money of the United States of America, for the payment of which sum, well and truly to be made, we bind ourselves and our respective heirs, executors, administrators, representative, successors and assigns, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION IS SUCH, that: **WHEREAS,** said Principal(s) have/has entered into, or are/is about to enter into, a certain written contract or agreement, dated as of the ______ day of ____________, 20____, with the said City of Torrance for the Construction of **Construction of the North Torrance Well Field Project, CIP I-108, Phase I, B2013-25** all as is more specifically set forth in said contract or agreement, a full, true and correct copy of which is hereunto attached, and hereby referred to and by this reference incorporated herein and made a part hereof;

NOW, THEREFORE, if the said Principal(s) shall faithfully and well and truly do, perform and complete, or cause to be done, performed and complete, each and all of the covenants, terms, conditions, requirements, obligations, acts and things, to be met, done or performed by said Principal(s), including any guarantee period as set forth in, or required by, said contract or agreement, all at and within the time or times, and in the manner as therein specified and contemplated, then this bond and obligation shall be null and void; otherwise it shall be and remain in full force, virtue and effect.

The said Surety, for value received, hereby stipulates and agrees that no amendment, change, extension of time, alteration or addition to said contract or agreement, or of any feature or item or items of performance required therein or thereunder, shall in any manner affect its obligations on or under this bond; and said Surety does hereby waive notice of any such amendment, change, extension of time, alteration, or addition to said contract or agreement, and of any feature or item or items of performance required therein or thereunder.

<u>PERFORMANCE BOND</u> (CONTINUED)

In the event any suit, action or proceedings is instituted to recover on this bond or obligation, said Surety will pay, and does hereby agree to pay, as attorney's fees for said City, such sum as the Court in any such suit, action or proceeding may adjudge reasonable.

EXECUTED, SEALED AND DATED this _________ day of ____________________, 2013.

CORPORATE SEAL

PRINCIPAL(S):

BY ________________________________

BY ________________________________

CORPORATE SEAL

SURETY:

BY ________________________________

LABOR AND MATERIAL BOND

KNOW ALL MEN BY THESE PRESENTS:

That we,____
As Principal(s) and ____ a corporation, incorporated, organized, and existing under the laws of the State of ______________, and authorized to execute bonds and undertakings and to do a general surety business in the State of California, as Surety, are jointly and severally held and firmly bound unto:

(a) The State of California for the use and benefit of the State Treasurer, as ex-officio Treasurer and custodian of the Unemployment Fund of said State; and

(b) The City of Torrance, California; and

(c) Any and all persons who do or perform or who did or performed work or labor upon or in connection with the work or improvement referred to in the contract or agreement hereinafter mentioned; and

(d) Any and all materialmen, persons, companies, firms, association, or corporations, supplying or furnishing any materials, provisions, provender, transportation, appliances or power, or other supplies used in, upon, for or about or in connection with the performance of the work or improvement contracted to be executed, done, made or performed under said contract or agreement; and

(e) Any and all persons, companies, firms, associations, or corporations furnishing, renting, or hiring teams, equipment, implements or machinery for, in connection with, or contributing to, said work to be done or improvement to be made under said contract or agreement; and

(f) Any and all persons, companies, firms, associations, or corporations who supply both work and materials;

and whose claim has not been paid by said Principal(s), in full and just sum of ____________________ Dollars ($___________), lawful money of the United States of America, for the payment of which will and truly to be made, said Principal(s) and said Surety do hereby bind themselves and their respective heirs, executors, administrators, representatives, successors and assigns, jointly and severally, firmly by these presents.

LABOR AND MATERIAL BOND (CONTINUED)

THE CONDITION OF THE FOREGOING OBLIGATION IS SUCH, THAT: WHEREAS, said Principal(s) have/has entered into or are/is about to enter into a certain written contract or agreement, dated as of the _______ day of _________________20 ___, with the City of Torrance for the Construction of **Construction of the North Torrance Well Field Project, CIP I-108, Phase I, B2013-25** all as is more specifically set forth in said contract or agreement, a full, true and correct copy of which is hereunto attached, and hereby referred to and by this reference incorporated herein and made a part hereof;

NOW, THEREFORE, if the said Principal(s) (or any of his/her, its, or their subcontractors) under said contract or agreement fails or fail to pay:

(1) For any materials, provisions, provender, transportation, appliances, or power, or other supplies; or

(2) For the hire of any teams, equipment, implements, or machinery; or

(3) For any work or labor; supplies, furnished, provided, used, done or performed in, upon, for or about or in connection with the said work or improvement; or

(4) For amounts due under the Unemployment Insurance Act of the State of California with respect to such work or improvement;

the Surety on this bond will pay the same in an amount not exceeding the sum hereinabove specified in this bond; and, also, in case suit is brought upon this bond, said Surety will (and does hereby agree to) pay a reasonable attorney's fee, to be fixed and taxed as costs, and included in the judgment therein rendered.

This bond shall (and it is hereby made to) insure to the benefit of any and all persons entitled to file claims under Section 1192.1 of the Code of Civil Procedure of the State of California, so as to give a right of action to them or their assigns in any suit brought upon this bond, all as contemplated under the provisions of Section 4205 of the Government Code, and of Chapter 1 of Title 4 of Part 3 of the Code of Civil Procedure, of the State of California.

This bond is executed and filed in connection with said contract or agreement hereunto attached to comply with each and all of the provisions of the laws of the State of California above mentioned or referred to, and of all amendments thereto, and the obligors so intend and do hereby bind themselves accordingly.

<u>LABOR AND MATERIAL BOND</u> (CONTINUED)

The said Surety, for value received, hereby stipulates and agrees that no amendment, change, extension of time, alteration, or addition to said contract or agreement, or of any feature or item or items of performance required therein or thereunder, shall in any manner affect its obligations on or under this bond; and said Surety does hereby waive notice of any such amendment, change, extension of time, alteration, or addition to said contract or agreement, and of any feature or item or items of performance required therein or thereunder.

EXECUTED, SEALED AND DATED this ______ day of __________________, 20__________

CORPORATE SEAL

PRINCIPAL:

BY ________________________________

CORPORATE SEAL

SURETY:

BY ________________________________

PUBLIC WORKS AGREEMENT

This PUBLIC WORKS AGREEMENT ("Agreement") is made and entered into as of ____________________, 20___ (the "Effective Date"), by and between the CITY OF TORRANCE, a municipal corporation ("CITY"), and ________________________________ ("CONTRACTOR").

RECITALS:

A. The CITY wishes to retain the services of an experienced and qualified CONTRACTOR for the **Construction of the North Torrance Well Field Project, CIP I-108, Phase I**

B. In order to obtain the desired services, The CITY has circulated a Notice Inviting Bids for the Construction of the North Torrance Well Field Project, CIP I-108, Phase I Notice Inviting Bids No. B2013-25 (the "NIB"); and

C. CONTRACTOR has submitted a Bid (the "Bid") in response to the NIB. CONTRACTOR represents that it is qualified to perform those services requested in the Plans and Specifications. Based upon its review of all Bids submitted in response to the NIB, The CITY is willing to award the contract to CONTRACTOR.

AGREEMENT:

1. SERVICES TO BE PERFORMED BY CONTRACTOR

CONTRACTOR will provide the services and install those materials listed in the Plans and Specifications, which are on file in the Public Works Department. The NIB and the Plans and Specifications are made a part of this Agreement. A copy of the Bid is attached as Exhibit A.

2. TERM

Unless earlier terminated in accordance with Paragraph 4 below, this Agreement will continue in full force and effect for one year from the Effective Date.

3. COMPENSATION

A. CONTRACTOR's Fee.

For services rendered pursuant to this Agreement, CONTRACTOR will be paid in accordance with CONTRACTOR's Bid; provided, however, that in no event will the total amount of money paid the CONTRACTOR, for services initially contemplated by this Agreement, exceed the sum of $_________________ ("Agreement Sum"), unless otherwise first approved in writing by the CITY.

B. Schedule of Payment.

Provided that the CONTRACTOR is not in default under the terms of this Agreement, upon presentation of an invoice, CONTRACTOR will be paid monthly, within 30 days after the date of the monthly invoice.

4. TERMINATION OF AGREEMENT

A. Termination by CITY for Convenience.

1. CITY may, at any time, terminate the Agreement for CITY's convenience and without cause.

2. Upon receipt of written notice from CITY of such termination for CITY's convenience, CONTRACTOR will:

   a) cease operations as directed by CITY in the notice;
   b) take actions necessary, or that CITY may direct, for the protection preservation of the work; and
   c) except for work directed to be performed prior to the effective date of termination stated in the notice, terminate all existing subcontracts and purchase orders and enter into no further subcontracts and purchase orders.

3. In case of such termination for CITY's convenience, CONTRACTOR will be entitled to receive payment for work executed; and costs incurred by reason of such termination, along with reasonable overhead and profit on the work not executed.

B. Termination for Cause.

1. If either party fails to perform any term, covenant or condition in this Agreement and that failure continues for 15 calendar days after the nondefaulting party gives the defaulting party notice of the failure to perform, this Agreement may be terminated for cause; provided, however, that if during the notice period the defaulting party has promptly commenced and continues diligent efforts to remedy the default, the defaulting party will have such additional time as is reasonably necessary to remedy the default.

2. In the event this Agreement is terminated for cause by the default of the CONTRACTOR, the CITY may, at the expense of the CONTRACTOR and its surety, complete this Agreement or cause it to be completed. Any check or bond delivered to the CITY in connection with this Agreement, and the money payable thereon, will be forfeited to and remain the property of the CITY. All moneys due the CONTRACTOR under the terms of this Agreement will be retained by the CITY, but the retention will not release the CONTRACTOR and its surety from liability for the default. Under these circumstances, however, the CONTRACTOR and its surety will be credited with the amount of money retained, toward any amount by which the cost of completion exceeds the Agreement Sum and any amount authorized for extra services.

3. Termination for cause will not affect or terminate any of the rights of the CITY as against the CONTRACTOR or its surety then existing, or which may thereafter accrue because of the default; this provision is in addition to all other rights and remedies available to the CITY under law.

C. Termination for Breach of Law.

In the event the CONTRACTOR or any of its officers, directors, shareholders, employees, agents, subsidiaries or affiliates is convicted (i) of a criminal offense as an incident to obtaining or attempting to obtain a public or private contract or subcontract, or in the performance of a contract or subcontract; (ii) under state or federal statutes of embezzlement, theft, forgery, bribery, falsification or destruction of records, receiving stolen property, or any other offense indicating a lack of business integrity or business honesty which currently, seriously, and directly affects responsibility as a public consultant or contractor; (iii) under state or federal antitrust statutes arising out of the submission of bids or proposals; or (iv) of violation of Paragraph 19 of this Agreement; or for any other cause the CITY determines to be so serious and compelling as to affect CONTRACTOR's responsibility as a public consultant or contractor, including but not limited to, debarment by another governmental agency, then the CITY reserves the unilateral right to terminate this Agreement or to impose such other sanctions (which may include financial sanctions, temporary suspensions or any other condition deemed appropriate short of termination) as it deems proper. The CITY will not take action until CONTRACTOR has been given notice and an opportunity to present evidence in mitigation.

5. FORCE MAJEURE

If any party fails to perform its obligations because of strikes, lockouts, labor disputes, embargoes, acts of God, inability to obtain labor or materials or reasonable substitutes for labor or materials, governmental restrictions, governmental regulations, governmental controls, judicial orders, enemy or hostile governmental action, civil commotion, fire or other casualty, or other causes beyond the reasonable control of the party obligated to perform, then that party's performance shall be excused for a period equal to the period of such cause for failure to perform.

6. RETENTION OF FUNDS

CONTRACTOR authorizes the CITY to deduct from any amount payable to CONTRACTOR (whether or not arising out of this Agreement) any amounts the payment of which may be in dispute or that are necessary to compensate the CITY for any losses, costs, liabilities, or damages suffered by the CITY, and all amounts for which the CITY may be liable to third parties, by reason of CONTRACTOR's negligent acts or omissions or willful misconduct in performing or failing to perform CONTRACTOR's obligations under this Agreement. In the event that any claim is made by a third party, the amount or validity of which is disputed by CONTRACTOR, or any indebtedness exists that appears to be the basis for a claim of lien, the CITY may withhold from any payment due, without liability for interest because of the withholding, an amount sufficient to cover the claim. The failure of the CITY to exercise the right to deduct or to withhold will not, however, affect the obligations of CONTRACTOR to insure, indemnify, and protect the CITY as elsewhere provided in this Agreement.

7. THE CITY'S REPRESENTATIVE

The Public Works Director is designated as the "City Representative," authorized to act in its behalf with respect to the work and services specified in this Agreement and to make all decisions in connection with this Agreement. Whenever approval, directions, or other actions are required by the CITY under this Agreement, those actions will be taken by the City Representative, unless otherwise stated. The City Manager has the right to designate another City Representative at any time, by providing notice to CONTRACTOR.

8. CONTRACTOR REPRESENTATIVE(S)

The following principal(s) of CONTRACTOR are designated as being the principal(s) and representative(s) of CONTRACTOR authorized to act in its behalf with respect to the work specified in this Agreement and make all decisions in connection with this Agreement:

____

____

____

9. INDEPENDENT CONTRACTOR

The CONTRACTOR is, and at all times will remain as to the CITY, a wholly independent contractor. Neither the CITY nor any of its agents will have control over the conduct of the CONTRACTOR or any of the CONTRACTOR's employees, except as otherwise set forth in this Agreement. The CONTRACTOR may not, at any time or in any manner, represent that it or any of its agents or employees are in any manner agents or employees of the CITY.

10. BUSINESS LICENSE

The CONTRACTOR must obtain a City business license prior to the start of work under this Agreement, unless CONTRACTOR is qualified for an exemption.

11. OTHER LICENSES AND PERMITS

CONTRACTOR warrants that it has all professional, contracting and other permits and licenses required to undertake the work contemplated by this Agreement.

12. FAMILIARITY WITH WORK

By executing this Agreement, CONTRACTOR warrants that CONTRACTOR (a) has thoroughly investigated and considered the scope of services to be performed, (b) has carefully considered how the services should be performed, and (c) fully understands the facilities, difficulties and restrictions attending performance of the services under this Agreement. If the services involve work upon any site, CONTRACTOR warrants that CONTRACTOR has or will investigate the site and is or will be fully acquainted with the conditions there existing, prior to commencement of services set forth in this Agreement. Should CONTRACTOR discover any latent or unknown conditions that will materially affect the performance of the services set forth in this Agreement, CONTRACTOR must immediately inform the CITY of that fact and may not proceed except at CONTRACTOR's risk until written instructions are received from the CITY.

13. CARE OF WORK

CONTRACTOR must adopt reasonable methods during the life of the Agreement to furnish continuous protection to the work, and the equipment, materials, papers, documents, plans, studies and other components to prevent losses or damages, and will be responsible for all damages, to persons or property, until acceptance of the work by the CITY, except those losses or damages as may be caused by the CITY's own negligence.

14. CONTRACTOR'S ACCOUNTING RECORDS; OTHER PROJECT RECORDS

Records of the CONTRACTOR's time pertaining to the project, and records of accounts between the CITY and the CONTRACTOR, will be kept on a generally recognized accounting basis. CONTRACTOR will also maintain all other records, including without limitation specifications, drawings, progress reports and the like, relating to the project. All records will be available to the CITY during normal working hours. CONTRACTOR will maintain these records for three years after final payment.

15. INDEMNIFICATION

CONTRACTOR will indemnify, defend, and hold harmless CITY, the Redevelopment Agency of the City of Torrance, the City Council, each member thereof, present and future, members of boards and commissions, its officers, agents, employees and volunteers from and against any and all liability, expenses, including defense costs and legal fees, and claims for damages whatsoever, including, but not limited to, those arising from breach of contract, bodily injury, death, personal injury, property damage, loss of use, or property loss however the same may be caused and regardless of the responsibility for negligence. The obligation to indemnify, defend and hold harmless includes, but is not limited to, any liability or expense, including defense costs and legal fees, arising from the negligent acts or omissions, or willful misconduct of CONTRACTOR, its officers, employees, agents, subcontractors or vendors. It is further agreed, CONTRACTOR's obligations to indemnify, defend and hold harmless will apply even in the event of concurrent negligence on the part of CITY, the City Council, each member thereof, present and future, or its officers, agents and employees, except for liability resulting solely from the negligence or willful misconduct of CITY, its officers, employees or agents. Payment by CITY is not a condition precedent to enforcement of this indemnity. In the event of any dispute between CONTRACTOR and CITY, as to whether liability arises from the sole negligence of the CITY or its officers, employees, agents, subcontractors or vendors, CONTRACTOR will be obligated to pay for CITY's defense until such time as a final judgment has been entered adjudicating the CITY as solely negligent. CONTRACTOR will not be entitled in the event of such a determination to any reimbursement of defense costs including but not limited to attorney's fees, expert fees and costs of litigation.

16. NON-LIABILITY OF THE CITY'S OFFICERS AND EMPLOYEES

No officer or employee of the CITY will be personally liable to CONTRACTOR, in the event of any default or breach by the CITY or for any amount that may become due to CONTRACTOR.

17. INSURANCE

A. CONTRACTOR must maintain at its sole expense the following insurance, which will be full coverage not subject to self insurance provisions:

1. Automobile Liability, including owned, non-owned and hired vehicles, with at least the following limits of liability:

    a. Combined single limits of $2,000,000 per occurrence.

2. General Liability including coverage for premises, products and completed operations, independent contractors, personal injury and contractual

obligations with combined single limits of coverage of at least $3,000,000 per occurrence, with an annual aggregate of no less than $5,000,000.

3. Workers' Compensation with limits as required by the State of California and Employers Liability with limits of at least $3,000,000.

B. The insurance provided by CONTRACTOR will be primary and non-contributory.

C. The CITY ("City of Torrance"), the Redevelopment Agency of the City of Torrance, the City Council and each member thereof, members of boards and commissions, every officer, agent, official, employee and volunteer must be named as additional insureds under the automobile and general liability policies.

D. CONTRACTOR must provide certificates of insurance and/or endorsements to the City Clerk of the City of Torrance before the commencement of work.

E. Each insurance policy required by this Paragraph must contain a provision that no termination, cancellation or change of coverage can be made without thirty days notice to the CITY.

F. CONTRACTOR must include all subcontractors as insureds under its policies or must furnish separate certificates and endorsements for each subcontractor. All coverage for subcontractors will be subject to all of the requirements of this Paragraph 17.

18. SUFFICIENCY OF INSURERS

Insurance required by this Agreement will be satisfactory only if issued by companies admitted to do business in California, rated "B+" or better in the most recent edition of Best's Key Rating Guide, and only if they are of a financial category Class VII or better, unless these requirements are waived by the Risk Manager of the CITY ("Risk Manager") due to unique circumstances. In the event the Risk Manager determines that the work or services to be performed under this Agreement creates an increased or decreased risk of loss to the CITY, the CONTRACTOR agrees that the minimum limits of any insurance policies and/or the performance bond required by this Agreement may be changed accordingly upon receipt of written notice from the Risk Manager; provided that CONTRACTOR will have the right to appeal a determination of increased coverage by the Risk Manager to the City Council of the CITY within 10 days of receipt of notice from the Risk Manager.

19. CONFLICT OF INTEREST

A. No officer or employee of the CITY may have any financial interest, direct or indirect, in this Agreement, nor may any officer or employee participate in any decision relating to the Agreement that effects the officer or employee's financial interest or the financial interest of any corporation, partnership or association in which the officer or employee is, directly or indirectly interested, in violation of any law, rule or regulation.

B. No person may offer, give, or agree to give any officer or employee or former officer or employee, nor may any officer or employee solicit, demand, accept, or agree to accept from another person, a gratuity or an offer of employment in connection with any decision, approval, disapproval, recommendation, preparation or any part of a program requirement or a purchase request, influencing the content of any specification or procurement standard, rendering of advice, investigation, auditing, or in any other advisory capacity in any way pertaining to any program requirement, contract or subcontract, or to any solicitation or proposal.

20. NOTICE

A. All notices, requests, demands, or other communications under this Agreement will be in writing. Notice will be sufficiently given for all purposes as follows:

1. Personal delivery. When personally delivered to the recipient: notice is effective on delivery.

2. First Class mail. When mailed first class to the last address of the recipient known to the party giving notice: notice is effective three mail delivery days after deposit in an United States Postal Service office or mailbox.

3. Certified mail. When mailed certified mail, return receipt requested: notice is effective on receipt, if delivery is confirmed by a return receipt.

4. Overnight delivery. When delivered by an overnight delivery service, charges prepaid or charged to the sender's account: notice is effective on delivery, if delivery is confirmed by the delivery service.

5. Facsimile transmission. When sent by fax to the last fax number of the recipient known to the party giving notice: notice is effective on receipt. Any notice given by fax will be deemed received on the next business day if it is received after 5:00 p.m. (recipient's time) or on a non-business day.

6. Addresses for purpose of giving notice are as follows:

CONTRACTOR:	______________________________ ______________________________ ______________________________ ______________________________ Fax: __________________________
CITY:	City Clerk City of Torrance 3031 Torrance Boulevard Torrance, CA 90509-2970 Fax: (310) 618-2931

B. Any correctly addressed notice that is refused, unclaimed, or undeliverable because of an act or omission of the party to be notified, will be deemed effective as of the first date the notice was refused, unclaimed or deemed undeliverable by the postal authorities, messenger or overnight delivery service.

C. Either party may change its address or fax number by giving the other party notice of the change in any manner permitted by this Agreement.

21. PROHIBITION AGAINST ASSIGNMENT AND SUBCONTRACTING

This Agreement and all exhibits are binding on the heirs, successors, and assigns of the parties. The Agreement may not be assigned or subcontracted by either the CITY or CONTRACTOR without the prior written consent of the other.

22. INTEGRATION; AMENDMENT

This Agreement represents the entire understanding of the CITY and CONTRACTOR as to those matters contained in it. No prior oral or written understanding will be of any force or effect with respect to the terms of this Agreement. The Agreement may not be modified or altered except in writing signed by both parties.

23. INTERPRETATION

The terms of this Agreement should be construed in accordance with the meaning of the language used and should not be construed for or against either party by reason of the authorship of this Agreement or any other rule of construction that might otherwise apply.

24. SEVERABILITY

If any part of this Agreement is found to be in conflict with applicable laws, that part will be inoperative, null and void insofar as it is in conflict with any applicable laws, but the remainder of the Agreement will remain in full force and effect.

25. TIME OF ESSENCE

Time is of the essence in the performance of this Agreement.

26. GOVERNING LAW; JURISDICTION

This Agreement will be administered and interpreted under the laws of the State of California. Jurisdiction of any litigation arising from the Agreement will be in Los Angeles County, California.

27. COMPLIANCE WITH STATUTES AND REGULATIONS

CONTRACTOR will be knowledgeable of and will comply with all applicable federal, state, county and city statutes, rules, regulations, ordinances and orders.

28. WAIVER OF BREACH

No delay or omission in the exercise of any right or remedy by a nondefaulting party on any default will impair the right or remedy or be construed as a waiver. A party's consent or approval of any act by the other party requiring the party's consent or approval will not be deemed to waive or render unnecessary the other party's consent to or approval of any subsequent act. Any waiver by either party of any default must be in writing and will not be a waiver of any other default concerning the same or any other provision of this Agreement.

29. ATTORNEY'S FEES

Except as provided for in Paragraph 15, in any dispute, litigation, arbitration, or other proceeding by which one party either seeks to enforce its rights under this Agreement (whether in contract, tort or both) or seeks a declaration of any rights or obligations under this Agreement, the prevailing party will be awarded reasonable attorney's fees, together with any costs and expenses, to resolve the dispute and to enforce any judgment.

30. EXHIBITS

All exhibits identified in this Agreement are incorporated into the Agreement by this reference.

31. CONTRACTOR'S AUTHORITY TO EXECUTE

The persons executing this Agreement on behalf of the CONTRACTOR warrant that (i) the CONTRACTOR is duly organized and existing; (ii) they are duly authorized to execute this Agreement on behalf of the CONTRACTOR; (iii) by so executing this Agreement, the CONTRACTOR is formally bound to the provisions of this Agreement; and (iv) the entering into this Agreement does not
violate any provision of any other Agreement to which the CONTRACTOR is bound.

CITY OF TORRANCE,
a Municipal Corporation

____
____

____
Frank Scotto, Mayor

By: ______________________________

ATTEST:

____
Sue Herbers, City Clerk

APPROVED AS TO FORM:

JOHN L. FELLOWS III
City Attorney

By: ______________________________
(Name)
Deputy City Attorney

Attachments: Exhibit A: Bid

EXHIBIT A

Bid

[To be attached]

CITY OF TORRANCE
CONSTRUCTION OR SERVICE CONTRACT ENDORSEMENT

To be attached to and made a part of all policies insuring the liability of any person, form or corporation performing services under contract for the City of Torrance.

Not withstanding any inconsistent expression in the policy to which this endorsement is attached, or in any other endorsement now or hereafter attached thereto, or made a part thereof, the protection afforded by said policy shall:

1. Include the City of Torrance as an additional insured. (To include the elected officials, appointed officials, and employees.)

2. Indemnify and save harmless the City of Torrance against any and all claims resulting from the undertaking specified in the contract known as:

PROPOSAL, SPECIFICATIONS, BOND AND AFFIDAVIT
<u>FOR THE CONSTRUCTION OF</u>
<u>THE NORTH TORRANCE WELL FIELD PROJECT, CIP I-108, PHASE I</u>

B2013-25

This hold harmless assumption on the part of the underwriters shall include all costs of investigation and defense, including claims based on damage to substructures not shown, not located on the plans, or shown incorrectly.

3. Not be cancelled except by notice to the City Attorney of the City of Torrance at least thirty (30) days prior to the date of cancellation.

4. Provide single limit for Bodily Injury Liability and Property Damage Liability combined, $3,000,000 each Occurrence, and $5,000,000 Aggregate.

5. Limited classifications, restricting endorsements, exclusions or other special provisions contained in the policy shall not act to limit the benefits of coverage as they shall apply to the City of Torrance as enumerated in this endorsement. However, nothing herein contained shall affect any rights of the insurer against the insured.

6. It is further expressly agreed by and between the parties hereto that the following two provisions, (a) and (b), are a part of this contract:

   (a) That the Contractor specifically agrees to comply with applicable provisions of Section 1777.5 of the Labor Code relating to the employment by contractor or subcontractor under it, of journeyman or apprentices, or workmen, in any apprenticeable craft or trade.

   (b) By my signature hereunder, as Contractor, I certify that I am aware of the provisions of Section 3700 of the Labor Code which requires every employer to be insured against liability for Workers' Compensation or to undertake self-insurance in accordance with the provisions of that code, and I will comply with such provisions before commencing the performance of the work of this contract.

The limits of liability as stated in this endorsement apply to the insurance afforded by this endorsement notwithstanding that the policy may have lower limits of liability applying elsewhere in the policy.

____
Duly Authorized Agent

Attached to and forming part of
Policy No. __________________
of the ___________________

Date: ______________________
Expiration Date: ______________

WORKERS' COMPENSATION INSURANCE CERTIFICATION

In compliance with Section 7-4 of the Standard Specifications, the Contractor shall complete and submit the following certification with a Certificate of Insurance before execution of the contract.

I am aware of, and will comply with, Section 3700 of the Labor Code, requiring every employer to be insured against liability for Workers' Compensation or to undertake self-insurance before commencing any of the work.

____
CONTRACTOR

By: ____________________________

Title:____________________________

SECTION E

SPECIAL PROVISIONS

TECHNICAL SPECIFICATIONS

CITY OF TORRANCE
NORTH TORRANCE WELL FIELD PROJECT
PHASE I CONSTRUCTION

TECHNICAL SPECIFICATIONS

TABLE OF CONTENTS

SECTION 011100 COORDINATION OF WORK AND PERMITS

A. Description

This section generally describes the project and includes Contractor's use of premises and construction permits.

B. General Nature of Work

The work includes but is not limited to construction of the following:

1. Inlet and outlet piping.
2. Sewer line.
3. Overflow (drain) line.
4. Manholes for the sewer and drain lines.
5. Electrical and instrumentation conduits.
6. Modifications to a school parking lot.

C. Location of Project Site

The project site is located at 17825 Yukon Avenue. The site is adjacent to Yukon Elementary School and the 405 Freeway, south of Artesia Boulevard in the City of Torrance in Los Angeles County, California.

D. Contractor's Use of Premises

The project site as delineated on the plans is available for the Contractor's use.

E. Permits

Obtain all necessary permits for proper execution of certain phases of the project. Fill out all forms and furnish all drawings required to obtain the permits. A copy of the permit shall be submitted to the Owner. All fees associated with these permits shall be paid by the Contractor as part of the project. Work shall not commence on any phase of the project requiring a permit until the permit is obtained.

1. The Owner will obtain a De Minimus permit (Order No. 98-67) from the State Water Resources Control Board for discharging wastes associated with construction and testing. The Contractor shall adhere to the requirements of the permit. A copy of the Order is included as Appendix A for reference. Note the reporting requirements. The actual permit will be provided to the Contractor after the project is awarded.

2. The Contractor shall prepare and submit a Notice of Intent to Discharge, along with appurtenant fee and Notice of Termination on behalf of the Owner, under the Construction Activities Storm Water Permit (99-08-DWQ).

3. The permits contain requirements which affect the cost of project work. Comply with the permit requirements.

END OF SECTION

SECTION 012000 MEASUREMENT AND PAYMENT

A. Work Listed in the Schedule of Work Items

1. Work under this contract will be paid on a unit price or lump-sum basis as outlined on the Bid Form for the quantity of work installed.

2. The unit prices and lump-sum prices include full compensation for furnishing the labor, materials, tools, and equipment and doing all the work involved to complete the work included in the contract documents.

3. The application for payment will be for a specific item based on the percentage completed or quantity installed. The percentage complete will be based on the value of the partially completed work relative to the value of the item when entirely completed and ready for service.

B. Work Not Listed in the Schedule of Work Items

1. The General Conditions and items in the Special Provisions, general requirements, and specifications which are not listed in the schedule of work items of the Bid Form are, in general, applicable to more than one listed work item, and no separate work item is provided therefor. Include the cost of work not listed but necessary to complete the project designated in the contract documents in the various listed work items of the Bid Form.

2. The bids for the work are intended to establish a total cost for the work in its entirety. Should the Contractor feel that the cost for the work has not been established by specific items in the Bid Form, include the cost for that work in some related bid item so that the Proposal for the project reflects the total cost for completing the work in its entirety.

C. Mobilization (Bid Item 1)

Payment for mobilization shall be made at the time of the first progress payment after the Contractor has purchased bonds and insurance and established a Contractor's site office.

D. Storm Water Pollution Prevention Plan (SWPPP)(Bid Item 2)

Payment will be at the lump sum price including preparation and processing the SWPPP and all measures necessary to conform to the specification requirements. If the City incurs any Administrative Civil Liability (fine), the City may withhold from payments otherwise due the Contractor an amount sufficient to cover the fine.

E. Relocate School Irrigation System (Bid Item 3)

Payment will be at the lump sum price including coordination with the Torrance Unified School District and restoration of existing surfaces.

F. Concrete Block Wall (Bid Item 4)

Includes removal of bushes and debris as necessary, grading and placement of concrete footing, and construction of CMU wall.

G. 6″ VCP Sewer Line (Bid Item 5)

Payment will be by the linear foot including fittings, leakage testing and connection to an existing sewer stub, measured horizontally over the pipe centerline, excluding manhole diameters.

H. Sewer Manholes (Bid Item 6)

Payment will be at the unit price including concrete base, precast manhole sections, frame and lid.

I. 30″ RCP or HDPE Drain Line (Bid Item 7)

Payment will be by the linear foot including fittings and leakage testing, measured horizontally over the pipe centerline, excluding manhole diameter.

J. Drain Manholes (Bid Item 8)

Payment will be at the unit price including concrete base, precast manhole sections, frame and lid.

K. 12″ DIP Blend Pipeline (Bid Item 9)

Payment will be by the linear foot including fittings, thrust blocks, polyethylene encasement, blind flanges and pressure testing measured horizontally over the pipe centerline.

L. <u>16″, 20″ and 24″ CMLCSP Pipelines (Bid Items 10, 11 and 12)</u>

Payment will be by the linear foot for each diameter including valves, fittings, thrust blocks, blind flanges, pressure testing, and disinfection, measured horizontally over the pipe centerline.

M. <u>Precast Concrete Vault (Bid Item 13)</u>

Payment will be at the lump sum price including precast manhole sections, access hatch and ladder. Price includes 12″ piping and valve, and excludes 16″ piping.

N. <u>Electrical and Telephone Conduits (Bid Items 14 and 15)</u>

Payment will be by the linear foot for the pair of 5″ electrical conduits and 4″ telephone conduit, including pull boxes.

O. <u>Parking Lot Improvements (Bid Item 16)</u>

Payment will be at the lump sum price including removal of existing curbs/gutters, construction of a driveway, placement of curbs/gutters, AC pavement and striping.

P. <u>Gates and Temporary Fencing (Bid Item 17)</u>

Payment will be at the lump sum price including cutting new gate into the existing chain link fence, providing a gate at the site entrance, removal of the temporary fencing and restoration of the grass surface.

Q. <u>Electrical Conduits for Future Sign (Bid Item 18)</u>

Payment will be at the lump sum price.

R. <u>Paved Access Road (Bid Item 19)</u>

Payment will be at the lump sum price including removal of concrete gutter and placement of AC pavement.

S. <u>Traffic Control (Bid Item 20)</u>

Payment will be at the lump sum price including preparation and processing plans for approval, signs, warning devices, and restoration of damaged existing facilities.

T. Sheeting, Shoring, and Bracing

Sheeting, shoring, and bracing will be included in the above bid items and not be paid as a separate item.

U. Thrust Blocks

Thrust blocks are required, as shown on design drawings and will be included in the above bid items and not paid as a separate item.

END OF SECTION

SECTION 013300 SUBMITTALS

A. Shop Drawings

1. Submit shop drawings in accordance with the General Provisions.

2. The use of contract drawing reproductions for shop drawings is subject to rejection.

3. Submit six copies of shop drawings. The Owner's Representative will keep four copies and return two copies. If the Contractor desires more than two copies, he shall transfer the Owner's Representative's comments onto additional copies at his own expense. Clearly indicate the specification section, and drawing number to which each shop drawing is referenced.

4. For materials originating outside of the United States for which tests are required, provide recertification and retesting by an independent domestic testing laboratory.

B. Contractor's Jobsite Drawings

Provide and maintain on the jobsite one complete set of prints of all drawings which form a part of the contract. Immediately after each portion of the work is installed, indicate all deviations from the original design shown in the drawings either by additional sketches or ink thereon. Upon completion of the job, deliver this record set to the Owner's Representative.

END OF SECTION

SECTION 014210 GENERAL ABBREVIATIONS

A. General

Interpret abbreviations used in the drawings and in the specifications as tabulated below. If an abbreviation on a drawing is not explained below, it shall be as explained in ANSI Y1.1. The interpretation of abbreviations shall consider the context or discipline in which they are used, for example:

1. FF usually means "finish floor" when referring to a floor slab.

2. FF usually means "flat face" when referring to a pipe flange.

B. List of General Abbreviations

Abbreviation	**Term**
A	
A	Ampere/Area
AA	Aluminum Association
AABC	Associated Air Balance Council
AAMA	Architectural Aluminum Manufacturer's Association
AASHTO	American Association of State Highway and Transportation Officials
AB	Anchor Bolt/Aggregate Base
ABAN	Abandoned
ABC	Asphalt Base Course
ABS	Acrylonitrile-Butadiene-Styrene
ABT	About
AC	Acre/Asphaltic Concrete/Alternating Current/Air Conditioning
ACI	American Concrete Institute
ACP	Asbestos-Cement Pipe
ACU	Air Conditioning Unit
AD	Access Door
ADDL	Additional
ADJ	Adjacent

Abbreviation	Term
AE	Architect-Engineer
AF	Air Filter/Ampere Frame
AFBMA	Anti-Friction Bearing Manufacturer's Association
AGA	American Gas Association
AGMA	American Gear Manufacturer's Association
AHD	Ahead
AHU	Air Handling Unit
AI	The Asphalt Institute
AIA	American Institute of Architects
AICS	Amperes Interrupting Capacity, Symmetrical
AIEE	American Institute of Electrical Engineers
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
AL	Aluminum
ALIGN	Alignment
ALM	Alarm
ALTN	Alternate
AMB	Ambient
AMCA	Air Movement and Control Association
AMP	Ampere
ANCH	Anchor
ANG	Angle
ANSI	American National Standards Institute
API	American Petroleum Institute
APPROX	Approximate
APWA	American Public Works Association
ARCH	Architecture/Architectural
AREA	American Railway Engineering Association
ARI	Air Conditioning and Refrigeration Institute
ARV	Air-Release Valve
ARVV	Air-Release/Vacuum Valve
ASCE	American Society of Civil Engineers
ASHRAE	American Society of Heating, Refrigerating, and Air Conditioning Engineers

Abbreviation	Term
ASME	American Society of Mechanical Engineers
ASPH	Asphalt
ASSY	Assembly
ASTM	American Society of Testing and Materials
ATS	Automatic Transfer Switch
AVE	Avenue
AVG	Average
AWG	American Wire Gauge
AWPA	American Wood Preservers Association
AWPB	American Wood Preservers Bureau
AWS	American Welding Society
AWWA	American Water Works Association
B	
BB	Back-to-Back
BC	Beginning of Curve/Back of Curve/Bolt Circle
BCR	Begin Curb Return
BEG	Begin
BEP	Best Efficiency Point
BETW	Between
BF	Blind Flange
BHP	Brake Horsepower
BK	Back/Brake
BKR	Breaker
BL	Base Line
BLDG	Building
BLK	Block
BM	Bench Mark/Beam
BO	Blowoff
BOCA	Building Officials Code Administration International, Inc.
BOD	Biochemical Oxygen Demand
BOT	Bottom
BP	Baseplate
BR	Bronze/Branch
BRG	Bearing

Abbreviation	Term
BTN	Button
BTU	British Thermal Unit
BUR CBL	Buried Cable
BV	Butterfly Valve
BVC	Begin Vertical Curve
BW	Block Wall
C	
C	Conduit/Celsius
CAB	Crushed Aggregate Base
CALTRANS	California Department of Transportation
CANTIL	Cantilevered
CAP	Capacity
CATV	Cable Television
CB	Catch Basin/Circuit Breaker
CBC	California Building Code
CC	Cooling Coil
C-C	Center-to-Center
CCB	Concrete Block
CCP	Concrete Cylinder Pipe
CCS	Central Control Station
CD	Cross Drain/Condensate Drain/Ceiling Diffuser
CEC	California Electrical Code
CEM	Cement
CF	Cubic Feet/Curb Face
CFH	Cubic Feet Per Hour
CFM	Cubic Feet Per Minute
CFS	Cubic Feet Per Second
CG	Ceiling Grill
C & G	Curb and Gutter
CGA	Compressed Gas Association
CH	Chiller
CHG	Change
CHKD PL	Checkered Plate
CI	Cast Iron

Abbreviation	Term
CIP	Cast in Place/Cast-Iron Pipe
CISP	Cast- Iron Soil Pipe
CISPI	Cast-Iron Soil Pipe Institute
CJ	Construction Joint
CL	Centerline/Class/Clearance
CLR	Clear
CMAA	Crane Manufacturer's Association of America
CMC	Cement-Mortar Coated or Coating
CML	Cement-Mortar Lined or Lining
CMLCSP	Cement-Mortar Lined and Coated Steel Pipe
CMP	Corrugated Metal Pipe
CMPA	Corrugated Metal Pipe Arch
CMU	Concrete Masonry Unit
CO	Cleanout/Conduit Only
COL	Column
COMM	Communication
COMP	Composite
COMPL	Complete
CONC	Concrete
CONN	Connection
CONST	Construct or Construction
CONT	Continuous
CONTR	Contractor
COORD	Coordinate/Coordinated
COP	Copper
COR	Corner
CPLG	Coupling
CPU	Central Processing Unit
CRES	Corrosion Resistant Steel
CRSI	Concrete Reinforcing Steel Institute
CS	Carbon Steel/Commercial Standard
CSP	Corrugated Steel Pipe
CT	Center Top/Current Transformer
CTG	Coating

Abbreviation	Term
CTR	Center
CTV	Cable Television
CULV	Culvert
CU YD, CY	Cubic Yard
CYL	Cylinder
D	
D	Degree of Curvature
DB	Direct Buried/Decibel
DBL	Double
DC	Direct Current
DEPT	Department
DET	Detail/Detour
DG	Decomposed Granite
DI	Drop Inlet/Ductile Iron
DIA	Diameter
DIAG	Diagonal
DIM	Dimension
DIMJ	Ductile-Iron Mechanical Joint
DIP	Ductile-Iron Pipe
DIPRA	Ductile-Iron Pipe Research Association
DISCH	Discharge
DIST	Distance
DIV	Divide/Division
DO	Dissolved Oxygen
DMH	Drop Manhole
DN	Down
DP	Differential Pressure
DPI	Differential Pressure Indicator
DPNL	Distribution Panel
DR	Drain/Door
DSL	Diesel
DWG	Drawing
DWY	Driveway

Abbreviation	Term
E	
E	East
EA	Each
EC	End of Curve
ECC	Eccentric
ECR	End of Curb Return
ED	External Distance
EDUC	Eductor
EE	Each End
EF	Each Face/Exhaust Fan
EFF	Efficiency
EFL	Effluent
EG	Existing Grade
EGL	Energy Grade Line
EL	Elevation/Each Layer
E/L	Easement Line
ELEC	Electric
ELEV	Elevation
ELL	Elbow
ELP	Elliptical
EMB	Embankment
ENC	Encasement
ENCL	Enclosure
ENG	Engine
ENGR	Engineer
EOP	Edge of Pavement
EOS	Equivalent Opening Size
EOTW	Edge of Traveled Way
EP	Explosion Proof/Edge of Pavement
EPA	Environmental Protection Agency (Federal)
EPR	Ethylene-Propylene Rubber
EQ	Equation
EQL	Equal
ESMT	Easement

Abbreviation	Term
EST	Estimate or Estimated
ETC	And so Forth
ETM	Elapsed Time Meter
EVAP	Evaporator
EVC	End Vertical Curve
EW	Each Way
EWC	Electric Water Cooler
EXC	Excavate or Excavation
EXP	Expansion
EXST	Existing
EXT	Exterior/Extension
F	
F	Fahrenheit/Floor
FAB	Fabricate
FBEL & C	Fusion-Bonded Epoxy Lined and Coated
FBRBD	Fiberboard
FC	Foot-Candle
FCC	Filter Control Console
FCO	Floor Cleanout
FCV	Flow Control Valve
FD	Floor Drain
FDN	Foundation
FE	Flanged End
FF	Finished Floor/Flat Face
FG	Finished Grade
FHY	Fire Hydrant
F&I	Furnish and Install
FIG	Figure
FIN	Final
FIT	Fitting
FL	Floor/Flow Line
FLEX	Flexible/Flexure
FLG	Flange
FLT	Float

Abbreviation	Term
FLUOR	Fluorescent
FM	Force Main/Factory Mutual
FMH	Flexible Metal Hose
FNSH	Finish
FOC	Face of Concrete
FOS	Face of Stud
FPC	Flexible Pipe Coupling
FPM	Feet Per Minute
FPS	Feet Per Second
FPT	Female Pipe Thread
FRP	Fiberglass-Reinforced Plastic
FS	Finished Surface/Floor Sink/Federal Specifications
FSTNR	Fastener
FT	Feet or Foot
FTG	Footing
FUT	Future
FWY	Freeway
FX	Fire Extinguisher
G	
G	Gas
GA	Gauge
GAL	Gallon
GALV	Galvanized
GAS	Gasoline
GB	Grade Break
GDR	Guard Rail
GE	Grooved End
GEN	Generator
GENL	General
GFI	Ground Fault Interrupter
GM	Gas Main
GMT	Greenwich Mean Time
GND	Ground
GPD	Gallons Per Day

Abbreviation	Term
GPM	Gallons Per Minute
GR	Grade
GRTG	Grating
GSKT	Gasket
GUT	Gutter
GV	Gate Valve
GWB	Gypsum Wallboard
GWBX	Gypsum Wallboard, Fire Rated
GYP	Gypsum
H	
H	Humidistat
HARN	Harness
HB	Hose Bibb
HC	Heating Coil
HD	Heavy Duty
HDPE	High Density Polyethylene
HEPA	High Efficiency Particulate Air
HGL	Hydraulic Grade Line
HGT	Height
HID	High Intensity Discharge
HOA	Hand-Off-Automatic
HOR	Hand-Off-Remote
HORIZ	Horizontal
HP	Horsepower/High Pressure
HPS	High Pressure Sodium
HPT	High Point
HR	Hour/Handrail
HS	High Strength
HTG	Heating
HTR	Heater
HV	Hose Valve
HVAC	Heating, Ventilating, and Air Conditioning
HVY	Heavy
HW	Headwall/Hot Water

Abbreviation	Term
HWL	High Water Level
HWY	Highway
HYDR	Hydraulic
HZ	Hertz (cycles per second)
I	
I	Intersection Angle
ICBO	International Conference of Building Officials
ID	Inside Diameter
IE	Invert Elevation
IEEE	Institute of Electrical and Electronics Engineers
IN	Inches
INCAND	Incandescent
INCL	Include
INL	Inlet
INS	Insulating
INSTL	Install or Installation
INTR	Interior/Intersection
INV	Invert
IP	Iron Pipe
IPS	Iron Pipe Size
IPT	Iron Pipe Thread
IRR	Irrigation
ISA	Instrument Society of America
IX	Ion Exchange
J	
J	Joist
JB	Junction Box
JCT	Junction
JIC	Joint Industrial Council
JN	Join
JT	Joint
K	
KG	Kilogram
KM	Kilometer

Abbreviation	Term
KIPS	Thousands of Pounds
KV	Kilovolt
KVA	Kilovolt-Ampere
KW	Kilowatt
KWH	Kilowatt-Hour
KWHM	Kilowatt-Hour Meter
L	
L	Length of Curve/Long/Left
LATL	Lateral
LAV	Lavatory
LB	Pound
LBR	Lumber
LCL	Local
LF	Linear Foot
LG	Long
LGTH	Length
LI	Level Indicator
LLO	Long Leg Outstanding
LOC	Location/Locate
LONGIT	Longitudinal
LOS	Lockout Stop
LP	Light Pole
LPT	Low Point
LR	Long Radius
LS	Lift Station
LT	Left/Light
LTG	Lighting
LWC	Lightweight Concrete
LWIC	Lightweight Insulating Concrete
LWL	Low Water Level
M	
MA	Milliampere
MAG	Magnet/Magnetic
MATL	Material

Abbreviation	Term
MAX	Maximum
MB	Machine Bolt/Megabyte/Millibars
MBH	Thousand BTU Per Hour
MECH	Mechanical
MC	Metal Channel
MCC	Motor Control Center
MCM	Thousand Circular Mils
MCP	Motor Circuit Protector
MD	Motorized Damper
MFR	Manufacturer
MG	Million Gallons/Milligram
MGD	Million Gallons Per Day
MG/L	Milligrams Per Liter
MH	Manhole
MHZ	Megahertz
MI	Malleable Iron/Mile
MIL	Military Specifications
MIN	Minimum
MISC	Miscellaneous
MLSS	Mixed Liquor Suspended Solids
MLVSS	Mixed Liquor Volatile Suspended Solids
MJ	Mechanical Joint
MMA	Monorail Manufacturer's Association
MO	Motor Operator/Motor Operated/Masonry Opening
MOD	Modification
MON	Monument
MOT	Motor
MPT	Male Pipe Thread
MSL	Mean Sea Level
MSS	Manufacturer's Standardization Society
MTD	Mounted
N	
N	North/Neutral/Nitrogen
NA	Not Applicable

Abbreviation	Term
NAAMM	National Association of Architectural Metal Manufacturers
NBFU	National Board of Fire Underwriters
NBS	National Bureau of Standards
N & C	Nail and Cap
NC	Normally Closed
NDT	Nondestructive Testing
NE	Northeast
NEC	National Electrical Code
NEMA	National Electrical Manufacturers Association
NFC	National Fire Code
NH	National Hose
NIC	Not in Contract
NIP	Nipple
NMTBA	National Machine Tool Builders Association
NO	Number/Normally Open
NOM	Nominal
NPT	National Pipe Taper
NRS	Nonrising Stem
NSF	National Sanitation Foundation
NTS	Not to Scale
NTU	Nephelometric Turbidity Unit
NW	Northwest
NWL	Normal Water Level
O	
OA	Overall/Outside Air
OC	On Center/Overcurrent
OD	Outside Diameter
ODP	Open Dripproof
OE	Or Equal
OF	Outside Face
OPER	Operator
OPNG	Opening
OPP	Opposite
ORIG	Original

Abbreviation	Term
OSA	Outside Air
OSHA	Occupational Safety and Health Administration
O TO O	Out to Out
OVFL	Overflow
OVHD	Overhead
P	
P	Pole
PARA	Paragraph
PB	Push Button/Pull Box
PC	Point of Curvature/Programmable Controller
PCA	Portland Cement Association
PCC	Point of Compound Curvature/Portland Cement Concrete
PDI	Plumbing and Drainage Institute
PE	Plain End/Polyethylene/Professional Engineer
PEN	Penetration
PERF	Perforated
PF	Power Factor
PG	Pressure Gauge
PI	Point of Intersection
PJTN	Projection
PKWY	Parkway
PL	Plate/Property Line
PLATF	Platform
PLC	Programmable Logic Controller
PLF	Pounds Per Lineal Foot
PNL	Panel
POB	Point of Beginning
POC	Point of Connection
POJ	Push-On Joint
PP	Power Pole/Polypropylene
PPB	Parts Per Billion
PPM	Parts Per Million
PR	Pair
PRC	Point of Reverse Curve

Abbreviation	Term
PRESS	Pressure
PRL	Parallel
PROV	Provisions
PRPSD	Proposed
PRVC	Point of Reverse Vertical Curve
PSI	Pounds Per Square Inch
PSIG	Pounds Per Square Inch Gauge
PSF	Pounds Per Square Foot
PSHL	Pressure Switch (High/Low)
PSL	Pressure Switch (Low)
PT	Point of Tangency
PV	Plug Valve
PVC	Polyvinyl Chloride
PVMT	Pavement
PWR	Power
Q	
Q	Flow Rate
QTY	Quantity
R	
R	Right/Radius
RAD	Radius/Radial
RAF	Return Air Fan
RAG	Return Air Grille
RC	Reinforced Concrete
RCB	Reinforced Concrete Box
RCP	Reinforced Concrete Pipe
RCPA	Reinforced Concrete Pipe Arch
RD	Road
RDC	Reduce
RDCR	Reducer
RDWY	Roadway
REF	Reference
REINF	Reinforce or Reinforced
RELOC	Relocated

Abbreviation	Term
REQ	Required/Requirement
REQD	Required
REV	Revise/Revision
RF	Raised Face
RH	Relative Humidity
RND	Round
RJ	Restrained Joint
RLG	Railing
RPM	Revolutions Per Minute
RR	Railroad
RST	Reinforcing Steel
RT	Right
RTD	Resistance Temperature Detector
RTU	Remote Terminal Unit
R/W	Right-of-Way
S	
S	South/Slope in Feet Per Foot/Sewer
SAE	Society of Automotive Engineers
SAN	Sanitary
SAR	Supply Air Register
SBCCI	Southern Building Codes Congress International
SC	Seal Coat
SCFM	Standard Cubic Feet Per Minute
SCHED	Schedule
SCR	Silicon-Controlled Rectifier/Selective Catalytic Reduction
SCRN	Screen
SD	Storm Drain
SDG	Siding
SDI	Steel Deck Institute
SDWK	Sidewalk
SE	Southeast
SECT	Section
SF	Square Feet
SGL	Single

Abbreviation	Term
SH	Sheet/Sheeting/Shielded
SIM	Similar
SLP	Slope
SLV	Sleeve
SM	Sheet Metal
SMACNA	Sheet Metal and Air Conditioning Contractors National Association
SMAW	Shielded Metal Arc Welding
SOL	Solenoid
SOV	Solenoid-Operated Valve
SP	Space/Steel Pipe/Static Pressure/Spare
SPCG	Spacing
SPEC	Specification
SPLC	Splice
SPRT	Support
SQ	Square
SQ FT	Square Feet
SR	Short Radius
SS	Sanitary Sewer
SSPC	Steel Structures Painting Council
SST	Stainless Steel
ST	Street
STA	Station
STBY	Standby
STC	Sound Transmission Class
STD	Standard
STK	Stake
STL	Steel
STR	Straight
STRL	Structural
STRUCT	Structure
STS	Storm Sewer
STGR	Stringer
STWY	Stairway
SURF	Surface

Abbreviation	Term
SW	Southwest
SWG	Swing
SWI	Steel Window Institute
SYMM	Symmetrical
SYS	System
T	
T	Ton/Tangent Length of Curve/Telephone
TAN	Tangent
T/B	Top of Beam
TB	Top of Bank/Terminal Board
T & B	Top and Bottom
TBG	Tubing
TBM	Temporary Bench Mark
TC	Top of Curb
TD	Time Delay
TDH	Total Dynamic Head
TDS	Total Dissolved Solids
TEFC	Totally Enclosed Fan Cooled
TEL	Telephone
TEMP	Temperature/Temporary
TENV	Totally Enclosed Nonventilated
THB	Thrust Block
THD	Thread or Threaded
THH	Thrust Harness
THK	Thick
TIG	Tungsten Inert Gas
TIR	Total Indicator Reading
TO	Turnout
T/O	Top of
TOC	Top of Concrete
TOS	Top of Slab/Top of Steel
TOT	Total
TP	Telephone Pole
TRD	Tread

Abbreviation	Term
TRA	Tie Rod Assembly
TS	Tube Steel
TV	Television
TYP	Typical
U	
UBC	Uniform Building Code
UD	Underdrain
UG	Underground
UH	Unit Heater
UHMW	Ultra High Molecular Weight
UL	Underwriters' Laboratories, Inc.
ULT	Ultimate
UNO	Unless Noted Otherwise
UPS	Uninterruptible Power Supply
UR	Urinal
USGS	United States Geological Survey
UTC	Underground Telephone Cable
UTR	Up Through Roof
UV	Ultraviolet
V	
V	Vent/Valve/Volt
VAC	Vacuum/Volts, Alternating Current
VC	Vertical Curve
VCP	Vitrified Clay Pipe
VEL	Velocity
VERT	Vertical
VFD	Variable Frequency Drive
VOL	Volume
VPC	Vertical Point of Curve
VPI	Vertical Point of Intersection
VPT	Vertical Point of Tangency
VSS	Volatile Suspended Solids
VTR	Vent Through Roof

Abbreviation	Term
W	
W	West/Watt/Wide/Water
W/	With
WC	Water Closet
WCO	Wall Cleanout
WG	Water Gauge
WH	Wall Hydrant
WL	Waterline
WLD	Welded
WM	Water Meter/Water Main
W/O	Without
WP	Waterproof/Working Point
WRGWB	Water-Resistant Gypsum Wallboard
WSE	Water Surface Elevation
WSP	Water Stop
WT	Weight
WTR	Water
WWF	Welded Wire Fabric (same as WWR)
WWM	Woven Wire Mesh (same as WWR)
WWR	Welded Wire Reinforcement
X	
XFMR	Transformer
XFR	Transfer
Y	
YCO	Yard Cleanout
YD	Yard
YP	Yield Point
YR	Year
YS	Yield Strength
Z	

END OF SECTION

SECTION 015100 CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

A. Construction Water

1. Related Work Specified Elsewhere:

   Trenching, Backfilling, and Compacting: 312316.

2. The Contractor shall make his own arrangements for developing water sources and supply labor and equipment to collect, load, transport, and apply water as necessary for compaction of materials, concrete construction operations, testing, pipeline disinfection, dust control, and other construction use.

3. Obtain water from the Owner's system. Obtain a construction water meter; all water shall be metered.

B. Electrical Power-Construction Phase

Provide for the purchase of power or provide portable power for the construction of the project where existing outlets are not available. Provide for the extension of utility lines to the point of usage.

C. Dust Control

Perform dust control operations to prevent construction operations from producing dust in amounts harmful to persons or causing a nuisance to persons living nearby or occupying buildings in the vicinity of the work. Use water or dust preventative to control dust.

D. Fire Danger

Minimize fire danger in the vicinity of and adjacent to the construction site. Provide labor and equipment to protect the surrounding private property from fire damage resulting from construction operations.

E. Construction Staking

Construction staking will be the responsibility of the Contractor.

F. Red Imported Fire Ant Quarantine (Southern California)

1. All of Orange County, portions of Los Angeles County, and portions of Riverside County are under federal and state quarantine for red imported fire ant (Solenopsis invicta). This quarantine affects the following items:

   a. Soil, separately or with other articles, except when commercially packaged. Soil for the purpose of this section shall include all excavated earth, fill material, and growing media.

   b. Baled hay and baled straw stored in direct contact with the ground.

   c. Plants and sod with roots and soil attached.

   d. Excess soil to be removed from the project site.

   e. Fill material and topsoil to be imported to the project site.

   f. Used soil/earth-moving equipment, unless free of all soil.

   g. Debris and excess material resulting from demolition and removal operations (such as concrete rubble, pipe that has been removed from the ground, and other materials that have come in direct contact with the ground), unless free of soil.

2. Under the provisions of this quarantine, it is unlawful to move within or from the quarantine area any commodity covered by the quarantine, except when certified by the County Agricultural Commissioner. Obtain any necessary inspections and certifications from the Orange County Agricultural Commissioner, prior to moving any quarantined product within or from the project area. Certification and inspections shall conform to the requirements of Title 23 California Code of Regulations, Section 3432.

END OF SECTION

SECTION 015526 TRAFFIC REGULATION

GENERALDescription

This section describes procedures for traffic regulation and temporary steel plate bridging during construction in public streets and highways.

B. Standard Specifications

Wherever reference is made to the State Specifications and Plans, such reference shall mean the State of California, Business, Transportation, and Housing Agency, Department of Transportation 2006 edition.

C. Submittals

Not less than 14 days prior to start of construction, submit a traffic control plan, prepared, signed, and sealed by a California licensed civil or traffic engineer to the City of Torrance for approval. No work shall begin until a traffic control plan is approved by the City.

D. General

1. Provide safe and continuous passage for pedestrian and vehicular traffic at all times.

2. Control traffic in conformance with the approved traffic control plans and specifications.

3. Furnish, construct, maintain, and remove detours, road closures, traffic signal equipment, lights, signs, barricades, fences, K-rail, flares, solar-powered flashing arrow signs, miscellaneous traffic devices, flagmen, drainage facilities, paving, and such other items and services as are necessary to adequately safeguard the public from hazard and inconvenience. All such work shall comply with the ordinances, directives, and regulations of authorities with jurisdiction over the public roads in which the construction takes place and over which detoured traffic is routed by the Contractor. After devices have been installed, maintain and keep them in good repair and working order until no longer required. Replace such devices that are lost or damaged, to such an extent as to require replacement, regardless of the cause of such loss or damage.

4. Prior to the start of construction operations, notify the police and fire department in whose jurisdiction the project lies, giving the expected starting date, completion date, and the names and telephone numbers of two responsible persons who may be contacted at any hour in the event of a condition requiring immediate emergency service to remove, install, relocate, and maintain warning devices. In the event these persons do not promptly respond or the authority deems it necessary to call out other forces to accomplish emergency service, the Contractor will be held responsible for the cost of such emergency service.

5. Provide a minimum of 48 hours' notice to the City of Torrance for any work which may affect signal loops, equipment, or devices. In the event that any underground utilities, traffic devices, pipes, or conduits are damaged and require emergency repair by the City of Torrance, all costs incurred by the City in making such repairs, plus 15% for administration costs, shall be paid by the Contractor.

6. Post temporary "No Parking - Tow Away" signs 48 hours prior to work in areas where parking is normally permitted. The City of Torrance Police Department shall be notified 48 hours prior to the posting of any temporary parking restrictions along the pipeline route.

7. Coordinate the relocation of public bus and school bus routes, bus stops, and trash collection services with the agencies listed on the plans in advance of construction activity.

8. Post construction information signs at least two weeks prior to construction.

E. Traffic Control Devices and Signs

1. Traffic control devices and temporary striping shall conform to the 2009 edition of the California Manual of Uniform Traffic Control Devices (Callifornia MUTCD. Construction signs shall conform to the State of California Sign Specification Sheets.

2. The placement of construction signing, striping, barricades, and other traffic control devices used for handling traffic and public convenience shall conform to the California MUTCD.

3. Signs shall be illuminated or reflectorized when they are used during hours of darkness. Cones and portable delineators used for night lane closures shall have reflective sleeves. Equip barricades used in the diversion of traffic with flashers if in place during hours of darkness.

4. During the duration of a detour, cover existing signs not in accordance with the traffic control plan. Relocate existing signs that are in force to provide visibility from all relocated traffic lanes.

F. Temporary Steel Plate Bridging, With a Nonskid Surface

1. When backfilling operations of an excavation in the traveled way, whether transverse or longitudinal, cannot be properly completed within a workday, provide steel plate bridging with a nonskid surface and shoring to preserve unobstructed traffic flow. In such cases, the following conditions shall apply:

2. Steel plates used for bridging shall extend a minimum of 12 inches beyond the edges of the trench.

3. Install steel plate bridging to operate with minimum noise.

4. Shore the trench to support the bridging and traffic loads.

5. Use temporary paving with cold asphalt concrete to feather the edges of the plates if plate installation by Method 2 is used.

6. Secure bridging against displacement by using adjustable cleats, shims, or other devices.

7. Install steel plate bridging and shoring using either Method 1 or 2:

   a. Method 1 (For Speeds More Than 45 mph): 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.

   b. Method 2 (For Speeds 45 mph or Less): Attach approach plate(s) and ending plate (if longitudinal placement) to the roadway by a minimum of two dowels predrilled into the corners of the plate and drilled 2 inches into the pavement. Butt subsequent plates to each other. Compact fine graded asphalt concrete to form ramps, maximum slope 8.5% with a minimum 12-inch taper to cover all edges of the steel plates. When steel plates are removed, backfill the dowel holes in the pavement with either graded fines of asphalt concrete mix or concrete slurry.

8. Maintain the steel plates, shoring, and asphalt concrete ramps.

9. Use of steel plate bridging at any given location shall not exceed four consecutive working days in any given week. Backfilling of excavation shall be covered with a minimum of 3 inches of temporary layer of cold asphalt concrete.

10. The following table shows the required minimal thickness of steel plate bridging required for a given trench width:

Trench Width (feet)	**Minimum Plate Thickness (inches)**
1	1/2
1 1/2	3/4
2	7/8
3	1
4	1 1/4

13. For spans greater than 4 feet, prepare a structural design by a registered civil engineer and submit to the Owner's Representative for review.

14. Design steel plate bridging for HS20-44 truck loading per Caltrans Bridge Design Specifications Manual. Maintain on the steel plate a nonskid surface having a minimum coefficient of friction equivalent to 0.35 as determined by California Test Method No. 342. The Contractor may use standard steel plate with known coefficient of friction equal or exceeding 0.35.

15. Use a "Rough Road" sign (W8-8) with black lettering on an orange background in advanced of steel plate bridging. This is to be used along with any other required construction signing.

G. Vehicular Traffic Control

1. Accomplish construction in phases by detouring traffic from its normal patterns. Restore traffic to normal patterns in each phase before proceeding to the next phase.

2. Transition traffic lane transitions from permanent lanes to construction zone patterns in accordance with the requirements for the normal posted speed limit and as shown in the drawings.

3. Unless otherwise shown in the drawings or allowed by the city of Torrance within whose jurisdiction the work is being performed, limit construction activities to 7 a.m. to 5 p.m. Monday through Friday. Return roadways and sidewalks to unrestricted vehicle and pedestrian usage when construction is not underway.

4. During the peak traffic volume hours of the day, from 6:00 a.m. to 8:30 a.m. and 3:30 p.m. to 7:00 p.m on weekdays only, limit construction activities within the construction zone to those which will not impact the free movement of vehicular traffic in its detoured pattern. Construction equipment or trucks shall not use or travel adjacent to traffic lanes during these time periods. Truck operations in and out of construction and staging areas shall be controlled by flagmen at all times.

H. Pedestrian Traffic Control

1. Maintain and delineate a minimum of one 4-foot-wide pedestrian walkway along each public street at all times during construction. Maintain existing pedestrian accesses at intersections at all times. When existing crosswalks are blocked by construction activity, install signs directing pedestrian traffic to the nearest alternative crosswalk.

2. Erect a fence or provide other means of securement to preclude unauthorized entry to any excavation during all nonworking hours on a 24-hour basis including weekends and holidays. Said fence shall be a minimum of 7 feet high around the entire excavation, consisting of a minimum 9-gauge chain-link type fence fabric and shall be sturdy enough to prohibit toppling by children or adults. There shall be no openings under the wire large enough for any child to crawl through. Lock any gates if no

adult is in attendance. Place warning signs spaced on 50-foot centers on the outside of the fence with the statement "DEEP HOLE DANGER."

I. Access to Adjacent Properties

Maintain reasonable access from public streets to adjacent properties at all times during construction. Prior to restricting normal access from public streets to adjacent properties, notify each property owner or responsible person, informing him of the nature of the access restriction, the approximate duration of the restriction, and the best alternate access route for that particular property.

J. Permanent Traffic Control Devices

1. Existing permanent traffic control signs, barricades, and devices shall remain in effective operation unless a substitute operation is arranged for and approved as a portion of vehicular traffic control above. Traffic signal modification and restoration work shall be in accordance with Section 86 of the State Specifications.

2. Maintain daily liaison with the Owner's Representative in regards to traffic diversion at signalized intersections.

3. Contact the Owner's Representative 48 hours prior to work affecting traffic signal phasing or vehicular detection loops.

4. Provide a certified signal contractor to be responsible for all traffic modifications required to implement the traffic control plans and as directed by the City of Torrance including installing new traffic signal heads, realigning signal heads, temporary poles and wiring, all other hardware modifications and controller modifications.

5. Completely restore traffic signals affected by the construction to its original operation immediately upon completion of the work requiring the signal modification.

6. Traffic Control Detection Loops: Completely replace traffic control detection loops which are cut, removed, or otherwise disturbed for construction of the pipeline to the original position or as directed by the Owner's Representative immediately after the specific stage

affecting loops is completed. Check new loops for continuity from the traffic signal cabinet to assure splicing and signal operation is correct.

7. Replace traffic signal conduits damaged to the nearest pull box, including new wire, back to the terminal, and/or back to the signal controller to the satisfaction of the owning agency before proceeding to the next construction stage. Splicing is not permitted. Report all such damage immediately to the Owner's Representative.

8. Restriping of Streets: Permanent restriping shall be in accordance with the requirements of the agencies having jurisdiction. Place and remove temporary striping required for traffic control during construction by sandblasting. Temporary striping includes any striping required on any pavement replaced prior to the final surface course. Replace any damaged or obliterated raised pavement markers in accordance with the standards of the agency having jurisdiction.

END OF SECTION

SECTION 015723 STORM WATER RUNOFF CONTROL

PART 1 - GENERAL

A. Description

1. This section describes work necessary by the Contractor to allow the Owner to comply with the California State Water Resources Control Board (SWRCB) Construction Activities Storm Water General Permit No. 2009-0009-DWQ (NPDES No. CAS000002) for discharges of storm water associated with construction activities for linear underground/overhead projects (LUP). Specifically, this includes the development and implementation of a Storm Water Pollution Prevention Plan (SWPPP). The work shall reflect the Contractor's experience, resources, and capabilities in determining and meeting the requirements of the General Permit.

2. Disposal of construction water from operations such as groundwater dewatering and water used for testing, disinfecting, and flushing pipelines is not part of the work under this section. Refer to Sections 312316, 331300 and 400515 for permit requirements for those discharges.

B. Related Work Described Elsewhere

1. Coordination of Work and Permits: 011100.

2. Submittals: 013300.

3. Construction Facilities and Temporary Controls: 015100.

4. Trenching, Backfilling, and Compacting: 312316.

5. Disinfection of Piping and Structures: 331300.

6. Pressure Testing of Piping: 400515.

C. Submittals

1. Submit the SWPPP in electronic format following the procedure described for shop drawings in Section 013300.

2. Prepare and submit a hazardous materials business plan prior to equipment use on the site. The approved plan

shall be followed for project construction. The plan shall include:

a. Specific bermed equipment maintenance and refueling areas.

b. Bermed and lined hazardous material storage areas on site that are covered during the rainy season.

c. Hazardous material spill cleanup equipment on site (e.g., sorbent pads, shovels, and bags to place contaminated soil in).

d. Workers trained in location and use of cleanup equipment.

D. Summary of Procedure for Pipelines

1. Perform the risk determination per Section VIII of the General Permit No. 2009-0009-DWQ and the Division of Water Quality Fact Sheet Part II, "Rationale"; Section J, "Risk Determination"; paragraph 2, "Linear Projects."

2. Use Chart Nos. I, II, III, and IV in Attachment A of the General Permit.

3. Establish the LUP type determination per Attachment A.1 in the General Permit.

4. For the various LUP types, follow the LUP type-specific requirements in Attachment A, Section J.

E. General Construction Activity Storm Water Permit

1. Prepare and submit the SWPPP to the Owner for inclusion in the PRDs. For information regarding preparation of the SWPPP, see www.waterboards.ca.gov. The Owner will submit permit registration documents (PRDs) along with appurtenant fee, under the Construction Activities Storm Water General Permit (2009-0009-DWQ).

2. No work on the project site shall commence prior to the Owner submitting the PRDs. Allow no less than seven days after submitting the SWPPP to the Owner for receipt of notice from the Owner that the PRDs have been filed.

3. The SWPPP shall be appropriate for the type and complexity of the project and shall be developed and implemented to address project-specific conditions. The

project SWPPP shall identify specific BMPs needed to address all possible generated pollutants.

4. Read and be familiar with the requirements contained in the General Permit necessary to develop an SWPPP. Attention is directed to the publication entitled *Construction General Permit Fact Sheet (2009-0009-DWQ)* which has been prepared by the state and should assist the Contractor in the development of the SWPPP. Copies of the Fact Sheet may be purchased by writing the SWRCB, Division of Water Quality, 1001 I Street, Sacramento, CA 95814, telephone 916-341-5455, www.waterbooks.ca.gov. In addition, see the California Storm Water Quality Association Storm Water *Best Management Practice Handbook 2003*, www.cabmphanbdbooks.com.

5. Compliance with the requirements contained in the General Permit may require the use of erosion and sedimentation control procedures outside the limits of immediate construction activity.

F. Notice of Intent (NOI)

The General Permit requires the Owner to file an NOI with the SWRCB. A copy of this NOI must be included in the SWPPP. The Owner will file the NOI with the SWRCB and provide a copy to the Contractor for inclusion in the SWPPP.

G. Erosion Control Protocol

1. Prior to start of any work, prepare an SWPPP for construction in compliance with the SWRCB's Construction Activities Storm Water General Permit No. 2009-0009-DWQ. The General Permit became effective on July 1, 2010 and superseded order No. 99-008-DWQ. This plan shall be designed for no less than a 10-year, eight-hour duration storm event. Where possible, erosion control measures shall be installed prior to work beginning. Erosion and sediment control features shall be utilized during and immediately after grading to minimize impacts associated with erosion and off-site silt deposition.

2. Construct straw bale/filter fabric barriers, backed by wire fencing for strength, around spoil piles to contain sediment from runoff. Install these barriers prior to any stockpiling during the rainy season and immediately after stockpiling during the dry season and shall be regularly

maintained, including during major rainfall events, until the stockpiles are completely removed.

H. Hazards and Hazardous Materials

1. The project-specific SWPPP shall be prepared in compliance with the Statewide Construction Activities Storm Water General Permit No. 2009-0009-DWQ to prevent adverse impacts associated with construction-related incidental spills. This plan shall include a description of BMPs, spill prevention measures, spill containment equipment, and monitoring requirements.

2. The following pollution prevention measures shall be followed in association with pipeline construction:

   a. If rain occurs during or within three days after concrete is placed for any pipeline structures, spread and secure plastic sheets or tarps over the concrete in such a manner to prevent rain from coming in contact with the concrete.

   b. Wash out concrete trucks in a designated area where the material cannot percolate into the groundwater. This area shall be specified on all applicable construction plans and be in place before any concrete is poured.

   c. Upon entering the site and regularly thereafter, inspect and maintain. Repair leaks or hoses/fittings in poor condition before the equipment begins work.

I. Measurement and Payment

The Contractor shall be responsible for all costs associated with the preparing and implementation of the SWPPP and coordination with the Owner for the Owner's implementation of the MP, including the installation, maintenance, and removal of erosion control practices described in the SWPPP upon completion of the project or as requested by the Owner's Representative. These costs shall be included in the prices shown for the other related bid items.

PART 2 - MATERIALS

Not used.

PART 3 - EXECUTION

A. General

1. Develop and submit the SWPPP as required by the SWRCB Fact Sheet and the General Permit for acceptance by the Owner prior to commencement of construction activities. Comply with the conditions identified in the General Permit that apply to the work under this contract.

2. The Contractor's personnel and subcontractors shall comply with the SWPPP.

3. Keep the SWPPP on site during construction activity. Make available upon request of a representative of the RWQCB and/or other regulatory agency.

4. Amend the SWPPP whenever there is a change in construction or operations which may affect the discharge of significant quantities of pollutants to surface waters, groundwaters, or a municipal storm sewer system.

B. Storm Water Pollution Prevention Plan

The SWPPP shall provide a description of potential sources which are likely to add significant quantities of pollutants to storm water discharges or which may result in nonstorm water discharges from the construction site. A description of the items required to be included in the SWPPP is included in the General Permit.

C. Implementation for Pipeline Projects

1. The SWPPP shall be implemented at the appropriate level to protect water quality at all times throughout the life of the project. The SWPPP shall remain on the site during construction activities, commencing with the initial mobilization and ending with the termination of coverage under the General Permit. For LUPs, the discharger shall make the SWPPP available at the construction site during working hours while construction is occurring and shall be made available upon request by a state or municipal inspector. When the original SWPPP is retained by a crew member in a construction vehicle and is not currently at the construction site, current copies of the BMPs and map/drawing shall be left with the field crew and the original SWPPP shall be made available via a request by radio or telephone. Once construction activities are

complete, until stabilization is achieved, the SWPPP shall be available from the SWPPP contact listed in the PRDs.

2. Comply with Part II, Section I of the Division of Water Quality Fact Sheet regarding sampling, monitoring, reporting, and recordkeeping and Section XVI of the General Permit. Comply with the monitoring and reporting requirements for the previously established risk level and Attachment A, paragraph J.7 and paragraph M.

D. Duty to Comply

1. Comply with the conditions identified in the General Permit and the SWPPP. Nonadherence with the conditions specified in the General Permit may constitute a violation of the Clean Water Act and the Porter-Cologne Water Quality Control Act and may be grounds for enforcement action by the RWQCB.

2. Take all reasonable steps to minimize or prevent any discharge in violation of the General Permit.

E. Compliance Certification

1. An officer or other authorized representative of the Contractor shall certify in writing to the Owner annually and at the completion of construction, if it occurs before the next annual report, that its construction activity is and has been in compliance or has been modified to comply with the requirements of the General Permit and the SWPPP.

2. If compliance with any of the General Permit and SWPPP requirements cannot be certified, notify the Owner immediately. The notification shall identify the type of noncompliance, describe the actions necessary to achieve compliance, and include a time schedule when compliance will be achieved. Submit each noncompliance notification to the Owner within 15 days of identification of the event.

END OF SECTION

SECTION 017410 CLEANING DURING CONSTRUCTION AND FINAL CLEANING

A. General

1. This section includes cleaning during construction and final cleaning on completion of the work.

2. At all times maintain areas covered by the contract and adjacent properties and public access roads free from accumulations of waste, debris, and rubbish caused by construction operations.

3. Conduct cleaning and disposal operations to comply with local ordinances and antipollution laws. Do not burn or bury rubbish or waste materials on project site. Do not dispose of volatile wastes, such as mineral spirits, oil, or paint thinner, in storm or sanitary drains. Do not dispose of wastes into streams or waterways.

4. Use only cleaning materials recommended by manufacturer of surface to be cleaned.

B. Cleaning During Construction

1. During execution of work, clean site, adjacent properties, and public access roads and dispose of waste materials, debris, and rubbish to assure that buildings, grounds, and public properties are maintained free from accumulations of waste materials and rubbish.

2. Wet down dry materials and rubbish to lay dust and prevent blowing dust.

3. Provide containers for collection and disposal of waste materials, debris, and rubbish.

4. Cover or wet excavated material leaving and arriving at the site to prevent blowing dust. Clean the public access roads to the site of any material falling from the haul trucks.

C. Final Cleaning

1. At the completion of work and immediately prior to final inspection, clean the entire project site as follows:

   a. Clean, sweep, wash, and polish all work and equipment including finishes.

b. Remove grease, dust, dirt, stains, labels, fingerprints, and other foreign materials from sight-exposed interior and exterior finished surfaces; polish surfaces.

c. Repair, patch, and touch up marred surfaces to match adjacent surfaces.

d. Broom clean paved surfaces; rake clean landscaped areas.

e. Remove from the site temporary structures and materials, equipment, and appurtenances not required as a part of, or appurtenant to, the completed work.

END OF SECTION

SECTION 020120 PROTECTING EXISTING UNDERGROUND UTILITIES

PART 1 - GENERAL

A. Description

This section includes materials and procedures for protecting existing underground utilities.

B. Related Work Specified Elsewhere

Trenching, Backfilling, and Compacting: 312316.

PART 2 - MATERIALS

A. Replacement in Kind

Except as indicated below or as specifically authorized by the Owner's Representative, reconstruct utilities with new material of the same size, type, and quality as that removed.

B. Vitrified Clay Sewer Pipe and Couplings

For sewer pipe 8 inches and less in diameter, replacement shall consist of plain-end pipe conforming to ASTM C 700. Compression couplings shall conform to ASTM C 594, band seal couplings or equal. Use at least two lengths of pipe in crossing the trench section or as shown on the details in the drawings.

PART 3 - EXECUTION

A. General

1. Replace in kind street improvements, such as curbs and gutters, barricades, traffic islands, signalization, fences, signs, etc., that are cut, removed, damaged, or otherwise disturbed by the construction.

2. Where utilities are parallel to or cross the construction but do not conflict with the permanent work to be constructed, follow the procedures given below and as indicated in the drawings. Notify the utility owner 48 hours in advance of the crossing construction and

coordinate the construction schedule with the utility owner's requirements. For utility crossings not shown in the drawings, refer to the General Provisions and the instructions of the Owner's Representative for guidance.

3. Determine the true location and depth of utilities and service connections which may be affected by or affect the work. Determine the type, material, and condition of these utilities. In order to provide sufficient lead time to resolve unforeseen conflicts, order materials and take appropriate measures to ensure that there is no delay in work.

B. Procedures

1. Protect in Place: Protect utilities in place, unless abandoned, and maintain the utility in service, unless otherwise specified in the drawings or in the specifications.

2. Cut and Plug Ends: Cut abandoned utility lines and plug the ends. Plug storm drains and sewers with an 8-inch wall of brick and mortar. Cap waterlines with a cast-iron cap or install a 3-foot-long concrete plug. Dispose of the cut pipe as unsuitable material.

3. Remove and Reconstruct: Where so indicated in the drawings or as required by the Owner's Representative, remove the utility and, after passage, reconstruct it with new materials. Provide temporary service for the disconnected utility.

C. Compaction

1. Utilities Protected in Place: Backfill and compact under and around the utility so that no voids are left.

2. Utilities Reconstructed: Prior to replacement of the utility, backfill the trench and compact to an elevation 1 foot above the top of the ends of the utility. Excavate a cross trench of the proper width for the utility and lay, backfill, and compact.

3. Alternative Construction--Sand-Cement Slurry: Sand-cement slurry consisting of one sack (94 pounds) of portland cement per cubic yard of sand and sufficient moisture for workability may be substituted for other backfill materials to aid in reducing compaction

difficulties. Submit specific methods and procedures for the review of the Owner's Representative prior to construction.

D. Thrust Blocks on Waterlines

1. The Contractor's attention is called to thrust blocks for waterlines throughout the project whose thrust is in the direction of the new excavation and, therefore, may be affected by the construction. These waterlines are owned and operated by the Owner. Protect thrust blocks in place or shore to resist the thrust by a means approved by the Owner's Representative. If the thrust blocks are exposed or rendered to be ineffective in the opinion of the Owner's Representative, reconstruct them to bear against firm unexcavated or backfill material.

2. Provide firm support by backfilling that portion of the trench for a distance of 2 feet on each side of the thrust block to be reconstructed from the pipe bedding to the pavement subgrade, with either:

   a. Sand-cement slurry (94 pounds of cement per cubic yard).

   b. The native material compacted to a relative compaction of 95%.

3. Then excavate the backfill material for construction of the thrust block.

4. Test compaction of the backfill material before pouring any concrete thrust block. Use Class C concrete per Section 030500 for reconstruction.

END OF SECTION

SECTION 030500 GENERAL CONCRETE CONSTRUCTION

PART 1 - GENERAL

A. Description

This section includes materials, installation, and testing of formwork, reinforcing steel, joints, concrete, and finishing and curing for general concrete construction.

B. Submittals

1. Submit shop drawings in accordance with the General Provisions and Section 013300.

2. Prepare concrete and mortar mix designs and laboratory 7-day and 28-day compressive tests, or submit test reports of 7- and 28-day compressive tests of the mix where the same mix has been used on two previous projects. Prepare mix designs in accordance with ACI 318, Chapters 4 and 5, except as modified herein. Submit mix design in writing for review by the Owner at least 15 days before placing of any concrete.

3. Submit mill test certificates identifying chemical and physical analyses of each load of reinforcing steel delivered. If mill test reports are unavailable and the quantity of steel for a structure exceeds 5 tons, provide a laboratory test to prove conformance with the specified ASTM standard.

4. Submit reinforcing bending lists and placing drawings for all reinforcing. Placing drawings shall indicate all openings or joints. Placing drawings shall be coordinated with the concrete placing schedule. Each bending list and placing drawing submitted shall be complete for each major element of a structure including dowels for CMU units. Furnishing such lists shall not be construed that the lists will be reviewed for accuracy. The Contractor shall be wholly and completely responsible for the accuracy of the lists and for furnishing and placing reinforcing steel in accordance with the details shown in the drawings and as specified. Placing drawings shall be prepared by the Contractor and shall not incorporate photocopies of the contract drawings.

5. Submit six copies of a report from a testing laboratory verifying that aggregate material contains less than 1% asbestos by weight or volume and conforms to the specified gradations or characteristics.

PART 2 - MATERIALS

A. Nondomestic Cement and Additives

1. The use of nondomestic cement and additives in concrete may be permitted only after review of a written request to use such materials. The request to use nondomestic materials shall include a chemical analysis that indicates the material meets the project specifications. Certifications that state the nondomestic materials meet the project requirements will not be accepted.

2. Test reports for concrete materials shall be current to within three months of inclusion into the project and shall be identifiable to the materials supplied.

B. Formwork

1. Design forms according to ACI 347.

2. Class II Forms: Use plywood in good condition, metal, or smooth-planed boards free from large or loose knots with tongue and groove or ship lap joints.

3. Class II forms may be used for exterior concrete surfaces that are 1 foot or more below finished grade. Use Class I forms for all other surfaces.

4. Coat forms with form release agent.

C. Form Release Agent

Form release agent shall effectively prevent absorption of moisture and prevent bond with the concrete. Agent shall be nonstaining and nontoxic after 30 days.

D. Reinforcing Steel

1. Reinforcement shall conform to ASTM A615 or A706, Grade 60 deformed.

2. Fabricate reinforcing in accordance with the current edition of the Manual of Standard Practice, published by

the Concrete Reinforcing Steel Institute. Bend reinforcing steel cold.

3. Deliver reinforcing steel to the site bundled and with identifying tags.

E. Tie Wire

Tie wire shall be 16 gauge minimum, black, soft annealed.

F. Bar Supports

Use concrete supports for reinforcing in concrete placed on grade.

G. Bar Couplers

Reinforcing steel bar splicing couplers shall be a mechanical type as manufactured by Dayton Barsplice Inc. or equal. Use couplers that do not reduce tensile or ultimate strength of bars.

H. Joint Sealant for Concrete Structures

1. Joint sealant shall be a multipart, gray, nonstaining, nonsagging, gun grade polyurethane sealant, which cures at ambient temperature to a firm, flexible, resilient, tear-resistant rubber. Sealant shall comply with ASTM C920, Type M, Grade P, Class 25 for horizontal joints and Grade NS, Class 25 for vertical joints and be recommended by the manufacturer for continuous immersion in water.

Characteristic or Parameter	**Technical Requirements**
Pot life	1 to 3 hours
Hardness	35 Shore A, ±5, ASTM D2240
Elongation	650%, ASTM D412
Tensile strength	200 psi, ASTM D412
Peel strength on concrete	No adhesion loss at 25 pounds
Temperature service range	40°F to 167°F
Immersion in water	Continuous

2. Sealant shall be Tremco Vulkem 227 or Sikaflex-2CNS (for Grade NS, Class 25), Sikaflex-2CSL of Sika Corporation or Vulkem 245 (for Type M, Grade P, Class 25), or equal. Troweling of sealants into joints will not be permitted.

I. Preformed Control Joint

Preformed control joint shall be a one-piece, flexible, PVC joint former, such as Kold-Seal Zip-Per Strip KSF-150-50-50, manufactured by Vinylex Corp., Knoxville, Tennessee, or a one-piece steel strip with preformed groove, such as Keyed Kold Retained Kap, manufactured by Burke Concrete Accessories, Inc., San Mateo, California, or equal. Provide the preformed control joint material in full-length unspliced pieces.

J. Cement

1. Use domestic portland cement that conforms to ASTM C150, Type II/V.

2. Use only one brand of cement in any individual structure. Use no cement that has become damaged, partially set, lumpy, or caked. Reject the entire contents of the sack or container that contains such cement. Use no salvaged or reclaimed cement.

3. Maximum tricalcium aluminate shall not exceed 8%. The maximum percent alkalies shall not exceed 0.6%.

K. Aggregates

Aggregates shall be natural rock, sand, or crushed natural rock; shall comply with ASTM C33; and shall contain less than 1% asbestos by weight or volume. Aggregates shall be free from any substances that will react with the cement alkalies, as determined by Appendix X-1 of ASTM C33.

L. Water and Ice

Use water and ice that is clean and free from objectionable quantities of organic matter, alkali, salts, and other impurities that might reduce the strength, durability, or otherwise adversely affect the quality of the concrete. Water shall not contain more than 500 mg/L of chlorides or more than 500 mg/L of sulfate.

M. Color Additive for Exterior Electrical Duct Encasement

For exterior electrical duct concrete encasements, use a color additive for identification purposes: brick red "Colorfull" as manufactured by Owl Manufacturing Company, Arcadia, California; coral red "Chromix C-22" as manufactured by L. M. Scofield Company, Los Angeles, California; or equal. Add the color additive while the concrete is being mixed using the quantity per cubic yard of concrete recommended by the manufacturer for the class of concrete indicated.

N. Concrete Admixtures

1. Class A concrete shall contain an air-entraining admixture conforming to ASTM C260. Admixtures shall be Master Builders MB-AE 90, Sika AER, or equal.

2. Class A concrete shall contain a water-reducing admixture conforming to ASTM C494, Type A or D. It shall be compatible with the air-entraining admixtures. The amount of admixture added to the concrete shall be in accordance with the manufacturer's recommendations. Admixture shall be Master Builders Pozzolith polymer-type normal setting, Plastocrete 161 or Plastiment, Sika Chemical Corporation, or equal.

3. Pozzolan Admixture: Where specified, provide concrete containing pozzolan admixture conforming to ASTM C618.

4. Do not use any admixture that contains chlorides or other corrosive elements in any concrete. Admixtures shall be nontoxic after 30 days.

O. Repair Mortar

1. Mortar used for repair of concrete voids shall be made of the same materials as used for concrete, except that the coarse aggregate shall be omitted or the mortar shall consist of not more than one part cement to two and one-half parts sand by damp loose volume. The quantity of mixing water shall be no more than necessary for handling and placing.

2. Materials for repair of major defects or cracks shall be in accordance with "Repair of Defects and Cracks" specified in Part 3.

P. Bonding Compound

1. Epoxy bonding compound shall be Sikadur 32 Hi-Mod, Sika Chemical Corporation, Lyndhurst, New Jersey; Concresive by BASF; Euco Epoxy 452 by Euclid Chemical Company; or equal.

2. Nonepoxy bonding compound shall be Weldcrete by Larsen Products Corp., Link by Sta-Dry Manufacturing Corp., Euco Weld by Euclid Chemical Co., or equivalent. The compound shall be rewettable for up to two weeks.

Q. Concrete Mix Design

1. Conform to ASTM C94, except as modified by these specifications.

2. Air content as determined by ASTM C231 shall be 4% ±1%.

3. Maximum water-cement ratio for Class A concrete = 0.45 by weight.

4. Use classes of concrete as described in the following table:

Class	**Type of Work**	**28-Day Compressive Strength (in psi)**	**Minimum Cement Content (in lbs per C.Y.)**
A	Concrete for all structures and concrete not otherwise specified. Concrete fill at structure foundations, cradle, supports across pipe trenches.	4,000	564
C	Unreinforced concrete.	2,000	376

5. Measure slump in accordance with ASTM C143. Slump shall be as follows:

Slab on grade or heavy sections wider (in plan view) than 3 feet	3 inches maximum
Footings	4 inches maximum

Proportion and produce the concrete to have a maximum slump as shown. A tolerance of up to 1 inch above the indicated maximum shall be allowed for individual batches provided the average for all batches or the most recent 10 batches tested, whichever is fewer, does not exceed the maximum limit. Concrete of lower than usual slump may be used provided it is properly placed and consolidated.

6. Aggregate size shall be 1 inch maximum for slabs and sections greater than 8 inches and less than 17 inches. Aggregate size shall be 1-1/2 inches maximum for all larger slabs and sections.

7. Combined aggregate grading shall be as shown in the following table:

Sieve Sizes	**Maximum Aggregate Size**		
	1-1/2"	**1"**	**3/4"**
	Percent Passing		
2"	100	---	---
1-1/2"	90 - 100	100	---
1"	50 - 86	90 - 100	100
3/4"	45 - 75	55 - 100	90 - 100
3/8"	38 - 55	45 - 75	60 - 80
No. 4	30 - 45	35 - 60	40 - 60
No. 8	23 - 38	27 - 45	30 - 45
No. 16	17 - 33	20 - 35	20 - 35
No. 30	10 - 22	12 - 25	13 - 23
No. 50	4 - 10	5 - 15	5 - 15
No. 100	1 - 3	1 - 5	0 - 5
No. 200	0 - 2	0 - 2	0 - 2

8. Mix design for pumped concrete shall produce a plastic and workable mix. The percentage of sand in the mix shall be based on the void content of the coarse aggregate.

R. Curing Compound

1. Curing compound shall conform to ASTM C309.

2. Curing compound shall be compatible with required finishes and coatings and shall meet the State of California Clean Air Quality Standards which limit the

quantity of volatile organic compounds to 350 grams per liter.

S. Mats, Paper, and Sheeting for Curing

1. Burlap mats shall conform to AASHTO M182.

2. Sisal-kraft paper and polyethylene sheets shall conform to ASTM C171.

T. Reinforcing Dowel Adhesive

Dowel anchor adhesive shall be HIT-RE 500-SD by Hilti; Sikadur 31, Hi-Mod Gel by Sika; or equal.

PART 3 - EXECUTION

A. Form Tolerances

1. Failure of the forms to produce the specified concrete surface and surface tolerance shall be grounds for rejection of the concrete work. Rejected work shall be repaired or replaced at no additional cost to the Owner.

2. The following table indicates tolerances or allowable variations from dimensions or positions of structural concrete work:

	Maximum Tolerance (inch)
Sleeves and inserts	+1/4 -1/4
Projected ends of anchors	+1/4 -0.0
Anchor bolt setting	+1/4 -1/4
Finished concrete, all locations	+1/4 -1/4 in 10 feet
	Max ±1-inch in total length

B. Form Surface Preparation

1. Clean form surfaces to be in contact with concrete of foreign material prior to installation.

2. Coat form surfaces in contact with concrete with a release agent prior to form installation.

C. Form Reuse

Reuse only forms that provide a uniform surface texture on exposed concrete surfaces. Apply light sanding or other surface treatment between uses for uniform texture. Plug unused tie rod holes with corks, shave flush, and sand the concrete surface side. Do not patch forms other than filling tie rod holes, except in the case of Class II forms. Do not use metal patching discs on Class I forms.

D. Removal of Forms

1. Forms and shoring for elevated structural slabs or beams shall remain in place until the concrete has reached a compressive strength equal to the specified 28-day compressive strength as determined by test cylinders. Do not remove supports and reshore. The following table indicates the minimum allowable time after the last cast concrete is placed before forms, shoring, or wall bracing may be removed:

Sides of footings and encasements	8 hours

2. Do not remove forms from concrete that has been placed with outside air temperature below 50°F without first determining if the concrete has properly set without regard for time. Do not apply heavy loading on green concrete. Immediately after forms are removed, the surface of the concrete shall be carefully examined and any irregularities in the surface shall be repaired and finished as specified.

E. Construction Joints

1. Provide construction joints where shown in the drawings.

2. Layout of construction joints shall be as shown in the drawings.

3. After a concrete placement pour has been completed to the construction joint and the concrete has hardened, thoroughly clean the entire surface of the joint of surface laitance, loose or defective concrete, and foreign material. Expose clean aggregate by sandblasting and thoroughly cleaning the surface of construction joints before placing the new concrete. Cover horizontal construction joints with grout bedding. Spread uniformly

and work thoroughly into all irregularities of the surface. The consistency of the mortar shall be suitable for placing and working and shall be placed immediately prior to placing new concrete.

4. In case of emergency, place additional construction joints. (An interval of 45 minutes constitutes cause for an emergency construction joint.)

F. Placing Reinforcement

1. Place reinforcing steel in accordance with the current edition of Recommended Practice for Placing Reinforcing Bars, published by the Concrete Reinforcing Steel Institute.

2. Place reinforcing in accordance with the following, unless otherwise indicated:

   a. Reinforcement indicated in the drawings is continuous through the structure to the farthest extent possible. Terminate bars and hooks 2 inches clear from faces of concrete.

   b. Splicing of reinforcement that is detailed to be continuous in the drawings is 40 diameters.

3. Reinforcing steel, before being positioned and just prior to placing concrete, shall be free from loose mill and rust scale and from any coatings that may destroy or reduce the bond. Clean reinforcing steel by sandblasting or wire brushing and remove mortar, oil, or dirt to remove materials that may reduce the bond.

4. Do not straighten or rebend reinforcing steel in the field. Do not use reinforcing with bends not shown in the drawings.

5. Position reinforcing steel in accordance with the drawings and secure by using annealed wire ties or clips at intersections and support by concrete dobies. Bend tie wires away from the forms to provide the specified concrete coverage. Bars, in addition to those shown in the drawings, which may be found necessary or desirable by the Contractor for the purpose of securing reinforcement in position shall be provided by the Contractor at his own expense.

6. Place reinforcement a minimum of 2 inches clear of forms.

7. Secure reinforcing dowels in place prior to placing concrete. Do not press dowels into the concrete after the concrete has been placed.

8. Position dowels for masonry walls to occur at reinforced block cells.

G. Site-Mixed Concrete

Conform to ACI 304.

H. Ready-Mixed Concrete

Conform to ASTM C94.

I. Placing Concrete

Conform to ACI 304.

J. Pumping Concrete

Conform to ACI 304.2R-91.

K. Weather Requirements

Conform to ACI 305 for placing during hot weather.

L. Concrete Finishes

1. Complete concrete surfaces in accordance with the following schedule:

Finish Designation	**Area Applied**
F-1	Footings.

2. Finish F-1: Repair defective concrete, fill depressions deeper than 1/2 inch, and fill tie holes. Wood float finish.

M. Curing Concrete

1. Conform to ACI 308.

2. Water cure with burlap mats unless optional curing methods are permitted.

3. It is the responsibility of the Contractor to select the appropriate curing method in response to climatical and/or site conditions occurring at the time of concrete placement. Take appropriate measures as described in ACI 305 and 306 for protecting and curing concrete during hot and cold weather.

N. Repair of Defects and Cracks

1. Do not repair defects until concrete has been evaluated by the Owner's Representative.

2. Surface Defects:

    a. Repair surface defects that are smaller than 1 foot across in any direction and are less than 1/2 inch in depth.

    b. Repair by removing the honeycombed and other defective concrete down to sound concrete, cut or grind edges perpendicular to the surface and at least 3/8 inch deep, abrasive clean and thoroughly dampen the surface, work into the surface an epoxy bonding agent, and fill the hole with one part cement to one part fine sand. Match the finish on the adjacent concrete, and cure as specified.

3. Severe Defects:

    a. Repair severe defects that are larger than surface defects but do not appear to affect the structural integrity of the structure.

    b. Repair by removing the honeycombed and other defective concrete down to sound concrete, make edges of the repair area perpendicular to the surface, as required above, sandblast the sound concrete surface, coat the exposed surfaces with epoxy bonding compound, place nonshrink grout, match the finish on the adjacent concrete, and cure as specified.

4. If the cracks are major, the Owner's Representative may require the concrete to be repaired by epoxy injection.

5. Major Defects and Cracks: If the defects affect the structural integrity of the structure or if patching does not satisfactorily restore quality and appearance

to the surface, the Owner's Representative may require the concrete to be removed and replaced, complete.

O. Concrete Tests

Concrete quality testing will be performed on the concrete by the Contractor's independent testing laboratory.

1. Frequency of Sampling: Cast four concrete test cylinders from each 50 cubic yards, or fraction thereof, of each class of concrete placed in any one day. Sampling and curing of cylinders shall conform to ASTM C31.

2. Strength Testing: Test cylinders in accordance with ASTM C39. Test one cylinder at 7 days for information; test two cylinders at 28 days for acceptance; and hold one cylinder for verification. Strength acceptance will be based on the average of the strengths of the two cylinders tested at 28 days. If one cylinder of a 28-day test manifests evidence of improper sampling, molding, or testing, other than low strength, discard it and use the fourth cylinder for the test result.

3. Determine concrete slump by ASTM C143 with each strength test sampling and as required to establish consistency.

4. Determine air content of the concrete using ASTM C231 to verify the percentage of air in the concrete immediately prior to depositing in forms.

5. The average value of concrete strength tests shall be equal to or greater than the specified 28-day strength. No test shall be less than 90% of the specified 28-day strength.

6. If the 28-day strength tests fail to meet the specified minimum compressive strength, the concrete will be assumed to be defective and one set of three cores from each area may be taken as selected by the Owner and in accordance with ASTM C42. If the average compressive strength of the set of three concrete cores fails to equal 85% of the specified minimum compressive strength or if any single core is less than 75% of the minimum compressive strength, the concrete will be considered defective. The Owner may require additional coring, nondestructive load testing, or repair of defective concrete. Costs of coring, testing of cores, load

testing, and required repairing pertaining thereto shall be paid by the Contractor at no extra cost to the Owner.

END OF SECTION

SECTION 034210 PRECAST CIRCULAR CONCRETE MANHOLES

PART 1 - GENERAL

A. Description

This section includes design, materials, testing, and installation of precast circular concrete manholes.

B. Related Work Specified Elsewhere

1. General Concrete Construction: 030500.

2. Trenching, Backfilling, and Compacting: 312316.

3. Crushed Rock Base for Structures: 312323.

4. Leakage and Infiltration Testing: 330130.

5. Vitrified Clay Pipe: 333110.

6. HDPE Profile Wall Gravity Drain Pipe: 333118.

7. Reinforced Concrete Culvert Pipe: 334216.

C. Submittals

1. Submit shop drawings in accordance with the General Provisions and Section 013300.

2. Submit manufacturer's catalog data on precast concrete manholes, frames, pipe connections, joint sealing compound, external sealing bands for joints, and covers. Show dimensions and materials of construction by ASTM reference and grade. Show lettering on manhole covers.

PART 2 - MATERIALS

A. Precast Circular Concrete Manholes

1. Precast circular concrete manholes shall comply with ASTM C478, except that the wall thickness shall be 6 inches minimum. Minimum manhole diameter shall be 48 inches. Design manholes for the depths shown in the drawings, assuming a soil density of 130 pounds per cubic foot.

2. Minimum allowable steel shall be hoops of No. 4 wire cast into each unit.

3. Precast top sections shall be eccentric cone, except where shown otherwise in the drawings.

4. Design joints using a butyl rubber sealant per ASTM C990.

B. Concrete

1. Cement for manholes shall conform to ASTM C150 and C595, Type IP (MS) or, in lieu of Type IPMS, provide a mixture of 85% Type II portland cement and 15% pozzolan fly ash.

2. Concrete used in pouring the manhole base shall be Class A per Section 030500.

C. Steps or Rungs

Cast manholes without steps (ladder rungs).

D. Manhole Frames and Covers

1. Manhole frames and covers shall be made of cast iron conforming to ASTM A48, Class 30. Castings shall be smooth, clean, and free from blisters, blowholes, and shrinkage. Frames and covers shall be designed for H20-44 traffic loads. The cover shall seat firmly into the frame without rocking.

2. Grind or otherwise finish each cover so that it will fit in its frame without rocking. Frames and covers shall be matchmarked in sets before shipping to the site.

3. Sewer manhole covers shall have the words "TORRANCE SEWER" cast thereon. Drain line covers shall have the words "TORRANCE DRAIN" cast thereon.

4. Before leaving the foundry, clean castings and subject them to a hammer inspection.

5. Coat castings with an asphalt coating complying with ASTM A849, Class A, to a minimum thickness of 50 mils.

E. Sealing Compound and Mortar

Butyl rubber sealing compound shall comply with ASTM C990. Mortar shall comply with ASTM C387, Type S, or use grout complying with Section 030500.

F. Pipe Connections for Sewer Manholes

Provide resilient watertight connectors between the manhole and piping in accordance with ASTM C923. Connections shall consist of a chemically resistant neoprene EPDM flexible boot, locking ring, and pipe clamp(s). The locking ring shall be stainless steel and shall lock the boot into the preformed opening in the manhole. The pipe clamp shall be stainless steel. Alternatively, cast the flexible boot in the manhole and eliminate the locking ring. Pipe connections shall be Kor-N-Seal (Dukor Corporation), Z-Lok-XP (A-Lok Products, Inc.), or equal.

G. Crushed Rock for Manhole Base

Crushed rock shall comply with Section 312323. Crushed rock shall be the same material as the pipe bedding. If rock is not used for the pipe bedding, use 3/4-inch crushed rock for the manhole base.

PART 3 - EXECUTION

A. Manhole Base

1. Excavate for the manhole and install a crushed rock base, 12 inches thick, per Section 312323. Crushed rock base material shall extend 1 foot beyond the outside edge of the concrete manhole base. Compact to 90% relative density.

2. Form and pour concrete bases as one monolithic pour. For sewer manholes, form the portion above the invert elevation of the sewer pipe to provide a smooth channel section. Channels shall vary uniformly in size and shape from inlet to outlet.

B. Installing Manholes

1. Set each precast concrete manhole unit plumb on a bed of sealant or mortar to make a watertight joint at least 1/2 inch thick with the concrete base or with the preceding unit. Point the inside joint and wipe off the excess sealant or mortar. Secure the manhole frame to the grade ring with grout and cement mortar fillet. Backfill, compact, and replace pavement.

2. Assemble units so that the cover conforms to the elevation determined by the manhole location as follows:

   a. In Paved Areas: Top of cover shall be flush with the paving surface.

b. In Unpaved Areas: Top of cover shall be flush with existing surface where it is in traveled way and 0.1 foot above existing surface where outside limits of traveled way.

C. <u>Sealing and Grouting of Manhole Sections</u>

Clean ends of precast sections of foreign materials. Place two wraps of butyl rubber sealing compound around the groove of the lower section or place a bed of grout in and completely around the groove of the lower section. Set next section in place. Fill remaining interior and exterior joint cavity completely with mortar of the proper consistency. Trowel interior and exterior surfaces smooth on tongue-and-groove joints. Wipe off any excess grout from the interior and exterior of the joints. Prevent mortar from drying out by applying curing compound or comparable method. Chip out and replace cracked or defective mortar. Completed manhole shall be rigid and watertight.

D. <u>Flexible Pipe Joints at Manhole Walls</u>

Provide two 2-foot-long pipe sections from manhole walls. Lay pipes entering manhole base penetrations on compacted base.

E. <u>Leakage Testing of Sewer Manholes</u>

Test manholes for leakage along with the pipe.

F. <u>Backfill Around Manholes</u>

Backfill and compact around the manholes using native material, per Section 312316 and the pipe specification.

END OF SECTION

SECTION 034220 PRECAST CONCRETE VAULTS

PART 1 - GENERAL

A. Description

This section includes materials, design, and installation of precast concrete vaults and structures.

B. Related Work Specified Elsewhere

1. General Concrete Construction: 030500.

2. Ladders: 055100.

3. Grating and Access Hatches: 055300.

4. Earthwork: 312300.

5. Gravel and Crushed Rock Base for Structures: 312323.

C. Submittals

1. Submit shop drawings in accordance with the General Provisions and Section 013300.

2. Submit manufacturer's catalog data on precast concrete items. Show dimensions of vaults and thicknesses of walls, floors, and top slabs. Show reinforcing wire and steel. Show materials of construction by ASTM reference and grade.

3. Submit manufacturer's design calculations and certification signed and sealed by a professional civil or structural engineer registered in the state of California that vault design and construction comply with the specified design load conditions and the referenced ASTM specifications (e.g., ASTM C857 and C858).

PART 2 - MATERIALS

A. Manufacturers

Precast concrete vaults shall be manufactured by Brooks Products Inc., Utility Vault Company, or equal.

B. Precast Concrete Vaults

1. Precast concrete vaults shall comply with ASTM C858 except as modified herein.

2. Design loads shall be in accordance with ASTM C857, except as modified herein. Traffic loads, unless otherwise stated, shall conform to Load Designation A-16 per Table 1. Soil lateral loads shall be as determined by ASTM C857 or loadings specified in the project soils report, whichever is greater. Alternate design by the strength design method shall include a load factor of 1.7 times the lateral earth or hydrostatic pressures.

3. Include the following load conditions in the design:

   a. Vault roof removed while structure is backfilled to grade and subject to live and dead loads.

   b. Vault roof in place and walls subject to simultaneous vertical and horizontal application of all live, impact, and dead loads. Include the case of an A-16 designated load placed directly above the wall.

   c. Open bottom with a reinforced concrete slab.

4. Design shall also comply with the following restrictions:

   a. The maximum reinforcement ratio allowed is one-half the reinforcement ratio that would produce a balanced strain condition.

   b. Earth pressure shall be converted to a horizontal pressure using a coefficient of earth pressure at rest of 0.5 and not a coefficient of active earth pressure.

   c. Include a live load surcharge of 2 feet of soil in the design of the walls.

5. Design all vaults to receive the specified traffic loading.

6. Precast vault construction shall be in the form of monolithic walls or horizontal wall sections; do not use panel walls.

7. Minimum wall thickness shall be 6 inches. Design knockout wall panels to accommodate loading pressures defined above.

8. Design and construct vaults to be watertight when subjected to groundwater over the entire height of the vault.

9. Floor slab shall be precast concrete. Calculations for the floor slab design shall be included in the vault design submittal.

10. Design joints using a butyl rubber sealant per ASTM C990.

C. Sealant

Butyl rubber sealing compound shall comply with ASTM C990.

D. Ladders

Provide stainless steel ladders per Section 055100.

E. Access Hatches

Provide traffic-rated access hatches per Section 055300.

F. Sump Covers

Steel, minimum 1/4-inch thick, galvanized per ASTM A123.

G. Cement

Cement shall be ASTM C150, Type II.

H. Admixtures

Provide air-entraining and water-reducing concrete admixtures as specified in Section 030500.

I. Crushed Rock Base

Crushed rock base material shall comply with Section 312323.

PART 3 - EXECUTION

A. Vault Base

1. Excavate for the vault and install a crushed rock base, 12 inches thick.

2. Crushed rock base material shall extend 1 foot beyond the outside edge of the concrete vault base. Compact to 85% relative density.

B. Sealing and Grouting

Fill joints between precast sections with butyl rubber sealing compound.

C. Installing Vaults

1. Set each precast concrete vault section plumb on a bed of sealant or cement mortar at least 1/2-inch thick to make a watertight joint with the concrete base and with the preceding unit. Point the inside joint and wipe off the excess mortar or sealant.

2. Install the concrete roof such that it slopes at least 1/8 inch per foot toward the drainage channel around the roof hatch.

3. Install drainpipe from vault roof drainage channel and terminate at the adjacent curb.

D. Backfill Around Vaults

Backfill and compact around the vaults using imported sand as specified in Section 312316. Compact to 90% relative compaction.

END OF SECTION

SECTION 042223 CONCRETE UNIT MASONRY

PART 1 - GENERAL

A. Description

This section includes materials and installation of hollow block concrete unit masonry.

B. Related Work Specified Elsewhere

General Concrete Construction: 030500.

C. Submittals

1. Submit shop drawings in accordance with the General Provisions and Section 013300.

2. Submit manufacturer's catalog data of each type including special shapes required to show range of colors, texture, finishes, and dimensions. If colored, state source of color for coordination with mortar mix.

3. Submit manufacturer's certificate and test results to show that masonry units comply with the cited ASTM specification.

4. Provide statement from concrete products supplier results of ASTM tests and gradations when requested by Owner's Representative.

5. Furnish grout mix design including admixture with laboratory 7- and 28-day compressive tests prior to placing plant-mixed grout on the project.

6. Submit which method of grouting is to be used for masonry work: low-lift or high-lift.

7. Submit two copies of a report from a testing laboratory verifying that aggregate material is asbestos-free and conforms to the specified gradations or characteristics.

8. Submit reinforcing bending lists and placing drawings for all reinforcing. Placing drawings shall indicate all openings including additional reinforcing at joints. Placing drawings shall be coordinated with the sequence of masonry construction. Each bending list and placing

drawing submitted shall be complete for each major element of a structure. Furnishing such lists shall not be construed that the lists will be reviewed for accuracy. The Contractor shall be wholly and completely responsible for the accuracy of the lists and for furnishing and placing reinforcing steel in accordance with the details shown in the drawings and as specified. Placing drawings shall include elevation views showing the location of each bar. Placing drawings shall be prepared by the Contractor and shall not incorporate photocopies of the contract drawings.

9. Submit test results of mortar and grout tests conducted by an independent testing agency.

D. <u>Quality Control</u>

Construct in accordance with the CBC, Section 2104, except as specified herein.

PART 2 - MATERIALS

A. <u>Concrete Masonry Units</u>

1. Provide ASTM C90, hollow load-bearing concrete masonry units, medium weight, average compressive strength over net area: 1,900 psi. Nominal face dimensions: 8 inches by 8 inches by 16 inches, unless 4-inch-high units are noted. Color shall be ORCO Block Co. Nu-Fad.

2. Units shall be split face on one side and precision face on the other. Units shall be manufactured by ORCO Block Co., Stanton, California or equal.

3. Units shall be modular and shall include all special shapes and sizes to complete the work as shown. Units shall be sound and free from cracks, chipped edges, or other defects that would interfere with their proper setting or impair the strength or durability of the construction. Where used as the finished surface of exposed masonry walls, units shall be free from surface defects that would be noticeable and objectionable at a distance of 10 feet from the finished wall. Provide special units for bond beams, sills, and half blocks to hold cutting to a minimum.

B. Mortar and Grout

1. Mortar: Provide mortar mix that conforms to the requirements of ASTM C270.

2. Grout: Provide grout that conforms to the requirements of ASTM C476 for fine or coarse grout.

3. Cement: Portland Type I or II, ASTM C150. For mortar, use same cement coloring agent as in colored block manufacture.

4. Sand: Fine granular aggregate; a natural sand passing the No. 4 sieve with 10% to 35% passing the No. 50 and 2% to 15% passing the No. 100; or a manufactured sand, ASTM C144.

5. Coarse Aggregate for Grout: 95% passing the 3/8-inch sieve and no more than 5% passing the No. 8 sieve, ASTM C404. Aggregate shall be asbestos-free.

6. Lime: Hydrated lime, ASTM C207, Type S; lime putty, ASTM C1489; slaked quicklime, ASTM C5.

7. Admixture for Grout: Reduce early water loss and produce an expansive action sufficient to offset initial shrinkage. Products: Sika Grout Aid.

C. Reinforcement

Deformed bars, ASTM A615 or A706, Grade 60. Use annealed tie wires, 16 gauge.

D. Mortar and Grout Mix Proportions and Strengths

Use the following proportions for field mixes and obtain the following strengths of cement mortar with plant mixes:

MORTAR AND GROUT MIX PROPORTIONS AND STRENGTHS					
Type Mix	**Minimum 28-Day Compressive Strength (lbs/sq. in.)**	**Cement**	**Coarse Aggregate**	**Lime Putty or Hydrated Lime**	**Sand (Measure in a Damp, Loose Condition)**
Mortar, Type M	2,000	1	0	1/4 maximum	Not less than two and one-quarter and not more than three times the sum of the volumes of the cement and lime used.
Fine grout	2,000	1	0	0 minimum to 1/10 maximum	Not less than two and one-quarter and not more than three times the sum of the volumes of the cement and lime used.
Coarse grout	2,000	1	Not less than one and not more than two times the sum of the volumes of cement and lime used.	0 minimum to 1/10 maximum	Not less than two and one-quarter and not more than three times the sum of the volumes of cement and lime used.
Grout admixture		In accordance with admixture manufacturer's recommendations.			

E. Control Joint

Control joint shall be PVC conforming to ASTM D2287 Type PVC 654-4 or rubber conforming to ASTM D2000 2AA-805. Shore durometer hardness shall be 80 to 85. Control joint shall be as manufactured by Ty-Wall Accessories (supplier is Dayton Superior), Duro-O-Wal Inc., or equal.

F. Epoxy

Epoxy used for grouting misplaced dowels shall be Sikadur 32 by Sika Corporation, HIT RE 500 by Hilti, or equal.

G. Anti-Graffiti Coating

See specification 099000.

PART 3 - EXECUTION

A. Product Delivery, Storage, and Handling

1. Store masonry units above ground on level platforms that allow air circulation under stacked units. Cover and protect against wetting prior to use.

2. Deliver units on pallets or flatbed barrows. Do not permit free discharge from conveyor or mortar trays.

B. Mixing and Handling Mortar

Mechanically mix mortar for at least five minutes with the amount of water required to produce the desired workability. Retemper on mortar boards by adding water within a basin formed in the mortar and rework the mortar into the water. Do not dash or pour water over the mortar. Do not retemper harsh, nonplastic mortar. Remove from the work mortar that is unused after one hour of the initial mixing.

C. Mixing and Handling Grout

For block spaces 2 inches or less or if the clear distance between the reinforcing and masonry surface is less than 1/2 inch, use fine grout. For block spaces greater than 2 inches, use coarse grout. Add grout admixture in accordance with the manufacturer's recommendations. Mechanically mix grout for at least five minutes. Completely empty the mixer drum before placing in the succeeding batch of materials. Discard grout that is unused after one hour from initial mixing.

D. Quality Control of Mortar and Grout

Conform to CBC Section 2105. Allowable stresses are used for design. Mortar testing is not required.

E. Placement of Reinforcement

1. Use foundation dowels of the same size and spacing as vertical wall reinforcing. When a foundation dowel does not line up with the vertical core to be reinforced, epoxy-grout the misplaced dowel into a core in direct vertical alignment in a cell adjacent to the vertical wall reinforcing. Diameter and depth of hole shall be in accordance with the manufacturer’s recommendations.

2. Where walls are to be low-lift grouted, install vertical reinforcement such that bars are continuous or provide minimum laps of 48 bar diameters. Assure that the cells to be grouted are free from debris and that the vertical reinforcing bars contact the concrete footing or slab.

3. Where high-lift, full-height grouting is employed, clean out opened core and inspect for clearance of reinforcing and mortar debris. Place full-length vertical reinforcing. No splices are permitted in vertical reinforcing, unless indicated in the drawings.

4. Place horizontal reinforcing in special bond beam or other channel units. Lap splices by 50 diameters and securely tie.

F. Laying Masonry Units

1. Do not lay block on concrete footings until concrete has reached a compressive strength of 1,500 psi when tested in accordance with Section 030500.

2. Lay dry block units starting on a full mortar bed over a clean foundation. If the air temperature is below 40°F, heaters are required for curing. If the air temperature is above 95°F, provide shade over the mortar construction.

3. Laying: Lay masonry true to dimensions, plumb, square, and in running bond. All courses shall be level with joints of uniform width.

4. Adjust masonry unit to final position while mortar is soft and plastic. If units are displaced after mortar has stiffened, remove, clean joints and units of mortar, and re-lay with fresh mortar. When joining fresh masonry to set or partially set masonry construction, clean exposed surfaces of set masonry and remove loose mortar prior to laying new masonry.

5. Lay with full mortar coverage on horizontal and vertical faces. Cover webs in all courses of piers, columns and pilasters.

6. Maximum height of masonry laid prior to low-lift grouting shall be 4 feet. Where high-lift grouting is used, masonry may be laid full height of walls.

7. If height of masonry prior to any grouting exceeds 4 feet, provide cleanouts at the bottom of each cell for removing mortar droppings.

8. Securely hold vertical reinforcement in high-lift grouting at top and bottom and at 192 bar diameters.

9. Accessories: As masonry work progresses, install expansion joint material.

G. Protection of Work

Protect face materials against staining by removing misplaced mortar or grout immediately and by brushing the masonry surface at the end of each day's work.

H. Joints

1. Finish of Horizontal and Vertical Face Joints: Construct uniform 3/8-inch joints. Make vertical joints tight.

2. Tool joints with a round jointer as soon as they are thumbprint hard. Joints to receive caulking shall be raked out 3/4 inch and left ready for caulking. Strike flush unexposed joints.

3. Running Bond: Use running bond with vertical joints located at center of masonry units in alternate course below.

4. Install control joints where indicated in the drawings. Form control joints with square end masonry units having sash groove and filled with synthetic rubber filler. Omit mortar from joint. Joint sealant for control joints is specified in Section 030500.

I. Pointing and Cleaning, Wall Completion

1. At final completion of unit masonry work, fill any remaining holes in joints and tool. Cut out and repoint defective joints. Dry brush masonry surface after mortar has set, at end of each day's work, and after final pointing. Leave work and surrounding surfaces clean and free of mortar spots and droppings.

2. Do not saturate a masonry wall with water for curing, but where the atmosphere is dry, dampen the surfaces with a very light fog spray during a curing period for the mortar of three days.

3. Brace the wall against wind and seismic forces during construction.

J. Grout Placement

1. Before grouting, allow masonry joints to cure at least 18 hours for low-lift grouting and 72 hours for high-lift grouting.

2. After inspection and cleaning out of walls for grouting, place forms over any cleanout and inspection holes and fill cells requiring grout to not over 4 feet in height for low-lift grout placement. Limit high-lift grout pours to lifts of 4 feet maximum. Minimum time period between grout lifts shall be one hour.

3. Fill all cells. Fill cells solid with grout from footings to top of wall. Consolidate by puddling or vibrating.

4. Fill spaces around doorframes and other built-in items.

5. Immediately wash spilled grout from surfaces of masonry units.

K. Coating

Coat both faces with anti-graffiti coating per Section 099000.

END OF SECTION

SECTION 050520 BOLTS AND ANCHORS

PART 1 - GENERAL

A. Description

This section describes materials and installation of anchor bolts, connecting bolts, washers, drilled anchors, epoxy anchors, screw anchors, eyebolts, and stainless steel fasteners.

B. Related Work Specified Elsewhere

1. General Concrete Construction: 030500.

2. Ladders: 055100.

C. Submittals

1. Submit shop drawings in accordance with the General Provisions and Section 013300.

2. Submit manufacturer's catalog data and ICC reports for bolts, washers, and concrete anchors. Show dimensions and reference materials of construction by ASTM designation and grade.

PART 2 - MATERIALS

A. Anchor Bolts

Stainless steel bolts shall be ASTM F593, Type 304. Nuts shall be ASTM F594, Type 304. Provide washer for each nut and bolthead. Washers shall be of the same material as the nuts.

B. Drilled Anchors

Drilled anchors shall be Type 304 stainless steel heavy-duty wedge anchors suitable for dynamic loading. Anchors shall be HSL-3 heavy-duty wedge anchor by Hilti, Power-Bolt by Rawlplug Company, or equal. For metric anchors, use the size that is closest to, but no smaller than, the required English size.

C. Epoxy Anchors

Epoxy anchors in concrete shall be Type 304 stainless steel threaded rod adhesive anchors. Adhesive shall be Rawl Power-Fast, Hilti HIT RE 500-SD, Simpson SET-XP, or equal. Epoxy anchor assemblies shall be ICC approved.

PART 3 - EXECUTION

A. Storage of Materials

Store material, either plain or fabricated, above ground on platforms, skids, or other supports. Keep material free from dirt, grease, and other foreign matter and protect from corrosion.

B. Installing Anchor Bolts

1. After anchor bolts have been embedded, protect projecting threads by applying grease and having the nuts installed until the time of installation of the equipment or metalwork.

2. Minimum depth of embedment of drilled mechanical anchors and screw anchors shall be as recommended by the manufacturer, but no less than that shown in the drawings.

3. Minimum depth of embedment of epoxy anchors shall be as recommended by the manufacturer, but no less than that shown in the drawings.

4. Prepare holes for epoxy anchors in accordance with the anchor manufacturer's recommendations prior to installation.

END OF SECTION

SECTION 055100 LADDERS

PART 1 - GENERAL

A. Description

This section describes materials, fabrication, and installation of ladders, prefabricated alternating tread stairs, stair nosings, and stair treads.

B. Related Work Specified Elsewhere

1. General Concrete Construction: 030500

2. Bolts, Washers, Anchors, and Eyebolts: 050520.

C. Design Criteria

OSHA, State Safety Standards. CBC.

D. Submittals

1. Submit shop drawings in accordance with the General Provisions and Section 013300.

2. Submit drawings of ladders. Show dimensions and reference materials of construction by ASTM designation and grade.

PART 2 - MATERIALS

2.01 Vertical Ladders

Fabricate ladders as shown in the drawings. Ladders shall be Type 304 stainless steel. Minimum diameter of rungs shall be 3/4 inch. The distance between rungs, cleats, and steps shall not exceed 12 inches and shall be uniform throughout the length of the ladder. The minimum clear length of rungs or cleats shall be 16 inches. Coat rungs with coarse grain nonskid epoxy coating No. 6901T44 as supplied by McMaster-Carr Supply Company, Los Angeles, California, or equal.

A. Safety Climb for Vertical Ladders

1. Equip the ladders with a ladder-centered notched safety climbing tube of ASTM A276, Type 304 stainless steel.

2. Provide a Saf-T-Pivot dismount post for each ladder that is equipped with a Saf-T-Climb.

3. Provide three sets of safety belts and sleeves. Posts shall be of the same material as the ladder.

B. Welding Electrodes

Welding electrodes for stainless steel shall conform to AWS 5.4. Use Electrodes E308 for Type 304 stainless steel and E316 for Type 316 stainless steel.

PART 3 - EXECUTION

A. Storage of Materials

Store structural material, either plain or fabricated, above ground on platforms, skids, or other supports. Keep material free from dirt, grease, and other foreign matter and protect from corrosion.

B. Installing Ladders

Mount ladders to provide clearance in back of ladder so that the distance from the centerline of rungs, cleats, or steps to the nearest permanent object in back of the ladder shall be not less than 7 inches.

C. Installing Anchor Bolts

See Section 050520.

END OF SECTION

SECTION 055300 GRATING AND ACCESS HATCHES

PART 1 - GENERAL

A. Description

This section describes materials, fabrication, and installation of steel and aluminum grating, cover and floor plates, and access hatches.

B. RELATED WORK SPECIFIED ELSEWHERE

General Concrete Construction: 030500.

C. Design Criteria

1. Grating: Design live load of 100 psf, maximum deflection of 1/240 of span.

2. Access Hatches: AASHTO H20 loading.

D. Submittals

1. Submit shop drawings in accordance with the General Provisions and Section 013300.

2. Submit drawings of grating and access hatches. Show dimensions and reference materials of construction by ASTM designation and grade. Show design criteria.

3. Submit placing or erection drawings that indicate locations of fabricated items. Reproductions of contract documents will not be accepted for this purpose.

PART 2 - MATERIALS

A. Grating

1. Grating shall be designed per subsection on "Design Criteria" in Part 1.

2. Field measure grating for proper cutouts and size.

3. Grating shall be completely banded.

B. Aluminum Access Hatches

1. Access hatches shall be U.S.F. Fabrications, Inc., Type or Bilco of the size and configuration shown in the drawings. Aluminum doors shall be anodized. Latch and lifting mechanism assemblies, hold-open arms and guides, and brackets, hinges, pins, and fasteners shall be Type 316 stainless steel.

2. Locking and Latching Device: Snap lock with a removable handle.

C. Frames and Supports for Grating

Fabricated frames and supports for grating shall be steel galvanized after fabrication. Corners of embedded angle frames shall be mitered and welded with the welds ground smooth.

D. Welding Electrodes

1. Welding electrodes for structural steel shall conform to AWS A5.5. Use electrodes in the E-70 series.

2. Welding electrode for aluminum shall be ER4043 filler metal.

PART 3 - EXECUTION

A. Storage of Materials

Store structural material, either plain or fabricated, above ground on platforms, skids, or other supports. Keep material free from dirt, grease, and other foreign matter and protect from corrosion.

B. Installation and Erection

1. Clean the surfaces of metalwork to be in contact with concrete of rust, dirt, grease, and other foreign substances before placing concrete.

2. Set grating seats and frames accurately in position when concrete is placed and support it rigidly to prevent displacement or undue vibration during or after the placement of concrete. Unless otherwise specified, where metalwork is to be installed in recesses in formed concrete, said recesses shall be made, metalwork

installed, and recesses filled with dry-pack mortar in conformance with Section 030500.

3. Set seat angles for grating so that the grating will be flush with the floor. Maintain the grating and floor plates flush with the floor. Seat angles and anchors shall be galvanized steel.

C. Galvanizing

Zinc coating for plates, bolts, anchor bolts, and threaded parts shall be in accordance with ASTM A153 and F2329.

D. Welding

1. Perform welding on steel by the SMAW process. Welding shall conform to AWS D1.1-2006, except as modified in AISC Section J2.

2. Perform welding on aluminum by the gas metal arc (MIG) or gas tungsten arc (TIG) process. Welding shall conform to AWS D1.2-2003.

3. Provide a minimum of two passes for metal in excess of 5/16-inch thickness.

4. Produce weld uniform in width and size throughout its length with each layer of weldment smooth; free of slag, cracks, pinholes, and undercuttings; and completely fused to the adjacent weld beads and base metal. Avoid irregular surface, nonuniform bead pattern, and high crown. Form fillet welds of the indicated size of uniform height and fully penetrating. Accomplish repair, chipping, and grinding of welds in manner that will not gouge, groove, or reduce the base metal thickness.

E. Repair of Galvanized Surfaces

Repair or replace metal with damaged galvanized surfaces at no additional cost to the Owner. Repair galvanized surfaces with RAMCO Specialty Products "Zinckit," NuWave "Galv-Match-Plus," or equal to a minimum thickness of 3 mils.

END OF SECTION

SECTION 099000 PAINTING AND COATING

PART 1 - GENERAL

A. Description

This section includes materials and application of painting and coating systems for the following surfaces:

1. Submerged metal.

2. Exposed metal.

3. Buried metal.

4. Masonry / block wall.

B. Submittals

1. Submit shop drawings in accordance with the General Provisions and Section 013300.

2. Submit manufacturer's data sheets showing the following information:

   a. Percent solids by volume.

   b. Minimum and maximum recommended dry-film thickness per coat for prime, intermediate, and finish coats.

   c. Recommended surface preparation.

   d. Recommended thinners.

   e. Statement verifying that the specified prime coat is recommended by the manufacturer for use with the specified intermediate and finish coats.

   f. Application instructions including recommended equipment and temperature limitations.

   g. Curing requirements and instructions.

3. Submit color swatches.

4. Submit certificate identifying the type and gradation of abrasives used for surface preparation.

5. Submit material safety data sheets for each coating.

PART 2 - MATERIALS

A. Painting and Coating Systems

The following index lists the various painting and coating systems by service and generic type:

PAINT COATINGS SYSTEM INDEX

No.	Title	Generic Coating
Submerged Metal Coating System		
7.	Submerged Metal, Potable or Nonpotable Water	Epoxy
Exposed Metal Coating System		
10.	Exposed Metal, Corrosive Environment	High-build epoxy (two-coat system) with polyurethane topcoat
Buried Metal Coating Systems		
21.	Buried Metal	Epoxy
24.	Buried Metal	Corrosion-resisting grease
Masonry Coating System		
31.	Exposed Concrete and Masonry, Antigraffiti	Epoxy with polyurethane topcoat

These systems are specified in detail in the following paragraphs. For each coating, the required surface preparation, prime coat, intermediate coat (if required), topcoat, and coating thicknesses are described. Mil thicknesses shown are minimum dry-film thicknesses.

B. Submerged Metal Coating System

System No. 7--Submerged Metal, Potable or Nonpotable Water:

Type: Epoxy.

Service Conditions: For use with structures, valves, piping, or equipment immersed in potable or nonpotable water.

Surface Preparation: SSPC SP-10.

Coating System: Apply the manufacturer's recommended number of coats to attain the specified minimum coating thickness. Products: Devoe Bar-Rust 233V, Sherwin-Williams Duraplate UHS B62-210 series, Tnemec L140F, or equal; 16 mils total. Color of topcoat: white. Each coat shall be different color than the one preceding it.

C. Exposed Metal Coating System

System No. 10--Exposed Metal, Corrosive Environment:

Type: High-build epoxy intermediate coat having a minimum volume solids of 60%, with an inorganic or organic zinc prime coat and a pigmented polyurethane finish coat having a minimum volume solids of 52%.

Service Conditions: For use with metal structures or pipes subjected to water condensation.

Surface Preparation: SSPC SP-10.

Prime Coat: Self-curing, two- or three-component inorganic or organic zinc-rich coating recommended by the manufacturer for overcoating with a high-build epoxy finish coat. Minimum zinc content shall be 12 pounds per gallon. Apply to a minimum thickness of 3 mils. Products: Tnemec 90-97 (shop application) or 94-H2O (field application), Devoe Catha-Coat 302V, Sherwin-Williams Zinc-Clad III B69 series, or equal.

Intermediate Coat: Tnemec Series L69F, Devoe Devran 224HS or 231, Sherwin-Williams Macropoxy 646 B58-620, or equal; 5 mils.

Finish Coat: Two-component pigmented acrylic or aliphatic polyurethane recommended by the manufacturer for overcoating a high-build epoxy coating. Apply to a thickness of at least 3 mils. Products: Tnemec Series 1081, Devoe Devthane 379H, Sherwin-Williams Hi-Solids Polyurethane B65-625, or equal.

D. Buried Metal Coating Systems

1. System No. 21--Buried Metal:

   Type: High-build solids epoxy or phenolic epoxy having a minimum volume solids of 80% (ASTM D2697).

   Service Conditions: Buried metal, such as valve boxes.

Surface Preparation: SSPC SP-10.

Coating System: Apply three or more coats of Tnemec 69F, Devoe Bar-Rust 233V, Sherwin-Williams Duraplate UHS B62 series, or equal; 30 mils total. Maximum thickness of an individual coating shall not exceed the manufacturer's recommendation.

2. System No. 24--Buried Metal:

Type: Corrosion-resisting grease.

Service Conditions: Buried metal, such as bolts, bolt threads, tie rods, and nuts.

Surface Preparation: SSPC SP-3 or SP-6.

Coating: NO-OX-ID GG-2 as manufactured by Sanchem, Inc. Apply to a minimum thickness of 1/4 inch.

E. Masonry Coating System

System No. 31A—Exposed Concrete and Masonry, Antigraffiti Coating:

Type: Two-component aliphatic polyurethane topcoat with epoxy intermediate coat. Minimum volume solids of the polyurethane topcoat shall be 70%. The polyurethane finish coat shall be formulated to have the following characteristics:

Impact resistance (ASTM D2794) 5 mils	
Direct	140 in-lbs minimum
Reverse	50 in-lbs minimum
Taber abrasion	
1 kg load/1,000 cycles	Weight loss:
CS-17 wheel	75 mg maximum
Elongation (ASTM D522)	32% minimum

Minimum volume solids of the epoxy intermediate coating shall be 80%.

Service Conditions: Masonry subjected to spray paint and marker graffiti.

Surface Preparation: In accordance with Part 3, subsection on "Preparation of Concrete and Masonry Surfaces To Be Coated."

Prime Coat: Epoxy filler compound or epoxy masonry filler having a minimum solids volume of 60%. Apply one coat to fill voids, pores, and cracks. Products: Tnemec Mortar Clad Series 218 or equal.

Intermediate Coat: One or more coats of Tnemec 287 or equal, 6 mils total.

Finish Coat: One coat of Tnemec Series 1080 or equal, 5 mils.

F. Abrasives for Surface Preparation

1. Abrasives used for preparation of ferrous surfaces shall be one of the following:

    a. 16 to 30 or 16 to 40 mesh silica sand or mineral grit.

    b. 20 to 40 mesh garnet.

    c. Crushed iron slag, 100% retained on No. 80 mesh.

    d. SAE Grade G-40 or G-50 iron or steel grit.

2. Abrasives used for preparation of masonry surfaces shall be 16 to 30 or 16 to 40 mesh silica sand.

3. In the above gradations, 100% of the material shall pass through the first stated sieve size and 100% shall be retained on the second stated sieve size.

PART 3 - EXECUTION

A. Weather Conditions

1. Do not paint in the rain, wind, mist, and fog or when steel or metal surface temperatures are less than 5°F above the dew point.

2. Do not apply paint when the relative humidity is above 85%.

3. Do not paint when temperature of metal to be painted is above 120°F.

4. Do not apply epoxy and polyurethane paints on an exterior or interior surface if air or surface temperature is below 60°F or expected to drop below 60°F in 24 hours.

B. Surface Preparation Procedures

1. Remove oil and grease from metal surfaces in accordance with SSPC SP-1. Use clean cloths and cleaning solvents and wipe dry with clean cloths. Do not leave a film or greasy residue on the cleaned surfaces before abrasive blasting.

2. Remove weld spatter and weld slag from metal surfaces and grind smoothly rough welds, beads, peaked corners, and sharp edges including erection lugs in accordance with SSPC SP-2 and SSPC SP-3. Grind 0.020 inch (minimum) off the weld caps on pipe weld seams. Grind outside sharp corners, such as the outside edges of flanges, to a minimum radius of 1/4 inch.

3. Do not abrasive blast or prepare more surface area in one day than can be coated in one day; prepare surfaces and apply coatings the same day. Remove sharp edges, burrs, and weld spatter.

4. Do not abrasive blast epoxy- or enamel-coated pipe that has already been factory coated, except to repair scratched or damaged coatings.

5. For carbon steel, do not touch the surface between the time of abrasive blasting and the time the coating is applied. Apply coatings within two hours of blasting or before any rust bloom forms.

6. Surface preparation shall conform with the SSPC specifications as follows:

Solvent Cleaning	SP-1
Hand Tool Cleaning	SP-2
Power Tool Cleaning	SP-3
White Metal Blast Cleaning	SP-5
Commercial Blast Cleaning	SP-6
Brush-Off Blast Cleaning	SP-7
Pickling	SP-8
Near-White Blast Cleaning	SP-10
Power Tool Cleaning to Bare Metal	SP-11
Surface Preparation and Cleaning of Steel and Other Hard Materials by High- and Ultrahigh-Pressure Water Jetting Prior to Recoating	SP-12
Surface Preparation of Concrete	SP-13

7. Wherever the words "solvent cleaning," "hand tool cleaning," "wire brushing," or "blast cleaning" or similar words are used in these specifications or in paint manufacturer's specifications, they shall be understood to refer to the applicable SSPC (Steel Structure Painting Council), surface preparation specifications listed above.

8. Brush-off blasting of masonry surfaces is defined as opening subsurface holes and voids and etching the surface for a coating to bond.

9. For carbon steel surfaces, after abrasive blast cleaning, the height of the surface profile shall be 2 to 3 mils. Verify the surface profile by measuring with an impresser tape acceptable to the Owner's Representative. Perform a minimum of one test per 100 square feet of surface area. Testing shall be witnessed by the Owner's Representative. The impresser tape used in the test shall be permanently marked with the date, time, and locations where the test was made. Test results shall be promptly presented to the Owner's Representative.

10. Do not apply any part of a coating system before the Owner's Representative has reviewed the surface preparation. If coating has been applied without this

review, if directed by the Owner's Representative, remove the applied coating by abrasive blasting and reapply the coat in accordance with this specification.

C. Abrasive Blast Cleaning

1. Use dry abrasive blast cleaning for metal surfaces. Do not use abrasives in automatic equipment that have become contaminated. When shop or field blast cleaning with handheld nozzles, do not recycle or reuse blast particles.

2. After abrasive blast cleaning and prior to application of coating, dry clean surfaces to be coated by dusting, sweeping, and vacuuming to remove residue from blasting. Apply the specified primer or touch-up coating within the period of an eight-hour working day. Do not apply coating over damp or moist surfaces. Reclean prior to application of primer or touch-up coating any blast cleaned surface not coated within said eight-hour period.

3. Keep the area of the work in a clean condition and do not permit blasting particles to accumulate and constitute a nuisance or hazard.

4. During abrasive blast cleaning, prevent damage to adjacent coatings. Schedule blast cleaning and coating such that dust, dirt, blast particles, old coatings, rust, mill scale, etc., will not damage or fall upon wet or newly coated surfaces.

D. Preparation of Masonry Surfaces To Be Coated

1. Surface preparation of masonry surfaces shall be in accordance with SSPC SP-13 and the following.

2. Masonry surfaces on which coatings are to be applied shall be of even color, gray or gray-white. The surface shall have no pits, pockets, holes, or sharp changes of surface elevation. Scrubbing with a stiff-bristle fiber brush shall produce no dusting or dislodging of cement or sand. Sprinkling water on the surface shall produce no water beads or standing droplets. Masonry shall be free of laitance and slick surfaces.

3. Detergent clean the masonry surface with trisodium phosphate per ASTM D4258. Then sandblast surfaces (brush-off blast).

4. Prior to coating concrete, plaster, and masonry with System No. 31A determine the presence of capillary moisture per ASTM D4263, except as modified below. Tape a 4-foot by 4-foot sheet of polyethylene plastic to the concrete surface to be coated. Allow the plastic sheet to remain in place at least 24 hours. After the specified time has elapsed, remove the plastic sheet and visually examine both the underside of the plastic sheet and the concrete surface beneath it. There shall be no indication of moisture on either surface. If moisture is indicated, allow additional curing time for the concrete and then retest. Provide one test sheet for every 500 square feet of concrete surface to be coated. For walls, provide one test sheet for each 10 feet (or fraction thereof) of vertical rise in all elevations starting within 12 inches of the floor or base slab.

E. Procedures for Items Having Shop-Applied Prime Coats

1. After application of primer to surfaces, allow coating to cure for a minimum of two hours before handling to minimize damage.

2. When loading for shipment to the project site, use spacers and other protective devices to separate items to prevent damaging the shop-primed surfaces during transit and unloading. If wood spacers are used, remove wood splinters and particles from the shop-primed surfaces after separation. Use padded chains or ribbon binders to secure the loaded items and minimize damage to the shop-primed surfaces.

3. Cover shop-primed items 100% with protective coverings or tarpaulins to prevent deposition of road salts, fuel residue, and other contaminants in transit.

4. Handle shop-primed items with care during unloading, installation, and erection operations to minimize damage. Do not place or store shop-primed items on the ground or on top of other work unless ground or work is covered with a protective covering or tarpaulin. Place shop-primed items above the ground upon platforms, skids, or other supports.

F. Field Touch-Up of Shop-Applied Prime Coats

1. Remove oil and grease surface contaminants on metal surfaces in accordance with SSPC SP-1. Use clean rags

wetted with a degreasing solution, rinse with clean water, and wipe dry.

2. Remove dust, dirt, salts, moisture, chalking primers, or other surface contaminants that will affect the adhesion or durability of the coating system. Use a high-pressure water blaster or scrub surfaces with a broom or brush wetted with a solution of trisodium phosphate, detergent, and water. Before applying intermediate or finish coats to inorganic zinc primers, remove any soluble zinc salts that have formed by means of scrubbing with a stiff bristle brush. Rinse scrubbed surfaces with clean water.

3. Remove loose or peeling primer and other surface contaminants not easily removed by the previous cleaning methods in accordance with SSPC SP-7. Take care that remaining primers are not damaged by the blast cleaning operation. Remaining primers shall be firmly bonded to the steel surfaces with blast cleaned edges feathered.

4. Remove rust, scaling, or primer damaged by welding or during shipment, storage, and erection in accordance with SSPC SP-10. Take care that remaining primers are not damaged by the blast cleaning operation. Areas smaller than 1 square inch may be prepared per SSPC SP-11. Remaining primers shall be firmly bonded to the steel surfaces with cleaned edges feathered.

5. Use repair procedures on damaged primer that protects adjacent primer. Blast cleaning may require the use of lower air pressure, smaller nozzles, and abrasive particle sizes, short blast nozzle distance from surface, shielding, and/or masking.

6. After abrasive blast cleaning of damaged and defective areas, remove dust, blast particles, and other debris by dusting, sweeping, and vacuuming; then apply the specified touch-up coating.

7. Surfaces that are shop primed with inorganic zinc primers shall receive a field touch-up of organic zinc primer per System No. 18 to cover scratches or abraded areas.

8. Other surfaces that are shop primed shall receive a field touch-up of the same primer used in the original prime coat.

G. <u>Painting Systems</u>

1. All materials of a specified painting system, including primer, intermediate, and finish coats, shall be produced by the same manufacturer. Thinners, cleaners, driers, and other additives shall be as recommended by the paint manufacturer for the particular coating system.

2. Deliver paints to the jobsite in the original, unopened containers.

H. Paint Storage and Mixing

1. Store and mix materials only in areas designated for that purpose by the Owner's Representative. The area shall be well-ventilated, with precautionary measures taken to prevent fire hazards. Post "No Smoking" signs. Storage and mixing areas shall be clean and free of rags, waste, and scrapings. Tightly close containers after each use. Store paint at an ambient temperature from 50°F to 100°F.

2. Prepare multiple-component coatings using all of the contents of the container for each component as packaged by the paint manufacturer. Do not use partial batches. Do not use multiple-component coatings that have been mixed beyond their pot life. Provide small quantity kits for touch-up painting and for painting other small areas. Mix only the components specified and furnished by the paint manufacturer. Do not intermix additional components for reasons of color or otherwise, even within the same generic type of coating.

I. <u>Procedures for the Application of Coatings</u>

1. Conform to the requirements of SSPC PA-1. Follow the recommendations of the coating manufacturer including the selection of spray equipment, brushes, rollers, cleaners, thinners, mixing, drying time, temperature and humidity of application, and safety precautions.

2. Obtain and comply with the coating manufacturer's recommendations concerning application requirements for the following minimum criteria:

   a. Required plural component equipment (or other application equipment) for the application of the particular coatings specified for the project.

b. Required degree of mixing for each coating.

c. Required coating temperature range during the mixing operations.

d. Required coating temperature range in the application or spraying equipment.

e. Allowable pot life for each coating.

f. Required application viscosity range for each coating.

g. Use of dehumidification equipment for the application of the particular coatings specified for the project.

h. Ambient application temperature range for each coating layer.

i. Substrate or surface application temperature range for each coating layer.

j. Ambient application relative humidity range for each coating layer.

k. Curing requirements for each coating layer.

l. Any particular special issues such as amine blush, formation of exudates, or other chemistry issues and the procedures to be followed to avoid application or curing failures.

3. Stir, strain, and keep coating materials at a uniform consistency during application. Power mix components. For multiple component materials, premix each component before combining. Apply each coating evenly, free of brush marks, sags, runs, and other evidence of poor workmanship. Use a different shade or tint on succeeding coating applications to indicate coverage where possible. Finished surfaces shall be free from defects or blemishes.

4. Do not use thinners unless recommended by the coating manufacturer. If thinning is allowed, do not exceed the maximum allowable amount of thinner per gallon of coating material. Stir coating materials at all times when adding thinner. Do not flood the coating material surface with thinner prior to mixing. Do not reduce coating materials

more than is absolutely necessary to obtain the proper application characteristics and to obtain the specified dry-film thicknesses.

5. Remove dust, blast particles, and other debris from blast cleaned surfaces by dusting, sweeping, and vacuuming. Allow ventilator fans to clean airborne dust to provide good visibility of working area prior to coating applications. Remove dust from coated surfaces by dusting, sweeping, and vacuuming prior to applying succeeding coats.

6. Apply coating systems to the specified minimum dry-film thicknesses as determined per SSPC PA-2.

7. Apply primer immediately after blast cleaning and before any surface rusting occurs, or any dust, dirt, or any foreign matter has accumulated. Reclean surfaces by blast cleaning that have surface colored or become moist prior to coating application.

8. Apply a brush coat of primer on welds, sharp edges, nuts, bolts, and irregular surfaces prior to the application of the primer and finish coat. Apply the brush coat prior to and in conjunction with the spray coat application. Apply the spray coat over the brush coat.

9. Before applying subsequent coats, allow the primer and intermediate coats to dry for the minimum curing time recommended by the manufacturer. In no case shall the time between coats exceed the manufacturer's recommendation.

10. Each coat shall cover the surface of the preceding coat completely, and there shall be a visually perceptible difference in applied shade or tint of colors.

11. Applied coating systems shall be cured at 75°F or higher for 48 hours. If temperature is lower than 75°F, curing time shall be in accordance with printed recommendations of the manufacturer, unless otherwise allowed by the Owner's Representative.

12. Assembled parts shall be disassembled sufficiently before painting or coating to ensure complete coverage by the required coating.

J. Surfaces To Be Coated

Coat surfaces with the specific coating systems as described below:

1. Coat exposed piping or piping in vaults and structures per System No. 10. Color to be selected by the Owner.

2. Coat submerged steel and ductile iron piping per System No. 7.

3. Coat buried bolts and nuts per System No. 24.

4. Coat masonry block wall on both faces with System No 31B.

K. Dry-Film Thickness Testing

1. Measure coating thickness specified for carbon steel surfaces with a magnetic-type dry-film thickness gauge in accordance with SSPC PA-2. Provide certification that the gauge has been calibrated by a certified laboratory within the past six months. Provide dry-film thickness gauge as manufactured by Mikrotest or Elcometer.

2. Test the finish coat of metal surfaces (except zinc primer and galvanizing) for holidays and discontinuities with an electrical holiday detector, low-voltage, wet-sponge type. Provide measuring equipment. Provide certification that the gauge has been calibrated by a certified laboratory within the past six months. Provide detector as manufactured by Tinker and Rasor or K-D Bird Dog.

3. Measure coating thickness specified for masonry surfaces in accordance with ASTM D4138. Test the finish coat of concrete and masonry surfaces in accordance with NACE SP0188-2006 or ASTM D4787. Patch coatings at the points of thickness measurement or holiday detection.

4. Check each coat for the correct dry-film thickness. Do not measure within eight hours after application of the coating.

5. For metal surfaces, make five separate spot measurements (average of three readings) spaced evenly over each 100 square feet of area (or fraction thereof) to be measured. Make three readings for each spot measurement of either the substrate or the paint. Move the probe or detector a

distance of 1 to 3 inches for each new gauge reading. Discard any unusually high or low reading that cannot be repeated consistently. Take the average (mean) of the three readings as the spot measurement. The average of five spot measurements for each such 100-square-foot area shall not be less than the specified thickness. No single spot measurement in any 100-square-foot area shall be less than 80%, nor more than 120%, of the specified thickness. One of three readings which are averaged to produce each spot measurement may underrun by a greater amount as defined by SSPC PA-2.

6. Perform tests in the presence of the Owner's Representative.

L. Repair of Improperly Coated Surfaces

If the item has an improper finish color or insufficient film thickness, clean and topcoat the surface with the specified paint material to obtain the specified color and coverage. Sandblast or power-sand visible areas of chipped, peeled, or abraded paint, feathering the edges. Then prime and finish coat in accordance with the specifications. Work shall be free of runs, bridges, shiners, laps, or other imperfections.

M. Cleaning

1. During the progress of the work, remove discarded materials, rubbish, cans, and rags at the end of each day's work.

2. Thoroughly clean brushes and other application equipment at the end of each period of use and when changing to another paint or color.

3. Upon completion of painting work, remove masking tape, tarps, and other protective materials, using care not to damage finished surfaces.

END OF SECTION

SECTION 099754 POLYETHYLENE SHEET ENCASEMENT

PART 1 - GENERAL

A. Description

This section includes materials and installation of a polyethylene sheet encasement for buried steel and ductile-iron pipe, fittings, and valves.

B. Related Work Specified Elsewhere

1. Trenching, Backfilling, and Compacting: 312316.

2. General Piping Requirements: 400500.

C. Submittals

1. Submit shop drawings in accordance with General Provisions and Section 013300.

2. Submit manufacturer's catalog literature and product data sheets describing the physical, chemical, and electrical properties of the encasement material.

PART 2 - MATERIALS

A. Polyethylene Wrap

1. The encasement shall consist of low-density polyethylene wrap of at least 8-mil thickness conforming to AWWA C105. Color: Black.

2. Polyethylene encasement for ductile-iron pipe shall be supplied as a flat tube meeting the dimensions of Table 1 in AWWA C105 and shall be supplied by the ductile-iron pipe manufacturer.

B. Plastic Adhesive Tape

1. Tape shall consist of polyolefin backing and adhesive which bonds to common pipeline coatings including polyethylene.

2. Minimum Width: 2 inches.

3. Products: Canusa Wrapid Tape, Tapecoat 35, Polyken 934, or equal.

PART 3 - EXECUTION

A. Applying Sheet Coating to Buried Piping and Fittings

1. Apply wrapping per AWWA C105 as modified herein.

2. Apply a single wrapping.

3. Install the polyethylene to completely encase the pipe and fittings to provide a watertight corrosion barrier. Continuously secure overlaps and ends of sheet and tube with polyethylene tape. Make circumferential seams with two complete wraps, with no exposed edges. Tape longitudinal seams and longitudinal overlaps, extending tape beyond and beneath circumferential seams.

4. Wrap bell-spigot interfaces, restrained joint components, and other irregular surfaces with wax tape or moldable sealant prior to placing polyethylene encasement.

5. Minimize voids beneath polyethylene. Place circumferential or spiral wraps of polyethylene tape at 2-foot intervals along the barrel of the pipe to minimize the space between the pipe and the polyethylene.

6. Overlap adjoining polyethylene tube coatings a minimum of 1 foot and wrap prior to placing concrete anchors, collars, supports, or thrust blocks. Hand wrap the polyethylene sheet, apply two complete wraps with no exposed edges to provide a watertight corrosion barrier, and secure in place with 2-inch-wide plastic adhesive tape.

B. Repair of Polyethylene Material

Repair polyethylene material that is damaged during installation. Use polyethylene sheet, place over damaged or torn area, and secure in place with 2-inch-wide plastic adhesive tape.

C. Applying Sheet Coating to Existing Buried Piping

When connecting polyethylene-encased pipe or fittings to existing pipe, expose existing pipe, thoroughly clean the surface, and securely tape the end of the polyethylene to the existing as specified above. When the existing pipe is polyethylene encased, wrap new polyethylene encasement over the existing, with overlap of at least 2 feet. Tape securely as specified above.

D. Backfill for Polyethylene-Wrapped Pipe

Place sand backfill within 1 foot of the pipe wrapped with polyethylene encasement per Section 312316.

END OF SECTION

SECTION 260534 CONDUITS AND FITTINGS

PART 1 - GENERAL

A. Description

This section includes material, installation, and testing for conduit and fittings.

B. Related Work Specified Elsewhere

1. Trenching, Backfilling, and Compacting: 312316.

2. Contractor shall coordinator with the local utility (Southern California Edison) to verify actually installation requirements, which may supersede this specification.

C. Submittals

1. Submit shop drawings in accordance with the General Conditions.

2. Submit product data for the following:

   a. Conduit and fittings for each type specified.

D. Quality Control

1. NEMA Compliance: Comply with NEMA standards pertaining to conduits and components.

2. UL Compliance and Labeling: Comply with requirements of UL standards pertaining to electrical conduits and components. Provide conduits and components listed and labeled by UL.

PART 2 - MATERIALS

A. Rigid Nonmetallic Conduit (PVC) and Fittings

1. Conduit: PVC Schedule 40, 90°C rise rating, conforming to NEMA TC-2 Type EC-40 and UL 651.

2. Long-Radius Elbows (90 Degrees): Rigid PVC-coated conduit or PVC Schedule 80 conduit of the same

dimension as specified for steel conduit. Couplings, Adapters, Bell Ends, Expansion Couplings, Elbows, and Turns of 30 Degrees: Factory-made in accordance with NEMA TC-2 and TC-3.

3. Joint Cement: As recommended by manufacturer as suitable for the climate, furnished with instructions to achieve watertight joints.

4. Manufacturers: Carlon, Condux, or equal.

PART 3 - EXECUTION

A. Conduit Installation, General

1. Make right-angle bends in conduit runs with long-radius elbows or conduits bent to radii not less than those specified for long-radius elbows.

2. Make bends and offsets so that the inside diameter of conduit is not effectively reduced. Unless otherwise indicated, keep the legs of a bend in the same plane and the straight legs of offsets parallel.

3. Cap all conduits immediately after installation to prevent entrance of foreign matter.

4. Do not use diagonal runs except when specifically noted in the drawings.

5. Conduit runs are shown schematically. Supports, pull boxes, junction boxes, and other ancillary equipment are not usually shown in drawings. If not shown, provide as required by NEC except that there shall not be more than the equivalent of three quarter bends (270 degrees) total between underground pull points. Provide additional boxes to permit pulling of wires without damage to the conductors or insulation.

6. The distance between pull boxes shall not exceed 150 feet.

7. Locations of conduit stub-ups shown in the drawings are schematic. Coordinate these locations with conduit entries of actual equipment served.

B. Requirements for Rigid Nonmetallic (PVC) Conduit

1. Comply with the installation provisions of NEMA TC-2, except as modified below.

2. Make cuts with a fine tooth handsaw. For sizes 2 inches and larger, use a miter box or similar saw guide to assure a square cut.

3. Use factory-made couplings for joining conduit.

4. Cementing and joining operation shall not exceed 20 seconds. Do not disturb joint for 5 minutes, longer (up to 10 minutes) at lower temperatures. Make joints watertight. Joining procedure shall conform to the procedures of ASTM D2855.

5. Install expansion fittings. Expansion fittings are required when the conduit is left exposed in trenches for a period of time during which the conduit's temperature can vary more than 2 degrees. Install expansion fittings near the fixed end of the run and 100 feet on center.

C. Conduits Underground

1. Where conduit is installed underground in locations other than under concrete slab, provide 24-inch minimum cover. Provide 3-inch minimum sand below conduit. Maintain a 12-inch minimum separation between conduit and other systems. Pitch conduit to drain away from buildings.

2. Provide sand-cement slurry extending 3 inches on top and sides of conduits. Slurry shall be as specified in Section 312316 with a red color additive.

3. Provide 6-inch-wide warning tape 12 inches above top of slurry.

D. Damaged Conduit

1. Repair or replace conduit damaged during or after installation.

2. Replace crushed or clogged conduit or any conduit whose inner surface is damaged or not smooth.

E. Empty Conduit

1. Provide 200-pound strength pull cord in all empty conduits or cord of higher strength if so required by the utility for which the conduit is intended.

2. Provide a waterproof label on each end of the pull cords to indicate the destination of the other end.

F. Pull Boxes

1. Provide and install per requirements of Southern California Edison.

END OF SECTION

SECTION 312316 TRENCHING, BACKFILLING, AND COMPACTING

PART 1 - GENERAL

A. Description

This section includes materials, testing, and installation for pipeline trench excavation, backfilling, and compacting.

B. Related Work Specified Elsewhere

1. Protecting Existing Underground Utilities: 020120.

2. Earthwork: 312300.

3. Asphalt Concrete Paving: 321216.

C. Submittals

1. Submit six copies of a report from a testing laboratory verifying that material conforms to the specified gradations or characteristics for pea gravel, granular material, imported sand, rock refill for foundation stabilization, and water.

2. Submit method(s) of compaction including removal sequence of shoring where used.

D. Testing for Compaction

The Contractor will test for compaction as described below.

1. Determine the density of soil in place by the sand cone method, ASTM D1556 or by nuclear methods, ASTM D2922 and D3017. Compaction tests will be performed for each lift or layer. Maximum spacing for sampling is 50 feet. If nuclear methods are used for in-place density determination, verify the accuracy with one sand cone, and one maximum laboratory dry density, for every five nuclear tests taken if the backfill material is processed fill or visually consistent. More sand cones and densities will be required if the backfill material is visually variable. The minimum depth for the sand cone test hole shall be 12 inches. The minimum size shall be 8 inches, and size 16/30 or 10/20 silica sand shall be used.

2. Determine laboratory moisture-density relations of soils per ASTM D1557. If nuclear methods are used for in-place density determination, the compaction test results for maximum dry density and optimum water content shall be adjusted in accordance with ASTM D4718. This will be required for determination of percent relative compaction and moisture variation from optimum.

3. Determine the relative density of cohesionless soils per ASTM D4253 and D4254.

4. Sample materials per ASTM D75.

5. "Relative compaction" is the ratio, expressed as a percentage, of the inplace dry density to the laboratory maximum dry density.

6. Compaction shall be deemed to comply with the specifications when no more than one test of any three consecutive tests falls below the specified relative compaction. The one test shall be no more than three percentage points below the specified compaction

E. Pavement Zone

The pavement zone includes the asphalt concrete and aggregate base pavement section placed over the trench backfill.

F. Street Zone

The street zone is the top 30 inches of the trench immediately below the pavement zone in paved areas. Where the depth of cover over the pipe does not permit the full specified thickness of the street zone, construct a thinner street zone, extending from the top of the pipe zone to the bottom of the pavement zone.

G. Trench Zone

The trench zone includes the portion of the trench from the top of the pipe zone to the bottom of the street zone in paved areas or to the existing surface in unpaved areas. If the resulting trench zone is less than 24 inches thick, the street zone shall extend to the top of the pipe zone and there shall be no separate trench zone.

H. Pipe Zone

The pipe zone shall include the full width of trench from the bottom of the pipe or conduit to a horizontal level above the top of the pipe, as specified below. Where multiple pipes or conduits are placed in the same trench, the pipe zone shall extend from the bottom of the lowest pipe to a horizontal level above the top of the highest or topmost pipe. Thickness of pipe zone above the highest top of pipe shall be as follows unless otherwise shown in the drawings or otherwise described in the specifications for the particular type of pipe installed.

Pipe Diameter	**Thickness of Pipe Zone Above Top of Pipe**
6 inches or smaller	6 inches
8 inches and larger	10 inches

I. Pipe Base or Bedding

The pipe base or bedding shall be defined as a layer of material immediately below the bottom of the pipe or conduit and extending over the full trench width in which the pipe is bedded. Thickness of pipe base shall be as follows unless otherwise shown in the drawings or otherwise described in the specifications for the particular type of pipe installed.

Pipe Diameter	**Thickness of Pipe Base**
Smaller than 4 inches	3 inches
4 inches through 16 inches	4 inches
18 inches and larger	6 inches

PART 2 - MATERIALS

A. Native Earth Backfill--Street and Trench Zones

1. Native earth backfill used above the pipe zone shall be excavated fine-grained materials free from roots, debris, rocks larger than 3 inches, asbestos, organic matter, clods, clay balls, broken pavement, and other deleterious materials. Less than 50% shall pass a No. 200 sieve. At least 40% shall pass a No. 4 sieve. The

coarser materials shall be well distributed throughout the finer material.

2. Backfill materials that are obtained from trench excavated materials to the extent such material is available shall be either screened directly into the trench or screened during the trenching operation. If screened during trenching, the material shall be maintained free of unscreened material during the handling and backfilling process. Hand selecting of rocks from earth as it is placed into the trench will not be permitted in lieu of the specified screening. Backfill shall be moisture conditioned to within approximately 2% of the optimum moisture content prior to being placed in trench.

B. Imported Sand--Pipe Zone and Pipe Base

Imported sand used in the pipe zone or for the pipe base shall have the following gradation:

Sieve Size	**Percent Passing By Weight**
3/8 inch	100
No. 4	75 to 100
No. 30	12 to 50
No. 100	5 to 20
No. 200	0 to 10

Imported sand shall have a minimum sand equivalent of 30 per ASTM D2419.

C. Sand-Cement Slurry--Pipe Zone

Sand-cement slurry backfill shall consist of one sack (94 pounds) of Type I or II portland cement added per cubic yard of imported sand and sufficient water for workability.

D. Controlled Low-Strength Material (CLSM) for Backfill - Pipe Zone

1. CLSM shall consist of a mixture of portland cement, aggregate, fly ash, water, and admixtures conforming to the following:

a. Portland Cement: ASTM C150, Type II, maximum of 50 pounds per cubic yard.

b. Aggregate: Concrete sand, selected material from the excavation, imported material, or a combination thereof. Aggregate size shall meet the following gradation:

Sieve Size	Percentage Passing
1 1/2 inches	100
1 inch	80 to 100
3/4 inch	60 to 100
3/8 inch	50 to 100
No. 4	40 to 80
No. 100	10 to 40

c. The soluble sulfate content shall not exceed 0.3% by dry weight.

d. Water: Potable quality.

e. Water-Cement Ratio: 3.5:1 maximum.

f. Fly Ash: Class C per ASTM C618, maximum of 300 pounds per cubic yard.

g. The minus No. 200 sieve fraction shall be nonplastic.

2. Proportion the CLSM to be a flowable, nonsegregating, self-consolidating nonshrink slurry. The water content shall not exceed that required to provide a mix that will flow, can be pumped, and will maintain the soil in suspension without segregation of the aggregate while being placed. Proportion the aggregate, cement, and water either by weight or by volume. Use as little cement for each cubic yard of material produced as necessary to make the CLSM flowable.

3. Soil for the soil-cement bedding may consist of local soil or it may be imported. Soil for the CLSM shall comply with the following requirements:

   a. Soil producing a color darker than the standard color in the colorimetric test for organic impurities will be rejected until further tests are performed to determine the nature of the material and its effect on the time of set and strength of the cement.

   b. Select or process the soil so that the gradation of the soil is such that all particles will remain in suspension and no segregation will occur when the CLSM is placed. The amount of soil passing the No. 200 screen shall not exceed 15% by weight, and the amount of soil passing the No. 100 screen shall not exceed 50% by weight. The maximum particle size in the soil shall not exceed one-eighth of the open distance between the pipe and the trench wall or 1 1/2 inches, whichever is less. The soil shall be nonplastic or of low plasticity.

c. The maximum size of any clay balls in the soil shall be 1/2 inch. The maximum percentage of clay balls, by wet weight, should not exceed 10%.

4. The unconfined compressive strength at seven days shall be minimum of 50 and a maximum of 100 psi per ASTM D4832.

5. The temperature of the CLSM discharged into the trench shall be below 90°F.

E. Prior to construction, perform trial mixes of the CLSM to verify placing and strength characteristics. Determine compressive strength per ASTM D4832. Notify the Owner's Representative at least one week prior to trial mix preparation.

F. <u>Water for Compaction</u>

Water shall be free of organic materials and shall have a pH of 7.0 to 9.0, a maximum chloride concentration of 500 mg/L, and a maximum sulfate concentration of 500 mg/L. Provide all water needed for earthwork. Provide temporary piping and valves to convey water from the source to the point of use. Provide meters if the water is taken from a city pipeline.

PART 3 - EXECUTION

A. <u>Sloping, Sheeting, Shoring, and Bracing of Trenches</u>

Trenches shall have sloping, sheeting, shoring, and bracing conforming with 29CFR1926, Subpart P--Excavations, CAL/OSHA requirements, and the Special Provisions.

B. <u>Sidewalk, Pavement, and Curb Removal</u>

Cut bituminous and concrete pavements regardless of the thickness and curbs and sidewalks prior to excavation of the trenches with a pavement saw or pavement cutter. Width of the pavement cut shall be at least equal to the required width of the trench at ground surface. Haul pavement and concrete materials from the site. Do not use for trench backfill.

C. Trench Excavation

1. Conform to the Owner's requirements for pipe bedding: Std. Nos. T204 (sewer pipe), T302 (storm drain pipe), and T701 (water pipe).

2. Excavate the trench to the lines and grades shown in the drawings with allowance for pipe thickness, sheeting and shoring if used, and for pipe base or special bedding. If the trench is excavated below the required grade, refill any part of the trench excavated below the grade at no additional cost to the Owner with granular material. Place the refilling material over the full width of trench in compacted layers not exceeding 6 inches deep to the established grade with allowance for the pipe base or special bedding.

3. Trench widths in the pipe zone shall be as shown in the drawings. If no details are shown, maximum width shall be 18 inches greater than the pipe outside diameter. Comply with 29CFR Part 1926 Subpart P--Excavations. Trench width at the top of the trench will not be limited except where width of excavation would undercut adjacent structures and footings. In such case, width of trench shall be such that there is at least 2 feet between the top edge of the trench and the structure or footing.

4. Construct trenches in rock by removing rock to a minimum of 6 inches below bottom of pipe bedding and backfilling with granular material.

D. Location of Excavated Material

During trench excavation, place the excavated material only within the working area or within the areas shown in the drawings. Do not obstruct any roadways or streets. Do not place trench spoil over pipe, buried utilities, manholes, or vaults. Conform to federal, state, and local codes governing the safe loading of trenches with excavated material.

E. Dewatering

Provide and maintain means and devices to remove and dispose of water entering the trench excavation during the time the trench is being prepared for the pipelaying, during the laying of the pipe, and until the backfill at the pipe zone has been completed. These provisions shall apply during both working and nonworking hours, including lunch time, evenings, weekends, and holidays. Dispose of the water in a manner to prevent damage to adjacent property and in accordance with regulatory agency requirements. Do not drain trench water through the pipeline under construction.

F. Installing Buried Piping

1. Grade the bottom of the trench to the line and grade to which the pipe is to be laid, with allowance for pipe thickness. Remove hard spots that would prevent a uniform thickness of bedding. Place the specified thickness of pipe base material over the full width of trench. Grade the top of the pipe base ahead of the pipelaying to provide firm, continuous, uniform support along the full length of pipe, and compact to the relative compaction specified herein. Before laying each section of the pipe, check the grade and correct any irregularities.

2. Excavate bell holes at each joint to permit proper assembly and inspection of the entire joint. Fill the area excavated for the joints with the bedding material specified or indicated in the drawings for use in the pipe zone. If no bedding material is specified or indicated, use imported sand.

3. Inspect each pipe and fitting before lowering the buried pipe or fitting into the trench. Inspect the interior and exterior protective coatings. Patch damaged areas in the field with material recommended by the protective coating manufacturer. Clean ends of pipe thoroughly. Remove foreign matter and dirt from inside of pipe and keep clean during and after installation.

4. Handle pipe in such a manner as to avoid damage to the pipe. Do not drop or dump pipe into trenches under any circumstances.

5. When installing pipe, do not deviate more than 1 inch from line or 1/4 inch from grade. Measure elevation at the pipe invert.

6. After pipe has been bedded, place pipe zone material simultaneously on both sides of the pipe, in maximum 6-inch lifts, keeping the level of backfill the same on each side. If no pipe zone material is specified or indicated, use imported sand. Carefully place the material around the pipe so that the pipe barrel is completely supported and no voids or uncompacted areas are left beneath the pipe. Use particular care in placing material on the underside of the pipe to prevent lateral movement during subsequent backfilling.

7. Compact each lift to the relative compaction specified herein.

8. Push the backfill material carefully onto the backfill previously placed in the pipe zone. If no backfill material is otherwise specified or indicated, use granular material for backfill. Do not permit free-fall of the material until at least 2 feet of cover is provided over the top of the pipe. Do not drop sharp, heavy pieces of material directly onto the pipe or the tamped material around the pipe. Do not operate heavy equipment or a sheepsfoot wheel mounted on a backhoe over the pipe until at least 3 feet or one-half of the internal diameter, whichever is greater, of backfill has been placed and compacted over the pipe.

9. When the pipelaying is not in progress, including the noon hours, close the open ends of pipe. Do not allow trench water, animals, or foreign material to enter the pipe.

10. Keep the trench dry until the pipelaying and jointing are completed.

G. Backfill Compaction

1. Unless otherwise shown in the drawings or otherwise described in the specifications for the particular type of pipe installed, relative compaction in pipe trenches shall be as follows:

   a. Pipe Zone: 90% relative compaction.

b. Backfill in Trench Zone Not Beneath Paving: 90% relative compaction. Compact backfill within embankment above the pipe zone to the same relative compaction as the adjacent embankment as specified in Section 312300.

c. Backfill in Trench Zone to Street Zone in Paved Areas: 90% relative compaction.

d. Backfill in Street Zone in Paved Areas: 95% relative compaction.

e. Rock Refill for Foundation Stabilization: 80% relative density.

f. Refill for Overexcavation: 80% relative density.

2. Compact trench backfill to the specified relative compaction. Compact by using mechanical compaction, water jetting, or hand tamping. Do not use high-impact hammer-type equipment except where the pipe manufacturer warrants in writing that such use will not damage the pipe.

3. Compact material placed within 12 inches of the outer surface of the pipe by hand tamping only.

4. Do not use any axle-driven or tractor-drawn compaction equipment within 5 feet of building walls, foundations, and other structures.

H. <u>Material Replacement</u>

Remove and replace any trenching and backfilling material that does not meet the specifications, at the Contractor's expense.

I. <u>Placement of CLSM</u>

1. Provide batching equipment to obtain the proper weights of soil, cement, water, and admixtures. Measuring devices shall be sensitive to a 2% variation above or below the actual weights required. Volumetric batching may be used, provided the same accuracy required for weight batching is maintained.

2. Design and operate the mixers used for mixing the CLSM so that the CLSM as discharged from the mixer is

uniform in composition and consistency throughout each batch.

3. Place the CLSM such that it flows easily into all openings between the pipe and the excavated trench. In some cases, such as trenches on a slope, a stiffer mix may be required to prevent it from flowing down the trench. In this case, use vibration to ensure that the CLSM completely fills all spaces.

4. Lay the pipe on the soil pads and place the CLSM bedding as shown in the drawings. Place bedding under pipe from one side and vibrate so that it flows under the pipe until it appears on the other side. Then add CLSM to both sides of the pipe and vibrate until it completely fills the space between the pipe and the excavated trench bottom. This operation shall follow as closely behind pipe laying operations as possible. Place CLSM in such a way as to prevent uplift or buckling of the pipe. Deposit CLSM as nearly as practicable in its final position. Do not disturb the pipe trench or cause foreign material to become mixed with the cement slurry.

5. Do not place backfill above the pipe until the CLSM has reached the initial set. Place and maintain a 6-inch cover of moist backfill cover until additional backfill is placed. If the ambient temperature is 50°F or less, place an additional 6-inch cover of backfill over the 6-inch moist backfill cover prior to the end of the working day.

END OF SECTION

SECTION 312323 CRUSHED ROCK BASE FOR STRUCTURES

PART 1 - GENERAL

A. Description

This includes materials, testing, and installation of gravel and crushed rock base for vaults, manholes, and ground wells.

B. Related Work Specified Elsewhere

1. General Concrete Construction: 030500.

2. Earthwork: 312300.

3. Grounding and Bonding: 260526.

C. Submittals

Submit six copies of a report from a testing laboratory verifying that material conforms to the specified gradations or characteristics.

D. Testing for Compaction

The Contractor will test for compaction or relative density as described in Section 312300.

PART 2 - MATERIALS

A. Crushed Rock

Crushed rock base shall conform to ASTM C33, coarse aggregate, size number 57. Durability Index shall be at least 40 per ASTM D3744.

PART 3 - EXECUTION

A. Placement of Crushed Rock

1. Place crushed rock or gravel base beneath structures where shown in the drawings, 12 inches thick unless otherwise indicated. Excavate below the required grade for the bottom of the structure and refill with crushed

rock as specified above. The rock base shall extend a minimum of 6 inches beyond the ground well.

2. Compact base to 85% relative density.

3. Place base material in maximum lifts of 8 inches.

END OF SECTION

SECTION 321216 ASPHALT CONCRETE PAVING

PART 1 - GENERAL

A. Description

This section includes materials, testing, and installation of asphalt concrete pavement, aggregate base course, herbicide, prime coat, tack coat, seal coat, slurry seal, and restriping.

B. Related Work Specified Elsewhere

Trenching, Backfilling, and Compacting: 312316.

C. Submittals

Submit six copies of a report from a testing laboratory verifying that aggregate material conforms to the specified gradations or characteristics.

D. Testing for Compaction

The Contractor will test for compaction as described in Section 321216.

E. Standard Specifications

Wherever reference is made to the Public Works Specifications such reference shall mean the Standard Specifications for Public Works Construction (SSPWC), 2012 edition.

F. Measurement and Payment

Include allowances for pavement removal in the lump-sum or unit prices bid for the work. No extra compensation will be made should the existing pavement sections vary from the conditions as listed or described.

PART 2 - MATERIALS

A. Asphalt Concrete Paving

Asphalt concrete paving shall conform to III-C2-AR-4000 as listed in Section 400-4 of the Public Works Specifications.

B. Aggregate Base Course

Aggregate base shall be crushed aggregate base as specified in Section 400-2 of the Public Works Specifications.

C. Tack Coat

Tack coat shall conform with Section 302-5.4 of the Public Works Specifications and shall be either AR1000 paving asphalt or Grade SS-1h emulsified asphalt.

D. Asphalt

Asphalt shall be viscosity grade AR 4000 or AR 8000. Asphalt content in the pavement shall be 5.5% to 6.0%.

E. Aggregate for Asphalt Concrete

Aggregate shall be in accordance with Section 400-1 of the Public Works Specifications.

F. Seal Coat

Seal coat shall be "Guardtop" as manufactured by Industrial Asphalt or equal.

G. Wood Headers

Size of wood headers shall be 2 inches by the depth of the asphalt concrete paving; minimum size shall be 2 inches by 4 inches. Wood shall be Douglas fir No. 1. Wood shall comply with Section 204-1 of the Public Works Specifications.

H. Herbicide or Weed Killer

Use Gallery (Isoxaben) by Dow AgroSciences, Pre-M (Pendimethalin) by American Cyanamid Co., Surflan (Orizalin) by Dow Chemical, or equal.

I. Slurry Seal

Slurry seal shall be Type II per Section 203.5.3 of the Public Works Specifications.

J. Paint for Traffic and Parking Lot Striping and Marking

Provide rapid-dry or fast-dry paint per Section 210-1.6 of the Public Works Specifications.

PART 3 - EXECUTION

A. Pavement Removal

1. Initially cut asphalt concrete pavement with pneumatic pavement cutter or other equipment at the limits of the excavation and remove the pavement. After backfilling the excavation, saw cut asphalt concrete pavement to a minimum depth of 2 inches at a point not less than 9 inches outside the limits of the excavation or the previous pavement cut, whichever is greater, and remove the additional pavement.

2. Saw cut concrete pavement, including cross gutters, curbs and gutters, sidewalks, and driveways, to a minimum depth of 1-1/2 inches at a point 1 foot beyond the edge of the excavation and remove the pavement. The concrete pavement may initially be cut at the limits of the excavation by other methods prior to removal and the saw cut made after backfilling the excavation. If the saw cut falls within 3 feet of a concrete joint or pavement edge, remove the concrete to the joint or edge.

3. Make arrangements for and dispose of the removed pavement.

4. Final pavement saw cuts shall be straight along both sides of trenches, parallel to the pipeline alignment, and provide clean, solid, vertical faces free from loose material. Saw cut and remove damaged or disturbed adjoining pavement. Saw cuts shall be parallel to the pipeline alignment or the roadway centerline or perpendicular to same.

B. Pavement Replacement

1. Backfill, compaction, and the permanent paving, except for the final asphalt surface course, shall be complete at the conclusion of the project. The final asphalt surface course shall be 1 inch thick. Do not place final surface course until at least three months after traffic has been returned to the pavement. Place temporary striping after the base course of A.C. pavement has been completed in the same configuration as the existing permanent striping so that traffic can be returned to normal patterns. This striping shall be considered temporary and is the Contractor's responsibility to place and maintain.

C. Installation

Producing, hauling, placing, compacting, and finishing of asphalt concrete shall conform to Section 302-5 of the Public Works Specifications. Apply seal coat to all paving except open asphalt concrete.

D. Connections with Existing Pavement

Where new paving joins existing paving, chip the existing surfaces 12 inches back from the joint line so that there will be sufficient depth to provide a minimum of 1 inch of asphalt concrete. Dispose of waste material offsite. Tack chipped areas prior to placing the asphalt concrete. Meet lines shall be straight and the edges vertical. Paint the edges of meet line cuts with liquid asphalt or emulsified asphalt prior to placing asphalt concrete. After placing the asphalt concrete, seal the meet line by painting with a liquid asphalt or emulsified asphalt and then immediately cover with clean, dry sand.

E. Preparation of Subgrade

1. Excavate and shape subgrade to line, grade, and cross section shown in the drawings. The subgrade shall be considered to extend over the full width of the base course.

2. Scarify and cultivate the top 6 inches of subgrade when the subgrade consists of dry soils which are impervious to the penetration of water, soils which contain excessive amounts of moisture which may result in unstable foundations, soils which are nonuniform in character which may result in nonuniform relative compactions and subsequent differential settlements of finished surfaces, or when pavement is to be placed directly on the roadbed material.

3. After rough grading has been completed, when scarifying and cultivating are required, loosen the roadbed to a depth of at least 6 inches. Work the loosened material to a finely divided condition and remove rocks larger than 2 inches in diameter. Bring the moisture content to optimum by the addition of water, by the addition and blending of dry material, or by the drying of existing material. Compact the material to the specified relative compaction.

4. Uniform pervious soils that allow the immediate penetration of water or uniform impervious soils which will allow the penetration of water to a depth of at least 6 inches after the addition of a suitable wetting agent will not require scarifying and cultivating. When scarifying and cultivating are not required, bring the moisture content of the top 6 inches of the subgrade material to optimum by the addition of water at the surface, and compact the material to the specified relative compaction.

5. Remove soft material disclosed by the subgrade preparation, replace with aggregate base course material, and recompact.

6. Compact the top 6 inches of subgrade to 90% relative compaction.

7. The finished subgrade shall be within a tolerance of ±0.08 of a foot of the grade and cross-section shown and shall be smooth and free from irregularities and at the specified relative compaction.

F. Installing Wood Headers

Provide wood header at edges of paving except where paving is adjacent to concrete slabs, gutters, walks, existing paving, or structures.

G. Placing Aggregate Base Course

Place aggregate base course to a minimum thickness of 6 inches, unless shown otherwise in the drawings. Compact to 95% relative compaction. Install in accordance with Section 301-2 of the Public Works Specifications.

H. Compaction of Aggregate Base and Leveling Courses

Compaction and rolling shall begin at the outer edges of the surfacing and continue toward the center. Apply water uniformly throughout the material to provide moisture for obtaining the specified compaction. Compact each layer to the specified relative compaction before placing the next layer.

I. Applying Herbicide or Weed Killer

Apply weed killer or herbicide on base prior to placing pavement. Apply at the rate recommended by the manufacturer to control dawny brome grass, puncture vine, and plaintain. Apply from outside of curb to opposite outside of curb and for the full width of roadways and parking areas.

J. Placing Tack Coat

Apply tack coat on surfaces to receive finish pavement per Section 302-5.4 of the Public Works Specifications. Apply tack coat to metal or concrete surfaces that will be in contact with the asphalt concrete paving.

K. Placing Asphalt Paving

Place asphalt paving to a minimum thickness of the existing thickness plus one inch unless otherwise shown in the drawings. Install in accordance with Section 302-5 of the Public Works Specifications.

L. Compaction of Asphalt Concrete Paving

Compact until roller marks are eliminated and a density of 92% minimum to 98% maximum has been attained per ASTM D2041.

M. Applying Seal Coat

Apply fog-type seal coat at the rate of 0.05 to 0.10 gallon per square yard.

N. Surface Tolerance

1. Finished grade shall not deviate more than 0.02 foot in elevation from the grade indicated in the drawings. Slopes shall not vary more than 1/4 inch in 10 feet from the slopes shown in the drawings.

2. After paving has been installed and compacted, spray water over the entire paved area. Correct any areas where water collects and does not drain away.

O. Slurry Seal

Apply slurry seal per Section 302-4 of the Public Works Specifications.

P. Applying Paint for Traffic Striping and Marking

Apply in accordance with Section 310-5.6 of the Public Works Specifications.

END OF SECTION

SECTION 330130 LEAKAGE AND INFILTRATION TESTING

PART 1 - GENERAL

A. Description

This section includes testing of gravity pipelines, sewers, drains, and manholes not intended to be pressurized in excess of 5 psi or 12 feet head of water. Leakage test is by internal air pressure or water. Infiltration test is by measurement of rate of flow of water.

B. Related Work Specified Elsewhere

1. Vitrified Clay Pipe: 333110.

2. HDPE Profile Wall Gravity Drain Pipe: 333118.

3. Reinforced Concrete Culvert Pipe: 334216.

4. Pressure Testing of Piping: 400515

PART 2 - MATERIALS

A. Test Plugs

Inflatable and expandable type, braced to contain 5 psi over the pipe cross-section area.

B. Pressure-Relief Valve

Set to limit the internal pipe test pressure to 5 psi.

PART 3 - EXECUTION

A. Selection of Alternate Test Criteria

1. When more than one pipe size is included in a test section, determine the test time by the criteria of ASTM C828 for vitrified clay pipe, ASTM C924 for concrete pipe, and ASTM F1417 for plastic pipe.

2. If the entire test section is submerged in groundwater, test for infiltration only.

B. Preparation of the Pipeline

1. Prior to testing, flush and clean the pipeline to wet the pipe surface and clean out debris.

2. Plug pipe outlets, including stoppers in laterals, to resist the leakage test pressure.

C. Leakage Test

1. Test for leakage or for infiltration by means of an air test or a water test. Test each section of pipe between manholes, along with the manholes. Use the air test where the difference in elevation between the invert of the upper structure and the invert of the lower structure is more than 10 feet.

2. Test each section of pipe subsequent to the last backfill compacting operation.

D. Water Test

1. Test each section of pipe between two successive structures by closing the lower end of the pipe to be tested and the inlet pipe of the upper structure with plugs or stoppers. Fill the pipe and structure with water to a point 4 feet above the invert of the open pipe in the upper structure or to a height of 10 feet above the invert of the sewer in the lower structure, whichever gives the least hydrostatic pressure on the lower structure.

2. The total leakage shall be the decrease in volume of water in the upper structure. The leakage shall not exceed 0.025 gpm per inch of nominal diameter of pipe per 1,000 feet of pipe being tested.

3. If the leakage is greater than allowed, overhaul the pipe and, if necessary, replace and re-lay until the joints and pipe comply with this test. Complete tests before trench is paved.

E. Air Test

1. Conduct air tests per the following standards:

Pipe Material	Specification Section	ASTM Specification
Concrete (4 to 24 inches)	334216	C924, Table 1
Concrete (27 inches and larger)	334216	C1103
Vitrified Clay	333110	C828, Table 1
PVC	333112	F1417, Table 1
HDPE	333118	F1417, Table 1

2. Test each section of pipe between two successive manholes by plugging pipe outlets with test plugs. Add air slowly until the internal pressure is raised to 4.0 psig. The compressor used to add air to the pipe shall have a blowoff valve set at 5 psig so that the internal pressure in the pipe never exceeds 5 psig. Maintain the internal pressure of 4 psig for at least two minutes to allow the air temperature to stabilize, then disconnect the air supply and allow the pressure to decrease to 3.5 psig. Measure the time in minutes that is required for the internal air pressure to drop from 3.5 psig to 2.5 psig. Compare the results with the values tabulated in the referenced ASTM specifications in paragraph A above.

3. If the pressure drop from 3.5 psig to 2.5 psig occurs in less time than the specified values, overhaul the pipe and, if necessary, replace and re-lay the pipe until the joints and pipe hold satisfactorily under this test.

4. Guard against the sudden expulsion of a poorly installed plug or a plug that is partially deflated.

F. Test for Infiltration

1. If, in the construction of a section of the sewer between structures, excessive groundwater is encountered, close the end of the pipe at the upper structure sufficiently to prevent the entrance of water. Discontinue pumping groundwater for at least three days. Then test the section for infiltration. The infiltration shall not exceed 0.025 gpm per inch of diameter per 1,000 feet of main line pipe being tested as measured at the downstream structure. Test period shall be at least eight hours.

2. Where infiltration exceeds the maximum acceptable, immediately uncover the pipe and reduce the infiltration to within the maximum acceptable by replacing, re-laying, or encasing the pipe in concrete.

G. Manhole Test

1. Watertightness of manholes may be tested in connection with hydrostatic tests of the pipeline or at the time the manhole is completed and backfilled. Repair any leakage as a result of testing.

2. Fill the manhole with water to an elevation 1 foot below the bottom of the cone section with a maximum water depth of 20 feet. Where the manholes are tested with the pipeline, no additional leakage will be allowed above that for the main line pipe.

3. Where a separate manhole leakage test is performed or requested by the Owner's Representative, plug inlets and outlets with stoppers or plugs and fill the manhole to the limits indicated above. The maximum allowable drop in the water surface shall be 1/2 inch for each 15-minute period of testing.

H. Correction of Observed Leaks

Even though the infiltration is less than the maximum acceptable, stop any individual leaks that may be observed.

I. Inspection by Contractor for Damaged or Defective Pipe in Place

1. After backfilling and pavement replacement is complete and upon completion of the air test or infiltration test, inspect the pipe for damage and other defects with the aid of mirrors.

2. Schedule the inspection in advance with the Owner's Representative.

3. If the "mirroring" inspection indicates any defects, excavate and repair or replace the faulty materials and construction and restore the work and the damage to work of others.

END OF SECTION

SECTION 331300 DISINFECTION OF PIPING

PART 1 - GENERAL

A. Description

This section includes materials and procedures for disinfection of water mains by the continuous feed method. Disinfect piping in accordance with AWWA C651, except as modified below.

B. Related Work Described Elsewhere

Pressure Testing of Piping: 400515.

C. Job Conditions

1. Discharge of chlorinated water into watercourses or surface waters is regulated by the National Pollutant Discharge Elimination System (NPDES). Disposal of the chlorinated disinfection water and the flushing water is the Contractor's responsibility. Dechlorinate the disinfection water such that the chlorine residual complies with California Regional Water Quality Control Board Order No. MRP R8-2003-0061, NPDES No. CA G998001.

2. Schedule the rate of flow and locations of discharges in advance to permit review and coordination with Owner and cognizant regulatory authorities: Regional Water Quality Control Board and County of Los Angeles. The allowable location of discharges is to the storm drain catch basin on Benson Avenue.

3. Use potable water for chlorination.

4. Submit request for use of water from waterlines of Owner 48 hours in advance.

PART 2 - MATERIALS

A. Liquid Chlorine

Inject with a solution feed chlorinator and a water booster pump. Follow the instructions of the chlorinator manufacturer.

B. Calcium Hypochlorite (Dry)

Dissolve in water to a known concentration in a drum and pump into the pipeline at a metered rate.

C. Sodium Hypochlorite (Solution)

Further dilute in water to desired concentration and pump into the pipeline at a metered rate.

D. Chlorine Residual Test Kit

For measuring chlorine concentration, supply and use a medium range, drop count, DPD drop dilution method kit per AWWA C651, Appendix A. Maintain kits in good working order available for immediate test of residuals at point of sampling.

PART 3 - EXECUTION

A. Continuous Feed Method for Pipelines

Introduce potable water into the pipeline at a constant measured rate. Feed the chlorine solution into the same water at a measured rate. Proportion the two rates so that the chlorine concentration in the pipeline is maintained at a minimum concentration of 50 mg/L. Check the concentration at points downstream during the filling to ascertain that sufficient chlorine is being added.

B. Disinfection of Blind Flanges

Swab exposed faces of blind flanges prior to bolting flanges in place with a 1% sodium hypochlorite solution.

C. Confirmation of Residual

After the chlorine solution applied by the continuous feed method has been retained in the pipeline for 24 hours, confirm that a chlorine residual of 10 mg/L minimum exists along the pipeline by sampling at air valves and other points of access.

D. Pipeline Flushing

After confirming the chlorine residual, flush the excess chlorine solution from the pipeline until the chlorine concentration in the water leaving the pipe is within 0.5 mg/L of the replacement water.

E. Bacteriologic Tests

Collect two sets of samples per AWWA C651, Section 5.1, deliver to a certified laboratory within six hours of obtaining the samples, and obtain a bacteriologic quality test to demonstrate the absence of coliform organisms in each separate section of the pipeline after chlorination and refilling. Collect at least one set of samples from every 1,200 feet of the new water main, plus one set from the end of the line and at least one set from each branch. At each connection to an existing pipeline, take two additional samples.

F. Repetition of Procedure

If the initial chlorination fails to produce required residuals and bacteriologic tests, repeat the chlorination and retesting until satisfactory results are obtained.

G. Test Facility Removal

After satisfactory disinfection, disinfect and replace air valves, restore the pipe coating, and complete the pipeline where temporary disinfection or test facilities were installed.

H. Piping to be Disinfected

Disinfect all piping except sewers and drainage piping.

END OF SECTION

SECTION 333110 VITRIFIED CLAY PIPE

PART 1 - GENERAL

A. Description

This section includes materials, installation, and testing of VCP for gravity sewers. Sizes are 4 inches through 42 inches.

B. Related Work Specified Elsewhere

1. General Concrete Construction: 030500.

2. Precast Circular Concrete Manholes: 034210.

3. Trenching, Backfilling, and Compacting: 312316.

4. Leakage and Infiltration Testing: 330130.

5. General Piping Requirements: 400500.

C. Submittals

1. Submit shop drawings in accordance with the General Provisions and Section 013300.

2. Submit report on factory leakage test of joints per ASTM C425. Submit report on crushing strength, absorption or hydrostatic pressure, and acid resistance tests per ASTM C700.

3. Submit report on factory tests specified herein.

4. Submit cut sheets showing invert elevations, ground elevations, and pay cuts every 25 feet.

D. Standard Specifications

Wherever reference is made to the Public Works Specifications such reference shall mean the Standard Specifications for Public Works Construction, 2012 edition.

E. Measurement and Payment

1. Measurement for furnishing and installing pipe will be by the linear foot for each diameter and for each class of bedding measured horizontally between the pipeline

stations between which the pipe is installed. Include pipe that is laid through structures and manholes and the ends of pipe required to protrude into manholes. Payment per linear foot includes bends.

2. The unit price paid for VCP includes full compensation for furnishing the labor, materials, tools, and equipment and doing all work involved to complete the pipeline except:

   a. Stabilization of yielding foundation per Section 312316.

   b. Concrete construction of special encasement, not included in the classes of bedding, and manhole bases.

PART 2 - MATERIALS

A. Pipe

1. VCP shall be extra strength and shall comply with ASTM C700, except for bearing strength. Bearing strength for high strength VCP shall comply with Section 207-8.5.3 of the Standard Specifications for Public Works Construction.

2. Laboratory Testing:

   a. Conduct loading tests per the three-edge bearing test, ASTM C301. Pipe shall withstand the loads tabulated in Table 207-8.5.3, SSPWC.

   b. Conduct hydrostatic pressure tests per ASTM C301, Section 7. The hydrostatic pressure test shall precede the loading test by not less than one hour and not more than three hours. Hydrostatically test each pipe that is to be tested for crushing.

   c. Conduct absorption tests per ASTM C301 on pipe subject to the loading test.

   d. Conduct acid resistance tests per ASTM C301 on pipe subject to the loading test.

   e. Perform calculations and prepare test reports per ASTM C301, paragraphs 5.5, 6.4, and 8.6.

f. Conduct tests on 2% of the number of each size of pipe furnished for the project. In no case shall less than five specimens be tested.

g. If all or the minimum designated percentage or number of the specimens tested meet the requirements of the test, then all of the pipe in the lot, shipment, or delivery corresponding to the sizes and classes so tested shall be considered as complying with the test. If, however, 10% or more of the specimens tested fail to meet the requirements of the test or if more than one specimen fails to meet the requirements of the test when the number to be tested is less than 10, then a second selection of pipe shall be made for the test. The number of specimens to be tested in the second selection of pipe shall be five for each specimen of the first selection that failed to meet the requirements. If 90% or more of the specimens tested, including those first tested, meet the requirements of the test, all the pipe in the lot, shipment, or delivery corresponding to the sizes and classes so tested shall be considered as complying with that test; otherwise, all pipe of these sizes and classes shall be rejected.

3. Clay Pipe Repair:

a. General: Structurally sound clay pipe larger than 15 inches in diameter may be repaired as provided in this section. Limit repairs of any type at the spigot or socket to one for each 60 degrees of circumference and a maximum of four at either end. Do not use repaired pipe for fabricated fittings unless the repaired pipe is tested. Molded fittings may be repaired within the scope of these specifications.

b. Cracks: The following longitudinal cracks parallel to the axis and not more than 1/32 inch wide may be repaired:

i. A crack on the exterior of the spigot that does not penetrate the entire barrel thickness and does not exceed 50% of the depth of the socket in length.

ii. A crack in the socket of the pipe that does not penetrate the entire thickness and does not exceed 75% of the depth of the socket in length.

iii. A crack that penetrates the entire thickness of the socket and does not exceed 50% of the depth of the socket in length.

iv. A crack on the interior of the socket and in the shoulder on the exterior of the socket which does not exceed 3 inches (75 mm) in length and does not penetrate more than 20% of the wall thickness.

c. Surface Chips: Surface chips located on the exterior of the spigot, the interior or exterior of the socket, or on the shoulder of the socket may be repaired, provided:

i. The length of the circumference of the chip does not exceed twice the barrel thickness.

ii. The width is not greater than 50% of the socket depth measured parallel to the axis.

iii. The depth is not greater than 25% of the wall thickness measured perpendicularly to the axis.

d. Full-Depth Chips: Full-depth chips located on the socket, may be repaired, provided the length of the chip does not exceed twice the barrel thickness or the width does not exceed 25% of the socket depth.

e. Repair Methods and Materials:

i. General:

1. Surfaces to be repaired shall be clean and dry. Grind unsound material at lumps or blisters smooth and flush with adjacent surfaces. Groove cracks 1/8 to 1/4 inch wide and 1/8 to 1/4 inch deep for the full length of the crack. Remove unsound material at chips, flakes, pits, and spalls. Edges shall be 1/16 inch minimum below adjacent surfaces. There shall be no feather edges.

2. Clean prepared areas of dust and other loose particles and then fill with repair material. Repair material shall resist bacterial attack and attack by chemicals or combinations of chemicals normally present in domestic and industrial sewage.

3. Mix, apply, and cure repair material as recommended by the manufacturer. Repair material shall have a color contrasting with the color of the pipe to be repaired. If necessary to produce a contrast in color, add carbon black in a small quantity to the repair material.

4. Subject the repair material to adhesion testing to determine its suitability for use.

ii. Adhesion Test:

1. Use vitrified clay bars 1-inch square in cross section and approximately 8 inches in length compounded of the same materials as the VCP and fired to clay pipe manufacturing temperature in preparing the test specimens. The bars shall have a modulus of rupture of not less than 1,600 psi when tested in flexure with third-point loading.

2. Cut the bars through at the mid-point and then bond with the repair material. Following a seven-day-maximum cure period at ambient room temperature, test the bonded bars in flexure with third-point loading.

3. The average modulus of rupture of five test bars bonded with the repair material shall not be less than 1,600 psi. Five additional test bars bonded with the repair material and immersed for 60 days in water at ambient room temperature shall have an average modulus of rupture not less than 1,500 psi.

f. Inspection of Repairs: Inspect pipe to be repaired after preparation for repair and again after repair has been made.

B. Joints

Joints shall be of the bell-and-spigot compression type, complying with ASTM C425. Joint design shall consist of polyurethane compression sealing components, one bonded to the outside of the spigot and the other bonded to the inside of the bell. The minimum required seal thickness shall be 1/8 inch, measured from the outside of the barrel surface. Joints shall be as manufactured by MCP Industries, Speed Seal as manufactured by Gladding, McBean & Co., or equal.

C. Stoppers

1. Vitrified clay stoppers shall be 3/4 inch in thickness and shall have a factory-made plasticized PVC compound joint material cast and bonded to the pipe, such as Speed Seal or equal. Mold and cure the material to a uniform hardness and compressibility and form a tight compression coupling when assembled. The material used for the compression joint shall conform to ASTM C425.

2. Neoprene (synthetic rubber) stoppers shall be of the type manufactured by Gladding, McBean & Co., or equal. The joint formed by the stopper and clay pipe shall be a tight compression coupling when assembled.

3. Joints for stoppers shall be adequate to withstand the internal pressure of the leakage test. Make joints in such a manner that they may be removed without injury to the socket.

D. Fittings

Fittings, including tees, wyes, and bends, shall comply with ASTM C700.

PART 3 - EXECUTION

A. Visual Inspection

Any pipe or fitting containing imperfections or blisters, fractures, and cracks in excess of those per ASTM C700, Sections 9 and 10, shall be rejected, regardless of the results of the laboratory tests.

B. Installing Pipe

1. Excavate trenches to the maximum width shown in the drawings. Install pipe in accordance with ASTM C12 and the following.

2. When installing piping in trenches, do not deviate more than 1 inch from line or 1/4 inch from grade. Measure for grade at the pipe invert.

3. Lay pipe without break, upgrade from structure to structure, with the socket ends of the pipe upgrade.

4. Do not use the pipe as a drain for removing water from the trench.

5. After joint assembly, bring the bedding material up to pipe spring line. Place the bedding material on each side of the pipe. Do not drop crushed rock or gravel directly onto the pipe. Walk and tamp the bedding material into final position at pipe spring line and continue to the top of the pipe.

6. Place bedding material to 1 foot above the top of the pipe and compact to the same relative compaction as in the pipe zone per Section 312316. Bedding material shall be CLSM per Section 312316. The remainder of the trench backfill material shall be installed per Section 312316.

C. Installing Joints

Apply the joint manufacturer's lubricant to the joint surfaces to assemble the joint. Joints shall be watertight and root-tight.

D. Installing Pipe at Manholes and Structures

1. Place two 2-foot lengths of pipe of the same inside diameter as the adjoining pipe at the inlet and outlet to each manhole or structure. Use one of the following methods:

   a. Directly cast a manhole coupling into the manhole base. Provide rubber-ring gasket in the coupling.

   b. Stretch a rubber-ring gasket around the pipe to serve as a water stop when cast into the structure wall.

2. Do not cast pipe bells into manholes or structures. Cut off the bell so that no recess or offset appears on the exposed face from the inside wall of the pipe to the outside wall of the pipe. The pipe shall have a plain end, flush with the inside wall of the manhole or structure, or as shown in the drawings.

E. Testing for Alignment and Grade

1. After the pipe has been installed, tested for leakage, backfilled to existing grade, and manholes raised to grade and resurfaced, "ball" the pipe from manhole to manhole with a sewer scrubbing ball. After balling the pipe, perform the following:

2. "Mirror" straight sewers and inlet/outlet ends of curvilinear sewers. Perform balling and mirroring in the presence of the Owner to test for alignment, grade, damaged or defective pipe in place, or any other type of faulty installation. Should balling and mirroring indicate any faulty installation of the pipe, repairs or replacements shall be made at the Contractor's expense.

F. Leakage Test

1. See Section 330130.

2. Even though a section may have previously passed the leakage or infiltration test, test each section of sewer subsequent to the last backfill compacting operation in which heavy compaction equipment may have damaged or affected the required watertight integrity of the pipe, structure, and appurtenances.

G. Water Test

See Section 330130.

H. Air Test

See Section 330130.

I. Test for Infiltration

Conduct infiltration test per Section 330130.

END OF SECTION

SECTION 333118 HDPE PROFILE WALL GRAVITY DRAIN PIPE

PART 1 - GENERAL

A. Description

This section includes materials, testing, and installation of HDPE profile wall gravity drain pipe, fittings, and appurtenances conforming to ASTM F894. The pipe to be installed is identified in the drawings by nominal diameter of pipe in inches followed by the abbreviation HDPE.

B. Related Work Specified Elsewhere

1. Trenching, Backfilling, and Compaction: 312316.

2. Leakage and Infiltration Testing: 330130.

C. Submittals

1. Submit shop drawings in accordance with the General Provisions and Section 013300.

2. Provide an affidavit that the pipe complies with ASTM F894 and that the gasket conforms to ASTM F477. Submit copies of the following manufacturer-required tests conducted on project pipe furnished:

   a. Ring Stiffness Constant (RSC) qualification tests.

   b. RSC quality control testing for the pipe supplied.

   c. Flattening resistance of pipe.

   d. Joint tightness per ASTM D3212.

   e. Laboratory tests of gaskets per ASTM F477.

   f. Record of additional tests after test sample failure.

   g. Laboratory test confirming base materials used in the manufacture of the pipe, per ASTM D1248 or D3350.

h. Laboratory tests of hydrostatic design basis per ASTM D2837, for base materials used in manufacture of the pipe.

3. The HDPE pipe manufacturer shall certify that pipe provided meets all requirements of this specification. Provide a copy of test results indicating certification with a lot or shipment. Failure to provide such test results can be cause for rejection of the lot or shipment.

4. Submit manufacturer's catalog data, outline drawings, material description, and details of connection to structures and other types and sizes of pipe. Submit calculations for pipe RSC and estimated installed short- and long-term deflection. "Long term" is defined as one year after installation of backfill.

5. The HDPE pipe manufacturer shall submit a written quality control procedure. In general, the manufacturer shall follow the "In-Plant Quality Control Program for 14-Inch and Larger Diameter Polyethylene Pipe" appearing in Annex A4 of the latest edition of ASTM D2513.

D. Inspection

1. The Owner will not witness the factory tests specified herein. Tests done in the absence of prescribed inspection shall be repeated. Materials failing required tests will be rejected.

2. The Owner reserves the right to inspect each shipment upon delivery. If, in any lot or shipment, there are items not meeting the specifications, that lot may be rejected at the option of the Owner. A lot shall mean all material covered by a single item on the order. The fact that a product has been successfully inspected or that performance tests were successfully performed by the Owner shall not relieve manufacturer of responsibility in the case of later discovery of any manufacturing material flaws or defects.

E. Measurement and Payment

1. Measurement: Measurement for payment of pipe shall be on the basis of linear footage constructed in place in accordance with the drawings and specifications.

Measurement shall be made horizontally between the centerlines of the manholes and the space occupied by manholes subtracted.

2. Payment for Pipe:

   a. Payment for pipe shall be made at the contract unit price per linear foot for each size pipe constructed, complete in place, in accordance with the drawings and specifications.

   b. The price paid per linear foot for pipe shall include full compensation for furnishing labor, materials, tools, and equipment and doing the work involved in furnishing, installing, and testing the pipe, complete in place, as shown in the drawings and as herein specified.

3. Payment for Fittings: The cost of fittings shall be included in the various contract unit prices and shall include full compensation for furnishing labor, materials, tools, and equipment necessary for the complete installation of fittings as shown in the drawings and in conformance with these specifications, and no additional allowance will be made therefor.

PART 2 - MATERIALS

A. Pipe

1. HDPE pipe and fittings shall have a minimum RSC of 260. The pipe shall conform to ASTM F894. The pipe shall be ribbed for stiffness and shall have integral bell-and-spigot joints. The pipe shall be homogeneous in structure; uniform in color, density, and physical properties; white in color; UV stabilized; impervious to moisture; free from cracks, broken extremities, holes, foreign inclusions, or other imperfections; and shall resist the detrimental effects of untreated water and stormwater. Clean rework material generated by the manufacturer's own production work may be used in the process, provided it makes up less than 10% of the total material used and the pipe produced meets the requirements of this specification.

2. HDPE pipe shall be externally ribbed and shall be manufactured by the continuous winding of extruded HDPE

material upon a mandrel to produce the nominal diameter. Ribs shall be completely fused to the pipe wall. The pipe ends shall be square with the longitudinal axis, and bells shall be true, circular, and concentric with the barrel of the pipe.

B. Quality Control

1. The following imperfections in a pipe or special fitting will be considered injurious and cause for rejection without consideration:

   a. Any cracks in the pipe barrel, bell, or spigot;

   b. Any indication of a nonhomogeneous mixture;

   c. Any deviation greater than 1/16 inch per lineal foot in any 8-foot length;

   d. Any broken or damaged areas on the barrel, bell, spigot, or gasket; or

   e. Any signs of a welding failure or similar manufacturing defect.

2. Pipe and special fittings shall comply with the requirements of these specifications.

C. Identification and Marking

Mark each length of pipe according to ASTM F894.

D. Factory Tests

1. Before being used in any work under these specifications, pipe shall be subjected to and shall meet the requirements of the following tests specified in ASTM F894:

   a. RSC qualification of pipe barrel and pipe bells,

   b. RSC quality control,

   c. Flattening, and

   d. Joint tightness.

2. Take samples for each of the tests listed above as follows:

One length for each class of project pipe from the first 10% of the lengths manufactured, one at approximately 50% of manufacture, and one from the final 15% of the pipe manufactured, or

3. One length from each 1,200 feet of each class of project pipe, whichever produces the greater number of test specimens. When any sample fails to meet a specified test requirement, perform additional tests to determine which items are acceptable of those produced from the same equipment as of the last favorable test. Reject pipe that fails to meet any test requirement.

E. Joints

1. Provide the pipe with integral bell-and-spigot joint rings designed to be field joined using an elastomeric gasket. The RSC of any bell-and-spigot joint, when assembled, shall be at least equal to the RSC of the adjacent pipe.

2. Assemble a minimum of three bell-and-spigot joints for each size and class of pipe, and determine the RSC of joint assembly using the same test procedures as for the pipe shell.

3. Confirm the integrity of the joint assembly in accordance with ASTM D3212 with an imposed deflection of 5% of the diameter.

F. Gaskets

1. Gaskets shall be molded or produced from an extruded shape approved by the pipe manufacturer and spliced into a circular form. The basic polymer shall not be natural rubber. Gaskets shall comply with the requirements of ASTM F477. Store gaskets in original shipping containers, protected from direct sunlight, and remove only as necessary for installation.

2. The lubricant used for pipe joint assembly shall be as recommended by the gasket manufacturer and have no detrimental effect on the gasket or pipe.

G. Mandrel for Field Testing of Pipe Deflection

1. The mandrel shall be a rigid, nonadjustable, odd-numbering-leg (nine legs minimum) mandrel having an effective length not less than its nominal diameter.

2. The mandrel shall have a minimum diameter at any point along the full length as follows:

    a. Base inside diameter as shown in Table X2.1 in ASTM F894.

    b. Minimum mandrel diameter equals 97% of the base inside diameter for net short-term deflection.

    c. Minimum mandrel diameter equals 95.5% of the base inside diameter for net long-term deflection.

3. The mandrel shall be fabricated of steel; fitted with pulling rings at each end; stamped or engraved on some segment other than a runner indicating the pipe material specification, nominal size, and mandrel outside diameter (e.g., PVC, F 894-18"-mandrel actual diameter); and furnished in a carrying case labeled with the same data as stamped or engraved on the mandrel.

PART 3 - EXECUTION

A. Delivery and Temporary Storage of Pipe

1. Ship, store, and place the pipe at a storage yard or installation site, supporting the pipe uniformly on flat, level ground with no rocks or other objects under the pipe. Avoid scratching or damaging the pipe. Do not stack higher than two rows or with weight on bells. To minimize out-of-roundness and curvature due to thermal expansion, cover to protect from sunlight. Alternatively, pipe may be stored in a shaded area.

2. Do not store pipe on site for more than 10 days.

B. Handling Pipe in Trenches

1. See Section 312316.

2. Do not install pipe that does not meet the tolerances specified in these specifications.

3. Install in accordance with ASTM D2321, except as modified herein.

4. Lay pipe without break, upgrade from structure to structure, with the bell ends of the pipe facing upgrade. Lay pipe in such a manner as to form a close, concentric joint with the adjoining pipe and prevent offsets of the flow line.

5. Install the gasket in accordance with the pipe manufacturer's instructions using the materials, lubricants, and equipment recommended by said manufacturer.

6. Backfill pipe zone immediately after pipe has been bedded and joined. Prevent movement of pipe while backfilling. Carefully place the material around the pipe so that the pipe barrel is completely supported and that no voids or uncompacted areas are left beneath the pipe or in between stiffening ribs. Backfill material placed under the haunches shall be shovel sliced. Use particular care in placing material on the underside of the pipe to prevent lateral movement during subsequent backfilling. Limit unbackfilled, installed pipe to five sections maximum. Avoid extended exposure to sun.

7. Backfill materials in the zone between the trench bottom and to a point 12 inches above the top of the pipe shall be CLSM per Section 312316.

8. Compact by means of vibratory equipment or by hand tamping. Apply backfill in layers having a maximum thickness of 8 inches. Do not add successive layers unless the previous layer is compacted to 90% relative compaction. Compact material placed within 12 inches of the outer surface of the pipe by hand tamping only.

9. Monitor pipe deflections during compaction, and limit the total elongation of the vertical diameter of the pipe to 1.5% of the reference inside diameter. Deflection measurements shall be taken when the pipe is backfilled to its crown.

10. Do not use sheepsfoot rollers or equipment with similar loads or AASHTO H 20 wheel loads until a minimum of one pipe diameter of backfill has been placed over the top of the pipe.

C. Sags or Standing Water in Pipe

1. Sags or standing water in pipe shall meet the following criteria:

Pipe Slope	**Complies With Specifications**	**Does Not Comply With Specs Resulting in No Payment**	**Does Not Comply With Specs and Reconstruction is Required**
Less than 0.4%	Less than 1/4-inch sag	Greater than 1/2-inch sag	Greater than 1-inch sag
Less than or equal to 0.7%	Less than 1/2-inch sag	Greater than 1-inch sag	Greater than 2-inch sag
Greater than 0.7%	Less than 1-inch sag	Greater than 1-1/2-inch sag	Greater than 3-inch sag

2. If standing water depth in the sag exceeds the value listed under "No Payment," then to compensate for anticipated higher than average pipeline operation and maintenance cost, no payment will be made for the installed portion of pipe. The nonpayment amount shall include all construction costs including such items as excavation, pipe installation, backfilling, and resurfacing for the full length of standing water. Due to unacceptably high operation and maintenance costs and poor system reliability, pipeline portions with sag depths exceeding those listed for "Reconstruction is Required" will be rejected. Reconstruction of the length of standing water plus 20 feet on each side of the standing water will be required. Remove and do not reuse damaged pipe.

D. Assembly of Pipe Joint

1. The spigot and bell or bell coupling shall be dirt free and slide together without displacing the rubber gasket ring.

2. If the pipe is not perfectly round, lay the bell end of the pipe with the elongated diameter in the vertical position for joining to the matching elongated spigot of

the adjacent pipe. Do not use pipe sections that have maximum inside diameters greater than allowed in ASTM F894.

3. Insert the gasket into the groove in the spigot just before joining the pipes. First clean the groove. Observe the correct direction of the shaped gasket ring. Slip a screwdriver or other smooth object under the gasket and run it around the outside circumference of the pipe spigot two or three times to equalize the tension in the gasket. Check that the gasket ring is completely seated.

4. Lubricate the spigot over the taper and up to the full insertion mark with the lubricant supplied by the pipe manufacturer. If the lubricated pipe end touches dirt, clean the pipe end and reapply lubricant.

5. Insert the spigot into the bell and force it slowly and carefully into position.

6. Check that the gasket has not left the groove during assembly by passing a feeler gauge around the completed joint. If the gasket has left the groove, then disassemble the joint and replace the gasket.

E. Connection to Structures, Manholes, and Encasements

Provide leak-free connections of HDPE pipe to structures, manholes, and encasements. Cut a core wall closure pipe, as shown in the drawings, to the required length with "Tomahawk" feature and insert in the structure or encasement as shown. Align the bell and seat as for bell-and-spigot joint. Grout in place. As an alternative, furnish and install standard HDPE pipe and grout in place as shown in the drawings. Backfill around stub outs and closure pieces as required for the pipe zone. Refer to the connection details shown in the drawings.

F. Field Testing of Pipe Deflection

1. The net short-term (15 days after backfill) deflection shall not exceed 3% of the reference inside diameter of the pipe. The net long-term (one year after backfill) deflection shall not exceed 4.5% of the reference inside diameter of the pipe. The reference diameter for both the elongations and the net short-term and long-term deflections shall be the measured vertical diameter within the tolerances of ASTM F894 as the pipe lays in

the trench, prior to any backfilling. Perform a deflection test of the pipe by use of a nine-point mandrel pulled through the pipe. The pipe shall pass both the physical measurement of deflections and the mandrel testing. If the specified deflections are exceeded, remove and reinstall the pipes. The Contractor may, at his option, strut the pipe during installation in order to achieve the deflection and tolerance criteria specified. No struts or other temporary supports shall be in place at the time measurements are taken.

2. Measure each pipe section at the quarter-length, mid-length, and three-quarter length. The average inside diameter tolerance, out-of-roundness, and all deflection criteria shall be met at all measured locations. Uncover any overdeflected pipe and, if not damaged, reinstall. Remove damaged pipe from the site. Any pipe subjected to any method or process other than removal, which attempts, even successfully, to reduce or cure any overdeflection, shall be uncovered, removed from the site, and replaced with new pipe.

3. In order to make all elongation deflection tests of the installed pipe, the Contractor shall furnish all equipment and manpower required to make the section to be tested comply with CAL/OSHA requirements for entering and conducting such test. Equipment shall include, but not be limited to, blowers, ladders, harnesses for personnel, companion personnel, lighting (underground inspection with possible wet conditions), and assistance to the Owner's Representative in making such measurements. All costs associated with furnishing equipment and personnel shall be included in the contract unit price for the item to which it is appurtenant.

4. All costs incurred by the Contractor attributable to mandrel and deflection testing, including any delays, shall be borne by the Contractor at no cost to the Owner.

5. Eleven months after the project has been accepted as complete, the Contractor shall return to the project and conduct a mandrel test as stated above using the same approved type of mandrel as used in the short-term deflection testing. Any deflections greater than 4.5% of the average inside diameter after 11 months after acceptance of the work will require the Contractor to either repair or dig up and replace. Correction by the

use of a re-rounder is unacceptable and shall not be allowed.

G. Field Testing for Leakage and Infiltration

1. The completed HDPE drain pipes shall be watertight. Test each section of HDPE drain between two successive structures or encasements for leakage and for infiltration per Section 330130.

2. Test each section of drain after the last backfill compaction operation where, in the opinion of the Owner's Representative, heavy compaction equipment or any of the operations of the Contractor or others may have damaged or affected the required watertight integrity of the pipe, structure, and appurtenances. Provide all material required for the tests and bear all costs in connection therewith. Perform tests in the presence of the Owner's Representative.

3. If the leakage or infiltration rate, as shown by the tests specified herein, is greater than the amount specified, repair the pipe joints or, if necessary, remove and relay the pipe. The drain will not be considered acceptable until the leakage and infiltration rate, as determined by test, is less than the allowable.

   a. Leakage Test: The Contractor, at his option, shall air test or water test for leakage. Test per Section 330130.

   b. Test for Infiltration: See Section 330130.

H. Tests for Alignment and Grade and Damaged or Defective Pipe in Place

After the pipe has been installed, tested for leakage and infiltration, and backfilled to existing grade, the pipe shall be "mirrored" by the Owner's Representative with the assistance of the Contractor's forces. This shall constitute tests for alignment, grade, damaged or defective pipe in place, or any other type of faulty installation. Should mirroring indicate any faulty installation of the pipe, repairs or replacements shall be made at the Contractor's expense as determined by the Owner's Representative. Full compensation for making these tests shall be included in the contract unit prices, and no additional allowance will be made therefor.

I. Plugs

Plugs and joints for plugs shall withstand the internal pressure of the leakage and infiltration test; however, joints shall be made in such a manner that they may be removed without injury to the socket. Plugs shall be approved by the manufacturer prior to review by the Owner.

END OF SECTION

SECTION 334216 REINFORCED CONCRETE CULVERT PIPE

PART 1 - GENERAL

A. Description

This section includes materials, fabrication, testing, and installation of circular reinforced concrete culvert pipe complying with ASTM C655.

B. Related Work Specified Elsewhere

1. Trenching, Backfilling, and Compacting: 312316.

2. Leakage and Infiltration Testing: 330130.

C. Submittals

1. Submit shop drawings in accordance with the General Provisions and Section 013300.

2. Prior to delivery of pipe from each manufacturing lot or run, submit:

a. Test results for external load crushing strength test per Section 10 of ASTM C655.

b. Certification of compliance with cited ASTM specifications of cement, aggregate, and reinforcement.

c. Manufacturer's description of admixtures used.

d. Manufacturer's report of visual inspection.

D. Measurement and Payment

a. Payment for each diameter and for each pipe strength designation will be by the linear foot measured horizontally over the pipe centerline. Include pipe that is laid through structures and manholes and the ends of pipe required to protrude into manholes.

PART 2 - MATERIALS

A. Circular Reinforced Concrete Culvert Pipe

1. Comply with ASTM C655. Method of manufacture shall be either cast or spun. Provide D-1200 pipe.

2. Cement shall comply with ASTM C150, Type II.

3. Acceptance shall be on the basis of plant load-bearing tests, material tests, and inspection of manufactured pipe for visible defects and imperfections as defined in ASTM C655. Conduct three-edge bearing test for load to produce a 0.01-inch crack. Conduct tests on 2% of the number of each size of pipe furnished for the project. For extended delivery schedules, conduct tests on two pipe sections for each size preliminary to delivery of pipe. Conduct remainder of tests during extended delivery schedule.

B. Joints

1. Use push-on rubber-gasketed watertight type.

2. Bells, spigots, and rubber gaskets shall conform to ASTM C361 or C443 and shall be compatible with ASTM C655 pipe barrel. Use flared or flush bell design.

C. Base, Bedding, and Backfill Material

Use the following materials as specified in Section 312316:

D. Zone	**E. Material**
Base, Pipe Zone, Trench Zone	1-inch gravel
Street Zone	Native earth backfill

PART 3 - EXECUTION

A. Product Marking

1. Letter on the interior of each section of pipe the following:

2. D-load to produce a 0.01-inch crack.

3. Date of manufacture.

4. Name of manufacturer and plant.

B. Rejection

1. Reject and replace pipe exhibiting any of the following:

   a. Fractures or cracks passing through the wall, except for a single end crack that does not exceed the depth of the joint.

   b. Defects that indicate imperfect proportioning, mixing, and molding.

   c. Surface defects indicating honeycombed or open texture.

   d. Damaged or cracked ends where such damage would prevent making a satisfactory joint.

   e. Any continuous crack having surface width of 0.01 inch or more and extending for a length of 12 inches or more, regardless of position in the wall of the pipe.

   f. Exposure of any reinforcement indicating incorrect placement.

   g. Any tested pipe that fails to meet the specified D-load.

C. Installing Buried Pipe

1. Install in accordance with Section 312316 and as follows.

   a. When installing pipe in trenches, do not deviate more than 1 inch from line or 1/4 inch from grade. Measure elevation at the pipe invert.

   b. Lay pipe upgrade from structure to structure, with the bell ends of the pipe upgrade.

   c. After joint assembly, bring the pipe zone and bedding material up to 1 foot above the top of pipe. Place the material in even lifts on each side of the pipe.

D. Leakage and Infiltration Testing of Rubber Gasket Joints

See Section 330130.

END OF SECTION

SECTION 400500 GENERAL PIPING REQUIREMENTS

PART 1 - GENERAL

A. Description

This section describes the general requirements for selecting piping materials; selecting the associated bolts, nuts, and gaskets for flanges for the various piping services in the project; and miscellaneous piping items.

B. Submittals

1. Submit shop drawings in accordance with the General Provisions and Section 013300.

2. Submit affidavit of compliance with referenced standards (e.g., AWWA, ANSI, ASTM, etc.).

3. Submit certified copies of mill test reports for bolts and nuts, including coatings if specified. Provide recertification by an independent domestic testing laboratory for materials originating outside of the United States.

4. Submit manufacturer's data sheet for gaskets supplied showing dimensions and bolting recommendations.

C. Definitions of Buried and Exposed Piping

1. Buried piping is piping buried in the soil, commencing at the wall or beneath the slab of a structure. Where a coating is specified, provide the coating up to the structure wall. Piping encased in concrete is considered to be buried. Do not coat encased pipe.

PART 2 - MATERIALS

A. Materials Selection and Alternative Materials

The drawings may show alternative piping materials for certain services. In such cases, the same pipe material shall be used for all pipe sizes in all locations for the given piping service. Do not intermix piping materials.

B. Thread Forming for Stainless Steel Bolts

Form threads by means of rolling, not cutting or grinding.

C. Bolts and Nuts for Flanges for Steel Piping (Specification Section 402066)

1. Bolts and nuts for Class 150 flanges shall be Type 316 stainless steel conforming to ASTM A193, Grade B8M for bolts and ASTM A194, Grade 8M for nuts.

2. Fit shall be Classes 2A and 2B per ANSI B1.1 when connecting to cast-iron valves having body bolt holes.

3. Bolts used in flange insulation kits shall conform to ASTM A193 (Grade B7). Nuts shall conform to ASTM A194 (Grade 2H).

4. Provide washers for each nut. Washers shall be of the same material as the nuts.

D. Lubricant for Stainless Steel Bolts and Nuts

Lubricant shall be chloride free and shall be RAMCO TG-50, Anti-Seize by RAMCO, Specialty Lubricants Corporation Husky™ Lube O'Seal, or equal.

E. Gaskets for Flanges for Steel Piping in Water Service (Specification Section 402066)

1. Gaskets for flat face and raised face flanges shall be 1/8-inch thick and shall be one of the following nonasbestos materials:

   a. Cloth-inserted rubber with a Shore "A" hardness of 75 to 85. Gaskets shall be suitable for a pressure of 200 psi at a temperature of 180°F. Products: Garlock Style 19 or equal.

   b. Acrylic or aramid fiber bound with nitrile. Products: Garlock "Bluegard," Klinger "Klingersil C4400," or equal. Gaskets shall be suitable for a pressure of 500 psi at a temperature of 400°F.

PART 3 - EXECUTION

A. Installing Flanged Piping

1. Set pipe with the flange bolt holes straddling the pipe horizontal and vertical centerline. Install pipe without springing, forcing, or stressing the pipe or any adjacent connecting valves or equipment. Before bolting up, align flange faces to the design plane within 1/16 inch per foot measured across any diameter. Align flange bolt holes within 1/8-inch maximum offset.

2. Clean flanges by wire brushing before installing flanged fittings. Clean flange bolts and nuts by wire brushing, lubricate carbon steel bolts with oil and graphite, and tighten nuts uniformly and progressively.

3. Bolt lengths shall extend completely through their nuts. Any which fail to do so shall be considered acceptably engaged if the lack of complete engagement is not more than one thread.

4. Do not use more than one gasket between contact faces in assembling a flanged joint.

5. If flanges leak under pressure testing, loosen or remove the nuts and bolts, reset or replace the gasket, reinstall or retighten the bolts and nuts, and retest the joints. Joints shall be watertight.

B. Installing Blind Flanges

1. At outlets not indicated to be connected to valves or to other pipes and to complete the installed pipeline hydrostatic test, provide blind flanges with bolts, nuts, and gaskets.

2. Coat the inside face of blind flanges per Section 099000, System No. 7.

C. Installation of Stainless Steel Bolts and Nuts

Prior to assembly, coat threaded portions of stainless steel bolts and nuts with lubricant.

END OF SECTION

SECTION 400515 PRESSURE TESTING OF PIPING

PART 1 - GENERAL

A. Description

This section specifies the hydrostatic and leakage testing of pressure piping for water mains.

B. Related Work Specified Elsewhere

Disinfection of Piping: 331300.

C. Submittals

1. Submit shop drawings in accordance with the General Provisions and Section 013300.

2. Submit test bulkhead locations and design calculations, pipe attachment details, and methods to prevent excessive pipe wall stresses.

3. Submit six copies of the test records to the Owner's Representative upon completion of the testing.

D. Test Pressures

Test pressures for the various services and types of piping are shown in Part 3.J.

E. Testing Records

Provide records of each piping installation during the testing. These records shall include:

1. Date and times of test.

2. Identification of pipeline or pipeline section tested or retested.

3. Identification of pipeline material.

4. Identification of pipe specification.

5. Test fluid.

6. Test pressure at low point in pipeline or pipeline section.

7. Remarks: Leaks identified (type and location), types of repairs, or corrections made.

8. Certification by Contractor that the leakage rate measured conformed to the specifications.

PART 2 - MATERIALS

A. Vents and Drains for Aboveground Piping

Install vents on the high points of aboveground piping, whether shown in the drawings or not. Install drains on low points of aboveground piping, whether shown in the drawings or not. Provide a valve at each vent or drain point. Valves shall be 3/4 inch.

B. Manual Air-Release Valves for Buried Piping

Provide temporary manual air-release valves at test bulkheads for pipeline test. Construct the pipe outlet in the same manner as for a permanent air valve and after use, seal with a blind flange, pipe cap, or plug and coat the same as the adjacent pipe.

C. Test Bulkheads

Design and fabricate test bulkheads per Section VIII of the ASME Boiler and Pressure Vessel Code. Materials shall comply with Part UCS of said code. Design pressure shall be at least 2.0 times the specified test pressure for the section of pipe containing the bulkhead. Limit stresses to 70% of yield strength of the bulkhead material at the bulkhead design pressure. Include air-release and water drainage connections.

D. Testing Fluid

1. Testing fluid shall be potable water.

2. Submit request for use of water from waterlines of Owner 48 hours in advance.

3. The Contractor may obtain the water from the Owner at no charge.

E. Testing Equipment

Provide calibrated pressure gauges, pipes, bulkheads, pumps, compressors, chart recorder, and meters to perform the hydrostatic testing.

PART 3 - EXECUTION

A. Testing Preparation

1. Pipes shall be in place, backfilled, and anchored before commencing pressure testing.

2. For buried piping, the pipe may be partially backfilled and the joints left exposed for inspection during an initial leakage test. Perform the final pressure test, however, after completely backfilling and compacting the trench.

3. Provide any temporary piping needed to carry the test fluid to the piping that is to be tested. After the test has been completed and demonstrated to comply with the specifications, disconnect and remove temporary piping. Do not remove exposed vent and drain valves at the high and low points in the tested piping; remove any temporary buried valves and cap the associated outlets. Plug taps or connections to the existing piping from which the test fluid was obtained.

4. Provide temporary drain lines needed to carry testing fluid away from the pipe being tested. Remove such temporary drain lines after completing the pressure testing. Pipes shall remain full after testing.

5. Prior to starting the test, the Contractor shall notify the Owner's Representative.

B. Cleaning

Before conducting hydrostatic tests, flush pipes with water to remove dirt and debris. Maintain a flushing velocity of at least 3 fps for water testing. Flush pipes for time period as given by the formula

$$T = \frac{2L}{3}$$

in which:

T = flushing time (seconds)

L = pipe length (feet).

C. Testing and Disinfection Sequence for Potable Water Piping

1. Perform required disinfection after hydrostatic testing, except when pipeline being tested is connected to a potable waterline.

2. Locate and install test bulkheads, valves, connections to existing pipelines, and other appurtenances in a manner to provide an air gap separation between existing potable water pipelines and the pipeline being tested. Disinfect water and pipeline being tested before hydrostatic testing when connected to a potable waterline.

D. Initial Pipeline Filling for Hydrostatic Testing

Maximum rate of filling shall not cause water velocity in pipeline to exceed 1 fps. Filling may be facilitated by removing automatic air valves and releasing air manually.

E. Hydrostatic Testing of Buried Piping

1. Where any section of the piping contains concrete thrust blocks or encasement, do not make the pressure test until at least 10 days after the concrete has been placed. When testing mortar-lined or PVC piping, fill the pipe to be tested with water and allow it to soak for at least 48 hours to absorb water before conducting the pressure test.

2. Apply and maintain the test pressure by means of a positive displacement hydraulic force pump.

3. Maintain the test pressure for four hours by restoring it whenever it falls an amount of 5 psi.

4. After the test pressure is reached, use a meter to measure the additional water added to maintain the pressure. This amount of water is the loss due to

leakage in the piping system. The allowable leakage volume is defined by the formula

$$L = \frac{HND(P)^{1/2}}{C}$$

in which:

L = allowable leakage (gallons)

H = specified test period (hours)

N = number of rubber-gasketed joints in the pipe tested

D = diameter of the pipe (inches)

P = specified test pressure (psig)

C = 7,400

5. The allowable leakage for buried piping having threaded, brazed, or welded (including solvent welded) joints shall be zero.

6. Repair and retest any pipes showing leakage rates greater than that allowed in the above criteria.

F. Repetition of Test

If the actual leakage exceeds the allowable, locate and correct the faulty work and repeat the test. Restore the work and all damage resulting from the leak and its repair. Eliminate visible leakage.

G. Bulkhead and Test Facility Removal

After a satisfactory test, remove the testing fluid, remove test bulkheads and other test facilities, and restore the pipe coatings.

H. Test Pressure and Test Fluids

Testing and design pressures (psig) shall be as listed below:

Pipe Service	Pipe Material	Testing Fluid	Design Pressure (psi)	Test Pressure (psi)
Potable Water: Inlet/Outlet lines	Steel, DI	Water	100	150

END OF SECTION

SECTION 402001 GENERAL REQUIREMENTS FOR STEEL PIPING

PART 1 - GENERAL

A. Description

This section includes general requirements for materials, fabrication, installation, and testing of steel pipe.

B. Related Work Specified Elsewhere

1. Painting and Coating: 099000.
2. General Piping Requirements: 400500.
3. Pressure Testing of Piping: 400515.
4. Fabricated Steel Specials: 402050.
5. CML&C Steel Pipe: 402066.

C. Submittals

1. Submit shop drawings in accordance with the General Provisions and Section 013300.
2. Submit materials list showing material of pipe and fittings with ASTM reference and grade. Submit manufacturer's certification of compliance with referenced standards, e.g., ASTM A 53, A 135, and A 587 and AWWA C200. Show piping service (fuel oil, gasoline, water, air, etc.).
3. For piping 6 inches and larger, submit piping layout drawings showing location and dimensions of pipe and fittings. Include laying lengths of valves, meters, in-line pumps, and other equipment determining piping dimensions. Label or number each fitting or piece of pipe and provide the following information for each item:
    a. Material of construction, with ASTM or API reference and grade.
    b. Wall thickness of steel cylinder.

SECTION 402001 GENERAL REQUIREMENTS FOR STEEL PIPING

PART 1 - GENERAL

A. Description

This section includes general requirements for materials, fabrication, installation, and testing of steel pipe.

B. Related Work Specified Elsewhere

1. Painting and Coating: 099000.

2. General Piping Requirements: 400500.

3. Pressure Testing of Piping: 400515.

4. Fabricated Steel Specials: 402050.

5. CML&C Steel Pipe: 402066.

C. Submittals

1. Submit shop drawings in accordance with the General Provisions and Section 013300.

2. Submit materials list showing material of pipe and fittings with ASTM reference and grade. Submit manufacturer's certification of compliance with referenced standards, e.g., ASTM A 53, A 135, and A 587 and AWWA C200. Show piping service (fuel oil, gasoline, water, air, etc.).

3. For piping 6 inches and larger, submit piping layout drawings showing location and dimensions of pipe and fittings. Include laying lengths of valves, meters, in-line pumps, and other equipment determining piping dimensions. Label or number each fitting or piece of pipe and provide the following information for each item:

   a. Material of construction, with ASTM or API reference and grade.

   b. Wall thickness of steel cylinder.

c. Mortar lining thickness (if pipe has been specified to have a mortar lining).

d. Mortar coating thickness, where mortar coating is required.

e. Paint prime coating, where prime coat is required.

f. Manufacturer's certificates of compliance with referenced pipe standards, e.g., ASTM A 53, ASTM A 135, API 5L, AWWA C200.

g. Show weld sizes and dimensions of grooved-end collars, flanges, reinforcing collars, wrapper plates, and crotch plates.

4. Submit coating application test records for field measuring paint coating thickness and holiday detection for each pipe section and fitting. Describe repair procedures used.

D. <u>NDT Qualification</u>

Personnel performing NDT shall meet the requirements of AWWA C200, Section 5 or shall be qualified as an AWS Certified Welding Inspector (CWI or SCWI) or shall hold a current AWS Radiographic Interpreter Certification.

PART 2 - MATERIALS

A. <u>Steel Pipe Cylinders</u>

1. The yield strength of the steel for pipe and fabricated fittings having grooved-end joints shall be minimum 35,000 psi.

2. Provide seamless pipe or pipe having straight longitudinal weld seams where pipe passes through rubber annular sealing devices.

B. <u>Fittings</u>

See Section 402050.

C. Grooved-End Couplings

1. Grooved-end couplings shall be ductile iron, ASTM A536, Grade 60-40-18 or 65-45-12. Gaskets shall be EPDM conforming to ASTM D2000.

2. Bolts shall conform to ASTM A193, Grade B8M, Class 2.

D. Flanges

1. Forged flange material shall conform to ASTM A 105, A 181, or A 182. Steel flange material shall conform to ASTM A283 (Grade C or D), A285 (Grade C), or A 36.

2. Flanges shall comply with AWWA C207, Class D or E as follows. Flanges shall be flat faced. Use the following pressure classes of flanges based on the specified test pressures:

Test Pressure (psi)	**Flange Pressure Class**
150	Class D
200	Class E

3. Provide flat-faced flanges as described above where connecting to cast-iron flanges and where otherwise indicated.

4. Blind flanges shall comply with AWWA C207, Table 7.

E. Bolts, Nuts, and Gaskets for Flanges

See Section 400500.

F. Lubricant for Stainless Steel Bolts and Nuts

See Section 400500.

PART 3 - EXECUTION

A. Fabrication, Assembly, and Erection

1. Beveled ends for butt-welding shall conform to ANSI B16.25. Remove slag by chipping or grinding. Surfaces shall be clean of paint, oil, rust, scale, slag, and other material detrimental to welding. When welding the reverse side, chip out slag before welding.

2. Fabrication shall comply with ANSI B31.3, Chapter V. Welding procedure and performance qualifications shall be in accordance with Section IX, Articles II and III, respectively, of the ASME Boiler and Pressure Vessel Code.

3. The minimum number of passes for welded joints shall be as follows:

Steel Cylinder Thickness (inch)	Minimum Number of Passes for Welds
Less than 0.1875	1
0.1875 through 0.25	2
Greater than 0.25	3

Welds shall be full penetration.

4. Use the shielded metal arc welding (SMAW) submerged arc welding (SAW), flux-cored arc welding (FCAW), or gas-metal arc welding (GMAW) process for shop welding. Use the SMAW process for field welding.

5. Welding preparation shall comply with ANSI B31.3, paragraph 328.4. Limitations on imperfections in welds shall conform to the requirements in ANSI B31.3, Table 341.3.2 and paragraph 341.4 for visual examination.

6. Identify welds in accordance with ANSI B31.3, paragraph 328.5.

7. Clean each layer of deposited weld metal prior to depositing the next layer of weld metal, including the final pass, by a power-driven wire brush.

8. Welding electrodes shall comply with AWS A5.1.

B. Reinforcement for Specials

See Section 402050.

C. Shop Testing of Fabricated or Welded Components

1. After completion of fabrication and welding in the shop and prior to the application of any lining or coating, test each component according to the referenced standards. Test fabricated fittings per AWWA C200. Test the seams in fittings that have not been previously shop

hydrostatically tested by the dye penetrant method as described in ASME Boiler and Pressure Vessel Code Section VIII, Appendix B. In lieu of the dye penetrant method of testing, completed fittings may be hydrostatically tested. Use the field hydrostatic test pressure or 125% of the design pressure, whichever is higher.

2. Plainly mark each length of straight pipe and each special and fitting at the bell end to identify the design pressure or head, the steel wall thickness, the date of manufacture, and the proper location of the pipe item by reference to the layout schedule. For beveled pipe, show the degree of bevel and the point on the circumference to be laid uppermost.

D. Installing Flanged Piping

See Section 400500.

E. Installation of Stainless Steel Bolts and Nuts

See Section 400500.

F. Installing Buried Piping

Install in accordance with Section 312316.

G. Field Hydrostatic Testing

Hydrostatically test pipe and fittings in the field in accordance with Section 400515. See Section 400515 for test pressures.

H. Painting and Coating

Coat the interior metal surfaces of blind flanges per Section 099000, System No. 7.

I. Coating Buried Bolts and Nuts

Coat buried bolts and nuts per Section 099000, System No. 24.

END OF SECTION

SECTION 402040 DUCTILE-IRON PIPE

PART 1 - GENERAL

A. Description

This section describes materials, testing, and installation of ductile-iron pipe and fittings 54 inches and smaller.

B. Related Work Specified Elsewhere

1. Painting and Coating: 099000.

2. Polyethylene Sheet Encasement (AWWA C105): 099754.

3. Trenching, Backfilling, and Compacting: 312316.

4. Disinfection of Piping and Structures: 331300.

5. General Piping Requirements: 400500.

6. Pressure Testing of Piping: 400515.

C. Submittals

1. Submit shop drawings in accordance with the General Provisions and Section 013300.

2. Provide an affidavit of compliance with standards referenced in this specification, e.g., AWWA C151. Submit copy of report of pressure tests for qualifying the designs of all sizes and types of AWWA C153 fittings that are being used in the project. The pressure test shall demonstrate that the minimum safety factor described in AWWA C153, Section 5.5 is met.

3. Provide the following information:

    a. Mortar lining thickness.

    b. Wall thickness.

    c. Show deflections at push-on and mechanical joints.

    d. Submit joint and fitting details and manufacturer's data sheets.

4. Submit calculations and test data proving that the proposed restrained joint arrangement can transmit the required forces with a minimum safety factor of 1.5.

5. Submit certificate that cement for mortar lining complies with ASTM C150, designating type.

6. Submit test report on physical properties of rubber compound used in the gaskets.

7. Submit drawing or manufacturer's data sheet showing flange facing, including design of facing serrations.

8. Submit weld procedure specification, procedure qualification record, and welder's qualifications prior to any welding to ductile-iron pipe.

PART 2 - MATERIALS

A. Pipe

Pipe shall be cast ductile (nodular) iron, conforming to AWWA C151. Provide pipe in nominal 18- or 20-foot laying lengths.

B. Pipe Marking

Plainly mark each length of straight pipe to identify the design pressure class, the ductile-iron wall thickness, and the date of manufacture. Mark the spigot end of restrained joint pipe to show clearly the required depth of insertion into the bell.

C. Pipe Wall Thickness

Minimum wall thickness for pipe having push-on or mechanical joints, restrained joints, plain ends, or cast flange ends shall be Class 350 per AWWA C151, unless otherwise shown in the drawings.

D. Fittings

Fittings shall conform to AWWA C110 with a minimum pressure rating of 350 psi. Material shall be cast or ductile iron. Flanges shall be flat faced.

E. Flanges

1. Flanges shall be solid back, Class 125 per AWWA C115. Flanges on pipe shall be either cast or threaded. Material shall be ductile iron.

2. Flanged pipe and fittings shall be shop fabricated, not field fabricated. Threaded flanges shall comply with AWWA C115. Flanges shall be individually fitted and machine tightened in the shop, then machined flat and perpendicular to the pipe barrel. Flanges shall be backfaced parallel to the face of flange. Prior to assembly of the flange onto the pipe, apply a thread compound to the threads to provide a leak-free connection. There shall be zero leakage through the threads at a hydrostatic test pressure of 250 psi without the use of the gasket.

F. Pipe Lining--Cement Mortar

1. Line pipe interior and fittings with cement-mortar per AWWA C104. Lining thickness shall be the double thickness listed in AWWA C104, Section 4.7. Cement for lining material shall conform to ASTM C150, Type II.

2. Line blind flanges per Section 099000, System No. 7.

3. Maintain a moist environment inside the lined pipe and fittings by sealing the ends with polyethylene sheet.

4. Loose areas of cement-mortar lining are not acceptable. Remove and reconstruct lining in areas where quality is defective, such as sand pockets, voids over sanded areas, blisters, drummy areas, cracked areas, and thin spots. Repair longitudinal cracks in excess of 1/32 inch in width or where crack extends to metal with epoxy. Repair all cracks larger than 1/16 inch with epoxy.

G. Gaskets for Flanges

See Section 400500.

H. Bolts and Nuts for Flanges

See Section 400500.

I. Joints

Joints in buried piping shall be of the push-on type per AWWA C111 except where flanged joints are required.

PART 3 - EXECUTION

A. Delivery, Unloading, and Temporary Storage of Pipe at Site

1. Use unloading and installation procedures that avoid cracking of the lining. If necessary, use plastic sheet bulkheads to close pipe ends and keep cement-mortar lining moist.

2. Deliver the pipe alongside the pipelaying access road over which the pipe trailer-tractors can travel under their own power. Place the pipe in the order in which it is to be installed and secure it from rolling.

3. Do not move pipe by inserting any devices or pieces of equipment into the pipe barrel. Field repair linings damaged by unloading or installation procedures.

B. Sanitation of Pipe Interior

1. During laying operations, do not place tools, clothing, or other materials in the pipe.

2. When pipelaying is not in progress, close the ends of the installed pipe by a child- and vermin-proof plug.

C. Installing Flanged Pipe and Fittings

Install in accordance with Section400500. Cut the bore of the gaskets such that the gaskets do not protrude into the pipe when the flange bolts are tightened.

D. Installing Buried Piping

1. Install in accordance with AWWA C600, Section 312316, and as follows.

2. When installing piping in trenches, do not deviate more than 1 inch from line or ¼ inch from grade. Measure for grade at the pipe invert.

3. Provide thrust blocks at fittings per Section 312316.

4. Assemble restrained joints per manufacturer's instructions.

E. Painting and Coating

1. Provide asphaltic coating on buried pipe per AWWA C151.
2. Coat buried bolts and nuts per Section 099000, System No. 24.

F. Polyethylene Encasement of Buried Pipe and Fittings

Wrap buried pipe, fittings, and joints with polyethylene per Section 099754.

G. Cleaning Pipe

After interior joints have been pointed and mortar has hardened, sweep pipe clean of all dirt and debris. If hardened mud exists in the pipe, remove with the use of pressurized water hoses.

H. Field Hydrostatic Testing

Test pressures are shown in Section 400515. Test in accordance with Section 400515.

END OF SECTION

SECTION 402050 FABRICATED STEEL SPECIALS

PART 1 - GENERAL

A. Description

This section includes materials and fabrication of steel pipe specials of sizes 4 through 120 inches, in accordance with AWWA C200, C205, and C208 and the following options and restrictions, for use in manifold piping facilities, such as pumping stations, metering structures, and other piping associated with mechanical equipment.

B. Specials

A special is defined as any piece of pipe other than a normal full-length straight section. This includes but is not limited to elbows, manhole sections, short pieces, reducers, adapter sections with special ends, sections with outlets, etc.

C. Related Work Specified Elsewhere

1. General Piping Requirements: 400500.

2. Pressure Testing of Piping: 400515.

3. General Requirements for Steel Piping: 402001.

4. CML&C Steel Pipe: 402066.

D. Submittals

1. Submit shop drawings in accordance with the General Provisions and Section 013300.

2. Submit drawings for fabricated steel specials showing dimensions, wall thickness, reinforcing at openings, type of coating, and lining. Label or number each special and provide the following information:

    a. Material of construction, with ASTM or API reference and grade.

    b. Paint primer coating, where primer coat is required.

c. Weld sizes and dimensions of grooved-end collars, flanges, reinforcing collars, wrapper plates, and crotch plates.

3. Submit affidavit of compliance with referenced standards (e.g., AWWA C208, ASTM A53, etc.).

4. Submit welding procedure specifications (WPS) and procedure qualification records (PQR) for each welding process and welder qualification records (WQR) for each welder and welding operator.

5. Submit certified original copies of mill test reports on each heat from which steel is rolled. Tests shall include physical and chemical properties. Submit certified original copies of mill test reports for flanges including details of stress relief used. Manufacturer's certificates of compliance with referenced pipe standards, e.g., ASTM A53, ASTM A135, API 5L. Provide recertification by an independent domestic testing laboratory for materials originating outside of the United States.

6. Submit dimensional check reports on each steel pipe special after fabrication.

7. Submit manufacturer's certificates of welding consumables used for shop and field welding.

PART 2 - MATERIALS

A. <u>Fittings and Specials</u>

1. Provide cement-mortar lined and coated fabricated steel fittings for buried service.

2. Provide fabricated cement-mortar lined steel fittings for exposed service.

3. Mortar Lining: See Section 402066.

4. Ends of the fittings shall be compatible with the pipe joint for the particular type of pipe to which the steel fittings or specials connect.

B. Steel Fittings

1. A fitting is defined as a special piece of pipe other than a normal straight section. Elbows, manhole sections, reducers, and sections with outlets are fittings.

2. Unless stated otherwise in the detailed pipe specifications, fittings shall comply with ANSI B16.9 or AWWA C208, as follows:

   a. Specials and wrought steel butt-welded fittings 4 through 10 inches shall comply with ASME B16.9. Wall thickness shall be standard weight per ASME B36.10. Material shall comply with ASTM A234, Grade WPB. Elbows shall be of the long-radius type unless otherwise shown in the drawings.

   b. For tees and crosses, comply with ASME B16.9 or AWWA C208, Figure 1 and Table 1. Minimum wall thickness for fittings smaller than 12 inches shall be standard weight per ASME B36.10. Minimum wall thickness for fittings 12 inches and larger shall be the same as specified for the pipe cylinder in Section 402066.

   c. For reducing tees, laterals, wyes, reducers, and tangent outlets, comply with AWWA C208, Section 4. Reducers complying with ASME B16.9 may also be used. Minimum wall thickness for fittings smaller than 12 inches shall be standard weight per ASME B36.10. Minimum wall thickness for fittings 12 inches and larger shall be per Section 402066.

   d. For mitered elbows 42 inches and smaller, provide the number of pieces and wall thicknesses of 0.375 inch as tabulated below:

Class A (degrees)	**Class B (degrees)**	**No. of Pieces**
0 to 30	0 to 22.5	2
31 to 60	22.5 to 45	3
61 to 90	45 to 67.5	4
	67.5 to 90	5

e. Locate field-welded lap joints no closer than 4 feet 0 inches to a miter.

3. If no design pressure is shown in the drawings, assume the design pressure to be the test pressure, with a minimum design pressure of 200 psi.

4. Material for fabricated fittings 12 through 30 inches in diameter shall be the same as the pipe or shall comply with ASTM A283 (Grade C or D), ASTM A285 (Grade C), ASTM A36, or ASTM A572 (all grades).

5. Minimum mortar lining thickness shall comply with Section 402066.

C. Flanges

See Section 402001.

D. Bolts, Nuts, and Gaskets for Flanges

See Section 400500.

PART 3 - EXECUTION

A. Fabrication, Assembly, and Erection of Steel Specials

See Section 402001.

B. Reinforcement for Fittings 42 Inches and Smaller

1. The requirement for additional reinforcement of fabricated fittings at branches and openings shall be determined by the procedure given in ANSI B31.3, paragraph 304.3 and Appendix H. If additional reinforcement is required, it shall be accomplished as described below.

2. Select the type of reinforcement for fittings with outlets from the following table:

$$R = \frac{\text{ID outlet}}{\text{ID main run x sinB}}$$

where B = Angle between the longitudinal axis of the main run and the branch

R	**Type of Reinforcement**
Maximum of 0.5	Collar
Maximum of 0.7	Wrapper Plate
No limit	Crotch Plate

When outlets are located opposite each other in a special (i.e., a cross), the limiting values of "R" shall be 0.25 and 0.35, respectively.

C. Collar Reinforcement

1. For collar reinforcement, select an effective shoulder width "W" of a collar from the inside surface of the steel outlet to the outside edge of the collar, measured on the surface of the cylinder of the main run, such that:

$$W = (1/3 \text{ to } 1/2) \times \frac{\text{ID outlet}}{\sin B}$$

2. For collar reinforcement of tangential outlets, use

$$\text{SinB} = \sqrt{\frac{\text{OD outlet}}{\text{OD main run}}}$$

3. The minimum thickness "T" of the collar is determined by:

$$T = \frac{P \times \text{ID main run} \times \text{ID outlet} \times (2 - \sin B)}{4 \times F \times W \times \sin B}$$

where:

P = Design pressure

F = Allowable design stress

= 40% of minimum yield stress

B = As in Part 2 above.

4. Collars may be oval in shape or rectangular with rounded corners.

D. Wrapper Plate Reinforcement

For a wrapper plate, use the above collar formula except that the wrapper is of thickness "T," its total width is (2W + ID outlet/sinB), and it extends entirely around the main pipe diameter portion of the steel fitting.

E. Crotch Plate Reinforcement

Base crotch plate design on Swanson, H.S. et al., *Design of Wye Branches for Steel Pipes*, summarized in AWWA Manual M11 (1989 edition), Chapter 13.

F. Shop Testing of Fabricated Specials

See Section 402001.

G. Hydrostatic, Radiographic, Ultrasonic, Soap and Compressed Air, Liquid Penetrant, and Magnetic Particle Test Methods

See Section 402001.

H. Field Hydrostatic Testing

See Section 402001.

END OF SECTION

SECTION 402066 CML&C STEEL PIPE

PART 1 - GENERAL

A. Description

This section includes materials, fabrication, installation, and testing of cement-mortar lined and coated steel pipe for manifold piping in facilities such as pumping stations. Sizes are 6 through 42 inches.

B. Related Work Specified Elsewhere

1. Painting and Coating: 099000.
2. Trenching, Backfilling, and Compacting: 312316.
3. General Piping Requirements: 400500.
4. Pressure Testing of Piping: 400515.
5. General Requirements for Steel Piping: 402001.
6. Fabricated Steel Specials: 402050.

C. Submittals

Submit shop drawings in accordance with Section 402001.

PART 2 - MATERIALS

A. Steel Pipe Cylinders

1. Steel pipe 18 inches and smaller in diameter shall be API 5L, Grade B; ASTM A 53 (Type E or S), Grade B; ASTM A 106, Grade B; or ASTM A 135, Grade B.
2. See Section 402001 for additional requirements.

B. Mortar Lining and Coating

1. Pipe 12 through 18 inches having joints other than grooved-end shall have dimensions as shown in the following table:

Nominal Pipe Size (inches)	Steel Cylinder Outside Diameter (inches)	Steel Cylinder Wall Thickness (inches)	Mortar Lining Thickness (inches)	Net Pipe Inside Diameter (inches)
16	18	1/4	3/4	16

2. Pipe 20 inches and larger having a maximum design pressure of 150 psi shall have dimensions as shown in the following table:

Nominal Pipe Size (inches)	Minimum Steel Cylinder Wall Thickness (inches)	Minimum Mortar Lining Thickness (inches)	Net Pipe Inside Diameter (inches)
20	3/8	5/16	20
24	3/8	3/8	24

Select mortar lining and steel cylinder thickness to yield net pipe internal diameter shown.

3. Apply mortar lining in accordance with AWWA C205, using the lining thicknesses specified above. Cement shall be ASTM C 150, Type II.

4. Buried pipe shall be cement-mortar coated per AWWA C205. Cement shall be ASTM C 150, Type II. Mortar coating thickness shall be 1 inch minimum.

5. Hold back the cement-mortar coating 12 inches (minimum) from the end of the plain-end joint where flexible pipe couplings are to be installed.

C. Fittings

1. A fitting is defined as a special piece of pipe other than a normal straight section. Elbows, manhole sections, reducers, and sections with outlets are fittings. See Sections 402001 and 402050.

2. Fittings 12 inches and larger shall comply with Section 402050.

3. Material for fittings larger than 10 inches but less than or equal to 30 inches in diameter shall comply with Section 402050.

4. Grooved-end fittings smaller than 20 inches shall be square-cut grooved, flexible type, with the groove dimensions as shown in AWWA C606, Table 3. Lining and coating of grooved-end fittings shall be as specified previously for pipe. Steel wall thickness shall be standard weight, ANSI B36.10. Mortar lining and inside diameter dimensions shall be the same as the pipe specified previously.

5. Mortar lining thickness and internal diameter dimensions shall be the same as the pipe.

D. Joints

1. Joints for aboveground piping shall be flanged or grooved end, except where flanged joints are required to connect to valves, pumps, and other equipment.

2. Buried joints shall be butt strap welded or bell-and-spigot lap welded, except where flanged joints are required to connect to valves, meters, and other equipment.

3. Grooved-end joints for pipes 18 inches and smaller shall be flexible, square-cut grooved, per AWWA C606, Table 3.

4. See Section 402001 for additional requirements.

E. Flanges

See Section 402001.

F. Bolts and Nuts for Flanges

See Section 400500.

G. Lubricant for Stainless Steel Bolts and Nuts

See Section 400500.

H. Gaskets for Flanges

See Section 400500.

PART 3 - EXECUTION

A. Fabrication, Assembly, and Erection

See Section 402001.

B. Reinforcement

See Section 402001.

C. Shop Testing of Fabricated or Welded Components

See Section 402001.

D. Buried Joints

1. Field-welded joints shall be made in compliance with AWWA C206 and the subsection on "Fabrication, Assembly, and Erection" above.

2. Apply cement mortar to the inside and outside of buried joints per Section 4.7 of AWWA C205. Use cloth diapers to bridge the outside of the buried joint and maintain the specified mortar coating thickness. Pour and rod the mortar from one side only until it is visible on the opposite side.

E. Installing Flanged Piping

See Section 400500.

F. Installation of Stainless Steel Bolts and Nuts

See Section 400500.

G. Installing Buried Piping

Install in accordance with Sections 312316 and 402001.

H. Field Pressure Testing

See Section 402001.

I. Coating Buried Bolts and Nuts

See Section 402001.

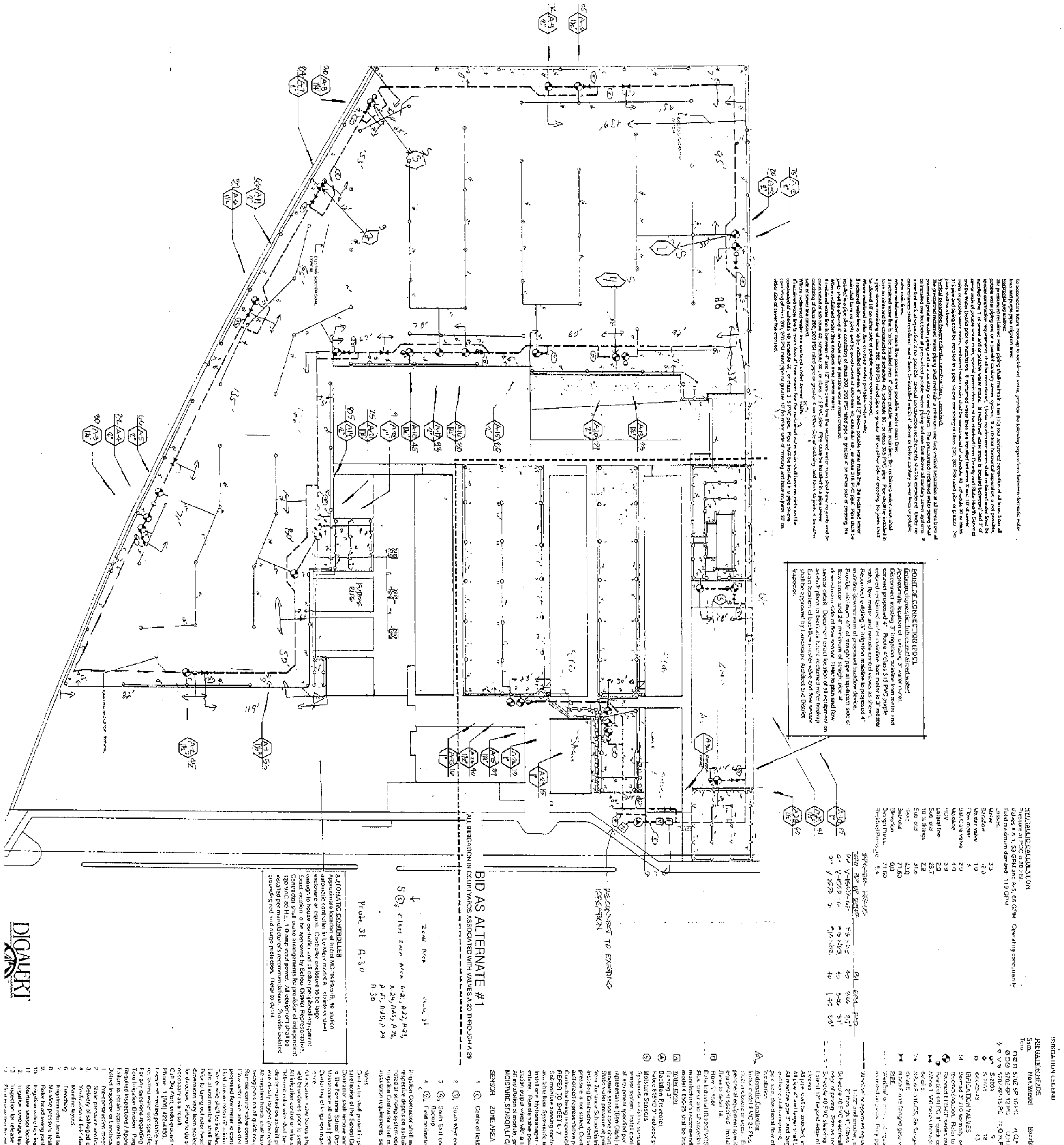
END OF SECTION

SECTION F

RECORD DRAWINGS

EXISTING SCHOOL SPRINKLER SYSTEM

Contractoris is responsible for relocation of existing sprinkler lines, valves, and related hardware, as necessary to accommodate construction of piping and other fixtures under this contract. Contractor shall provide shop drawings for design of proposed relocation plans for approval by Owner prior to proceeding with the work. A copy of the existing sprinkler plans are attached to this section



R. DALE HADFIELD, ASLA
LANDSCAPE ARCHITECT
26041 Cape Drive, Suite 23, Laguna Niguel, California 92677 • (714) 367-9275 • FAX (714) 367-9321

SHEET TITLE: YUKON ELEMENTARY IRRIGATION PLAN

PROJECT: TORRANCE U.S.D.
2335 PLAZA DEL AMO
TORRANCE, CA 90509

L-3

SECTION G

GEOTECHNICAL STUDY REPORT

Converse Consultants

Geotechnical Engineering, Environmental & Groundwater Science, Inspection & Testing Services

GEOTECHNICAL STUDY REPORT
North Torrance Wellfield Project
Torrance, California

Converse Project No. 10-31-228-01

August 11, 2011

PREPARED FOR:

AECOM
1501 Quail Street
Newport Beach, CA 92660

222 East Huntington Drive, Suite 211, Monrovia, California 91016-3500
Telephone: (626) 930-1200 ♦ Facsimile: (626) 930-1212 ♦ e-mail: converse@converseconsultants.com

Converse Consultants

Geotechnical Engineering, Environmental & Groundwater Science, Inspection & Testing Services

August 11, 2011

Mr. Russ Hulse, P.E.
AECOM
1501 Quail Street
Newport Beach, California 92660

Subject: **GEOTECHNICAL STUDY REPORT**
North Torrance Wellfield Project
Torrance, California
Converse Project No. 10-31-228-01

Dear Mr. Hulse:

Enclosed is the Geotechnical Study Report prepared by Converse Consultants (Converse) for the planned North Torrance Wellfield Project in the City of Torrance, California. Our services were performed in accordance with our proposal dated May 17, 2010, and our Subconsultant Agreement with AECOM dated October 15, 2010.

Based on the results of our background review and project-specific field exploration, laboratory testing, and geotechnical analysis, the site is considered suitable from a geotechnical standpoint for construction of the proposed facilities and pipelines associated with the North Torrance Wellfield Project, provided our conclusions and recommendations are implemented during design and construction.

We appreciate this opportunity to be of service to AECOM and the City of Torrance. If you should have any questions please do not hesitate to contact us at (626) 930-1200.

CONVERSE CONSULTANTS

William H. Chu, P.E., G.E.
Senior Vice President/Principal Engineer

Dist: 5/Addressee

GDS/SCL/WHC/amm

PROFESSIONAL CERTIFICATION

This report for the proposed North Torrance Wellfield Project in Torrance, California has been prepared by the staff of Converse under the professional supervision of the individuals whose seals and signatures appear hereon.

The findings, recommendations, specifications or professional opinions contained in this report were prepared in accordance with generally accepted professional engineering and engineering geologic principles and practice in this area of Southern California. There is no warranty, either expressed or implied.

In the event that changes to the property or project occur, or additional, relevant information about the property is brought to our attention, the conclusions contained in this report may not be valid unless these changes and additional relevant information are reviewed and the recommendations of this report are modified or verified in writing.

REGISTERED PROFESSIONAL ENGINEER
CHI-HSIN LIN
No.2921
Exp. 9/30/12
GEOTECHNICAL
STATE OF CALIFORNIA

Sean C. Lin, Ph.D., P.E., G.E.
Senior Engineer

PROFESSIONAL GEOLOGIST
Geoffrey Daniel Stokes
NO. 2266
CERTIFIED ENGINEERING GEOLOGIST
Exp. 7/31/13
STATE OF CALIFORNIA

Geoffrey D. Stokes, P.G., C.E.G.
Senior Geologist

REGISTERED PROFESSIONAL ENGINEER
CHU HSUEH-HSIN WILLIAM
No. 2482
Exp. 6/30/11
GEOTECHNICAL
STATE OF CALIFORNIA

William H. Chu, P.E., G.E.
Senior Vice President / Principal Engineer

EXECUTIVE SUMMARY

The following is the summary of our Geotechnical Study Report with our findings, conclusions, and recommendations presented in the body of this report. Please refer to the appropriate sections of this Geotechnical Study Report for more detailed discussion of our conclusions and recommendations. In the event of a conflict between this executive summary and the report, or an omission in the summary, the report content shall prevail.

- The North Torrance Wellfield Project consists of the following elements:
  1. Well No. 10 within the 1.5 acre parcel west of Yukon Elementary School.
  2. Booster Pump Station and Utility building within the 1.5 acre parcel west of Yukon Elementary School.
  3. One three-million-gallon storage tank within the 1.5 acre parcel west of Yukon Elementary School.
  4. Well No. 11 planned southeast of Yukon Elementary School within an approximately 40-foot-wide strip of level land at the top of a 3- to 8-foot-high descending slope.
  5. New water pipelines to connect existing Well No. 9 at McMaster Park and planned Well No. 11 with the proposed storage tank site west of Yukon Elementary School.
  6. New drain pipeline installed below the Caltrans Right-of-Way (Interstate 405) for connection from the storage tank pipeline easement to the existing storm drain system located near the intersection of Yukon Avenue and W. 182nd Street.
- Our subsurface exploration was performed with the aid of truck-mounted hollow-stem auger borings drilled between depths of approximately 16.5 to 31.5 feet below existing grades.
- In general, soils below the well sites and planned pipeline alignments consist of relatively firm to stiff clay, based on soil type classification and sampling blow-count correlation. Undocumented fill soils ranging in depth from approximately 6.5 to 11.5 feet were encountered in the area of the proposed storage tank and booster pump/utility building. Remedial grading will be needed for foundation support.
- Groundwater levels monitored since 1949 have been recorded at depths of 75 feet or deeper from the ground surface. Groundwater was not encountered in the borings drilled to depths of up to 31.5 feet below grade. In general, groundwater is anticipated to fluctuate with seasonal variations but is not anticipated during construction of the planned improvements.
- The upper five (5) feet of native site soils sampled and tested have a medium expansion potential, and the upper five (5) feet of undocumented fill soils sampled and

tested have a very low expansion potential. Expansive soil mitigation measures for improvements supported on future fill soils derived from on-site and imported sources are recommended.

- Site soils (undocumented fill and native) have concentrations of water soluble sulfates considered non-corrosive to concrete.
- Laboratory testing indicates that site soils (undocumented fill and native) are considered potentially corrosive to ferrous metals.
- The fine-grained soils (undocumented fill and native) below the area of the planned storage tank and booster pump/utility building were tested for collapse/consolidation, with the test results indicating a moderate potential for consolidation under saturated conditions.
- The site is not located within a mapped Seismic Hazard Zone for either liquefaction or slope instability.
- There are no known active faults projecting toward or extending across the proposed site. The site is not situated within a currently designated Earthquake Fault Zone for ground rupture hazard.
- Although clear of geologic hazards associated with fault ground rupture, liquefaction, and slope instability, the site is located within a seismically active area and will be subject to intense ground motion during a significant seismic event. Site-specific parameters have been calculated in general accordance with the 2010 California Building Code.
- The planned at-grade structures for well equipment, storage tank and booster pump/utility building can be supported on shallow footings or slab-on-grade bearing on compacted fill. Buildings can be supported on shallow footings bearing on future compacted fill.
- Site preparation for well structures will require over-excavation on the order of 2 feet from existing grade for support of concrete pads. The remedial grading should extend at least 2 feet beyond the well foundation slab.
- Site preparation for proposed storage reservoir tank and booster pump/utility building will require over-excavation and placement of compacted fill for support of concrete pads and foundations. Over-excavation for reservoir should be at least 8 feet below existing grade, or to the depth of fill, whichever is deeper. Over-excavation for building should be at least 12 feet below existing grade, or to the depth of fill, whichever is deeper.
- It is expected that the near-surface site soils can be excavated with conventional heavy-duty earth-moving equipment in good working condition. Shoring or sloped excavations should be anticipated for excavations deeper than approximately 5 feet. Excavated site soils free of organic matter and demolition debris are considered

suitable for placement as compacted fill after proper processing. Such processing may include moisture conditioning and mixing, and removal/screening of oversized debris.

Results of our study indicate that the areas of planned site improvements are suitable for the proposed development from a geotechnical standpoint, provided that the recommendations contained in this report (including over-excavation) are incorporated into the design and construction of the various projects discussed herein.

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Appendices

1.0 INTRODUCTION

This report contains the findings and recommendations of our geotechnical study performed for the proposed North Torrance Wellfield Project located in Torrance, California, as illustrated on Drawing No. 1, *Site Location Map*.

The purpose of this Geotechnical Study Report is to provide the results of our background review, subsurface exploration, laboratory testing, and geotechnical analyses, and to present geologic and geotechnical design parameters for use by the project design team.

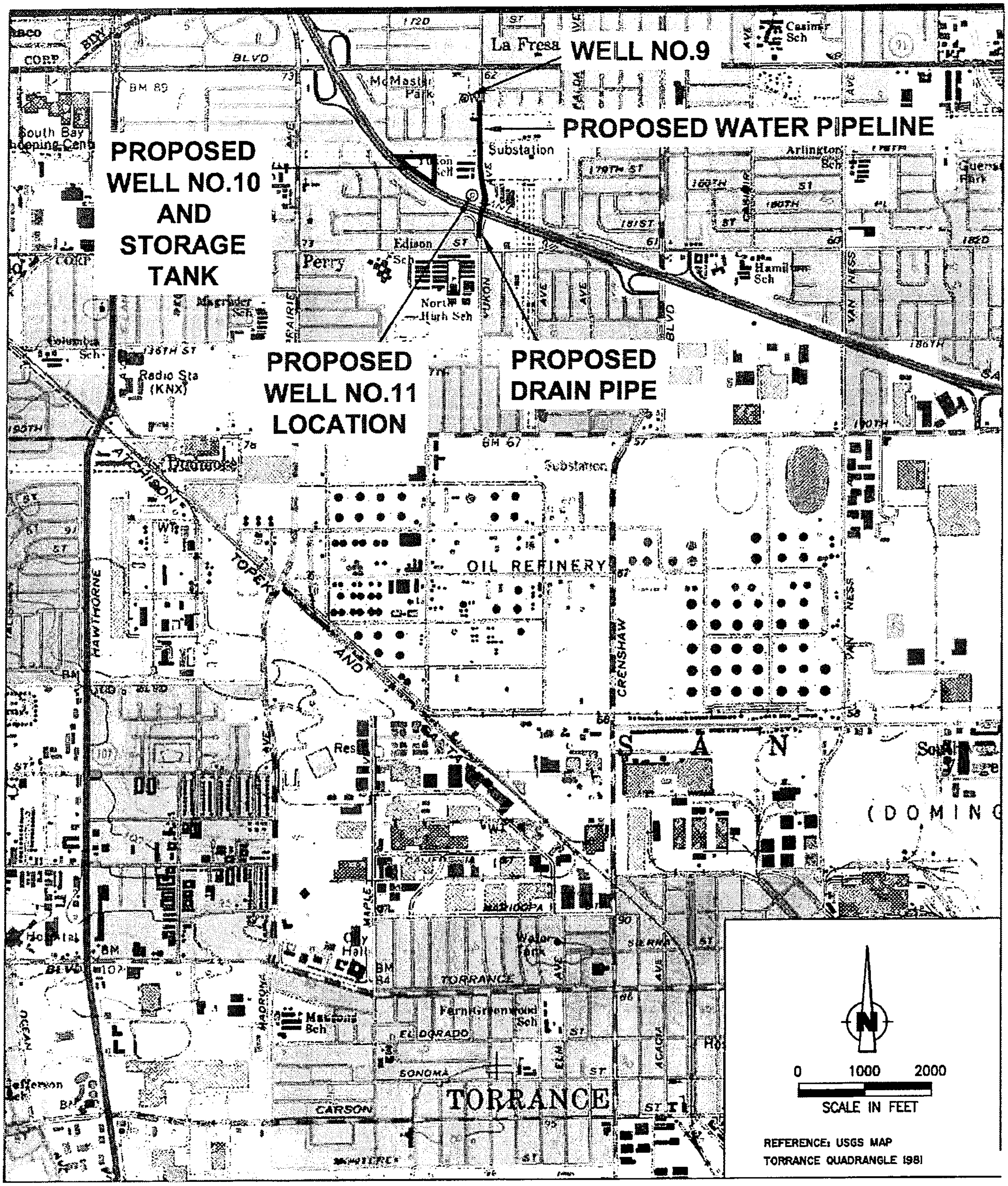
This report is written for the major project elements described herein, illustrated on Drawing Nos. 2a through 2e, *Approximate Location of Borings,* and listed on Table No. 1, *Summary of North Torrance Wellfield Project*.

The findings and recommendations of this Geotechnical Study Report are intended for use solely by AECOM and the project design team. This report should not be used as a bidding document but may be made available to the potential contractors for information on factual data only. For bidding purposes, the contractors should be responsible for making their own interpretation of the data contained in this report.

2.0 PROJECT AND SITE DESCRIPTIONS

The main area of the proposed North Torrance Wellfield Project is located on a triangular shaped, 1.5 acre parcel of undeveloped land located adjacent to and west of Yukon Elementary School. The parcel is bound by to the north by a Southern California Edison (SCE) transmission line easement and to the southwest and south by a Caltrans right-of-way for Interstate 405. Existing site topography is relatively flat.

A summary of the various elements of the planned North Torrance Wellfield Project are listed on the following table:



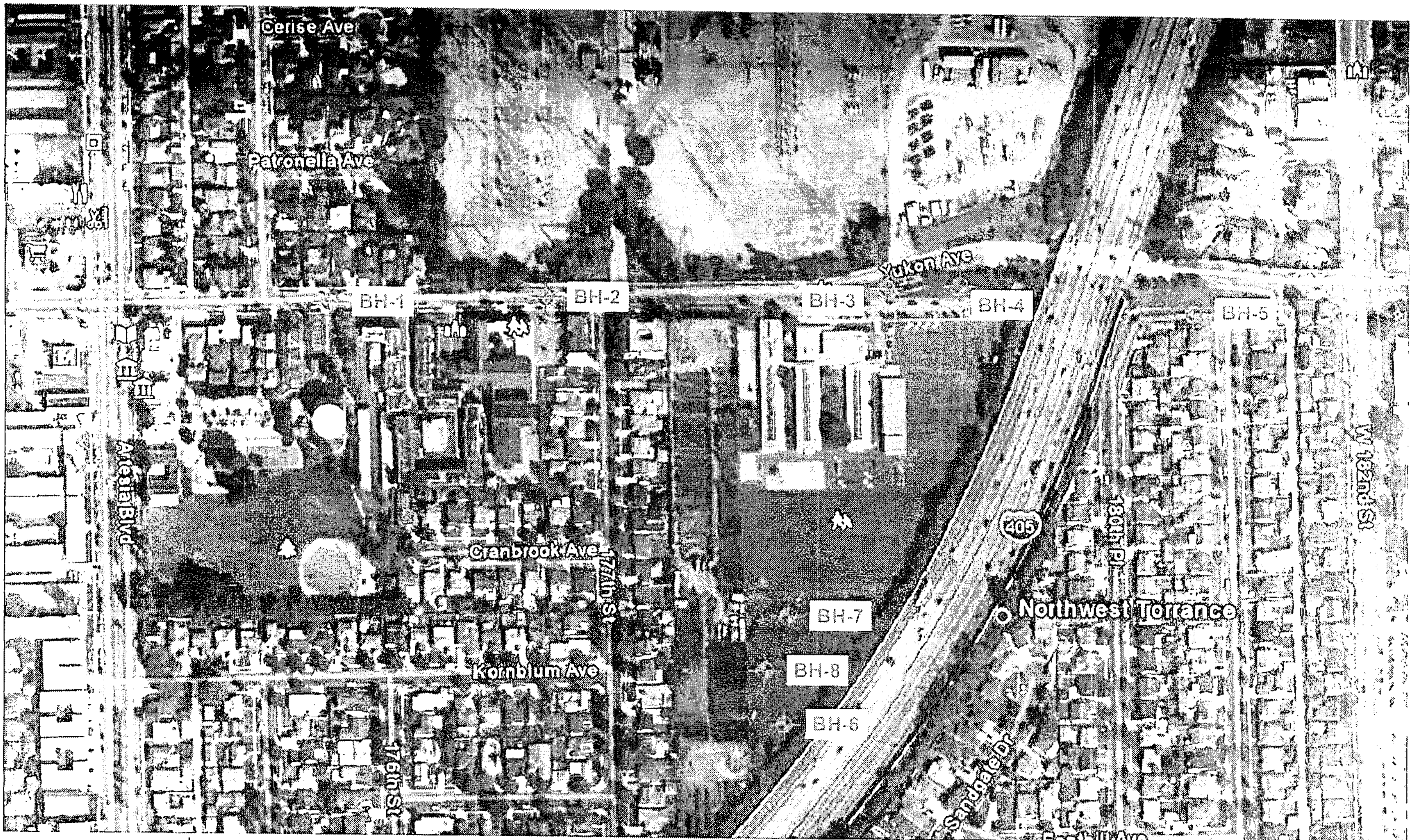
SITE LOCATION MAP

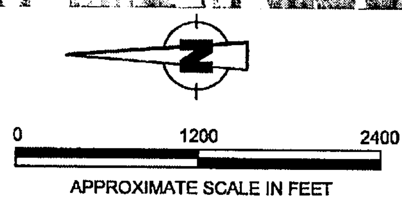
NORTH TORRANCE WELLFIELD PROJECT
TORRANCE, CALIFORNIA

Project No.
10-31-228-01

Drawing No.
1

Converse Consultants



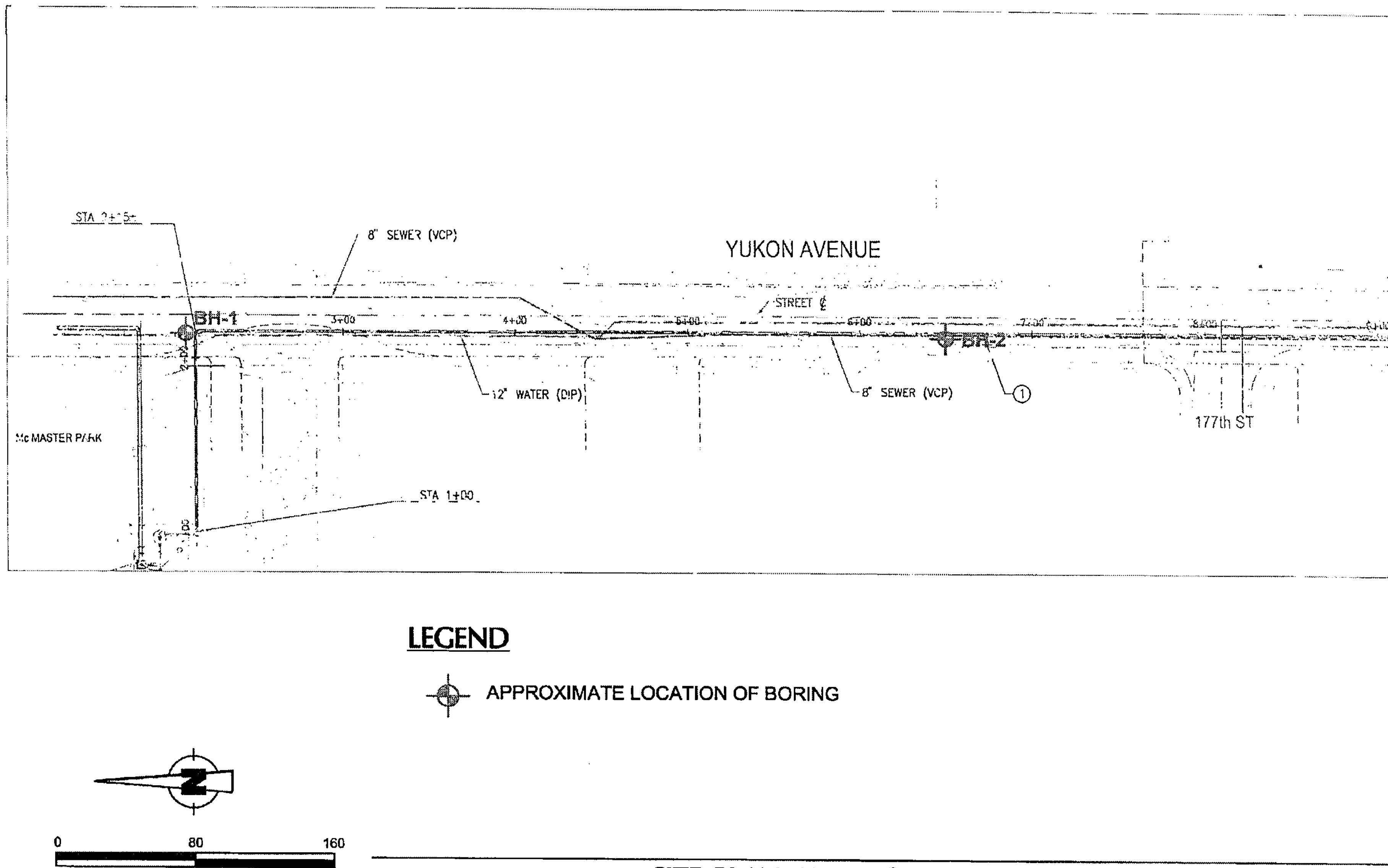


LEGEND

APPROXIMATE LOCATION OF BORING

SITE PLAN AND BORING LOCATION

Converse Consultants	NORTH TORRANCE WELLFIELD PROJECT TORRANCE, CALIFORNIA	Project No. 10-31-228-01	Drawing No. 2a



LEGEND

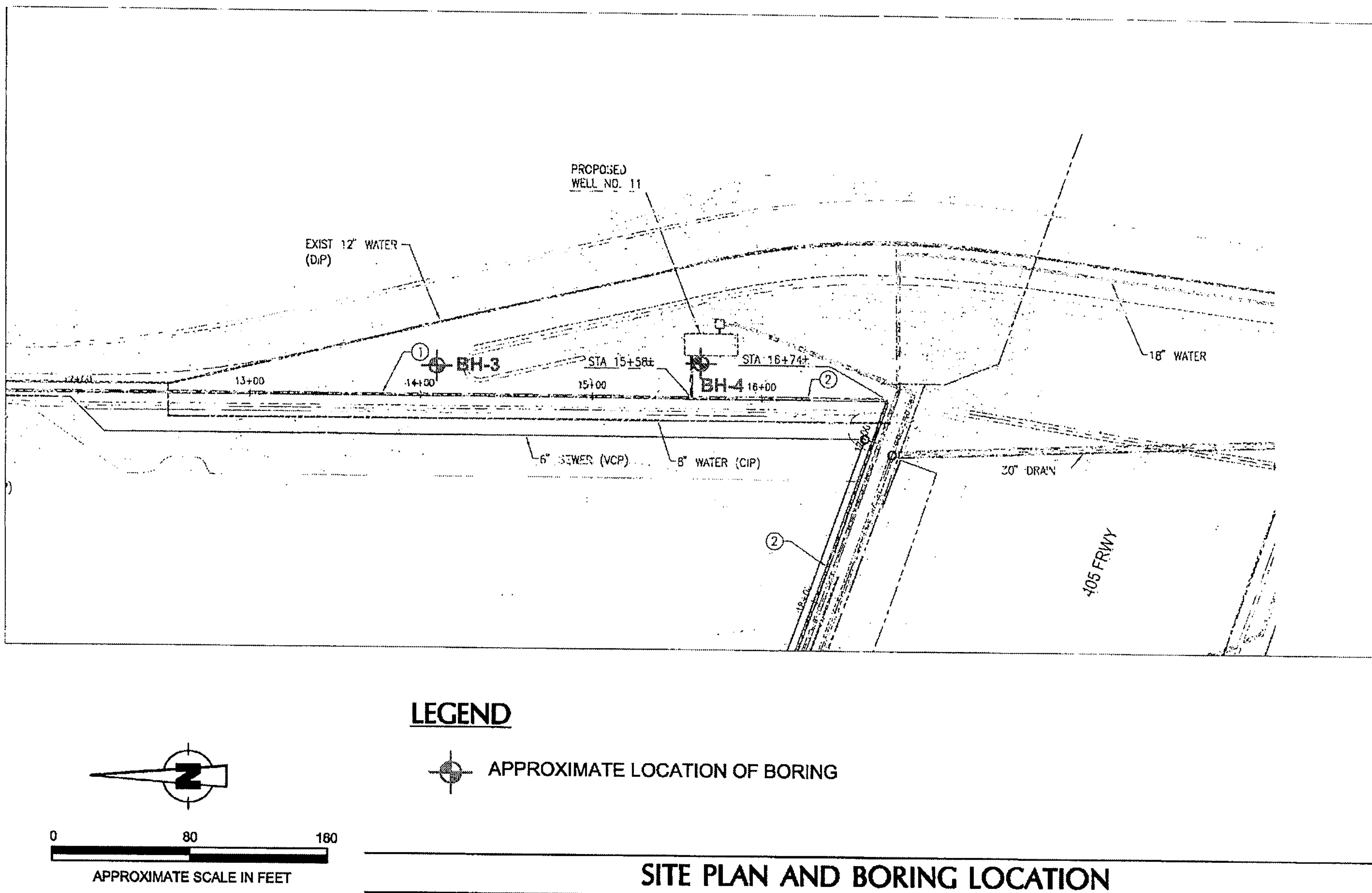
APPROXIMATE LOCATION OF BORING

SITE PLAN AND BORING LOCATION

Converse Consultants

NORTH TORRANCE WELLFIELD PROJECT
TORRANCE, CALIFORNIA

Project No.	Drawing No.
10-31-228-01	2b

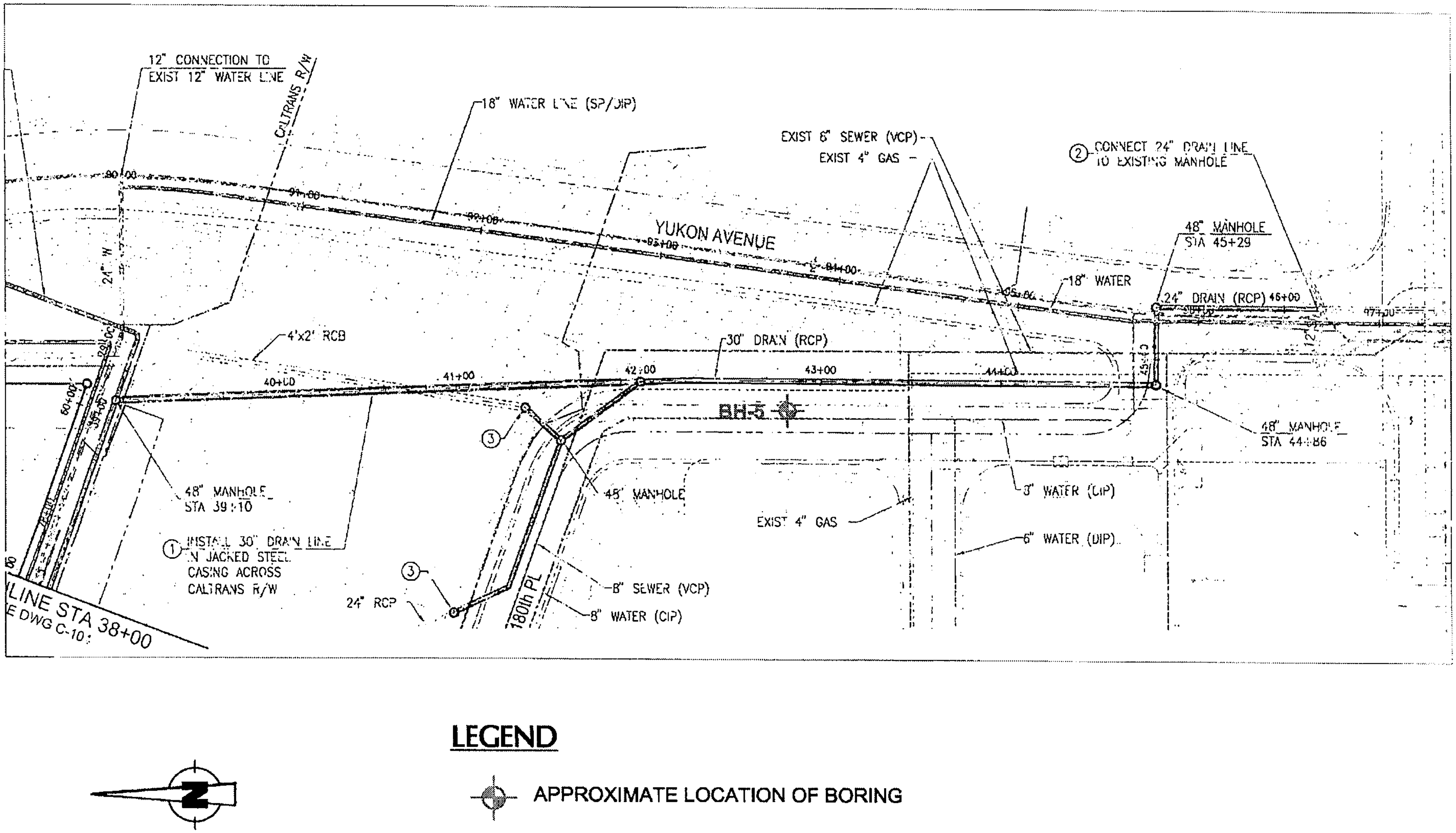


SITE PLAN AND BORING LOCATION

Converse Consultants

NORTH TORRANCE WELLFIELD PROJECT
TORRANCE, CALIFORNIA

Project No.	Drawing No.
10-31-228-01	2c

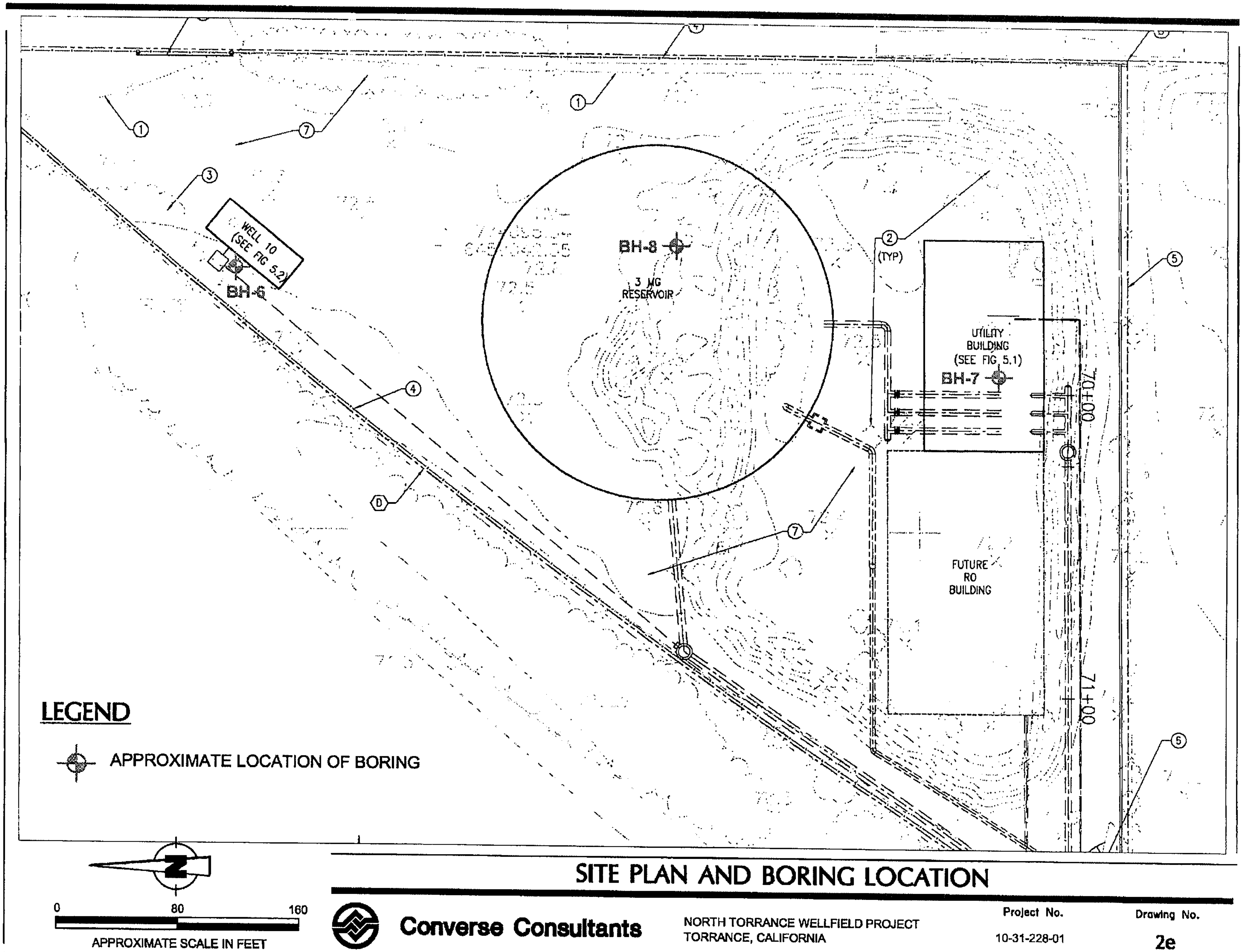


SITE PLAN AND BORING LOCATION

Converse Consultants

NORTH TORRANCE WELLFIELD PROJECT
TORRANCE, CALIFORNIA

Project No.	Drawing No.
10-31-228-01	2d



SITE PLAN AND BORING LOCATION

Converse Consultants

NORTH TORRANCE WELLFIELD PROJECT
TORRANCE, CALIFORNIA

Project No.	Drawing No.
10-31-228-01	2e

Table No. 1, Summary of North Torrance Wellfield Project

Project Component	Component Location	Site Description
Well No. 10	1.5 acre parcel west of Yukon Elementary School	Relatively flat vacant parcel
Booster Pump Station/ Utility Building	1.5 acre parcel west of Yukon Elementary School	Relatively flat vacant parcel
Three-million-gallon storage tank	1.5 acre parcel west of Yukon Elementary School	Relatively flat vacant parcel
Well No. 11	Approx. 40-foot-wide strip of land located southeast of Yukon Elementary School	Approx. 40-foot-wide level grass area situated at the top of a 3- to 8-foot-high descending slope
New water pipelines to connect existing Well No. 9 at McMaster Park and planned Well No. 11 with the proposed storage tank site	Alignment planned from the southeast corner of McMaster Park (Well No. 9 location) southward toward area of planned Well No. 11, then extending westerly toward .5 acre parcel west of Yukon Elementary School	Relatively level roadway (Yukon Avenue) and relatively flat vacant parcel
New drain pipeline	Extending southward from the southeast end of the easement for the proposed storage tank, to the existing storm drain system located on Yukon Avenue at W. 182nd Street.	Extending below the Caltrans Right-of-Way (Interstate 405) to the residential neighborhood located along the west side of Yukon Avenue, north of W. 182nd Street.

3.0 SITE COORDINATES

The coordinates representative of the three-million gallon storage tank were used to calculate earthquake ground motions with the United States Geological Survey computer program, *Seismic Hazards Curves, Response Parameters and Design Parameters, Version 5.0.9a.* These coordinates are north latitude 33.8689 degrees, west longitude 118.3378 degrees. Earthquake ground motions calculated from these coordinates are considered representative for all components of the planned North Torrance Wellfield Project.

4.0 SCOPE OF WORK

Our scope of work has consisted of the following tasks:

4.1 Task I: Project Set-up

Converse obtained an excavation permit from the City of Torrance Community Development Department prior to initiating the subsurface exploration. Coordination and preparation of traffic control plans were also performed by Converse as a part of the permit acquisition.

After obtaining the City permit, a Converse representative visited the site to mark the boring locations for utility clearance. Eight (8) boring locations (BH-1 through BH-8) were marked within the proposed project areas. Underground Service Alert of Southern California (USA) was notified of our proposed drilling locations 48 hours prior to initiation of the subsurface field work.

4.2 Task II: Field Investigation

Subsurface exploration and soil sampling was performed to evaluate the soil conditions in the areas of planned North Torrance Wellfield Project improvements. The number and locations of the borings were based in part on the Request for Proposal (RFP) to Provide Preliminary Design Services for the North Torrance Wellfield Project issued by the City of Torrance on April 28, 2010. The planned project has been modified since issuance of the RFP, therefore number and locations of the exploratory borings outlined in our May 17, 2010 proposal were also modified to better serve the needs of the project.

Our field exploration consisted of drilling, logging, and sampling eight (8) hollow-stem auger borings (BH-1 through BH-8) on July 7 and 8, 2011. The borings were drilled using truck mounted drilling equipment to depths of 16.5 to 31.5 feet below the existing ground surface (bgs). The boring locations are shown on Drawing Nos. 2a through 2e, *Approximate Location of Borings.*

The borings were visually logged by our staff and sampled at regular intervals and at changes in subsurface soils conditions. California Modified Sampler (Ring samples), Standard Penetration Test samples, and bulk soil samples were obtained for laboratory testing. The borings were backfilled with soil cuttings and 1-sack slurry cement following the completion of drilling. Paved surface areas were patched with asphalt concrete.

4.3 Task III: Laboratory Testing

Representative samples of the site soils were tested in our laboratory and the laboratory of Environmental Geotechnology Laboratory, Inc. of Arcadia to aid in the classification and to evaluate relevant engineering properties. The tests performed included:

- *In situ* moisture contents and dry densities (ASTM Standard D2216)
- Grain Size Distribution (ASTM Standard C136)
- Maximum Dry Density and Optimum-Moisture Content (ASTM Standard D1557)
- Direct Shear (ASTM Standard D3080)
- Consolidation and Collapse (ASTM Standard D2435)
- Expansion Index (ASTM Standard D4829)
- Soil Corrosivity (Caltrans 643, 422, 417, and 532)
- R-Value (Cal Standard Method 301-G)

For a description of the laboratory test methods and test results, see Appendix B, *Laboratory Testing Program.* For *in-situ* moisture and dry densities, see the Logs of Borings in Appendix A, *Field Exploration.*

4.4 Task IV: Geotechnical Evaluation and Report Preparation

Our geotechnical and engineering analyses included interpretation of the field data and laboratory data, consideration of the background data, and formulation of appropriate seismic coefficients for the site location. This data was integrated into our analysis for lateral earth pressures, shoring parameters and foundation design parameters.

Data obtained from the background review, exploratory borings, and laboratory testing program were analyzed and evaluated. This report was prepared to provide the findings, conclusions and recommendations developed during our study and evaluation.

5.0 GEOLOGY AND SUBSURFACE CONDITIONS

5.1 Regional Geologic Setting

The regional geologic setting consists of a broad sediment filled basin, known as the Los Angeles Basin, located at the convergence of the Transverse Ranges and Peninsular Ranges geomorphic provinces of California. The project site is located within the coastal portion of the Los Angeles Basin, locally referred to as the Torrance Plain. Sedimentary deposits within the Torrance Plain consist of older alluvial soils overlain to the west by older sandy sediments deposited in an eolian environment (dune sand), as mapped and described in the Seismic Hazard Zone Report for the Torrance Quadrangle (CDMG, 1998).

Drawing No. 3, *Regional Geologic Map*, based on the Geologic Map of the Long Beach 30' x 60' Quadrangle (CGS, 2003), has been prepared to show the location of the North Torrance Wellfield Project with respect to the regional geology.

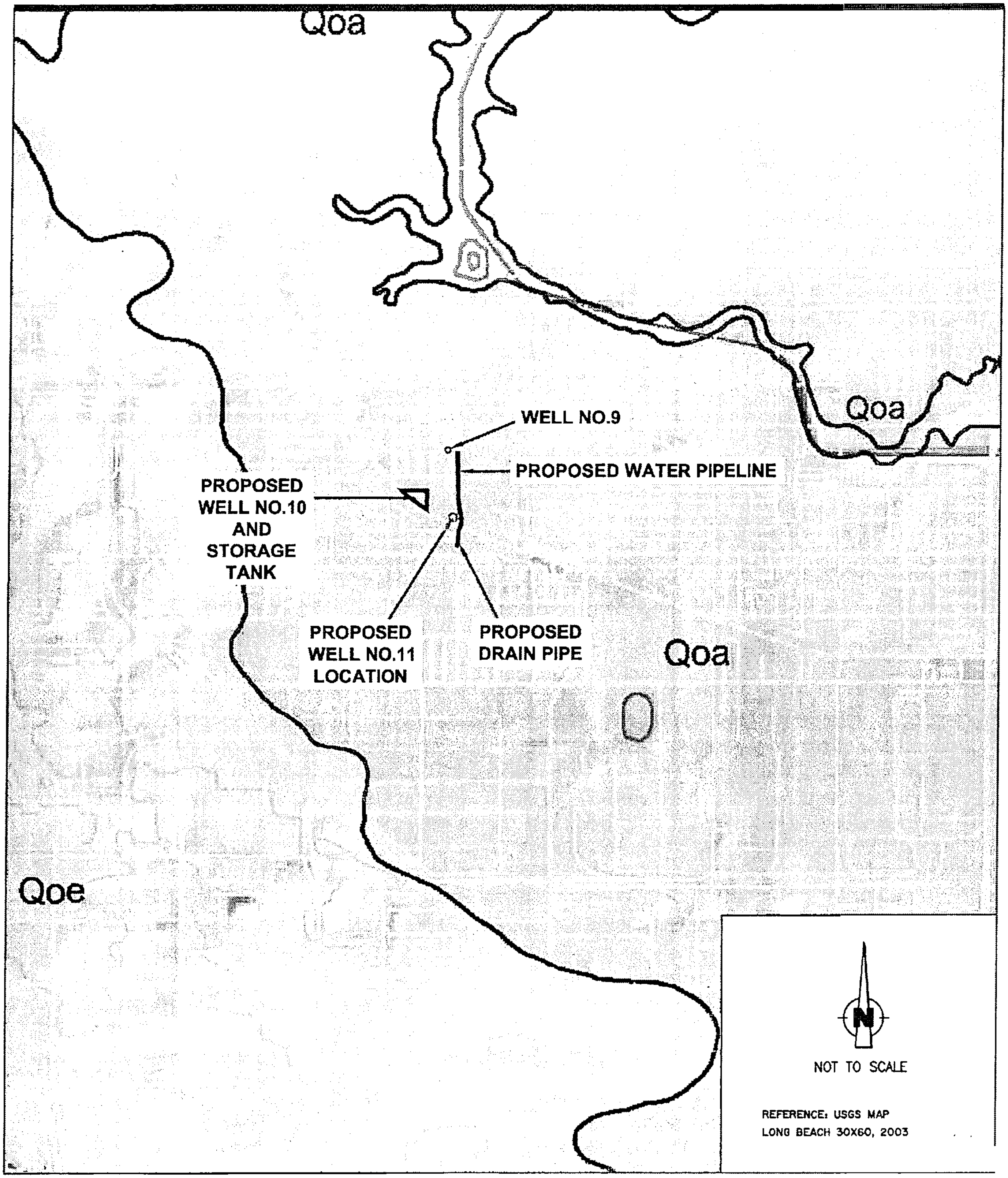
5.2 Geology and Subsurface Profile of Project Site

Undocumented fill soils ranging in depth from 2 to 11.5 feet were encountered in the borings drilled within the project areas. The fill consists of primarily clay soils, underlain by older alluvial soils. Native older alluvium generally consists of clay soils. Sampling blow counts for both fill and native soils correlate with firm to stiff conditions.

Logs of the subsurface conditions as encountered in the test borings and pump/observation wells were recorded at the time of drilling and are presented on the boring logs included in Appendix A, *Field Exploration*, along with our field exploration and soil sampling procedures. The following table summarizes the subsurface information gathered along the project alignment:

Table No. 2, Summary of Soil Profile at Boring Locations

Boring Locations / (Project Component)	Geologic Profile	Descriptions
BH-1, BH-2 and BH-3 (New pipelines to connect existing Well No. 9 and planned Well No. 11 with the proposed storage tank site)	**Fill:** encountered up to 6.5 feet below road surface at BH-2 and BH-3	Clay with Sand (CL)
	Older Alluvium: below the roadway pavement at BH-1 and below the fill at BH-2 and BH-3, to the maximum depth explored of 16.5 feet	Clay (CL), Clay with Sand (CL) and Clayey Silt (ML)
BH-4 (Well No. 11)	**Fill**: encountered up to 2 feet below the ground surface	Sandy Clay (CL)
	Older Alluvium: below the fill, to the maximum depth explored of 16.5 feet	Clay (CL)



REGIONAL GEOLOGIC MAP

NORTH TORRANCE WELLFIELD PROJECT
TORRANCE, CALIFORNIA

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Converse Consultants

Drawing No.
3

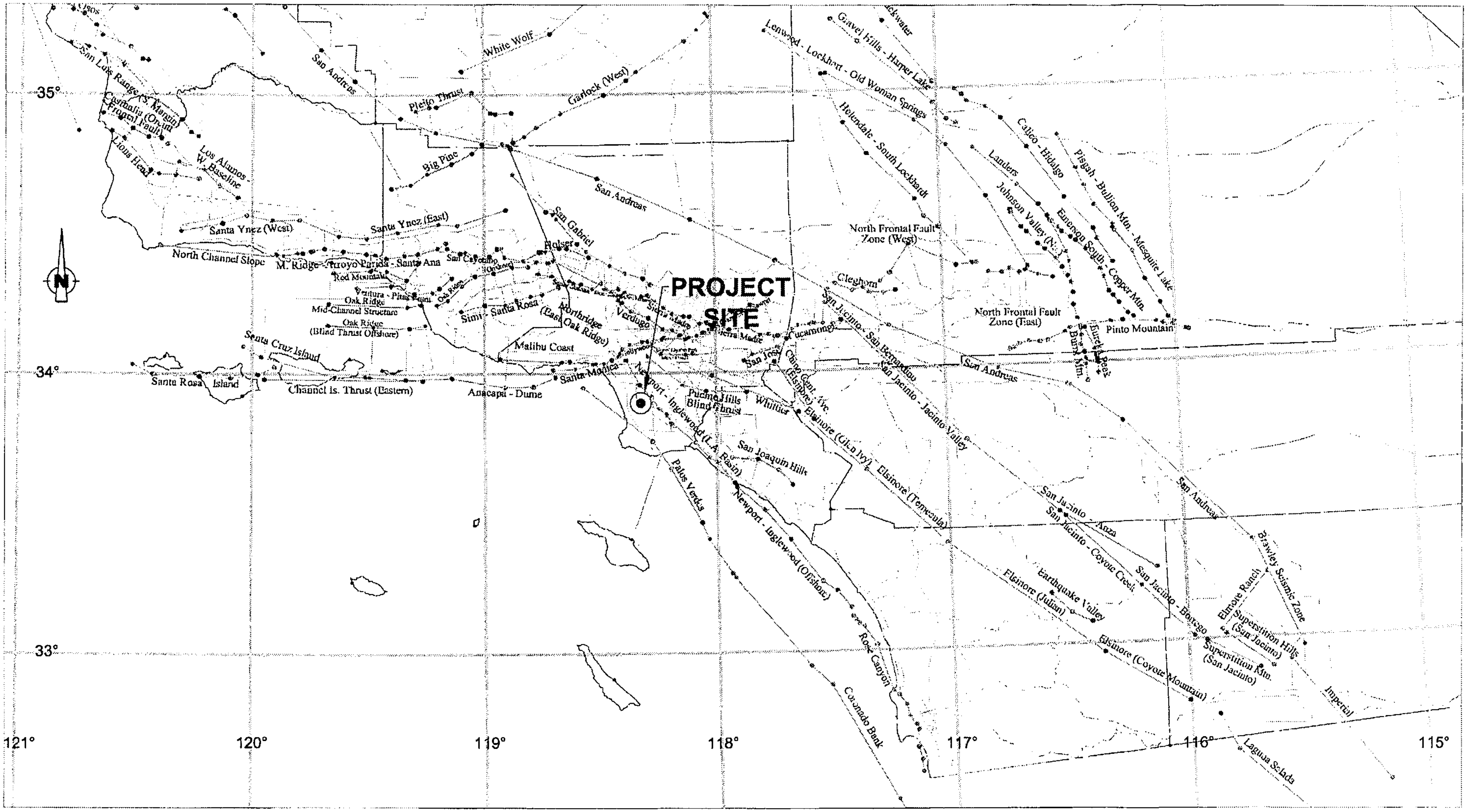
BH-5 (New drain pipeline)	**Fill:** encountered up to 3 feet below road surface	Clay with Sand (CL)
	Older Alluvium: below the fill, to the maximum depth explored of 16.5 feet	Clay (CL), Clay with Sand (CL) and Clayey Silt with Sand (ML)
BH-6 (Well No. 10)	**Fill**: encountered up to 2 feet below the ground surface	Sandy Clay (CL)
	Older Alluvium: below the fill, to the maximum depth explored of 31.5 feet	Clay (CL) to a depth of 25 feet, Silty Sand (SM) below 25 feet
BH-7 and BH-8 (Three-million-gallon storage tank, and Booster Pump Station/ Utility building)	**Fill:** encountered up to 11.5 feet deep at BH-7 and 6.5 feet deep at BH-8	Silty Sand (SM), Clay (CL) and Sandy Clay (CL)
	Older Alluvium: below the fill at BH-7 and BH-8, to the maximum depth explored of 31.5 feet	Clay (CL) to depths of 20- 25 feet, Sandy to Clayey Silt (ML) below 20 - 25 feet

5.3 Groundwater

Review of readily available water well data from the Los Angeles County Department of Public Works – Ground Water Wells Website (http://gis.dpw.lacounty.gov/wells) indicates groundwater levels at depths of 75 feet or deeper from the ground surface since 1949. Groundwater was not encountered in the borings drilled to the maximum depth explored of 31.5 feet bgs. In general, groundwater levels fluctuate with the seasons and local zones of perched groundwater may be present due to local conditions or during rainy seasons. Groundwater conditions below any given site vary depending on numerous factors including seasonal rainfall, local irrigation, and groundwater pumping, among other factors. Based on our review of available groundwater data, groundwater is not anticipated to be encountered during the planned construction.

5.4 Subsurface Variations

Based on results of the subsurface exploration and our experience, variations in the continuity and nature of subsurface conditions within the project site should be anticipated, especially for the undocumented fill soils. Because of the uncertainties involved in the nature and depositional characteristics of the earth material at the site, care should be exercised in interpolating or extrapolating subsurface conditions between or beyond the boring locations. If, during construction, subsurface conditions



REFERENCE: PORTION OF CGS 2002 CALIFORNIA FAULT MODEL MODIFIED FOR USE WITH FRISKSP AND EQFAULT BY THOMAS F. BLAKE, AUGUST 2004

FAULT SOURCES

BLIND THRUST FAULT, POLYGONS INDICATE RUPTURE PLANES AND DIP DIRECTION

SOUTHERN CALIFORNIA REGIONAL FAULT MAP

Converse Consultants

NORTH TORRANCE WELLFIELD PROJECT
TORRANCE, CALIFORNIA

Project No.	Drawing No.
10-31-228-01	4

differ significantly from those presented in this report, this office should be notified immediately so that recommendations can be modified, if necessary.

6.0 FAULTING AND SEISMIC HAZARDS

6.1 Seismic Setting

The subject site is situated within a seismically active region. As is the case for most areas of Southern California, ground-shaking resulting from earthquakes associated with nearby and more distant faults may occur at the project site. During the life of the project, seismic activity associated with active faults can be expected to generate moderate to strong ground shaking at the site.

There are a number of nearby fault systems which could produce ground shaking at the site during a major earthquake. The approximate locations of regional capable faults with respect to the project site are shown (excluding blind thrust faults) on Drawing No. 4, *Southern California Regional Fault Map.* Table No. 3, *Summary of Regional Faults,* summarizes selected data of known faults capable of seismic activity within 40 kilometers of the site. The data presented on Table No. 3, *Summary of Regional Faults*, was calculated using UBCSEIS Version 1.03 and EQFAULT Version 3.0 with updated fault data from *"The Revised 2002 California Probabilistic Seismic Hazard Maps (Cao et al., 2003)"*, Appendix A, and other published geologic data.

Table No. 3, Summary of Regional Faults

Fault Name and Section	Approximate * Distance to Site (kilometers)	Max. Moment Magnitude (Mmax)	Slip Rate (mm/yr)
Palos Verdes	5.3	7.3	3.00
Newport-Inglewood (L.A. Basin)	7.7	7.1	1.00
Puente Hills Blind Thrust**	20.0	7.1	0.70
Santa Monica	23.8	6.6	1.00
Hollywood	24.6	6.4	1.00
Malibu Coast	25.4	6.7	0.30
Raymond	30.1	6.5	1.50
Elsinore-Whittier	32.3	6.8	2.50
Verdugo/Eagle Rock	33.4	6.9	0.50
Anacapa-Dume	35.4	7.5	3.00
Sierra Madre (Central)	40.6	7.2	2.00

* Distance from the site (1.5 acre parcel) to the surface projection as computed by the computer program UBCSEIS, and per review of published geologic data and mapping.
** Distance from the site to nearest subsurface projection, per data in Appendix A of the 2002 California Fault Parameters Report (Cao et al.,2003).

The project site is not located within a currently designated State of California Earthquake Fault Zone (Alquist-Priolo Special Studies Zones) for surface fault rupture. No surface faults are known to project through or towards the site. The closest known faults to the project site with mappable surface expressions are the Palos Verdes fault located approximately 5.3 kilometers to the south and the onshore segments of the Newport Inglewood Fault, located approximately 7.7 kilometers to the east.

Palos Verdes Fault

The mapped trace of the Palos Verdes Fault is located about 5 kilometers south of the project site along the northern margin of the Palos Verdes Hills. The major component of uplift and tectonic deformation of the Palos Verdes Peninsula is attributed to movement along this fault. The Palos Verdes Fault is considered capable of producing a maximum moment magnitude (Mw) 7.3 earthquake.

Newport Inglewood Fault

The Newport Inglewood fault zone is located approximately 8 kilometers east of the project site. The Newport Inglewood fault system is about 66 km long on shore and extends northwest from Huntington Beach through Long Beach to Culver City and the Cheviot Hills. The Newport Inglewood fault continues offshore to the southeast of Huntington Beach and makes landfall in La Jolla as the Rose Canyon fault. The Newport Inglewood fault is characterized by a series of uplifts and anticlines including Newport Mesa, Huntington Beach Mesa, Bolsa Chica Mesa, Alamitos Heights and Landing Hill, Signal Hill and Reservoir Hill, Dominguez Hills and Baldwin Hills.

Several earthquakes have occurred along the fault zone including the March 10, 1933 "Long Beach" earthquake of M_W 6.4, with its epicenter off Newport Beach, and smaller earthquakes at Inglewood on June 20, 1920 (M 4.9) and May 17, 2009 (M 4.7), Torrance on October 21, 1941 (M_L 4.8), Gardena on November 14, 1941 (M_L 4.8), and Newport Beach on April 7, 1989 (M_L 4.7).

The Newport Inglewood fault is considered active and capable of producing a maximum moment magnitude (M_W) 7.1 earthquake. The slip rate is approximately 1.0 mm/year but may range up to 2 to 3 mm/year along isolated segments (Cao et al., 2003).

<u>Puente Hills Blind Thrust Fault</u>

The potential for damage from earthquakes along a zone of north-dipping blind thrust faults in the northern Los Angeles Basin was illustrated by the M_L 5.9 Whittier earthquake event on October 1, 1987. Smaller earthquakes experienced north/northeast of downtown Los Angeles on September 3, 1905 (est. M 5.3) and July 16, 1920 (est. M 5.0) are further indications of active faulting in the area.

Blind thrust faults are low angle reverse faults which generally have no surface trace. Conventional fault finding trenches, boreholes and paleoseismic dating methods used at the surface have limited use for investigation of these deeply buried thrust fault structures. The geometry and location of the blind thrust fault structures and thrust ramps are based on interpretation of oil well data, seismic and strong motion data solutions, high resolution geophysical data, paleoseismic studies and structural model analyses (Yeats, R.S. 2004; Dolan, J.F. et al., 2003). Examples of blind thrust fault landforms include folding and uplift of areas such as the Elysian, Repetto, Montebello and Puente Hills.

The nearest subsurface projection/interpretation of the Puente Hills Blind Thrust Fault is located approximately 20 kilometers east/northeast of the project site (Shaw et al., 2002). The Puente Hills Blind Thrust has been interpreted to include three segments with a combined length of approximately 42 kilometers and a depth range of 3 km to 13 km below ground surface, ramping down toward the east/northeast (Dolan, J.F., et al., 2003). Studies of the Puente Hills Blind Thrust have indicated the occurrence of at least four large (moment-magnitude 7.2 to 7.5) earthquakes for this fault system during the past 11,000 years (Dolan, J.F. et al., 2003).

Seismic hazard fault models for the Los Angeles Basin and vicinity will continue to be refined as new information and technology develops and becomes available through time.

6.2 Seismic History

An analysis of the seismic history of the site was conducted using the computer program EQSEARCH, (Blake, 2000) from the most recent earthquake database available, and attenuation relationships proposed by Boore et al. (1997) for alluvium soil conditions. Based on the analysis of seismic history, the number of earthquakes and aftershocks with a moment magnitude of 5.0 or greater occurring within a distance of 100 kilometers was 140, since the Year 1800. Based on the analysis, the largest earthquake induced ground acceleration affecting the site since the year 1800 was approximately 0.13g, generated from the M_W 6.7 Northridge Earthquake in 1994.

6.3 Seismic Hazards

As is the case for most areas of Southern California, seismic hazards resulting from earthquakes need to be considered in the design and construction of new projects. In addition to strong ground motion, such hazards include ground rupture, slope instability and liquefaction. As previously reported, the subject site is not located within a State of California Earthquake Fault Zone (formerly Alquist-Priolo Special Studies Zones) for surface fault rupture.

The State of California Seismic Hazard Zone Map for the Torrance Quadrangle (March 25, 1999) shows that the project site is not located within an area of potential liquefaction and is not located within a mapped area of potential earthquake-induced landslides due to the relatively flat condition of the site topography.

6.4 Potential Effects of Seismic Activity and Geologic Hazards

Other effects of seismic activity (strong ground motion), besides surface fault rupture, soil liquefaction, and landslide, include lateral spreading, earthquake-induced flooding, tsunamis, and seiches. Other geologic hazards to be considered in California include volcanic eruption hazard. Site-specific potential for each of these other seismic and geologic hazards is discussed in the following sections.

Surface Fault Rupture: The site is not located within a currently designated State of California Earthquake Fault Zone. Based on a review of existing geologic information, no known active surface fault zone crosses or projects toward the site. The potential for surface rupture resulting from the movement of the nearby major faults is considered remote.

Liquefaction/Seismic Settlement: Liquefaction is defined as the phenomenon where a saturated soil mass exhibits a substantial reduction in its shear strength. This strength reduction is due to the development of excess pore pressure in a saturated soil mass caused by earthquake induced ground motions.

Groundwater was not encountered during our subsurface exploration to depths of 31.5 and review of groundwater levels since 1949 indicate the depth to groundwater is greater than 75 feet below existing ground surface. Based on firm to stiff nature of the older alluvial soils encountered at the site, and the deep groundwater level, the potential for liquefaction is very low and dynamic settlement is considered negligible.

Lateral Spreading: Seismically induced lateral spreading involves primarily lateral movement of earth materials due to ground shaking. It differs from the slope failure in that complete ground failure involving large movement does not occur due to the relatively smaller gradient of the initial ground surface. Lateral spreading is demonstrated by near-vertical cracks with predominantly horizontal movement of the soil mass involved. The topography at the project site and in the immediate vicinity of the site is relatively flat, with no nearby unsupported slopes or embankments below the site. Under these circumstances, the potential for lateral spreading at the subject site is considered negligible.

***Earthquake-Induced Flooding*:** This is flooding caused by failure of dams or other water-retaining structures as a result of earthquakes. The potential of earthquake induced flooding of the subject site is considered to be remote because of regional flood control structures.

Tsunamis: Tsunamis are tidal waves generated by fault displacement or major ground movement. Based on the surface elevation and location of the site from the ocean (approximately 3.75 miles west of the site), tsunamis do not pose a hazard.

Seiches: Seiches are large waves generated in enclosed bodies of water in response to ground shaking. Based on site location, away from lakes and reservoirs, seiches do not pose a hazard.

Volcanic Eruption Hazard: Volcanic eruption hazards are not present at the site or nearby. According to Jennings (1994), the nearest Holocene-epoch volcanic eruption area is the Amboy Crater area located in the Mojave Desert approximately 130 miles east/northeast of the site.

7.0 SEISMIC ANALYSIS

7.1 CBC Seismic Design Parameters

Seismic parameters based on the 2010 California Building Code, calculated with the United States Geological Survey computer program *Seismic Hazards Curves, Response Parameters and Design Parameters, Version 5.1.0.*, and the site coordinates 33.8689 degrees North Latitude, 118.3378 degrees West Longitude are provided on the following table:

Table No. 4, CBC Seismic Parameters

Seismic Parameters	
Site Class	D
Mapped Short period (0.2-sec) Spectral Response Acceleration, S_S	1.508g
Mapped 1-second Spectral Response Acceleration, S_1	0.605g
Site Coefficient, F_a	1.0
Site Coefficient, F_v	1.5
MCE 0.2-sec period Spectral Response Acceleration, S_{MS}	1.508g
MCE 1-second period Spectral Response Acceleration, S_{M1}	0.907g
Design Spectral Response Acceleration for short period, S_{DS}	1.005g
Design Spectral Response Acceleration for 1-second period, S_{D1}	0.605g

7.2 Design Response Spectra

A site-specific response spectra was developed for the project for a Maximum Considered Earthquake (MCE) ground motion, defined as a horizontal peak ground acceleration that has a 2 percent probability of being exceeded in 50 years (return period of approximately 2,475 years).

In accordance with ASCE 7-05, Section 21.2 and Code Application Notice (CAN 2-1802A.6.2) the site-specific response spectra can be taken as the lesser of the probabilistic maximum rotated component of MCE ground motion and the 84th percentile of deterministic maximum rotated component of MCE ground motion response spectra. The design response spectra can be taken as $^2/_3$ of the site-specific MCE response spectra, but should not be lower than 80 percent of CBC general response spectra.

A site specific response analysis, using available fault data within 100 kilometers of the site, was developed using the computer program EZ-FRISK by Risk Engineering (v. 7.62) and the 2008 USGS Statewide Fault Model. Attenuation relationships proposed by Boore and Atkinson (2008), Campbell and Bozorgnia (2008), Chiou and Youngs (2008) were used in the analysis. These attenuation relationships are based on Next

Generation Attenuation (NGA) project model. An average shear wave velocity for the upper 30 meters of soil profile (V_{s30}) of 270 meters per second was used, based upon our site-specific exploration. Shear wave velocities of 1,000 meters per second at 150 meters below grade, and 2,500 meters per second at 3,000 meters below grade were also selected for our EZ-Frisk Analysis. Maximum rotated components were determined using Huang (2008) method.

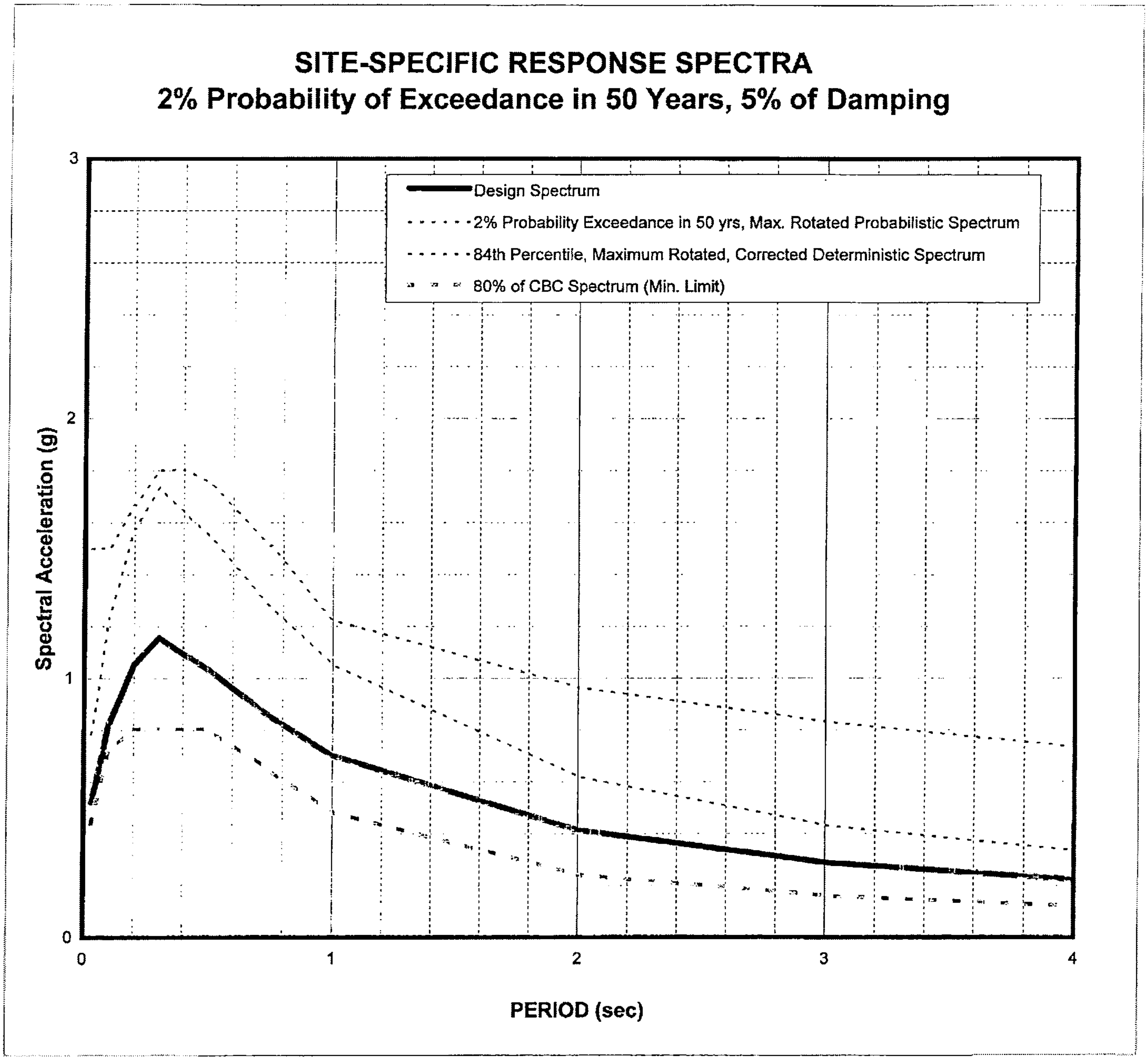
Applicable response spectra data are presented in a Table below and on Drawing No. 5, *Site-Specific Design Response Spectra.* These curves correspond to response values obtained from above attenuation relations for horizontal elastic single-degree-of-freedom systems with equivalent viscous damping of 5 percent of critical damping.

Table No. 5, Site-Specific Design Response Spectra Data

Period (sec)	Maximum Rotated Probabilistic MCE Spectra, (g)	84th Percentile of Maximum Rotated Deterministic MCE Response Spectra, (g)	Deterministic CBC Lower Level, (g)	Site Specific MCE, (g)	Design Response Spectra, (5% of Damping) (g)	General Response Spectra Lower Limit, (g)
0.03	0.786	0.881	1.50	0.786	**0.524**	0.442
0.05	0.891	0.979	1.50	0.891	**0.594**	0.522
0.10	1.232	1.289	1.50	1.232	**0.821**	0.723
0.20	1.579	1.668	1.50	1.579	**1.053**	0.804
0.30	1.734	1.800	1.50	1.734	**1.156**	0.804
0.40	1.641	1.805	1.50	1.641	**1.094**	0.804
0.50	1.550	1.755	1.50	1.550	**1.033**	0.804
0.75	1.278	1.511	1.50	1.278	**0.852**	0.645
1.00	1.052	1.224	0.90	1.052	**0.701**	0.484
2.00	0.620	0.965	0.45	0.620	**0.413**	0.242
3.00	0.433	0.832	0.30	0.433	**0.288**	0.161
4.00	0.335	0.733	0.23	0.335	**0.223**	0.121

Vertical acceleration at the site may be calculated in accordance with ASCE 7-05, Section 12.4.

The site-specific design response parameters are provided in the following table. These parameters were determined from Design Response Spectra presented in the table above, and following guidelines of ASCE Section 21.4.



Note: Calculated using EZFRISK program Risk Engineering, version 7.62
and USGS 2008 fault model database.

SITE-SPECIFIC RESPONSE SPECTRA	
North Torrance Wellfield Project For : AECOM & City of Torrance	Project Number: 10-31-228-01
Converse Consultants	Drawing No. 5

Table No. 6, Site-Specific Seismic Design Parameters

	Design Parameters (5% Damping)	Lower Limit, 80% of CBC Design Spectra
Site Specific 0.2-sec period Spectral Response Acceleration, S_{MS}	1.579	1.206
Site Specific1-second period Spectral Response Acceleration, S_{M1}	1.240	0.726
Site Specific Design Spectral Response Acceleration for short period S_{DS}	1.053	0.804
Site Specific Design Spectral Response Acceleration for 1-second period, S_{D1}	0.827	0.484

8.0 LABORATORY TESTING

Representative samples of the site soils were tested in our laboratory and the laboratory of Environmental Geotechnology Laboratory, Inc. of Arcadia to aid in the classification and to evaluate relevant engineering properties. Results of the various laboratory tests are summarized discussed below. For a more detailed description of the laboratory test methods and test results, see Appendix B, *Laboratory Testing Program.*

- *In-situ* Moisture and Dry Density: Results of *in-situ* moisture and dry density tests are presented on the Log of Borings in Appendix A, *Field Exploration.*
- Grain Size Analysis: Three (3) representative samples were tested to evaluate the relative grain size distribution of clay samples with sand. Results are presented in Appendix B, *Laboratory Testing Program*, and indicate the samples tested are predominately clay with 6 to 16 percent sand.
- Maximum Dry Density and Optimum Moisture Content: The moisture-density relationship of two (2) representative soil samples is presented in Appendix B, *Laboratory Testing Program.* The test results indicate that the laboratory maximum dry density for representative samples of the upper five feet of soil range from 111.2 pounds per cubic foot (pcf) to 117.4 pcf at 15.2 and 14.4 percent moisture content, respectively.
- Direct Shear: Two (2) direct shear test was performed on representative sample in-situ samples, and one (1) direct shear test was performed on a sample remolded to 90 percent relative compaction. Result of the direct shear tests is presented in Appendix B, *Laboratory Testing Program.*
- Consolidation Test: Five (5) consolidation tests were performed on representative samples of the soils encountered within the areas of the planned storage tank, water wells and Booster Pump Station/Utility building. The results of the test are presented

in Appendix B, *Laboratory Testing Program.* Based on the results of these tests, the compressibility of the site native soils is considered moderate.

- Expansion Index: Two (2) representative samples of the site soils (one sand and one clay) were tested to evaluate Expansion Index (EI). Test results are included in Appendix B, *Laboratory Testing Program.* The test results indicate that the native clay site soils have a medium expansion potential (EI 51 to 90) and the sandy fill soils in the vicinity of BH-7 have a very low expansion potential (EI 0 to 20).
- Soil Corrosivity: Two (2) representative samples of the site soils were tested to evaluate soil corrosivity with respect to common construction materials such as concrete and steel. The test results are presented in Appendix B, *Laboratory Testing Program.* Test results are also discussed in Section 12.8, *Soil Corrosivity Evaluation.*
- R-Value: Two (2) representative bulk soil samples were tested for resistance value (R-value) in accordance with State of California Standard Method 301-G. This test is designed to provide a relative measure of soil strength for use in pavement design. The test results are presented in Appendix B, *Laboratory Testing Program.*

For additional information on the subsurface conditions, see the Logs of Borings in Appendix A, *Field Exploration.*

9.0 GEOTECHNICAL EVALUATION AND CONCLUSIONS

Based on the results of our background review, subsurface exploration, laboratory testing, geotechnical analyses, and understanding of the planned construction, the project site consists of the following geotechnical conditions:

- Relatively shallow depths of undocumented fill soils (clay) over firm older alluvial soils (clay) in the areas of planned water pipelines, well sites, and drain pipelines.
- Undocumented fill soils (silty sand) ranging from approximately 6.5 to 11.5 feet deep in the areas of the planned storage tank and booster pump/utility building. Based on our laboratory test results, the undocumented fill soils are compressible and require mitigation for foundation and slab support. The fill soils are underlain by firm older alluvial soils.
- Onsite clayey soils have a “medium” expansive potential, and require mitigation for foundation and slab support.

Due to compressible undocumented fill and expansive soils conditions, we recommend the planned areas of the wells, storage tank and booster pump/utility building be supported on compacted fill soils achieved through over-excavation and re-compaction. Depths of grading for remedial earthwork are anticipated to be 2 feet for the well locations. Over-excavation for reservoir should be at least 8 feet below existing grade, or to the depth of fill, whichever is deeper. Over-excavation for building should be at least 12 feet below existing grade, or to the depth of fill, whichever is deeper. Over-excavation for pipelines is not needed.

Based on our understanding of the project, trenchless techniques may be utilized for installation of the drain pipeline planned below the Caltrans right-of-way (Interstate 405). The results of our subsurface exploration indicate relatively firm clay soils and a deep groundwater condition for this area. Therefore, it is our opinion that trenchless construction for the drain pipeline can be accomplished by an experienced contractor using pipe jacking/micro-tunneling equipment.

10.0 EARTHWORK AND SITE GRADING RECOMMENDATIONS

Based on our field exploration, laboratory testing, and analyses of subsurface conditions at the site, remedial grading will be required to prepare the planned areas of the wells, storage tank and booster pump/utility building for slab and foundation support. Vertical excavations greater than 5 feet at the site will require either shoring or sloped excavation. To reduce differential settlement of future at-grade improvements, the variations in the soil type, degree of compaction, and thickness of the compacted fill placed underneath future improvements should be kept uniform.

Site grading recommendations provided below are based on our experience with similar projects in the area and our evaluation of this study.

10.1 Excavatability

Based on our field exploration, the site soils should be excavatable with conventional heavy-duty earth-moving and trenching equipments. Temporary sloped excavation is feasible if performed in accordance with the slope ratios provided in Section 12.2, *Temporary Excavations.* If temporary sloped excavation is not feasible due to space limitations, temporary shoring is required. Existing utilities should be accurately located and either protected or removed as required.

10.2 Over-excavation/Removal

Existing soils below planned wells should be over-excavated to a depth of approximately 2 feet, moisture-conditioned if needed, and replaced as compacted fill. The remedial grading should extend at least 2 feet beyond the well foundation slab.

Due to compressible undocumented fill and expansive soils conditions, we recommend the planned areas of the wells, storage tank and booster pump/utility building be supported on compacted fill soils achieved through over-excavation and re-compaction.

Depths of grading for remedial earthwork are anticipated to be 2 feet for the well locations. Over-excavation for reservoir should be at least 8 feet below existing grade, or to the depth of fill, whichever is deeper. Over-excavation for building should be at least 12 feet below existing grade, or to the depth of fill, whichever is deeper. The extent and depth of over-excavation shall be verified and approved by a geotechnical consultant during grading operations. The remedial grading should extend laterally to a distance equal to the depth of removal, or at least 5 feet beyond the foundation/slab, whichever is greater. Over-excavation for pipelines is not needed.

For new pavement areas we recommend an over-excavation of at least two (2) feet below existing grades. The remedial grading should extent horizontally a distance equal to the depth of over-excavation.

10.3 Structural Fill

The bottom of the excavations should be scarified to a depth of at least six (6) inches and compacted to at least 90 percent of relative compaction, to establish a firm and unyielding surface for receiving compacted structural fill.

Prior to compaction, fill materials should be thoroughly mixed and moisture conditioned within two (2) percent of optimum moisture content for granular soils or at about three (3) percent above optimum moisture content for fine-grained soils.

Excavated site soils, free of deleterious materials and rocks greater than three (3) inches in the largest dimension, are suitable for placement as compacted fill. Any import fill should be tested and approved by a geotechnical consultant. All import fill should have an expansion potential less than 20.

To mitigate the expansive soils, we recommend at least 24 inches thick crushed aggregate base (CAB), i.e. Caltrans Class 2 aggregate base, be placed beneath reservoir foundations and slab. For pump station/utility building, at least 24 inches thick sandy soils (EI less than 20) or CAB shall be placed beneath foundations and slab.

All fill, if not specified otherwise elsewhere in this report, should be compacted to at least 90 percent of the laboratory dry density in accordance with the ASTM Standard D1557 test method. Crushed aggregate base beneath foundation and slab and the upper twelve (12) inches of fill underlying pavements should be compacted to at least 95 percent of the laboratory maximum dry density.

Moisture conditioning of excavated soils may be necessary prior to the material being placed as compacted fill. The amount of processing required for proper moisture conditioning at the site will depend on the seasonal variations in the *in-situ* moisture conditions, the depth of cut, the equipment, and the processing method.

10.4 Subterranean Structure Wall Backfill

Compaction of backfill adjacent to structural walls can produce excessive lateral pressures. Improper types and locations of compaction equipment and/or compaction techniques may damage the walls. The use of heavy compaction equipment should not be permitted within a horizontal distance of five (5) feet from the wall. Backfill behind any structural walls within the recommended 5-foot zone should be compacted using lightweight construction equipment such as handheld compactors to avoid overstressing the walls.

Excavated site soils, free of deleterious materials and rocks larger than three (3) inches in the largest dimension should be suitable for placement as compacted backfill. Care should be taken to avoid placing expansive, on-site fine-grained material within three (3) feet of structural walls. Any import fill should be tested for soil classification and expansion index (less than 20) and approved by a geotechnical consultant prior to delivery to the site.

As an alternative to compacted fill, Controlled Low-Strength Material (CLSM) can be used for backfill. CLSM is a low strength- and high slump- self compacted, cementitious material used primarily as backfill in lieu of compacted fill. CLSM shall be a mixture of Portland cement, fly ash or other approved materials, aggregates, water and admixtures proportioned to provide a non-segregating, self-consolidating, free-flowing and excavatable material, which will result in a hardened, dense, non-settling fill. CLSM used for backfill should have a cast density of 120 pcf minimum and a compressive strength at 28 days of 200 psi minimum and proportion to be a flowable, non-segregating, self-consolidating low shrink slurry.

10.5 Pipe Backfill Recommendations

It is anticipated that the natural soils will provide a firm foundation for planned water pipelines and drain pipelines. Any soft and/or unsuitable material encountered at the pipe invert should be removed and replaced with an adequate bedding material.

10.5.1 Pipe Subgrade Preparation

The pipe subgrade should be level, firm, uniform, free of loose materials and properly graded to provide uniform bearing and support to the entire section of the pipe placed on bedding material. Subgrade soil surfaces for pipeline should be scarified to a depth of at least six (6) inches and be compacted to a minimum of 90 percent relative compaction. Protruding oversize particles larger than two (2) inches in the largest dimension, if any, should be removed from the trench bottom and replaced with compacted materials. If yielding soft subgrade is encountered, we recommend over-excavate at least 18 inches, place geofabric (Mirafi HP570 or equivalent) at bottom of excavation to receive 18 inches compacted base materials (CMB or equivalent). Base material should be compacted to at least 90 percent of relative compaction.

During the digging of depressions for proper sealing of the pipe joints, the pipe should rest on a prepared bottom for as near its full length as is practicable.

10.5.2 Pipe Bedding

Bedding is defined as the material supporting and surrounding the pipe to 12 inches above the pipe. To provide uniform and firm support for the pipe, compacted granular materials such as clean sand, gravel or ¾-inch crushed aggregate or crushed rock may be used as pipe bedding material. The type and thickness of the granular bedding placed underneath and around the pipe, if any, should be selected by the pipe designer. The load on the rigid pipes and deflection of flexible pipes and, hence, the pipe design, depends on the type and the amount of bedding placed underneath and around the pipe. Care should be taken to densify the bedding material below the springline of the pipe.

Pipe design generally requires a granular material with a sand equivalent (SE) greater than 30. Bedding material for the pipes should be free from oversized particles (greater than 1-inch). Therefore, on-site native materials and undocumented fill soils are not suitable to be used for pipe bedding.

Migration of fines from the surrounding native and/or fill soils must be considered in selecting the gradation of any imported bedding material. We recommend that the pipe bedding material should satisfy the following criteria:

$$D_{15} < 2.5 \text{ mm and } D_{50} < 19.0 \text{ mm}$$

Where D_{15} and D_{50} represent particle sizes of the bedding material corresponding to 15 percent and 50 percent passing by weight, respectively.

10.5.3 Trench Zone Backfill

The trench zone is defined as the portion of the trench above the pipe bedding extending up to the final grade level of the trench surface.

The following specifications are recommended to provide a basis for quality control during the placement of trench backfill.

Trench excavations to receive backfill shall be free of trash, debris or other unsatisfactory materials at the time of backfill placement. Excavated on-site soils free of oversize particles, defined as larger than one (1) inch in maximum dimension in the upper 12 inches of subgrade soils and larger than three (3) inches in the largest dimension in the trench backfill below, and deleterious matter after proper processing may be used to backfill the trench zone. Imported trench backfill, if used, should be approved by the project geotechnical consultant prior to delivery at the site.

Trench backfill shall be compacted to 90 percent of the laboratory maximum dry density as per ASTM Standard D1557 test method. At least the upper twelve (12) inches of trench underlying pavements should be compacted to at least 95 percent of the laboratory maximum dry density.

Trench backfill shall be compacted by mechanical methods, such as sheepsfoot, vibrating or pneumatic rollers, or mechanical tampers, to achieve the density specified herein. The thickness of soil lifts/layers prior to compaction should not exceed eight (8) inches. Each layer shall be evenly spread, moistened or dried as necessary, and then tamped or rolled until the specified density has been achieved.

As an alternative to compacted fill for trench backfill, controlled low-strength material may be used. Please refer to report section 10.4 for specifications.

The contractor shall select the equipment and processes to be used to achieve the specified density without damage to adjacent ground and completed work. The field density of the compacted soil shall be measured by the ASTM Standard D1556 or ASTM Standard D2922 test methods or equivalent. Observation and field tests should be performed by Geotechnical Consultant during construction to confirm that the required degree of compaction has been obtained. Where compaction is less than that specified, additional effort shall be made with adjustment of the moisture content as necessary, until the specified compaction is obtained. It should be the responsibility of the contractor to maintain safe conditions during cut and/or fill operations. Trench backfill shall not be placed, spread or rolled during unfavorable weather conditions. When the work is interrupted by heavy rain, fill operations shall not be resumed until field tests by the project's geotechnical consultant indicate that the moisture content and density of the fill are as previously specified.

10.5.4 Flexible Pipe Joints

We recommend flexible joints should be installed to compensate possible differential settlements where the buried pipes interface with structures and for joints between the structures.

10.6 Expansive Soil Mitigation

The native soils at the site have a "medium" expansion potential. The onsite soil materials will be mixed during the grading and the expansion potential might change. Therefore, the expansion potential of site soils should be verified after the grading. Slabs, foundations and pavement placed directly on expansive subgrade soil will likely crack over time.

The soil materials with expansion index higher than 20 should be mitigated. We recommend at least 24 inches thick crushed aggregate base (CAB), i.e. Caltrans Class 2 aggregate base, shall be placed beneath foundations and slab-on-grade to mitigate the expansive soils.

10.7 Shrinkage and Subsidence

For the remedial grading, the shrinkage and/or bulking of soils will depend on, among other factors, the depth of cut and/or fill, and the grading method and equipment utilized. For preliminary estimation, utilizing our current exploration information, bulking and shrinkage factors for various units of earth material at the site may be taken as presented below:

- The approximate shrinkage factor for native and undocumented fill soils is estimated to range from ten (10) to fifteen (15) percent.
- Subsidence would depend on the construction methods including type of equipment utilized. For estimation purposes, ground subsidence may be taken as 0.15 feet.

Although these values are only approximate, they represent our best estimates of the factors to be used to calculate lost volume that may occur during grading. If more accurate shrinkage and subsidence factors are needed, it is recommended that field-testing using the actual equipment and grading techniques be conducted.

10.8 Site Drainage

Adequate positive drainage should be provided away from building pad/excavation areas to prevent ponding and to reduce percolation of water into the foundation soils. Building pads should have a drainage gradient of at least two (2) percent towards drainage facilities.

A desirable drainage gradient is one (1) percent for paved areas and two (2) percent in landscaped areas.

Surface drainage should be directed to suitable non-erosive devices. Slope drainage should be constructed in accordance with the California Building Code (2010).

11.0 DESIGN RECOMMENDATIONS

The proposed well slabs, storage tank and booster pump/utility building should be supported on compacted fill soils. The subject site is located within an area underlain by variable depths of undocumented fill soils.

11.1 Shallow Foundation Design

The well slabs, storage tank and booster pump/utility building can be supported on slabs and shallow footings bearing on future compacted fill provided the following recommendations incorporated into design and construction.

11.1.1 Vertical Capacity

Footings should be founded at least 18 inches below lowest adjacent final grade on compacted fill. Footings should be at least 12 inches wide for continuous footings and 24 inches wide for isolated footings. The allowable dead plus live load bearing value is 2,000 psf for footings supported on 24-inch-thick compacted soil fill, and 3,000 psf for footings supported on 24-inch-thick compacted CAB. The allowable bearing pressure can be increased by 600 psf for each additional foot of excavation depth and by 300 psf for each additional foot of excavation width up to a maximum value of 4,500 psf.

The net allowable bearing values indicated above are for the dead loads and frequently applied live loads and are obtained by applying a factor of safety of 3.0 to the net ultimate bearing capacity.

11.1.2 Lateral Capacity

Resistance to lateral loads can be provided by friction acting at the base of the foundation and by passive earth pressure. A coefficient of friction of 0.3 may be assumed with normal dead load forces. An allowable passive earth pressure of 300 psf per foot of depth up to a maximum of 3,000 psf may be used for footings poured against compacted fill or native soil. The values of coefficient of friction and allowable passive earth pressure include a factor of safety of 1.5.

11.1.3 Settlement

The static settlement of structures supported on continuous and/or spread footings founded on competent native soils will depend on the actual footing dimensions and the imposed vertical loads. Most of the footing settlement at the project site is expected to occur immediately after the application of the load. Based on the maximum allowable net bearing pressures presented above, static settlement is anticipated to be less than

0.75 inch. Differential settlement is not expected to exceed one-half of the total settlement over a 50-foot span.

11.1.4 Dynamic Increases

Bearing values indicated above are for total dead load and frequently applied live loads. The above vertical bearing may be increased by 33% for short durations of loading which will include the effect of wind or seismic forces. The allowable passive pressure may be increased by 33% for lateral loading due to wind or seismic forces.

11.2 Slabs-on-grade

The design of the slab-on-grade will depend on, among other factors, the expansion potential of the pad soils. Based on the expansion index test performed during this evaluation, the expansion potential of the native site soils at a shallow depth is medium (EI 51 to 90). Slabs-on-grade supported directly on expansive soils should be designed accordingly. Mitigation of expansive soil is recommended in Section 10.6.

Slabs-on-grade should be supported on properly compacted fill. Compacted fill used to support slabs-on-grade should be placed and compacted in accordance with report section 10.0 Recommendations – Earthwork and Site Grading, and the general recommendations given in Appendix C, *Earthwork Specifications*.

Slabs-on-grade should have a minimum thickness of four (4) inches nominal for support of normal ground-floor live loads. Minimum reinforcement for slabs-on-grade should be No. 4 reinforcing bars, spaced at 24 inches on-center each way. The thickness and reinforcement of more heavily-loaded slabs will be dependent upon the anticipated loads and should be designed by a structural engineer. A static modulus of subgrade reaction equal to 150 pounds per square inch per inch may be used in structural design of concrete slabs-on-grade.

It is critical that the exposed subgrade soils should not be allowed to desiccate prior to the slab pour. Care should be taken during concrete placement to avoid slab curling. Slabs should be designed and constructed as promulgated by the ACI and Portland Cement Association (PCA). Prior to the slab pour, all utility trenches should be properly backfilled and compacted.

11.3 Modulus of Subgrade Reaction

Design of the structures supported on subgrade prepared in accordance with the recommendations provided in this report may be based on a soil modulus of subgrade reaction of (k_s) of 150 pounds per square inch per inch.

11.4 Retaining Wall Design

The following recommendations should be followed in the design and construction for any planned retaining structures. The earth pressure behind any buried wall depends primarily on the allowable wall movement, type of backfill materials, backfill slopes, wall inclination, surcharges, and any hydrostatic pressure. The following equivalent fluid pressures are recommended for vertical walls with no surcharge, and level backfill.

Table No. 7, Earth Pressures for Retaining Wall Design

Retaining Wall Types	Earth Pressure (Equivalent Fluid pressure)
Cantilever Wall (Active pressure)	45 pcf (triangular distribution)
Restrained Wall (At-rest pressure)	60 pcf (triangular distribution)

The recommended lateral pressures assume that the walls are fully back-drained to prevent build-up of hydrostatic pressure. Adequate drainage could be provided by means of permeable drainage materials wrapped in filter fabric installed behind the walls. The drainage system should consist of perforated pipe surrounded by one cubic foot of free draining, uniformly graded, ¾ -inch washed, crushed aggregate, and wrapped in filter fabric such as Mirafi 140N or equivalent, placed at bottom of wall. The filter fabric should overlap approximately 12 inches or more at the joints. The subdrain pipe should consist of perforated, four-inch diameter, rigid ABS (SDR-35) or PVC A-2000, or equivalent, with perforations placed down. Alternatively, a prefabricated drainage composite system such as the Miradrain G100N or equivalent can be used. The subdrain should be connected to a sump pump.

Design recommendations presented above are based on the assumption that retaining walls will retain either on-site soils or imported non-expansive soils that have been properly compacted. All backfill should be compacted to at least 90 percent relative compaction, with the comparative maximum density evaluated through laboratory testing in accordance with ASTM D 1557. Large equipment surcharge adjacent to newly constructed concrete walls should be avoided until the curing concrete reaches design strength. Backfill operations should be performed as specified in report section 10.

Surcharge pressures from other on-grade structures should be added to the above earth pressures for surcharges within a horizontal distance less than or equal to the wall height. Surcharge coefficients of 45% of any uniform vertical surcharge should be added as a horizontal wall pressure for walls retaining level backfill.

11.5 Structural Pavement Recommendations

The flexible pavement structural section design recommendations were performed using R-value of 5 for the subgrade soil in accordance with the *CALTRANS Highway Design Manual*, Chapter 630 without a factor of safety. No specific traffic study was performed to determine the Traffic Index (TI) for the proposed project. Pavement sections are provided for the Traffic Indices (TIs) ranging from 4 to 9. The recommended flexible pavement structural sections for various TI conditions are presented in the following table:

Table No. 8, Flexible Pavement Structural Sections

Design R-value	**Design TI**	**Asphalt Concrete (AC) Over Aggregate Base (AB) Structural Sections**		**Full AC Structural Section**
		AC (inches)	**AB (inches)**	**AC (inches)**
5	4	3	6.0	5.5
	5	4	7.5	7.0
	6	5	9.5	9.0
	7	6	11.5	10.5
	8	7	13.5	12.0
	9	8	15.0	13.5

Actual traffic index and traffic load should be determined by either Civil Engineer or Traffic Engineer. The above pavement sections are recommended as a guideline for basic usage of the indicated TI values, and may not be sufficient for actual traffic loading.

Base material shall conform to requirements for a Class 2 Aggregate Base (AB) or equivalent (such as crushed miscellaneous base - CMB) and should be placed in accordance with the requirements of the Standard Specifications for Public Works Construction (SSPWC, latest Edition).

Asphaltic materials should conform to Section 203-1, "*Paving Asphalt*," of the Standard Specifications for Public Works Construction (SSPWC, latest Edition) and should be placed in accordance with Section 302-5, "*Asphalt Concrete Pavement*," of the SSPWC, 2009 edition.

11.6 Soil Corrosivity Evaluation

Converse retained the services of Environmental Geotechnical Laboratory, Inc., located in Arcadia, California, to test two (2) bulk soil samples taken in the general area of the proposed improvements. The tests included minimum resistivity, pH, soluble sulfates, and chloride content, with the results summarized on the following table:

Table No. 9, Corrosivity Test Results

Boring No.	Sample Depth (feet)	pH (Caltrans 643)	Soluble Chlorides (Caltrans 422) ppm	Soluble Sulfate (Caltrans 417) ppm	Saturated Resistivity (Caltrans 643) Ohm-cm
BH-1	1-5	8.30	105	360	970
BH-7	0-5	7.48	230	10	1,500

The pH value and chloride content of soil samples tested are in the non-corrosive range to ferrous metal. The saturated resistivity is in the potentially corrosive range to ferrous metal. The soluble sulfate concentrations tested are in the non-corrosive range to concrete according to the *California Department of Transportation Corrosion Guidelines*, dated September 2003.

If imported soils are used during construction, additional testing and evaluation of the as-graded soils is recommended. A corrosion engineer may be consulted for appropriate mitigation procedures and construction design, if needed. Conventional corrosion mitigation measures may include the following:

- Steel and wire concrete reinforcement should have at least three inches of concrete cover where cast against soil, unformed.

- Below-grade ferrous metals should be given a high-quality protective coating, such as 18-mil plastic tape, extruded polyethylene, coal-tar enamel, or Portland cement mortar.

- Below-grade metals should be electrically insulated (isolated) from above-grade metals by means of dielectric fittings in ferrous utilities and/or exposed metal structures breaking grade.

11.7 Site Drainage

Adequate positive drainage should be provided away from the structures to prevent ponding and to reduce percolation of water into structural backfill. A desirable slope for surface drainage is two (2) percent in landscaped areas and one (1) percent in paved areas.

Planters and landscaped areas adjacent to the building perimeter should be designed to minimize water infiltration into the subgrade soils. Gutters and downspouts should be installed on the roof, and runoff should be directed to the storm drain through non-erosive devices. Lower level walkways and open patio areas may require special drainage provisions and sump pumps to provide suitable drainage.

11.8 Soil Parameters for Pipe Design

Structural design of pipeline requires proper evaluation of all possible loads acting on the walls, including dead and live or transient loads. The stresses and strains induced on the walls depend on many factors, including the type of soil density, bearing pressure, angle of internal friction, coefficient of passive earth pressure, and coefficient of friction at the interface between the backfill and native soils.

The recommended values of the various soil parameters for the pipe design are provided below:

- Average compacted fill unit weigh — γ=125 pcf
- Angle of internal friction of soils — $\phi = 30^o$
- Soil cohesion — c = 0 psf
- Coefficient of friction between backfill and native soils — $f_s = 0.30$
- Bearing pressure against alluvial soils or compacted fill — 1,500 psf
- Coefficient of passive earth pressure — $K_p = 3.0$

11.9 Bearing Pressure for Anchor and Thrust Blocks

Allowable net bearing pressure of 1,500 pounds per square foot may be used for anchor and thrust block design against existing fill and alluvium. Such thrust blocks should be at least 24 inches wide.

Resistance to lateral forces can be assumed provided by friction at the base of thrust blocks and by passive earth pressure. Frictional and passive resistance can be combined for the design of anchors and thrust blocks.

An ultimate value of coefficient of friction of 0.3 may be used between the thrust block and the supporting natural soil or compacted fill. A passive earth pressure of 300 psf per foot of depth may be used for the sides of thrust blocks or anchors poured against undisturbed or compacted fill. The value of the passive lateral earth pressure should be limited to 1,500 psf.

If normal code requirements are applied for design, the above recommended bearing capacity and passive resistances may be increased by 33 percent for short duration loading such as seismic or wind loading.

11.10 Modulus of Soil Reaction (E')

Deflection control in flexible pipe installation involves assessment of the deflection occurring during installation as well as that occurring due to the service loads (i.e. soils and superimposed loading). The modulus of Soil Reaction presented in the following table is determined using U.S. Bureau of Reclamation method. The pipe should be designed based on a composite modulus of soil reaction which depends on a modulus of soil reaction of native soils, pipe embedment material and a ratio of trench width to pipe diameter.

Table No. 10, Modulus of Soil Reaction

Material	E', psi
Native Soils or Compacted Fill	1,000
Pipe embedment per gravel	2,000
Composite Modulus for the minimum ratio of trench width to pipe diameter of 2	1,400

12.0 CONSTRUCTION RECOMMENDATIONS

12.1 General

Site soils should be excavatable using conventional heavy-duty excavating equipment. Temporary sloped excavation is feasible if performed in accordance with the slope ratios provided in Section 12.2, *Temporary Excavations*. Existing utilities should be accurately located and either protected or removed as required.

12.2 Temporary Excavations

Based on the materials encountered in the exploratory borings, sloped temporary excavations may be constructed according to the slope ratios presented in Table No. 11, *Slope Ratios for Temporary Excavation*. Any loose utility trench backfill or other fill encountered in excavations will be less stable than the native soils. Temporary cuts encountering loose fill or loose dry sand should be constructed at a flatter gradient than presented in the following table:

Table No. 11, Slope Ratios for Temporary Excavation

Maximum Depth of Cut (feet)	Maximum Slope Ratio* (horizontal: vertical)
0 – 5	vertical
5 – 9	1:1
9+	1.5:1

*Slope ratio assumed to be uniform from top to toe of slope.

Surfaces exposed in slope excavations should be kept moist but not saturated to minimize raveling and sloughing during construction. Adequate provisions should be made to protect the slopes from erosion during periods of rainfall. Surcharge loads, including construction, should not be placed within five (5) feet of the unsupported trench edge. The above maximum slopes are based on a maximum height of six (6) feet of stockpiled soils placed at least five (5) feet from the trench edge.

All applicable requirements of the California Construction and General Industry Safety Orders, the Occupational Safety and Health Act of 1987 and current amendments, and the Construction Safety Act should be met. The soils exposed in cuts should be observed during excavation by the project's geotechnical consultant. If potentially unstable soil conditions are encountered, modifications of slope ratios for temporary cuts may be required.

12.3 Special Consideration for Excavation Adjacent to Existing Structures

Various utility lines and existing structure foundations may be within the excavation limits for the proposed project. The depths and locations of the existing facilities may require special construction considerations during excavation to protect these facilities (if necessary) during excavation.

Temporary excavations for the proposed improvements should not extend below a 1:1 (horizontal: vertical) plane extending beyond and down from the bottom of the existing utility lines or foundations. The remedial grading excavations should not cause loss of bearing and/or lateral support for adjacent off-site utilities or structures.

If remedial grading excavations extend below a 1:1 horizontal:vertical (H:V) plane extending beyond and down from the bottom of adjacent off-site utility lines or structure foundations, shoring shall be employed. Backfill should be accomplished in the shortest period of time possible and in alternating sections.

12.4 Temporary Shoring

Due to site constraints (such as roadway pavement), sloped and/or stepped excavations may not always be feasible, thus requiring the need for shoring during construction. Shoring may consist of the use of a trench box (where feasible), and/or sheet piles. The shoring for pipeline excavations and trenchless construction jacking/receiving pits may be cantilevered or may be laterally supported by whalers and cross bracing. The shoring system should be designed to limit a maximum wall deflection of ½ inch.

Earth materials encountered in our borings within the anticipated construction zone consist of predominately clay soils. In consideration of the predominately clayey nature of the site soils, caving is not anticipated.

12.4.1 Cantilevered Shoring

Cantilevered shoring systems may include sheet piles to maintain temporary support of vertical wall excavations. Shoring design must consider the support of adjacent underground utilities and/or structures, and should consider the effects of shoring deflection on supported improvements.

Temporary cantilevered shoring should be designed to resist a lateral earth pressure equivalent to a fluid density of 30 pounds per cubic foot (pcf) for non-surcharged condition above groundwater level.

Surcharge pressures from the existing structures should be added to the above earth pressures for surcharges within a horizontal distance less than or equal to the wall height. Surcharge coefficients of 45% of any uniform vertical surcharge should be added as a horizontal earth pressure for shoring design.

Surcharge pressures due to miscellaneous loads, such as vehicular traffic, soil stockpiles or construction equipments located adjacent to the shoring, should be included in the upper 10 feet of the shoring to account for normal vehicular and construction traffic within 10 feet of the excavation. Regular traffic surcharge can be considered as 100 psf for the upper 10 fee of shoring excavation. Construction surcharge of 500 psf should be considered for the heavy construction vehicle/equipment. All shoring should be designed and installed in accordance with state and federal safety regulations.

Lateral resistance for sheet piles can be provided by passive pressure below the bottom of excavations. The allowable passive pressure for soldier piles can be taken as an equivalent fluid pressure of 300 psf on the pile per foot of depth, measured below the bottom of excavation. The allowable maximum passive resistance should not exceed 3,000 psf.

All shoring system should be designed by experienced California licensed Civil Engineer and installed by experienced contractors. Shoring design should also be reviewed by Geotechnical Consultant to verify the soil parameters used in the design conformance with geotechnical report.

All applicable requirements of the California Construction and General Industry Safety Orders, the Occupational Safety and Health Act of 1987 and current amendments, and the Construction Safety Act should be met. The soils exposed in cuts should be observed during excavation by a competent person employed by the contractor. If potentially unstable soil conditions are encountered, modifications of slope ratios for temporary cuts may be required.

It is recommended that Converse review plans and specifications for proposed shoring and that a Converse representative observes the installation of shoring. A licensed surveyor should be retained to establish monuments on shoring and the surrounding ground prior to excavation. Such monuments should be monitored for horizontal and vertical movement during construction. Results of the monitoring program should be provided immediately to the project Structural (shoring) Engineer and Converse for review and evaluation. Adjacent building elements should be photo-documented prior to construction.

12.5 Trenchless Construction

Based on our understanding of the project, trenchless techniques may be utilized for the drain pipeline planned below the Caltrans right-of-way. The results of our subsurface exploration indicate relatively firm clay soils and deep groundwater for this area. It is our opinion that trenchless construction at this location can be accomplished by an experienced contractor using pipe jacking/micro-tunneling equipment.

Pipe jacking and micro-tunneling operations involve the initial construction of a jacking/tunneling pit and a receiving pit at each end of the pipe segment to be jacked. Micro-tunneling occupies a position at the heavy end of trenchless technology, and can be regarded as an extension of pipe jacking where a new pipe is pushed through a hole excavated ahead of the advancing pipe string. Whereas traditional pipe jacking requires a team of workers at the face, micro-tunneling replaces this manual work with a small tunnel boring machine (TBM).

The working/access shafts are utilized to remove the spoil and to transport the construction materials and personnel for a tunnel project. The vertical face of the working shaft should be supported with shoring. Frequent contact grouting may be necessary to backpack the shoring during construction to minimize settlement.

Grouting through the pipe casing after jacking is recommended to fill any possible voids created by the jacking operation. Jacking operations and tunneling operations should be performed in accordance with the Standard Specifications for Public Works Construction, Sections 306-2 and 306-3 to the latest edition.

Consideration should be given to performing a pre-condition survey of improvements in the area prior to construction, to document any current existing distress. Settlement points should be considered to monitor any settlement of adjacent facilities during construction.

Excavation and shoring systems should be properly designed and installed to minimize the effect of settlement during construction. The preparation of plans for the excavation and shoring is normally the responsibility of the contractor. Such plans should be submitted to the engineer for review prior to construction. Consideration should be given to characterize the material during the excavation of tunnel and based on the behavior of the soil the support system and method of trenchless may be altered accordingly.

It is the contractor's responsibility to design and select the appropriate tunnel construction method, support system and to follow the requirements of the health and safety rules of the State of California pertaining to micro-tunnel construction and permit requirement of local agencies.

12.6 Geotechnical Services During Construction

This report has been prepared to aid in the site preparation and site grading plans and specifications, and to assist the architect, civil and structural engineers in the design of the proposed structures. It is recommended that this office be provided an opportunity to review final design drawings and specifications to verify that the recommendations of this report have been properly implemented.

Recommendations presented herein are based upon the assumption that adequate earthwork monitoring will be provided by a geotechnical consultant. Excavation bottoms should be observed by a Converse representative prior to the placement of compacted fill. Structural fill and backfill should be placed and compacted during continuous observation and testing by a geotechnical consultant. Footing excavations should be observed by a geotechnical consultant prior to placement of steel and concrete so that footings are founded on satisfactory materials and excavations are free of loose and disturbed materials.

During construction, the geotechnical engineer and/or their authorized representatives should be present at the site to provide a source of advice to the client regarding the geotechnical aspects of the project and to observe and test the earthwork performed.

Their presence should not be construed as an acceptance of responsibility for the performance of the completed work, since it is the sole responsibility of the contractor performing the work to ensure that it complies with all applicable plans, specifications, ordinances, etc.

This firm does not practice or consult in the field of safety engineering. We do not direct the contractor's operations, and cannot be responsible for other than our own personnel on the site; therefore, the safety of others is the responsibility of the contractor.

13.0 CLOSURE

The findings and recommendations of this report were prepared in accordance with generally accepted professional engineering and engineering geologic principles and practice. We make no other warranty, either expressed or implied. Our conclusions and recommendations are based on the results of the background review, field and laboratory studies, combined with an interpolation and extrapolation of soil conditions between and beyond boring locations. If conditions encountered during construction appear to be different from those shown by the borings, this office should be notified.

Design recommendations given in this report are based on the assumption that the earthwork and site grading recommendations contained in this report are implemented. Additional consultation may be prudent to interpret Converse's findings for contractors, or to possibly refine these recommendations based upon the review of the final site grading and actual site conditions encountered during construction. If the scope of the project changes, if project completion is to be delayed, or if the report is to be used for another purpose, this office should be consulted.

This geotechnical report was prepared for AECOM to aid in the design and construction of the project elements described herein. Converse is not responsible for technical interpretations made by others of our exploratory information. Specific questions or interpretations concerning the findings and conclusions presented herein may require a written clarification to avoid any misunderstandings.

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APPENDIX A

FIELD EXPLORATION

APPENDIX A

FIELD EXPLORATION

Field work included site reconnaissance and subsurface exploration consisting of advancing eight (8) hollow stem auger borings drilled to depths of 16.5 to 31.5 feet. During the site reconnaissance, the surface conditions were noted, and the approximate locations of the borings were marked for utility clearance. The exploratory boring were approximately located using existing boundary and other features as a guide and should be considered accurate only to the degree implied by the method used. The various field study methods performed are discussed below.

Encountered earth materials were continuously logged by a Converse professional and classified in the field by visual examination in accordance with the Unified Soil Classification System (USCS) where appropriate, field descriptions and classifications have been modified to reflect laboratory test results.

Sampling Procedures

Ring samples of the subsurface materials were obtained at frequent intervals in the exploratory borings using a drive sampler (2.4-inches inside diameter and 3.0-inches outside diameter) lined with sample rings. The steel ring sampler was driven into the bottom of the borehole with successive drops of a 140-pound driving weight falling 30 inches, using an automatic hammer. Samples are retained in brass rings (2.4-inches inside diameter and 1.0-inch in height). The central portion of the sample was retained and carefully sealed in waterproof plastic containers for shipment to the Converse laboratory. Blow counts for each sample interval are presented on the logs of borings. Bulk samples of typical soil types were also obtained.

Standard Penetration Test (SPT) was also performed using a standard (1.4-inches inside diameter and 2.0-inches outside diameter) split-barrel sampler. The mechanically driven hammer for the SPT sampler was 140 pounds, failing 30 inches for each blow. The recorded blow counts for every six inches for a total of 1.5 feet of sampler penetration are shown on the Logs of Borings in the "BLOWS" column. The standard penetration test was performed in accordance with the ASTM Standard D1586 test method.

It should be noted that the exact depths at which material changes occur cannot always be established accurately. Unless a more precise depth can be established by other means, changes in material conditions that occur between driven samples are indicated in the logs at the top of the next drive sample. A key to soil symbols and terms is presented as Drawing No. A-1. The log of the exploratory boring is presented in Drawing Nos. A-2 through A-9, *Log of Borings*.

SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			SYMBOLS GRAPH	SYMBOLS LETTER	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	GRAVEL AND GRAVELLY SOILS MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVELS (LITTLE OR NO FINES)		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
				GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
		GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
	SAND AND SANDY SOILS MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	CLEAN SANDS (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
				SP	POORLY-GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES
		SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND - SILT MIXTURES
				SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE GRAINED SOILS MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY
				OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

BORING LOG SYMBOLS

SAMPLE TYPE

- STANDARD PENETRATION TEST
  Split barrel sampler in accordance with ASTM D-1586-84 Standard Test Method
- DRIVE SAMPLE 2.42" I.D. sampler.
- DRIVE SAMPLE No recovery
- BULK SAMPLE
- GROUNDWATER WHILE DRILLING
- GROUNDWATER AFTER DRILLING

LABORATORY TESTING ABBREVIATIONS

TEST TYPE		STRENGTH	
(Results shown in Appendix B)		Pocket Penetrometer	p
		Direct Shear	ds
		Direct Shear (single point)	ds*
		Unconfined Compression	uc
CLASSIFICATION		Triaxial Compression	tx
Plasticity	pi	Vane Shear	vs
Grain Size Analysis	ma		
Passing No. 200 Sieve	wa	Consolidation	c
Sand Equivalent	se	Collapse Test	col
Expansion Index	ei	Resistance (R) Value	r
Compaction Curve	max	Chemical Analysis	ca
Hydrometer	h	Electrical Resistivity	er

UNIFIED SOIL CLASSIFICATION AND KEY TO BORING LOG SYMBOLS

Converse Consultants

Project Name	Project No.	Drawing No.
NORTH TORRANCE WELLFIELD PROJECT CITY OF TORRANCE, CALIFORNIA	10-31-228-01	A-1

Log of Boring No. BH-1

Dates Drilled: 7/8/2011 Logged by: SMW Checked By: GDS

Equipment: 8" HOLLOW STEM AUGER Driving Weight and Drop: 140 lbs / 30 in

Ground Surface Elevation (ft): N/A Depth to Water (ft): NOT ENCOUNTERED

Depth (ft)	Graphic Log	SUMMARY OF SUBSURFACE CONDITIONS This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	SAMPLES DRIVE	SAMPLES BULK	BLOWS	MOISTURE (%)	DRY UNIT WT. (pcf)	OTHER
		4" ASPHALT OVER 7" BASE						
		OLDER ALLUVIUM (Qoa): **CLAY WITH SAND (CL):** fine-grained sand, dark brown.						ma,ei,r ca,er
5		**CLAY (CL):** trace fine-grained sand, some silt, trace gravels up to 3/4" in maximum dimension, trace caliche, olive brown.			3/5/7	17	99	
10		**CLAYEY SILT (ML):** olive brown.			5/11/16	22	101	
15					3/5/7	21	102	
		End of borehole at 16.5 feet. Groundwater not encountered during drilling. Borehole backfilled with cement slurry and capped with asphalt cold patch on 7-8-2011.						

Converse Consultants

Project Name: NORTH TORRANCE WELLFIELD PROJECT, CITY OF TORRANCE, CALIFORNIA

Project No. 10-31-228-01 Drawing No. A-2

Log of Boring No. BH-2

Dates Drilled: 7/8/2011 Logged by: SMW Checked By: GDS

Equipment: 8" HOLLOW STEM AUGER Driving Weight and Drop: 140 lbs / 30 in

Ground Surface Elevation (ft): N/A Depth to Water (ft): NOT ENCOUNTERED

Depth (ft)	Graphic Log	SUMMARY OF SUBSURFACE CONDITIONS This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	SAMPLES: DRIVE	SAMPLES: BULK	BLOWS	MOISTURE (%)	DRY UNIT WT. (pcf)	OTHER
		3.5" ASPHALT OVER 7" BASE						
		FILL (Af): **CLAY WITH SAND (CL):** fine-grained sand, dark brown.						
5			■		3/6/9	24	97	ds
		OLDER ALLUVIUM (Qoa): **CLAY (CL):** trace of silt, olive brown.						
10		-trace caliche	■		6/12/16	24	99	
15			■		6/11/14	23	96	
		End of borehole at 16.5 feet. Groundwater not encountered during drilling. Borehole backfilled with cement slurry and capped with asphalt cold patch on 7-8-2011.						

Converse Consultants

Project Name
NORTH TORRANCE WELLFIELD PROJECT
CITY OF TORRANCE, CALIFORNIA

Project No. 10-31-228-01

Drawing No. A-3

Log of Boring No. BH-3

Dates Drilled: 7/8/2011 | Logged by: SMW | Checked By: GDS

Equipment: 8" HOLLOW STEM AUGER | Driving Weight and Drop: 140 lbs / 30 in

Ground Surface Elevation (ft): N/A | Depth to Water (ft): NOT ENCOUNTERED

Depth (ft)	Graphic Log	SUMMARY OF SUBSURFACE CONDITIONS This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	SAMPLES DRIVE	SAMPLES BULK	BLOWS	MOISTURE (%)	DRY UNIT WT. (pcf)	OTHER
		3" ASPHALT OVER 10" BASE						
		FILL (Af): **CLAY WITH SAND (CL):** fine-grained sand, dark brown.		X				ma,max,r
5			X		6/11/17	17	111	
		OLDER ALLUVIUM (Qoa): **CLAY WITH SAND (CL):** fine-grained sand, trace coarse-grained sand, trace caliche, olive brown.						
10			X		5/13/20	21	105	
15			X		7/15/18	14	109	
		End of borehole at 16.5 feet. Groundwater not encountered during drilling. Borehole backfilled with cement slurry and capped with asphalt cold patch on 7-8-2011.						

Converse Consultants

Project Name: NORTH TORRANCE WELLFIELD PROJECT, CITY OF TORRANCE, CALIFORNIA

Project No. 10-31-228-01 | Drawing No. A-4

Log of Boring No. BH-4

Dates Drilled: 7/8/2011 Logged by: SMW Checked By: GDS

Equipment: 8" HOLLOW STEM AUGER Driving Weight and Drop: 140 lbs / 30 in

Ground Surface Elevation (ft): N/A Depth to Water (ft): NOT ENCOUNTERED

Depth (ft)	Graphic Log	SUMMARY OF SUBSURFACE CONDITIONS This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	SAMPLES DRIVE	SAMPLES BULK	BLOWS	MOISTURE (%)	DRY UNIT WT. (pcf)	OTHER
		FILL (Af): **SANDY CLAY (CL):** fine to medium-grained sand, dark brown.						
		OLDER ALLUVIUM (Qoa): **CLAY (CL):** trace fine-grained sand, some silt, trace gravels up to 1/2" in maximum dimension, light olive brown.						
5		-trace caliche			5/15/24	20	104	c
10		-trace coarse-grained sand, trace orange oxidation			6/17/26	23	98	ds
15					7/17/22			
		End of borehole at 16.5 feet. Groundwater not encountered during drilling. Borehole backfilled with cement slurry and capped with asphalt cold patch on 7-8-2011.						

Converse Consultants

Project Name
NORTH TORRANCE WELLFIELD PROJECT
CITY OF TORRANCE, CALIFORNIA

Project No. 10-31-228-01

Drawing No. A-5

Log of Boring No. BH-5

Dates Drilled: 7/8/2011 Logged by: SMW Checked By: GDS

Equipment: 8" HOLLOW STEM AUGER Driving Weight and Drop: 140 lbs / 30 in

Ground Surface Elevation (ft): N/A Depth to Water (ft): NOT ENCOUNTERED

Depth (ft)	Graphic Log	SUMMARY OF SUBSURFACE CONDITIONS This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	SAMPLES DRIVE	SAMPLES BULK	BLOWS	MOISTURE (%)	DRY UNIT WT. (pcf)	OTHER
		4.5" ASPHALT OVER 22" BASE						
		FILL (Af): **CLAY WITH SAND (SC):** fine-grained sand, gravels up to 1/2" in maximum dimension, brown.						
5		**OLDER ALLUVIUM (Qoa):** **CLAY (CL):** trace coarse-grained sand and silt, black.			4/7/10	22	102	ma
10		**CLAY WITH SAND (CL):** fine-grained sand, gravels up to 1" in maximum dimension, olive brown.			8/15/21	21	104	
15		**CLAYEY SILT WITH SAND (ML):** fine-grained sand, gravels up to 1 1/4" in maximum dimension, yellow brown.			4/6/8			

End of borehole at 16.5 feet.
Groundwater not encountered during drilling.
Borehole backfilled with cement slurry and capped with asphalt cold patch on 7-8-2011.

Converse Consultants

Project Name: NORTH TORRANCE WELLFIELD PROJECT, CITY OF TORRANCE, CALIFORNIA

Project No. 10-31-228-01

Drawing No. A-6

Log of Boring No. BH-6

Dates Drilled: 7/7/2011 Logged by: SMW Checked By: GDS

Equipment: 8" HOLLOW STEM AUGER Driving Weight and Drop: 140 lbs / 30 in

Ground Surface Elevation (ft): N/A Depth to Water (ft): NOT ENCOUNTERED

SUMMARY OF SUBSURFACE CONDITIONS

This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.

Depth (ft)	Description	Samples: Drive	Samples: Bulk	Blows	Moisture (%)	Dry Unit Wt. (pcf)	Other
0	**FILL (Af):** **SANDY CLAY (CL):** fine-grained sand, brown.		X				
2	**OLDER ALLUVIUM (Qoa):** **CLAY (CL):** trace fine-grained sand and silt, light brown.		X				
5	-trace organic rootlets, light brown	X		13/13/16	20	99	
10	-trace caliche	X		13/25/34	16	109	
15		X		7/18/22	33	94	c
20		X		7/20/34	20	108	
25	**SILTY SAND (SM):** fine-grained, yellow brown.	X		7/10/13			
30	-little amount of fossile shells	X		5/7/13			

End of borehole at 31.5 feet.
Groundwater not encountered during drilling.
Borehole backfilled with soil cuttings on 7-7-2011.

Converse Consultants

Project Name: NORTH TORRANCE WELLFIELD PROJECT, CITY OF TORRANCE, CALIFORNIA

Project No. 10-31-228-01 Drawing No. A-7

Log of Boring No. BH-7

Dates Drilled: 7/7/2011 Logged by: SMW Checked By: GDS

Equipment: 8" HOLLOW STEM AUGER Driving Weight and Drop: 140 lbs / 30 in

Ground Surface Elevation (ft): N/A Depth to Water (ft): NOT ENCOUNTERED

Depth (ft)	Graphic Log	SUMMARY OF SUBSURFACE CONDITIONS This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	SAMPLES DRIVE	SAMPLES BULK	BLOWS	MOISTURE (%)	DRY UNIT WT. (pcf)	OTHER
		FILL (Af): **SILTY SAND (SM):** fine to medium-grained, trace gravels up to 1 1/4" in maximum dimension, trace brick debris, brown.						max,ds,ei ca,er
5		**CLAY (CL):** some silt, tan.			16/17/12	18	105	
10		**SANDY CLAY (CL):** fine-grained sand, little amount of wood and plastic debris, gray brown.			8/7/7	18	108	c
		OLDER ALLUVIUM (Qoa): **SANDY CLAY (CL):** fine to medium-grained sand, olive brown.						
15		-trace fine-grained sand, olive brown			17/28/35	25	97	c
20		**CLAY (CL):** trace fine to coarse-grained and silt, gravels up to 1/4" in maximum dimension, olive.			6/11/16	20	108	
25		**SANDY SILT (ML):** fine-grained sand, trace fine gravels up to 3/4" in maximum dimension, orange oxidation, yellow brown.			5/9/8			
30		-some amount of fossile shells			6/13/13			
		End of borehole at 31.5 feet. Groundwater not encountered during drilling. Borehole backfilled with soil cuttings on 7-7-2011.						

Converse Consultants

Project Name: NORTH TORRANCE WELLFIELD PROJECT, CITY OF TORRANCE, CALIFORNIA

Project No. 10-31-228-01 Drawing No. A-8

Log of Boring No. BH-8

Dates Drilled: 7/7/2011 Logged by: SMW Checked By: GDS

Equipment: 8" HOLLOW STEM AUGER Driving Weight and Drop: 140 lbs / 30 in

Ground Surface Elevation (ft): N/A Depth to Water (ft): NOT ENCOUNTERED

Depth (ft)	Graphic Log	SUMMARY OF SUBSURFACE CONDITIONS This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	SAMPLES DRIVE	SAMPLES BULK	BLOWS	MOISTURE (%)	DRY UNIT WT. (pcf)	OTHER
		FILL (Af): **SILTY SAND (SM):** fine to medium-grained, gravels up to 1/2" in maximum dimension, dark brown.						
5		**SANDY CLAY (CL):** fine-grained sand, trace gravels up to 2" in maximum dimension, dark brown.			6/9/8	22	100	
		OLDER ALLUVIUM (Qoa): **CLAY (CL):** trace fine to coarse-grained sand and silt, trace gravels up to 1/2" in maximum dimension, olive brown.						
10					10/16/17	22	99	c
15		-trace caliche			8/14/18	28	93	
20		**CLAYEY SILT (ML):** trace fine to coarse-grained sand, olive.			11/18/23			dist.
25		**SANDY SILT (ML):** fine-grained sand, yellow brown.			3/6/9			
30		**CLAY (CL):** trace fine-grained sand and silt, trace gravels up to 1 1/4" in maximum dimension, yellow brown.			5/6/7			
		End of borehole at 31.5 feet. Groundwater not encountered during drilling. Borehole backfilled with soil cuttings on 7-7-2011.						

Converse Consultants

Project Name
NORTH TORRANCE WELLFIELD PROJECT
CITY OF TORRANCE, CALIFORNIA

Project No. 10-31-228-01

Drawing No. A-9

APPENDIX B

LABORATORY TESTING PROGRAM

APPENDIX B

LABORATORY TESTING PROGRAM

Tests were conducted in our laboratory on representative soil samples for the purpose of classification and evaluation of their relevant physical characteristics and engineering properties. The amount and selection of tests were based on the geotechnical requirements of the project. Test results are presented herein and on the Logs of Borings in Appendix A, *Field Exploration*. The following is a summary of the laboratory tests conducted for this project.

Moisture Content and Dry Density

Results of moisture content and dry density tests, performed on relatively undisturbed ring samples were used to aid in the classification of the soils and to provide quantitative measure of the *in situ* dry density. Data obtained from this test provides qualitative information on strength and compressibility characteristics of site soils. For test results, see the Logs of Borings in Appendix A, *Field Exploration*.

Grain-Size Analysis

To assist in classification of soils, mechanical grain-size analyses were performed on three (3) selected samples. Testing was performed in general accordance with the ASTM Standard C136 test method. Grain-size curves are shown in Drawing No. B-1, *Grain Size Distribution Results*.

Maximum Dry Density Test

Two (2) laboratory maximum dry density-moisture content relationship tests were performed on representative bulk samples of the soil materials. The testing was conducted in accordance with ASTM Standard D1557 laboratory procedure. The test result is presented on Drawing No. B-2, *Moisture-Density Relationship Results*.

Direct Shear

Direct shear testing was performed on two (2) relatively undisturbed in-situ samples and one (1) remolded sample at soaked moisture conditions. For each test, three brass sampler rings were placed, one at a time, directly into the test apparatus and subjected to a range of normal loads appropriate for the anticipated conditions. The sample was then sheared at a constant strain rate of 0.01 inch/minute. Shear deformation was recorded until a maximum of about 0.25-inch shear displacement was achieved. Ultimate strength was selected from the shear-stress deformation data and plotted to determine the shear strength parameters. For test data, including sample density and moisture content, see Drawing Nos. B-3a through B-3c, *Direct Shear Test Results*.

Consolidation

Consolidation test was performed on five (5) relatively undisturbed in-situ samples. Data obtained from this test procedure was used to evaluate the settlement characteristics of the foundation soils under load. Preparation for this test involved trimming the sample and placing the one-inch high brass ring into the test apparatus, which contained porous stones, both top and bottom, to accommodate drainage during testing. Normal axial loads were applied to one end of the sample through the porous stones, and the resulting deflections were recorded at various time periods. The load was increased after the sample reached a reasonable state equilibrium. Normal loads were applied at a constant load-increment ratio, successive loads being generally twice the preceding load. The sample was tested at field and submerged conditions. The test results, including sample density and moisture content, are presented in Drawing Nos. B-4a through 4e, *Consolidation Test Results*.

Expansion Index

Two (2) representative bulk samples were tested to evaluate the expansion potential of materials encountered at the site. Test results are presented in the following table:

Table No. B-1, Expansion Index Test Results

Boring No.	Depth (feet)	Soil Description	Expansion Index	Expansion Potential
BH-1	1-5	Clay with Sand(CL)	70	Medium
BH-7	0-5	Silty Sand (SM)	9	Very Low

Soil Corrosivity

Two (2) representative soil samples were tested to evaluate minimum electrical resistivity, pH, and chemical content, including soluble sulfate and chloride concentrations. The purpose of these tests is to determine the corrosion potential of site soils when placed in contact with common construction materials. These tests were performed by Environmental Geotechnical Laboratory, Inc. (EGL), located in Arcadia, California. The test results received from EGL are included in the following table:

Table No. B-2, Corrosivity Test Results

Boring No.	Sample Depth (feet)	pH (Caltrans 643)	Soluble Chlorides (Caltrans 422) ppm	Soluble Sulfate (Caltrans 417) ppm	Saturated Resistivity (Caltrans 643) Ohm-cm
BH-1	1-5	8.30	105	360	970
BH-7	0-5	7.48	230	10	1,500

R-value

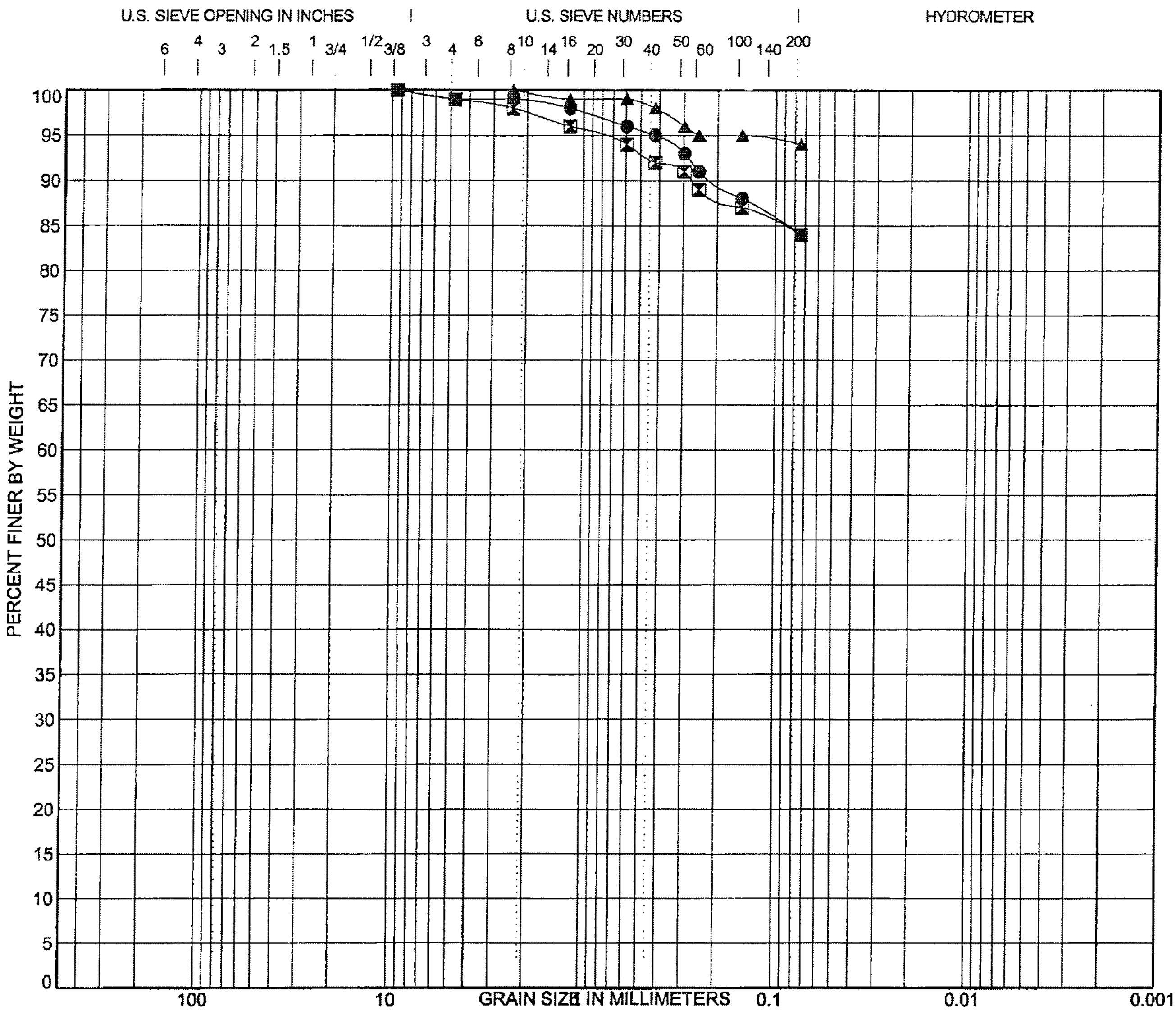
Representative bulk soil samples were tested for resistance value (R-value) in accordance with State of California Standard Method 301-G. This test is designed to provide a relative measure of soil strength for use in pavement design. The test result is shown in the following table:

Table No. B-3, R-value Test Result

Boring No.	Depth, ft	Soil Classification	Measured R-value
BH-1	1-5	Clay with Sand(CL)	5
BH-3	1-5	Clay with Sand (CL)	5

Sample Storage

Soil samples presently stored in our laboratory will be discarded 30 days after the date of this report, unless this office receives a specific request to retain the samples for a longer period.



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

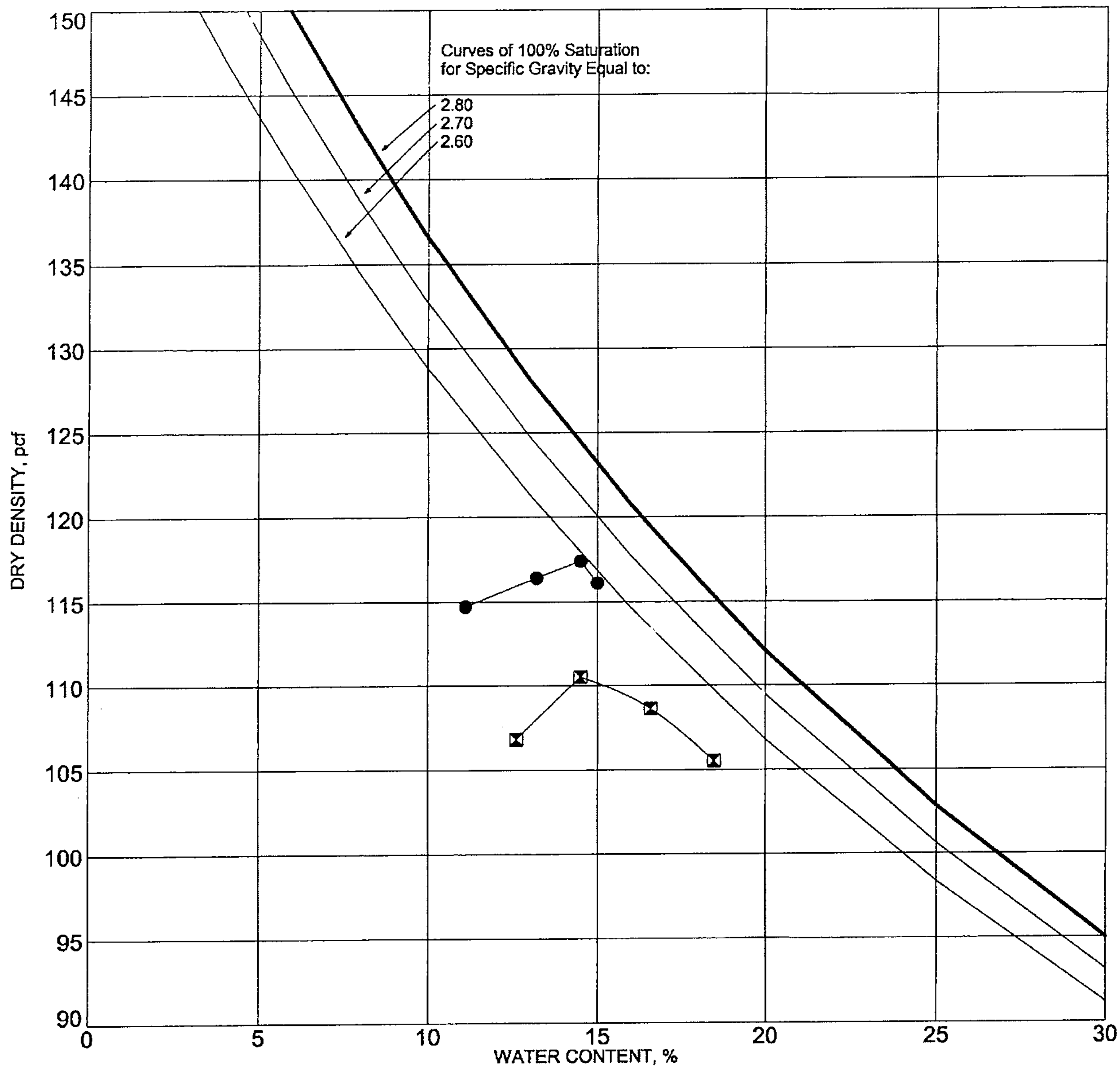
	Boring No.	Depth (ft)	Description	LL	PL	PI	Cc	Cu
●	**BH-1**	**1-5**	**CLAY WITH SAND (CL)**					
⧗	**BH-3**	**1-5**	**CLAY WITH SAND (CL)**					
▲	**BH-5**	**5-10**	**CLAY (CL)**					

	Boring No.	Depth (ft)	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**BH-1**	**1-5**	**9.5**				**1.0**	**16**	**84**	
⧗	**BH-3**	**1-5**	**9.5**				**1.0**	**16**	**84**	
▲	**BH-5**	**5-10**	**2.38**				**0.0**	**6**	**94**	

GRAIN SIZE DISTRIBUTION RESULTS

Converse Consultants

Project Name	Project No.	Drawing No.
NORTH TORRANCE WELLFIELD PROJECT **CITY OF TORRANCE, CALIFORNIA**	**10-31-228-01**	**B-1**

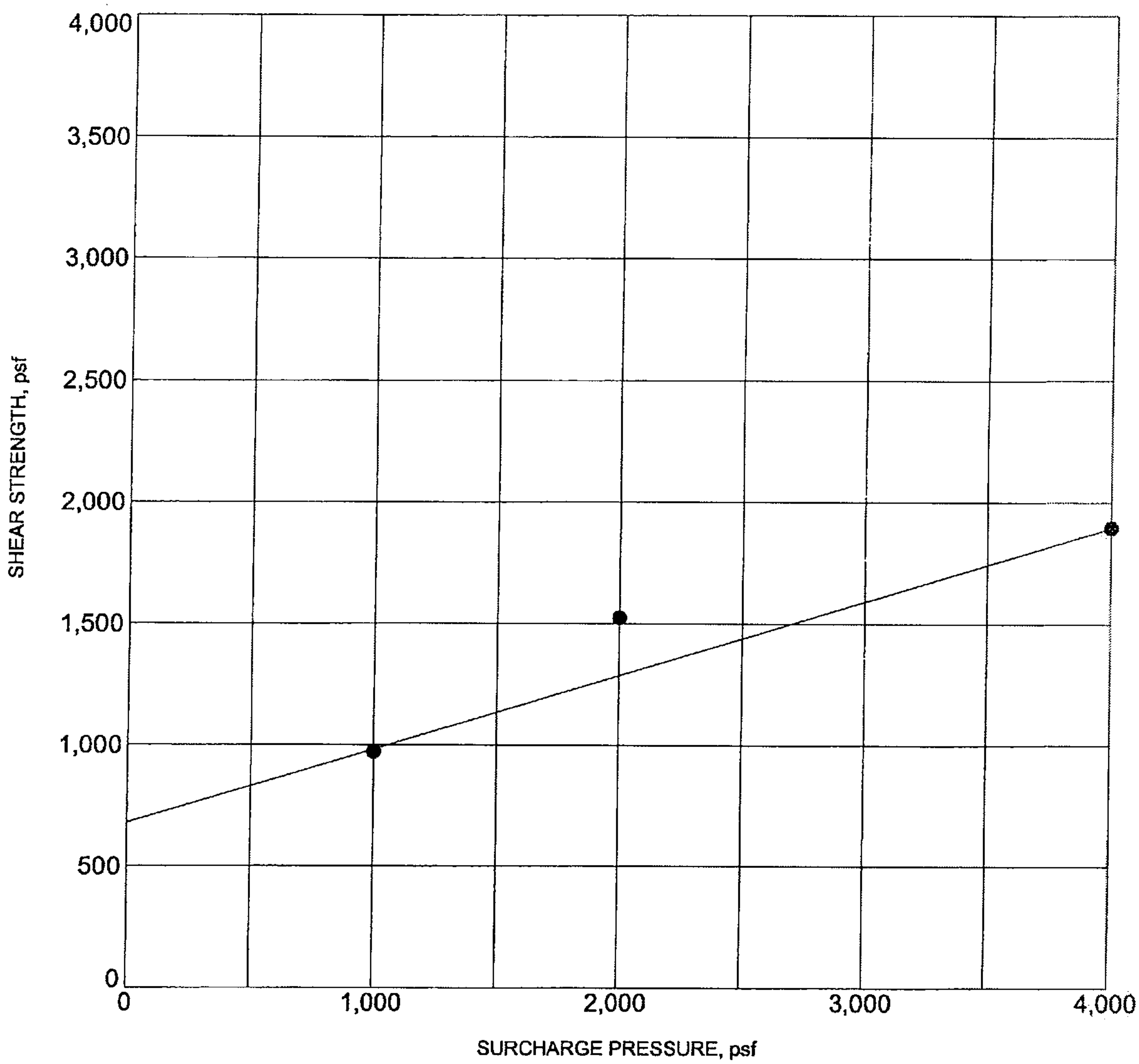


SYMBOL	BORING NO.	DEPTH (ft)	DESCRIPTION	ASTM TEST METHOD	OPTIMUM WATER, %	MAXIMUM DRY DENSITY, pcf
●	BH-3	1-5	CLAY (CL)	D1557 Method B	14.4	117.4
⊠	BH-7	0-5	SILTY SAND (SM)	D1557 Method B	15.2	111.2

MOISTURE-DENSITY RELATIONSHIP RESULTS

Converse Consultants

Project Name	Project No.	Drawing No.
NORTH TORRANCE WELLFIELD PROJECT CITY OF TORRANCE, CALIFORNIA	10-31-228-01	B-2



BORING NO. :	BH-2	DEPTH (ft) :	5
DESCRIPTION :	CLAY WITH SAND (CL)		
COHESION (psf) :	650	FRICTION ANGLE (degrees):	17
MOISTURE CONTENT (%) :	24.0	DRY DENSITY (pcf) :	96.5

NOTE: Ultimate Strength.

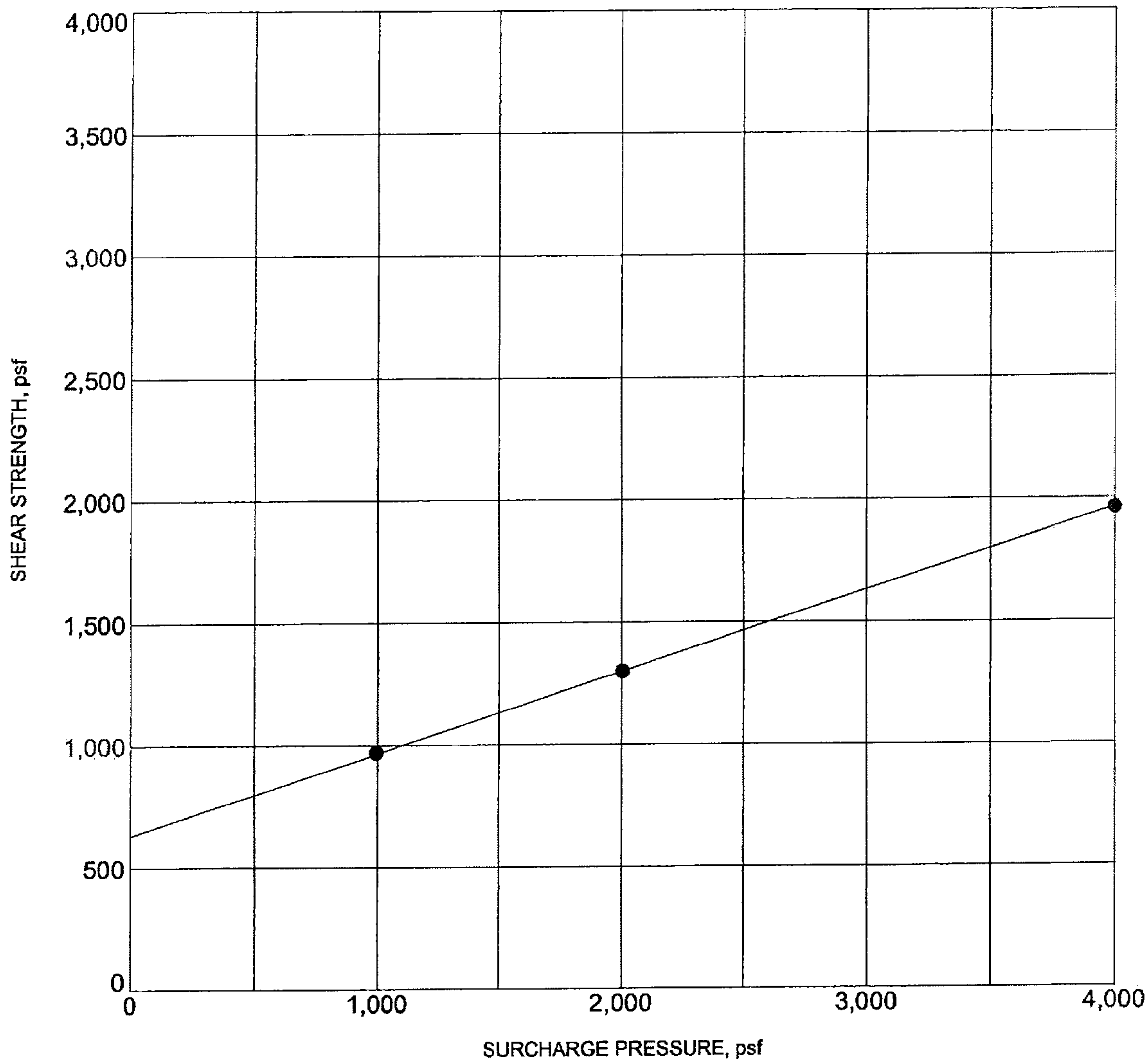
DIRECT SHEAR TEST RESULTS

Converse Consultants

Project Name
NORTH TORRANCE WELLFIELD PROJECT
CITY OF TORRANCE, CALIFORNIA

Project No. 10-31-228-01

Drawing No. B-3a



BORING NO. :	BH-4	DEPTH (ft) :	10
DESCRIPTION :	CLAY (CL)		
COHESION (psf) :	650	FRICTION ANGLE (degrees):	17
MOISTURE CONTENT (%) :	22.8	DRY DENSITY (pcf) :	98.1

NOTE: Ultimate Strength.

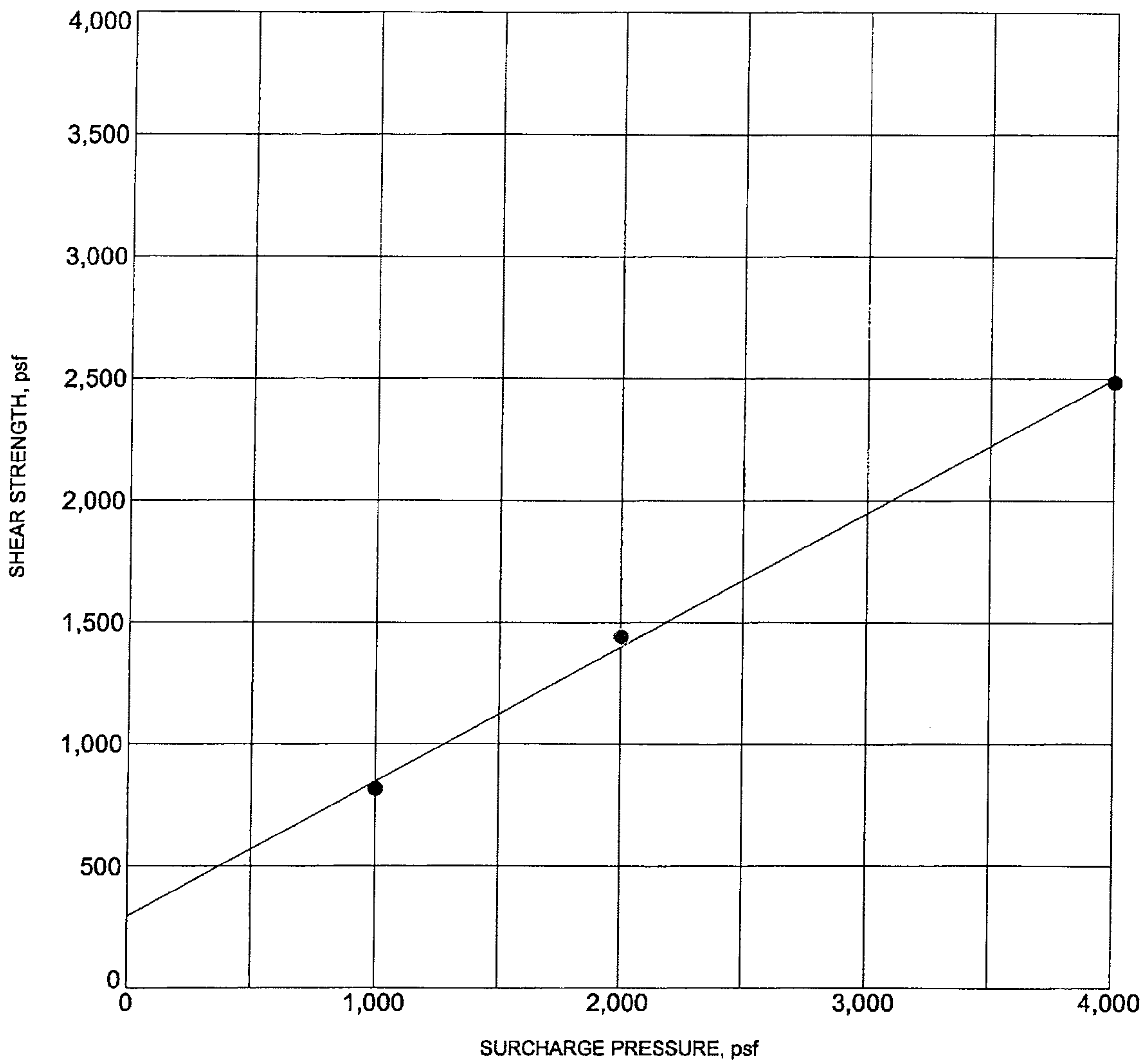
DIRECT SHEAR TEST RESULTS

Converse Consultants

Project Name
NORTH TORRANCE WELLFIELD PROJECT
CITY OF TORRANCE, CALIFORNIA

Project No.
10-31-228-01

Drawing No.
B-3b



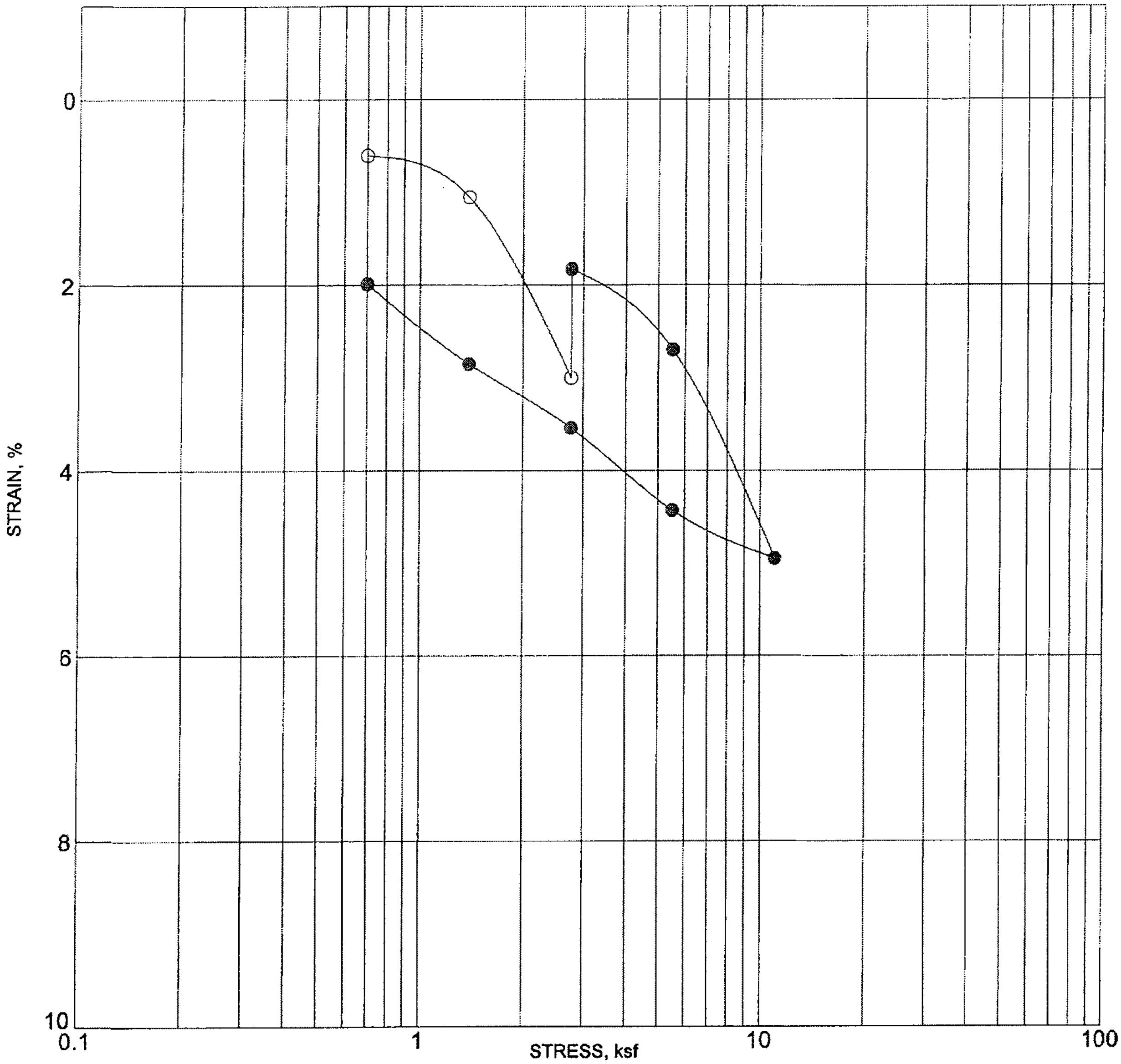
BORING NO. :	BH-7	DEPTH (ft) :	0-5
DESCRIPTION :	SILTY SAND (SM)		
COHESION (psf) :	300	FRICTION ANGLE (degrees):	29
MOISTURE CONTENT (%) :	15.8	DRY DENSITY (pcf) :	98.9

NOTE: Ultimate Strength. Remolded to 90% relative compaction.

DIRECT SHEAR TEST RESULTS

Converse Consultants

Project Name	Project No.	Drawing No.
NORTH TORRANCE WELLFIELD PROJECT CITY OF TORRANCE, CALIFORNIA	10-31-228-01	B-3c



BORING NO. :	BH-4	DEPTH (ft) :	5
DESCRIPTION :	CLAY (CL)		

	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	PERCENT SATURATION	VOID RATIO
INITIAL	20	103.9		
FINAL	24.5	103.9		

NOTE: SOLID CIRCLES INDICATE READINGS AFTER ADDITION OF WATER

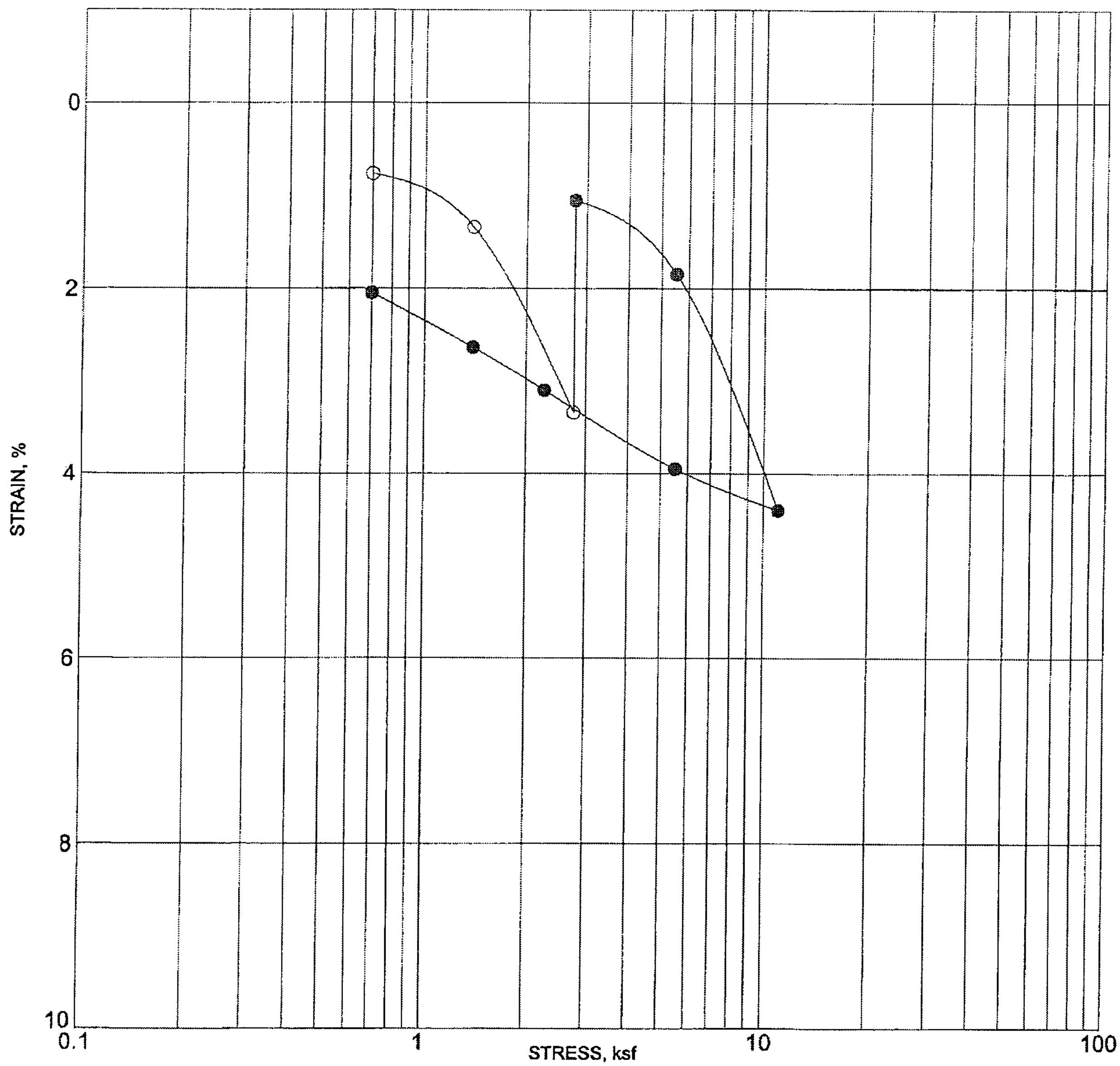
CONSOLIDATION TEST RESULTS

Converse Consultants

Project Name
NORTH TORRANCE WELLFIELD PROJECT
CITY OF TORRANCE, CALIFORNIA

Project No. 10-31-228-01

Drawing No. B-4a



BORING NO. :	BH-6	DEPTH (ft) :	15
DESCRIPTION :	CLAY (CL)		

	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	PERCENT SATURATION	VOID RATIO
INITIAL	32.5	93.5		
FINAL	37.1	93.5		

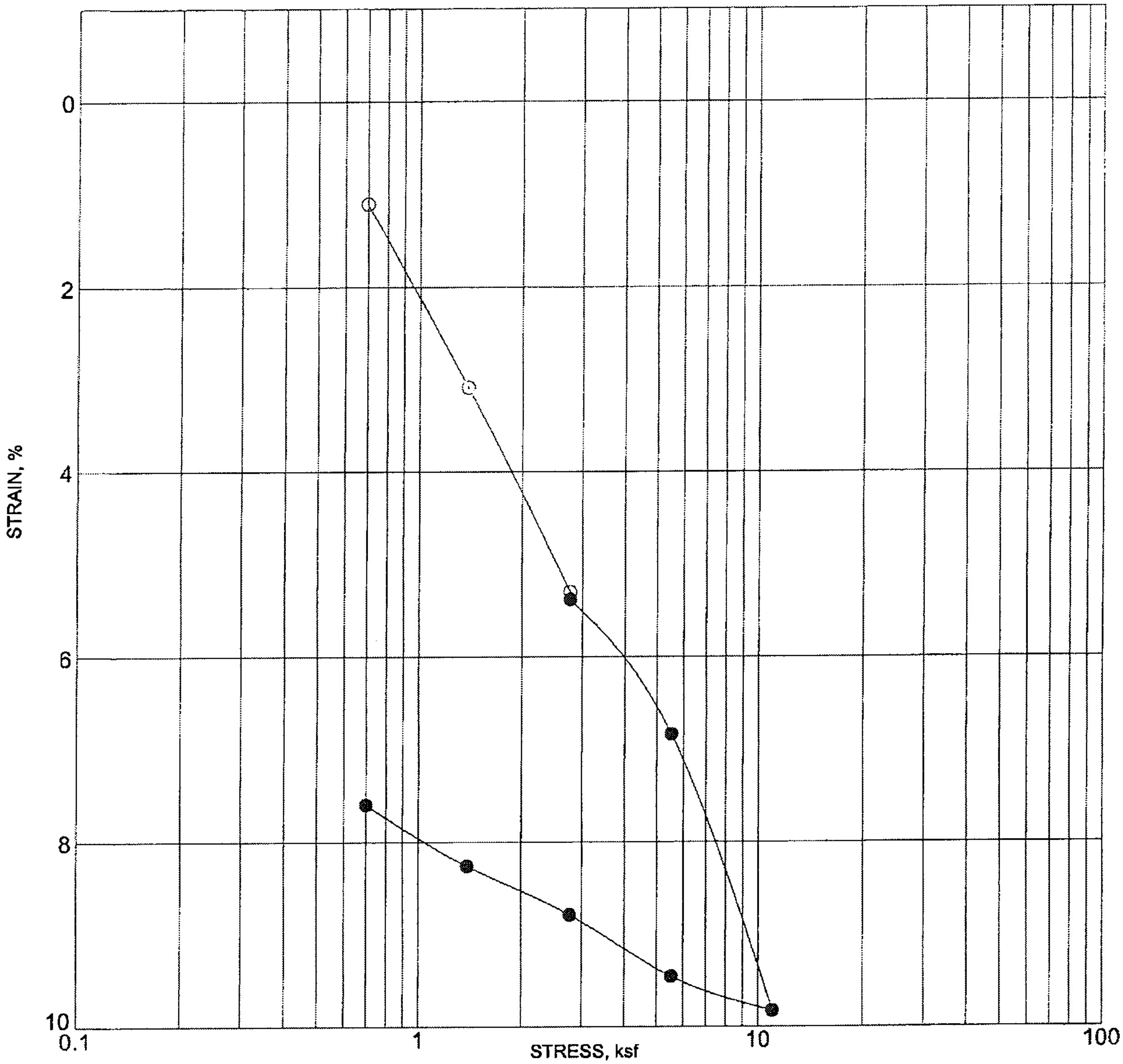
NOTE: SOLID CIRCLES INDICATE READINGS AFTER ADDITION OF WATER

CONSOLIDATION TEST RESULTS

Converse Consultants

Project Name
NORTH TORRANCE WELLFIELD PROJECT
CITY OF TORRANCE, CALIFORNIA

Project No.	Drawing No.
10-31-228-01	B-4b



BORING NO. :	BH-7	DEPTH (ft) :	10
DESCRIPTION :	SANDY CLAY (CL)		

	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	PERCENT SATURATION	VOID RATIO
INITIAL	17.9	108.3		
FINAL	21.4	108.3		

NOTE: SOLID CIRCLES INDICATE READINGS AFTER ADDITION OF WATER

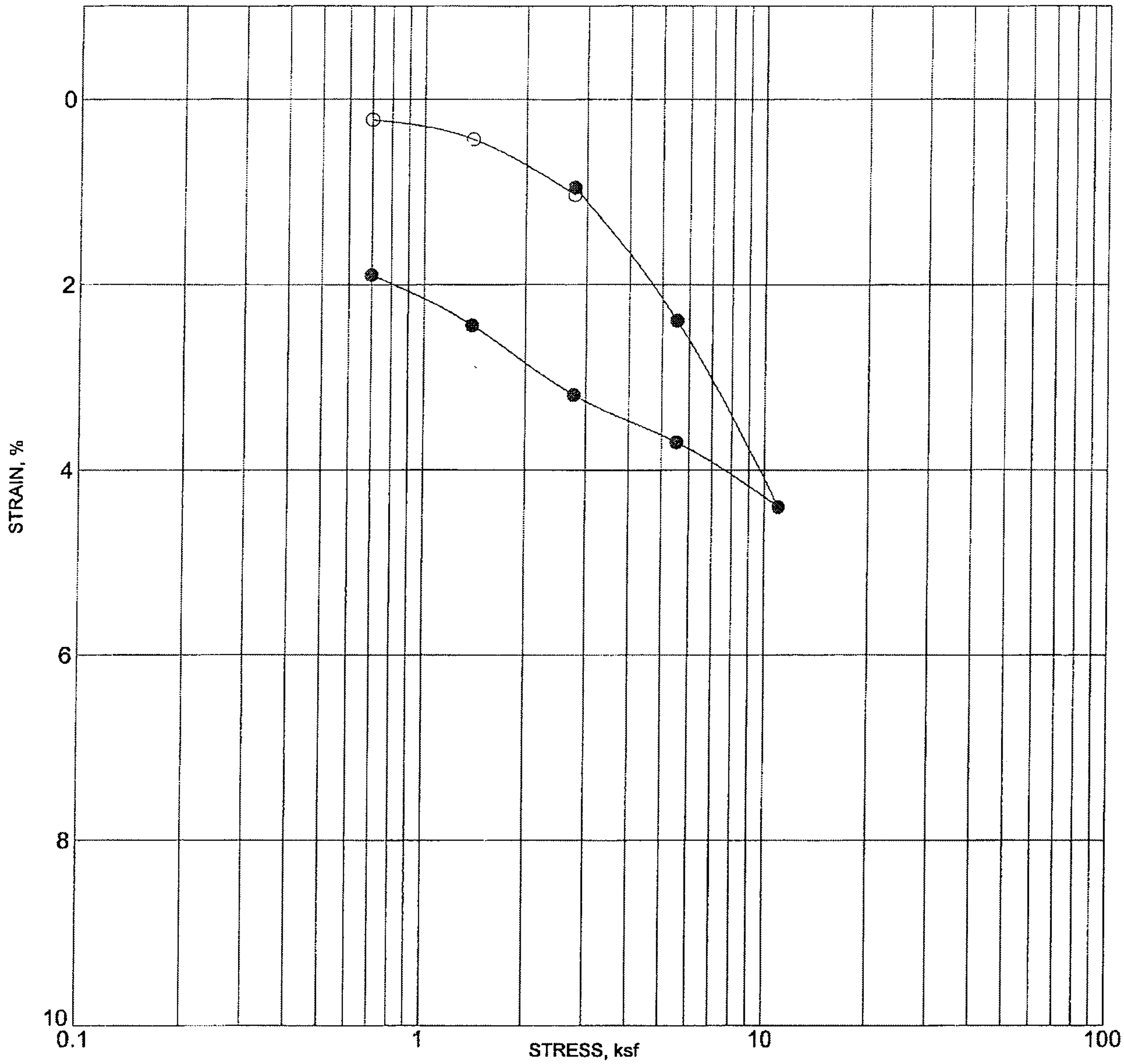
CONSOLIDATION TEST RESULTS

Converse Consultants

Project Name
NORTH TORRANCE WELLFIELD PROJECT
CITY OF TORRANCE, CALIFORNIA

Project No. 10-31-228-01

Drawing No. B-4c



BORING NO. :	BH-7	DEPTH (ft) :	15
DESCRIPTION :	SANDY CLAY (CL)		

	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	PERCENT SATURATION	VOID RATIO
INITIAL	24.6	97.1		
FINAL	28.3	97.1		

NOTE: SOLID CIRCLES INDICATE READINGS AFTER ADDITION OF WATER

CONSOLIDATION TEST RESULTS

Converse Consultants

Project Name
NORTH TORRANCE WELLFIELD PROJECT
CITY OF TORRANCE, CALIFORNIA

Project No. 10-31-228-01

Drawing No. B-4d

APPENDIX C

EARTHWORK SPECIFICATIONS

APPENDIX C

EARTHWORK SPECIFICATIONS

C1.1 Scope of Work

The work includes all labor, supplies and construction equipment required to construct the planned project in a good, workmanlike manner, as shown on the drawings and herein specified. The major items of work covered in this section include the following:

- Site Inspection
- Authority of Geotechnical Engineer
- Site Clearing
- Excavations
- Preparation of Fill Areas
- Placement and Compaction of Fill
- Observation and Testing

C1.2 Site Inspection

1. The Contractor shall carefully examine the site and make all inspections necessary, in order to determine the full extent of the work required to make the completed work conform to the drawings and specifications. The Contractor shall satisfy himself as to the nature and location of the work, ground surface and the characteristics of equipment and facilities needed prior to and during prosecution of the work. The Contractor shall satisfy himself as to the character, quality, and quantity of surface and subsurface materials or obstacles to be encountered. Any inaccuracies or discrepancies between the actual field conditions and the drawings, or between the drawings and specifications must be brought to the Owner's attention in order to clarify the exact nature of the work to be performed.

2. This *Geotechnical Study Report* by Converse Consultants may be used as a reference to the surface and subsurface conditions on this project. The information presented in this report is intended for use in design and is subject to confirmation of the conditions encountered during construction. The exploration logs and related information depict subsurface conditions only at the particular time and location designated on the boring logs. Subsurface conditions at other locations may differ from conditions encountered at the exploration locations. In addition, the passage of time may result in a change in subsurface conditions at the exploration locations. Any review of this information shall not relieve the

Contractor from performing such independent investigation and evaluation to satisfy himself as to the nature of the surface and subsurface conditions to be encountered and the procedures to be used in performing his work.

C1.3 Authority of the Geotechnical Engineer

1. The Geotechnical Engineer will observe the placement of compacted fill and will take sufficient tests to evaluate the uniformity and degree of compaction of filled ground.
2. As the Owner's representative, the Geotechnical Engineer will (a) have the authority to cause the removal and replacement of loose, soft, disturbed and other unsatisfactory soils and uncontrolled fill; (b) have the authority to approve the preparation of native ground to receive fill material; and (c) have the authority to approve or reject soils proposed for use in building areas.
3. The Civil Engineer and/or Owner will decide all questions regarding (a) the interpretation of the drawings and specifications, (b) the acceptable fulfillment of the contract on the part of the Contractor and (c) the matters of compensation.

C1.4 Site Clearing

1. Clearing and grubbing shall consist of the removal from building areas to be graded of all existing structures, pavement, utilities, and vegetation.
2. Organic and inorganic materials resulting from the clearing and grubbing operations shall be hauled away from the areas to be graded.

C1.5 Excavations

1. Based on observations made during our field explorations, the surficial soils can be excavated with conventional earthwork equipment.

C1.6 Preparation of Fill Areas

1. All organic material, organic soils, undocumented fill soils and demolition debris should be removed from the proposed building areas.
2. Due to compressible undocumented fill and expansive soils conditions, we recommend the planned areas of the wells, storage tank and booster pump/utility building be supported on compacted fill soils achieved through over-excavation and re-compaction. Depths of grading for remedial earthwork are anticipated to be 2 feet for the well locations, and approximately 7 to 12 feet for the storage tank and booster pump/utility building. The extent and depth of over-excavation shall be verified and approved by a geotechnical consultant during grading operations. The remedial grading should extend laterally to a distance equal to the

depth of removal, or at least 5 feet beyond the foundation/slab, whichever is greater. Over-excavation for pipelines is not needed. All loose, soft or disturbed earth materials should be removed from the bottom of excavations before placing structural fill. The actual depth of removal should be evaluated based on observations made during grading. Thickness of compacted fill underneath the buildings should not vary.

3. The subgrade in all areas to receive fill shall be scarified to a minimum depth of six (6) inches, the soil moisture adjusted between optimum and three (3) percent above optimum for fine-grained soils and within two (2) percent of optimum moisture content for granular soils, and then compacted to at least 90 percent of the laboratory maximum dry density as determined by ASTM Standard D1557 test method. Scarification may be terminated on moderately hard to hard, cemented earth materials with the approval of the Geotechnical Engineer.
4. Compacted fill may be placed on native soils that have been properly scarified and recompacted as discussed above.
5. All areas to receive compacted fill will be observed and approved by the Geotechnical Engineer before the placement of fill.

C1.7 Placement and Compaction of Fill

1. Compacted fill placed for the support of footings, slabs-on-grade, exterior concrete flatwork, and driveways will be considered structural fill. Structural fill may consist of approved on-site soils or imported fill that meets the criteria indicated below.
2. Fill consisting of selected on-site earth materials or imported soils approved by the Geotechnical Engineer shall be placed in layers on approved earth materials. Soils used as compacted structural fill shall have the following characteristics:
    a. All fill soil particles shall not exceed three (3) inches in nominal size, and shall be free of organic matter and miscellaneous inorganic debris and inert rubble.
    b. Imported fill materials shall have an Expansion Index (EI) less than 20. All imported fill should be compacted to at least 90 percent of the laboratory maximum dry density (ASTM Standard D1557) at about three (3) percent above optimum moisture for fine grained soils, and within three (3) percent of optimum for granular soils.
3. Fill soils shall be evenly spread in maximum 8-inch lifts, watered or dried as necessary, mixed and compacted to at least the density specified below. The fill shall be placed and compacted on a horizontal plane, unless otherwise approved by the Geotechnical Engineer.

4. All fill placed at the site shall be compacted to at least 90 percent of the laboratory maximum dry density as determined by ASTM Standard D1557 test method. The on-site soils shall be moisture conditioned within two (2) percent above the optimum moisture content. At least the upper 12 inches of subgrade soils underneath the concrete apron, pavement and parking areas should be compacted to a minimum of 95 percent relative compaction.
5. Fill exceeding five (5) feet in height shall not be placed on native slopes that are steeper than 5:1 horizontal:vertical (H:V). Where native slopes are steeper than 5:1 H:V, and the height of the fill is greater than five (5) feet, the fill shall be benched into competent materials. The height and width of the benches shall be at least two (2) feet.
6. Representative samples of materials being used, as compacted fill will be analyzed in the laboratory by the Geotechnical Engineer to obtain information on their physical properties. Maximum laboratory density of each soil type used in the compacted fill will be determined by the ASTM Standard D1557 compaction method.
7. Fill materials shall not be placed, spread or compacted during unfavorable weather conditions. When site grading is interrupted by heavy rain, filling operations shall not resume until the Geotechnical Engineer approves the moisture and density conditions of the previously placed fill.
8. It shall be the Grading Contractor's obligation to take all measures deemed necessary during grading to provide erosion control devices in order to protect slope areas and adjacent properties from storm damage and flood hazard originating on this project. It shall be the contractor's responsibility to maintain slopes in their as-graded form until all slopes are in satisfactory compliance with job specifications, all berms have been properly constructed, and all associated drainage devices meet the requirements of the Civil Engineer.

C1.8 Trench Backfill

The following specifications are recommended to provide a basis for quality control during the placement of trench backfill.

1. Trench excavations to receive backfill shall be free of trash, debris or other unsatisfactory materials at the time of backfill placement.
2. Trench backfill shall be compacted to a minimum relative compaction of 90 percent as per ASTM Standard D1557 test method.
3. Rocks larger than one (1) inch should not be placed within 12 inches of the top of the pipeline or within the upper 12 inches of pavement or structure subgrade. No more than 30 percent of the backfill volume shall be larger than 3/4-inch in largest dimension diameter, and rocks shall be well mixed with finer soil.

4. The pipe design engineer should select bedding material for the pipe. Bedding materials generally should have a Sand Equivalent (SE) greater than or equal to 30, as determined by the ASTM Standard D2419 test method. Trench backfill shall be compacted by mechanical methods, such as sheepsfoot, vibrating or pneumatic rollers, or mechanical tampers, to achieve the density specified herein. The backfill materials shall be brought to within three (3) percent of optimum moisture content for granular soils and between optimum and three (3) percent above optimum for fine-grained soils, then placed in horizontal layers. The thickness of uncompacted layers should not exceed eight (8) inches. Each layer shall be evenly spread, moistened or dried as necessary, and then tamped or rolled until the specified density has been achieved.

5. The contractor shall select the equipment and processes to be used to achieve the specified density without damage to adjacent ground and completed work.

6. The field density of the compacted soil shall be measured by the ASTM Standard D1556 or ASTM Standard D2922 test methods or equivalent.

7. Observation and field tests should be performed by Converse during construction to confirm that the required degree of compaction has been obtained. Where compaction is less than that specified, additional compactive effort shall be made with adjustment of the moisture content as necessary, until the specified compaction is obtained.

8. It should be the responsibility of the Contractor to maintain safe conditions during cut and/or fill operations.

9. Trench backfill shall not be placed, spread or rolled during unfavorable weather conditions. When the work is interrupted by heavy rain, fill operations shall not be resumed until field tests by the project's geotechnical consultant indicate that the moisture content and density of the fill are as previously specified.

C1.9 Observation and Testing

1. During the progress of grading, the Geotechnical Engineer will provide observation of the fill placement operations.

2. Field density tests will be made during grading to provide an opinion on the degree of compaction being obtained by the contractor. Where compaction of less than specified herein is indicated, additional compactive effort with adjustment of the moisture content shall be made as necessary, until the required degree of compaction is obtained.

3. A sufficient number of field density tests will be performed to provide an opinion to the degree of compaction achieved. In general, density tests will be performed on each one-foot lift of fill, but not less than one for each 500 cubic yards of fill place.

APPENDIX I

CITY OF TORRANCE

BUSINESS LICENSE APPLICATION

C & E PERMIT

Please call the Business License Office at 310-618-5923 for fee amounts. Payment must be submitted with your application.

FOR OFFICIAL USE ONLY

1. LICENSE NO. 2. CATEGORY NO.

HOME OCCUPATION HEALTH PERMIT 3. NAICS CODE

City of Torrance, Revenue Division

Business License Application

3031 Torrance Blvd, Torrance, CA 90503 • 310/618-5828 • 310/618-5852 Fax

PART I. APPLICANT TO ANSWER ALL QUESTIONS IN THIS SECTION (print or type)

4. BUSINESS NAME OR DBA			5. CORPORATE NAME (IF DIFFERENT FROM ABOVE)		
6. BUSINESS ADDRESS	SUITE #		CITY	STATE	ZIP
7. MAILING ADDRESS	SUITE #		CITY	STATE	ZIP
8. NATURE OF BUSINESS (state type of business being conducted at this location)		9. NO. OF PERSONS WORKING IN TORRANCE	10. BUSINESS PHONE	11. CELL PHONE	
12. NAME OF PERSON MAKING APPLICATION (must be an owner, partner or corporate officer)	13. TITLE		14. HOME PHONE	15. EMAIL ADDRESS	
16. RESIDENCE ADDRESS	CITY	STATE	ZIP	17. DRIVER'S LICENSE #	18. SOCIAL SECURITY #
19. STATE CONTRACTOR'S LICENSE #	20. SQUARE FOOTAGE	21. STATE SELLERS PERMIT #	22. FED. TAX ID #	23. STATE TAX ID #	

24. OWNERSHIP INFORMATION ☐ LLC ☐ PARTNERSHIP ☐ CORPORATION ☐ SOLE OWNERSHIP

NAMES OF OWNER, PARTNERS, OR PRINCIPAL OFFICERS	TITLE	HOME ADDRESS	HOME PHONE

I declare that I am the owner, partner, corporate officer or person with the power of attorney, and I understand if all the information provided above is not the true the business license being applied for may be revoked as outlined in section 31.9.10 of the Torrance Municipal Code.

I am duly authorized to make this application. All of the information provided in this application is true and correct. The business will not provide any service, good or product which is illegal under Federal, State, or Local Laws. I declare under penalty of perjury that the foregoing is true and correct.

SIGNATURE ______________________ DATE ______________

PART II. FOR OFFICIAL USE ONLY

BASIC FEE	APPLICATION SENT FOR ZONING? ☐ YES ☐ NO	PROCESSING FEE	FIRE INSP. FEE	OTHER	
PER PERSON FEE	OTHER (cont'd)				
PENALTY FEE	HOLD ☐ YES ☐ NO	ENT. FEE	DANCE/PIANO FEE		
RECEIVED BY	DATE	CHECK NO.	BANK NO.	CASH	TOTAL AMOUNT $

City of Torrance, Community Development Department

Permit Application Form

3031 TORRANCE BLVD. • TORRANCE, CA 90503

OWNER/APPLICANT INFORMATION

Name:______________________________

Address:______________________________

City/State:______________________________

Zip:______________________________

Telephone:______________________________

Fax:______________________________

Excavation permits will not be issued without USA I.D. Number.

Underground Service Alert
Call: 811

USA I.D. #______________________________
Date Received:______________________________

CONTRACTOR INFORMATION

____

____

____

____

____

____

State License #:______________________________

Class:____________________ Exp. Date:__________

City Business #:______________________________

CONTRACTOR: Certificate of Insurance REQUIRED prior to issuance of permit.

JOB LOCATION/ADDRESS (closest street address)

Please list cross streets:____

____

DESCRIPTION OF WORK

____

____

LF Trench______________ Width of Trench____________ LF Curb & Gutter____________

LF Bore______________ Sewer Connection__________ Number of Curb Drains________

SF Asphalt______________ SF Concrete______________

Work Order Number (for utility companies):______________________________

Applicant or Authorized Signature:______________________________

For further permit information, please call 310-618-5898 or fax 310-618-2846.

Contractor License Requirements

Curb/Gutter..............................A (General Engineering)
C8 (Concrete Contractor)

Driveways................................A (General Engineering)
C8 (Concrete Contractor)

Sidewalks................................A (General Engineering)
B (General Building)
C8 (Concrete Contractor)

Street/Alley.............................A (General Engineering)
C8 (Concrete Contractor)
C12 (Earth and Paving Contractor)

Sewer Lateral/Mainline..............A (General Engineering)
C34 (Pipeline Contractor)
C42 (Sanitation Contractor)

Storm Drain Lateral/Mainline.......................A (General Engineering)
C34 (Pipeline Contractor)
C42 (Sanitation Contractor)

U/G Utilities.........................A (General Engineering)
(Water, Gas or Oil)..................C34 (Pipeline Contractor)

U/G Electrical.........................A (General Engineering)
C8 (Concrete Contractor)
C12 (Earth and Paving Contractors)

Standard Requirements

1) **SCHEDULE INSPECTIONS 24 HOURS IN ADVANCE** (pre-job, work start, interim, final). Call 310-618-5898 between working hours of 7:30 AM – 5:30 PM. **Pre-job meetings for WATER permits shall be scheduled 72 hours in advance.**

2) **TRAFFIC CONTROL** shall be per City of Torrance standards or Manual on Uniform Traffic Control Devices (MUTCD). Street closure shall be per City of Torrance Standard T603. Major street lane closures between 8:30 AM – 3:30 PM only. **ONE STANDARD ARROWBOARD REQUIRED FOR EACH LANE CLOSURE.**

3) Do not remove any trees or shrubs without approval of Torrance Public Works Department/Streetscape (310-781-6900).

4) **Contractor will be billed for overtime inspection services.** OVERTIME REQUESTS must be submitted for approval 24 hours in advance.

5) Construction site **CLEANUP** and **GRAFFITI (USA MARKINGS)** removal must be completed prior to finaling of this permit. Any graffiti on construction signs must be removed or the sign replaced within 24 hours of notification.

6) Any street striping, crosswalk, raised reflective pavement marker or pavement markings damaged by this construction shall be replaced to the satisfaction of the Torrance Public Works Department/Traffic Division (310-781-6900).

7) **THIS PERMIT WILL BE REVOKED** if any pollutant is released into or allowed to remain in any component of the City drainage system.

8) Trench backfill and pavement repairs shall be per City of Torrance Standard T116.

9) Any public irrigation system components damaged by this construction shall be replaced to the satisfaction of Community Services/Park Services Division (310-618-2930).

10) All survey monuments in the project area **MUST** be located and tied out and a Corner Record filed prior to the start of construction. Also, all destroyed monuments must be replaced prior to receiving final inspection.

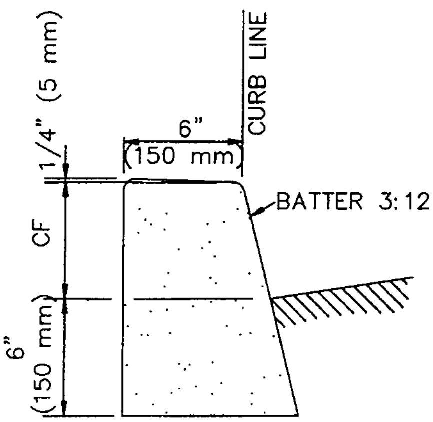
11) It is the responsibility of the contractor to **REPLACE** any **PAVEMENT** removed by this construction.

12) The City of Torrance is held harmless from the results of any action or accidents caused by the permittee, his employees, or equipment in the performance of the work described or covered in this permit. Validation of this permit **SHALL NOT** be held to permit or to be an approval of the violation of any applicable provision of the City Code covering this work, or any other provisions of the City of Torrance Code. In the granting of a Construction & Excavation permit, the Community Development Director may impose such conditions thereon, in addition to those otherwise provided herein, as are reasonably necessary to prevent the proposed operations from being conducted in such a manner as to constitute or create a **HAZARD OR BE DETRIMENTAL TO LIFE OR PROPERTY.**

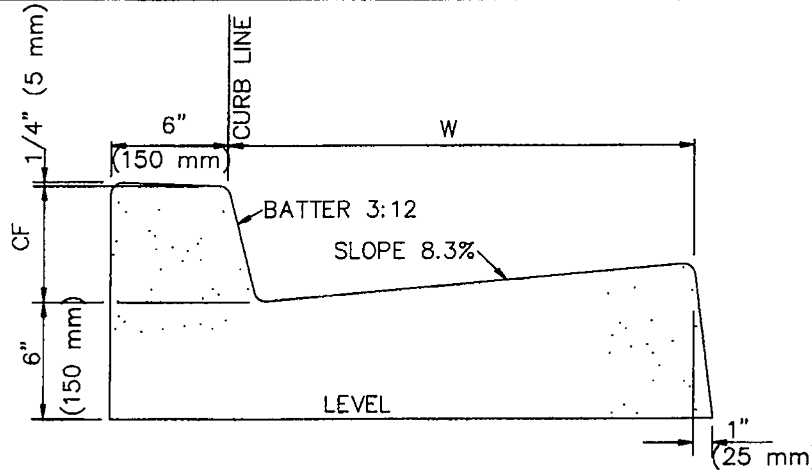
13) See additional conditions attached to this permit.

APPENDIX II

STANDARD PLANS



A1-6(150) AND
A1-8(200)



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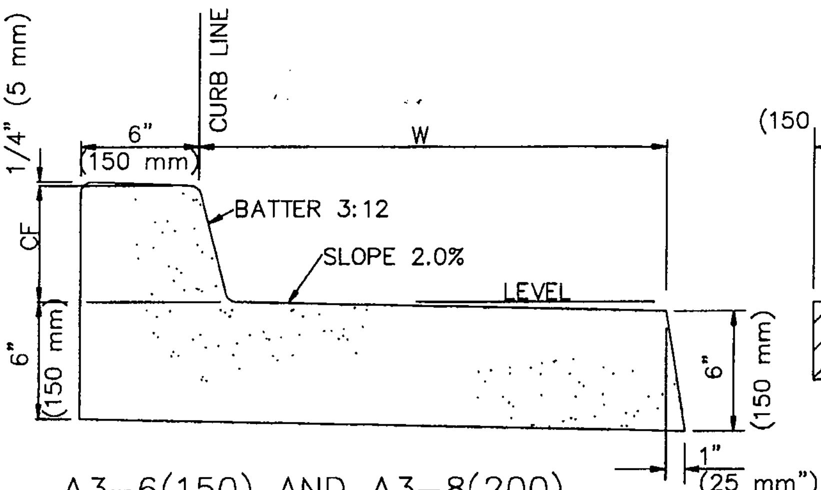

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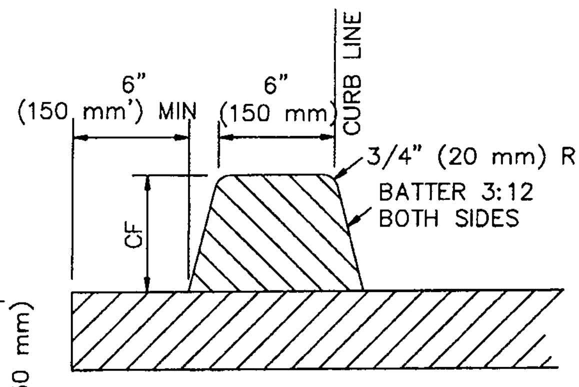
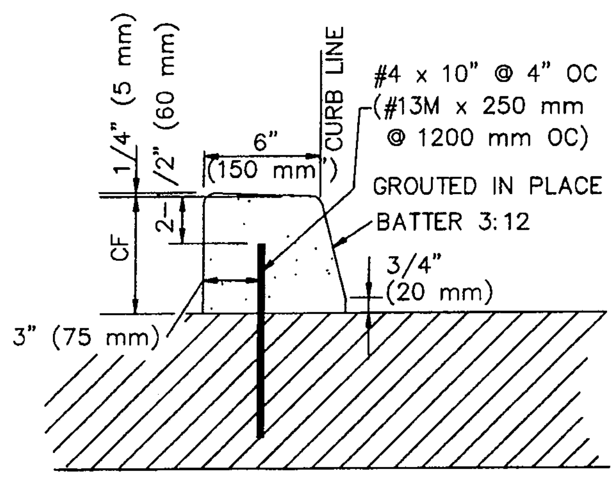


D1-6(150) AND
D1-8(200)

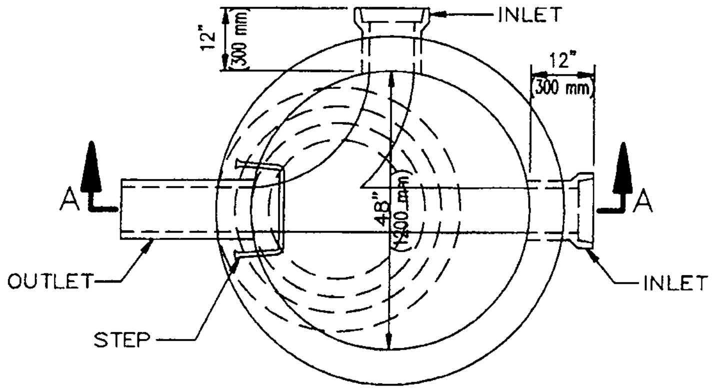
NOTES:

1. THE LAST NUMBER IN THE DESIGNATION IS THE CURB FACE (CF) HEIGHT, INCHES (mm).
2. GUTTER WIDTH, W, IS 24" (600 mm) UNLESS OTHERWISE SPECIFIED.
3. TYPES A1, A2, A3 AND C1 SHALL BE CONSTRUCTED FROM PCC.
4. TYPE D1 CURB SHALL BE CONSTRUCTED FROM ASPHALT CONCRETE.
5. TYPE C1 CURB SHALL BE ANCHORED WITH STEEL DOWELS AS SHOWN OR WITH AN EPOXY APPROVED BY THE ENGINEER.
6. ALL EXPOSED CORNERS ON PCC CURBS AND GUTTERS SHALL BE ROUNDED WITH A 1/2" (15 mm) RADIUS.

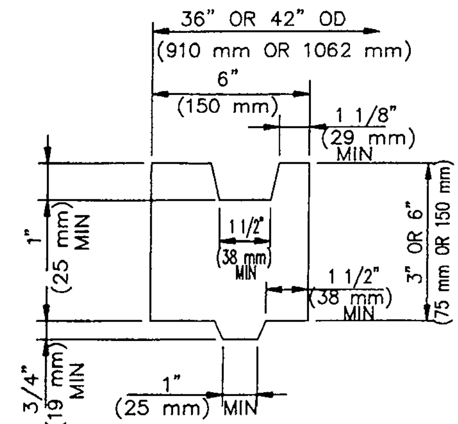


C1-6(150) AND C1-8(200)

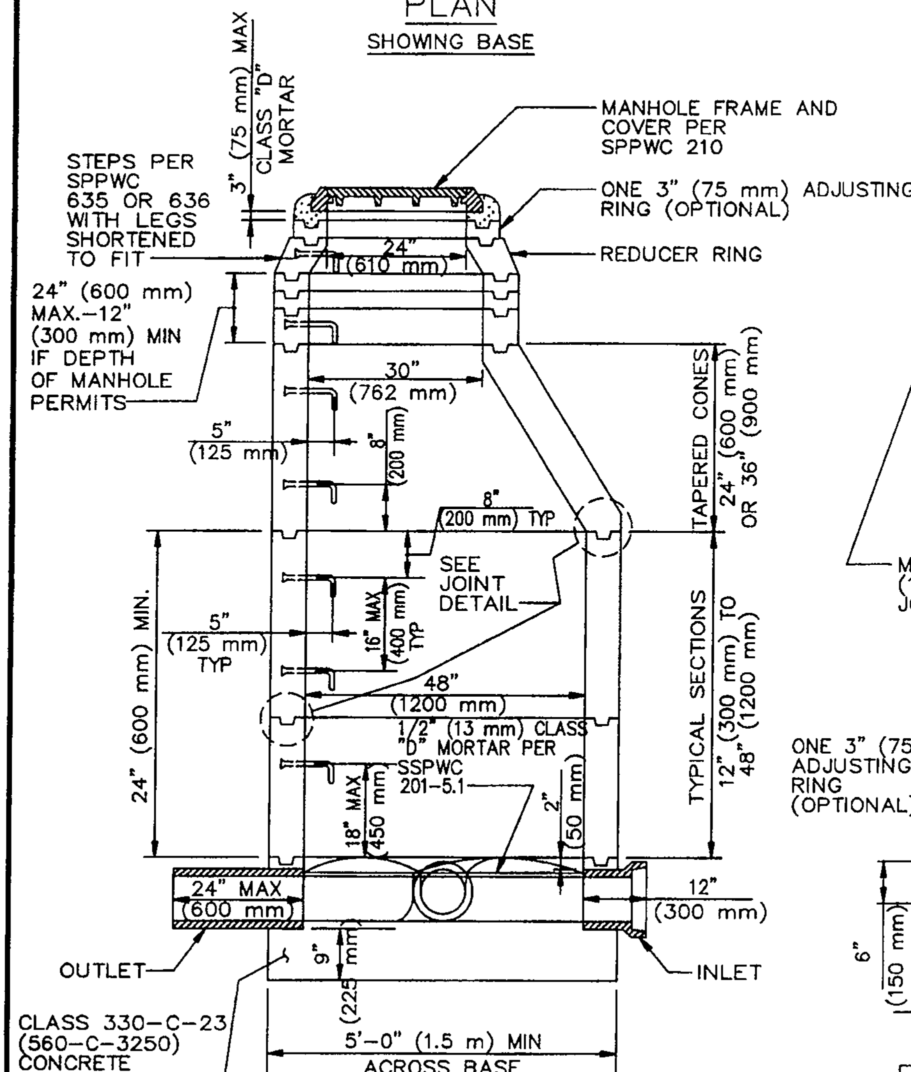
STANDARD PLAN FOR PUBLIC WORKS CONSTRUCTION		
PROMULGATED BY THE PUBLIC WORKS STANDARDS INC. GREENBOOK COMMITTEE 1984 REV. 1996, 2009	**CURB AND GUTTER — BARRIER** USE WITH STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION	STANDARD PLAN **120–2** SHEET 1 OF 1



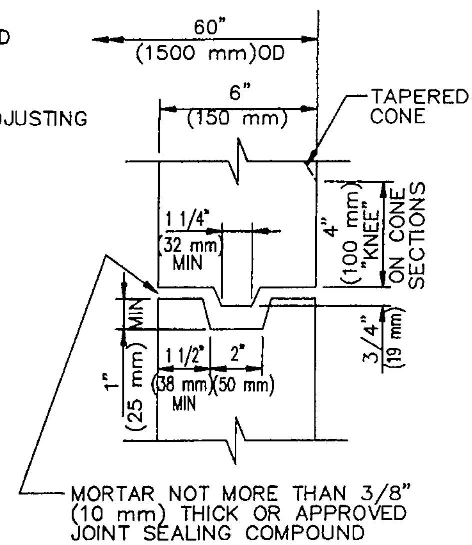
PLAN
SHOWING BASE



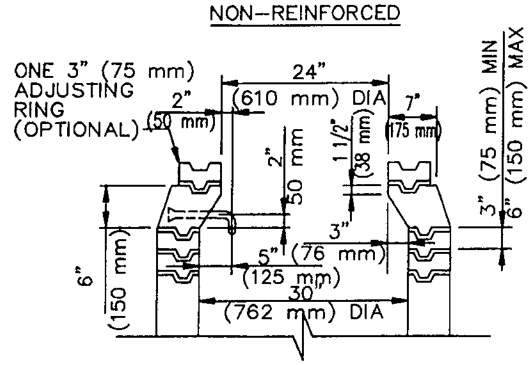
ADJUSTING
RING DETAIL



SECTION A-A



JOINT DETAIL
NON-REINFORCED



REDUCER RING AND
ADJUSTING RINGS

STANDARD PLANS FOR PUBLIC WORKS CONSTRUCTION

PROMULGATED BY THE PUBLIC WORKS STANDARDS INC. GREENBOOK COMMITTEE 1984 REV. 1993, 1995, 2009	**PRECAST CONCRETE SEWER MANHOLE**	STANDARD PLAN **200-3**
	USE WITH STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION	SHEET 1 OF 2

NOTES:

1. EXCEPT AS NOTED HEREON, THE PRECAST UNITS SHALL BE MANUFACTURED AND TESTED IN ACCORDANCE WITH ASTM C 478. AS AN ALTERNATE CURING METHOD, THE UNITS MAY BE CURED USING SATURATED STEAM FOR A MINIMUM OF 12 HOURS FOLLOWED BY 6 DAYS OF WATER CURING OR MEMBRANE CURING. IF THE UNITS ARE CURED BY THE ALTERNATE METHOD, THEY SHALL NOT BE SHIPPED PRIOR TO 8 DAYS AFTER CASTING NOR UNTIL THE CONCRETE HAS ATTAINED A STRENGTH OF 3500 PSI (25 MPa).

2. MANHOLE STEPS SHALL CONFORM TO SPPWC 635 TYPE 1 OR 3 OR SPPWC 636. THE MANHOLE STEPS SHALL BE UNIFORMLY SPACED AT A MAXIMUM OF 16" (400 mm). THE LOWEST STEP SHALL BE PLACED NOT LESS THAN 8" (200 mm) NOR MORE THAN 18" (450 mm) ABOVE THE SHELF. THE STEPS SHALL PROJECT 5" (125 mm) INSIDE THE MANHOLE.

3. RISER SECTIONS MAY BE REINFORCED OR UNREINFORCED. REINFORCED SECTIONS SHALL BE REINFORCED IN ACCORDANCE WITH ASTM C 478 AND SHALL HAVE A MINIMUM WALL THICKNESS OF 5" (125 mm). UNREINFORCED RISER SECTIONS SHALL HAVE A MINIMUM WALL THICKNESS OF 6" (150 mm).

4. THE 24"x48" (600 mm x 1200 mm) ECCENTRIC CONES MAY BE REINFORCED OR UNREINFORCED. IF REINFORCED, THE WALL THICKNESS SHALL BE NOT LESS THAN 5" (125 mm). IF UNREINFORCED, THE WALL THICKNESS SHALL NOT BE LESS THAN 6" (150 mm).

5. JOINTS SHALL BE TONGUE AND GROOVE. JOINTS FOR REINFORCED STRUCTURES SHALL CONFORM WITH ASTM C 478 SECTION 14.

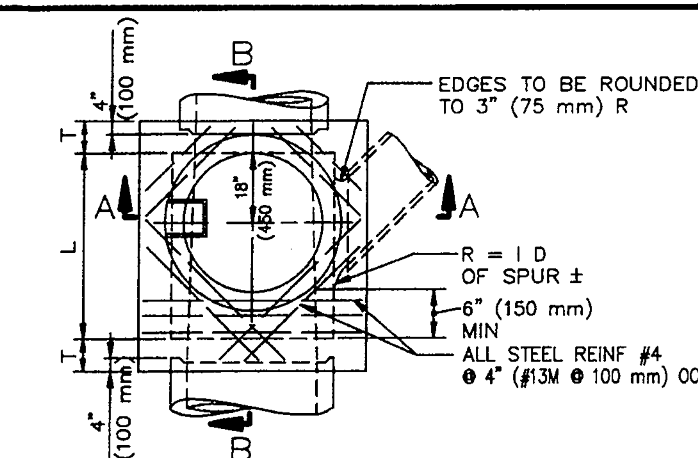
6. PRECAST UNITS SHALL BE ASSEMBLED USING CLASS "B" MORTAR.

7. IF 30" (762 mm) DIAMETER MANHOLE FRAME AND COVER IS REQUIRED, IT SHALL BE INSTALLED WHERE THE REDUCER RING IS SHOWN IN THE SECTION.

8. FOR REINFORCED PRECAST STRUCTURES, ALL REINFORCEMENT SHALL HAVE A MINIMUM OF 2" (50 mm) OF COVER OVER THE STEEL ON THE INSIDE FACE.

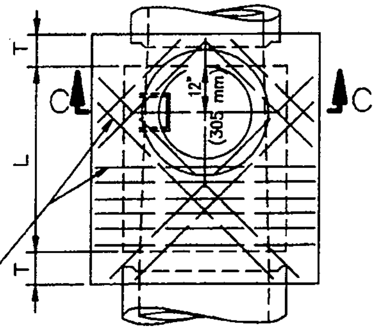
9. THE TOP OPENING OF THE MANHOLE AND THE STEPS SHALL BE PLACED DIRECTLY OVER THE OUTLET OF THE STRUCTURE EXCEPT AS OTHERWISE NOTED ON PLANS.

10. CONCRETE BASE AND STUB WALLS SHALL BE POURED IN ONE OPERATION TO A POINT 2" (50 mm) ABOVE THE INLET AND OUTLET PIPES. ALL PIPES SHALL BE RIGIDLY SUPPORTED BY TEMPORARY PIERS OR OTHER METHODS DURING THE OPERATION. CONCRETE SHALL SET FOR 24 HOURS BEFORE PLACING PRECAST UNITS.



PLAN

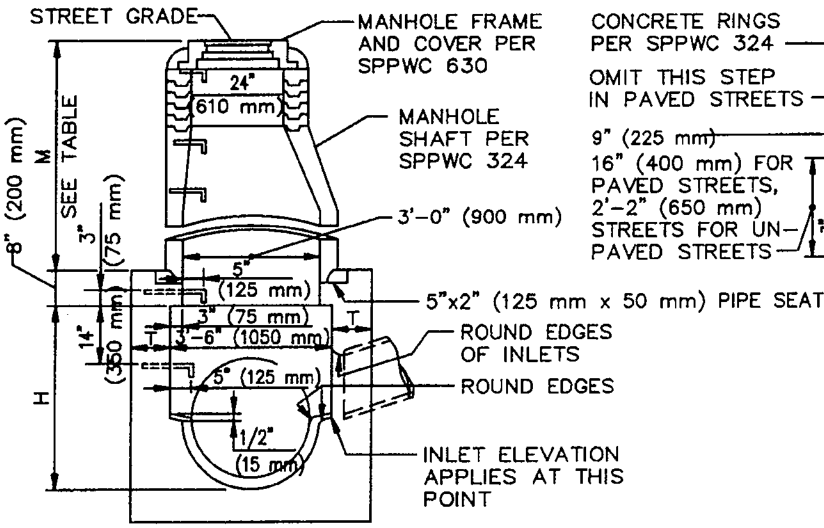
(SHAFT NOT SHOWN)



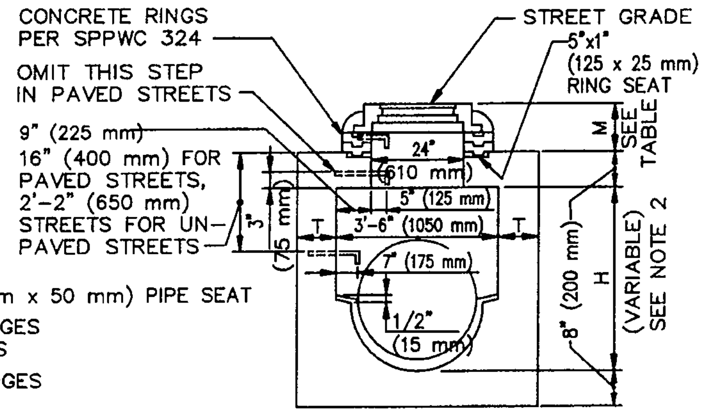
DETAIL "N" PLAN

(RINGS AND COVER NOT SHOWN)

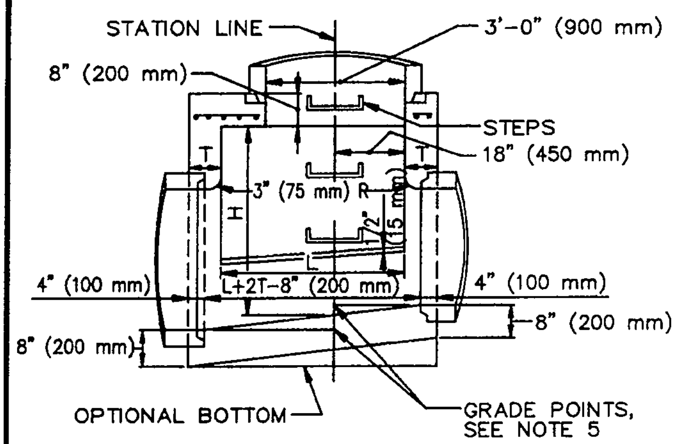
SEE NOTE 1



SECTION A–A



SECTION C–C



SECTION B–B

TABLE OF VALUES FOR M (SEE NOTE 1)

SECTION	PAVED STREET MAX	PAVED STREET MIN	UNPAVED STREET MAX	UNPAVED STREET MIN
A–A		2'-10 1/2" (867 mm)		3'-6" (1060 mm)
C–C	11" (282 mm)	8 1/2" (217 mm)	16" (410 mm)	15" (380 mm)

STANDARD PLANS FOR PUBLIC WORKS CONSTRUCTION

PROMULGATED BY THE PUBLIC WORKS STANDARDS INC. GREENBOOK COMMITTEE 1992 REV. 1996, 2009

MANHOLE PIPE–TO–PIPE (ONE OR BOTH MAIN LINE IDS 33" (825 mm) OR SMALLER)

USE WITH STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION

STANDARD PLAN

321–2

NOTES

1. WHEN DEPTH M FROM STREET GRADE TO THE TOP OF THE BOX IS LESS THAN 2'-10 1/2" (867 mm) FOR PAVED STREETS OR 3'-6" (1060 mm) FOR UNPAVED STREETS, CONSTRUCT SHAFT PER SECTION C-C AND DETAIL "N". DEPTH M MAY BE REDUCED TO AN ABSOLUTE LIMIT OF 6" (150 mm) WHEN LARGER VALUES OF M WOULD REDUCE H IN SECTION C-C TO 3'-6" (1060 mm) OR LESS.

2. H (IN SECTION A-A AND B-B) SHALL NOT BE LESS THAN 4'-0" (1.2 m), BUT MAY BE INCREASED PROVIDED THAT THE VALUE OF M SHALL NOT BE LESS THAN THE MINIMUM SPECIFIED AND THAT THE REDUCER SHALL BE USED. FOR H (IN SECTION C-C) SEE NOTE 1.

3. L SHALL BE 4'-0" (1.2 m) UNLESS OTHERWISE SHOWN. L MAY BE INCREASED OR LOCATION OF MANHOLE SHIFTED TO MEET PIPE ENDS, BUT ANY CHANGE IN LOCATION OF THE SPUR MUST BE APPROVED BY THE ENGINEER.

4. T SHALL BE 8" (200 mm) FOR VALUES OF H UP TO AND INCLUDING 8'-0" (2.4 m) AND 10" (250 mm) FOR VALUES OF H OVER 8'-0" (2.4 m).

5. STATIONS OF MANHOLES SHOWN ON PLANS APPLY AT CENTERLINE OF SHAFT. ELEVATIONS ARE SHOWN AT CENTERLINE OF SHAFT AND REFER TO THE PROLONGED INVERT GRADE LINES. SEE NOTE 3.

6. REINFORCEMENT SHALL CONFORM TO ASTM A 615, GRADE 40 (ASTM A 615M, GRADE 300), AND SHALL TERMINATE 1 1/2" (40 mm) CLEAR OF CONCRETE SURFACES UNLESS OTHERWISE SHOWN.

7. FLOOR OF MANHOLE SHALL BE STEEL TROWELED TO SPRING LINE.

8. BODY OF MANHOLE SHALL BE POURED IN ONE CONTINUOUS OPERATION EXCEPT THAT A CONSTRUCTION JOINT WITH A LONGITUDINAL KEYWAY MAY BE PLACED AT SPRING LINE.

9. THICKNESS OF THE DECK SHALL VARY WHEN NECESSARY TO PROVIDE A LEVEL SEAT BUT SHALL NOT BE LESS THAN 8" (200 mm).

10. STEPS SHALL CONFORM TO SPPWC 635 OR 636. UNLESS OTHERWISE SHOWN, STEPS SHALL BE UNIFORMLY SPACED 14" (350 mm) TO 15" (375 mm) OC. THE LOWEST STEP SHALL NOT BE MORE THAN 24" (600 mm) ABOVE THE LEDGE AT THE SIDE OF THE MANHOLE.

11. THE FOLLOWING CRITERIA SHALL BE USED FOR THIS MANHOLE:

A. MAIN LINE = 33" (825 mm) INSIDE DIAMETER OR LESS. (EXCEPTION - IF THE MAIN LINE RCP DOWNSTREAM OF THE MANHOLE IS 36" (900 mm) TO 42" (1050 mm) INSIDE DIAMETER AND THE MAIN LINE RCP UPSTREAM IS 33" (825 mm) OR LESS.) SPPWC 320 OR 322 IS NOT APPLICABLE WHERE THE MAIN LINE CONDUIT IS LESS THAN 36" (900 mm) IN DIAMETER.

B. SEE SECTION A - A. THE MAXIMUM SIZE LATERAL THAT MAY BE CONNECTED TO THIS MANHOLE IS SUCH THAT THE DISTANCE FROM THE OUTSIDE (TOP) OF THE LATERAL TO THE BOTTOM OF THE 8" (200 mm) THICK TOP OF THE MANHOLE CHAMBER, MEASURED VERTICALLY FROM THE END OF THE RCP, SHALL BE A MINIMUM OF 6" (150 mm).

C. IF THE SIZE OF THE LATERAL IS SUCH THAT THE ABOVE-SPECIFIED MINIMUM DISTANCES CANNOT BE MAINTAINED, THEN ONE OF THE FOLLOWING ALTERNATE SOLUTIONS MUST BE USED.

1. PROVIDE A SPECIAL STRUCTURE.

2. PROVIDE TWO STANDARD STRUCTURES, CONSISTING OF THIS MANHOLE PLACED UPSTREAM OR DOWNSTREAM FROM THE APPLICABLE JUNCTION STRUCTURE OR TRANSITION STRUCTURE.

12. MANHOLE FRAME AND COVER SHALL CONFORM TO SPPWC 630 UNLESS OTHERWISE SHOWN.

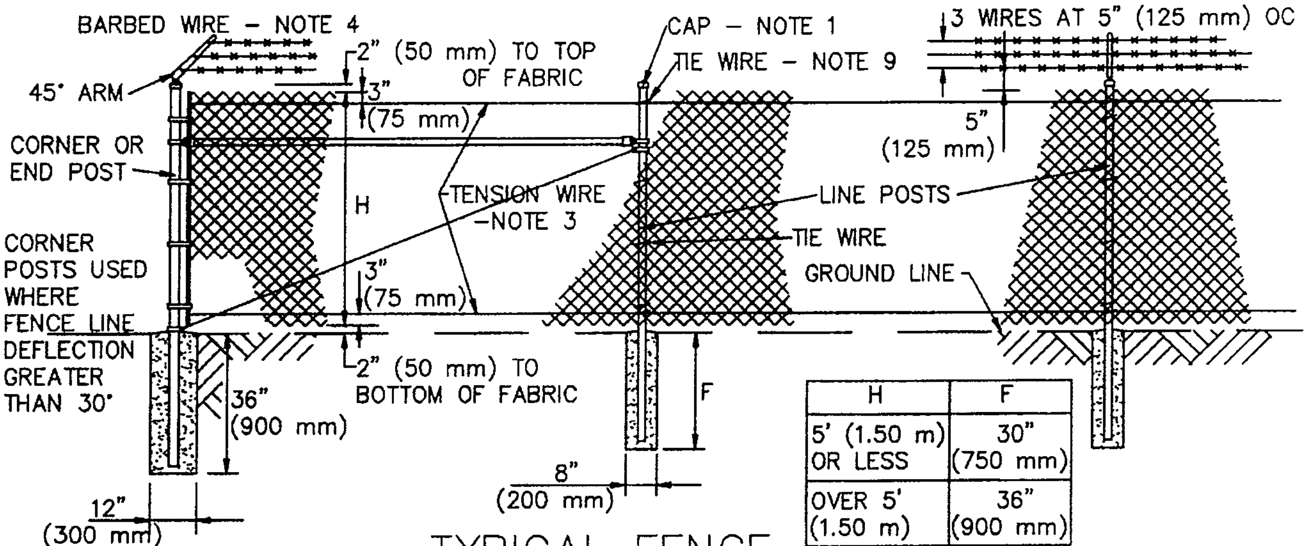
13. MANHOLE SHAFT SHALL CONFORM TO SPPWC 324 UNLESS OTHERWISE SHOWN.

14. WHERE A MANHOLE SHAFT - 36" (900 mm) WITHOUT REDUCER IS SPECIFIED REFER TO SPPWC 336.

15. WHERE A PRESSURE MANHOLE SHAFT - WITH ECCENTRIC REDUCER IS SPECIFIED REFER TO SPPWC 328.

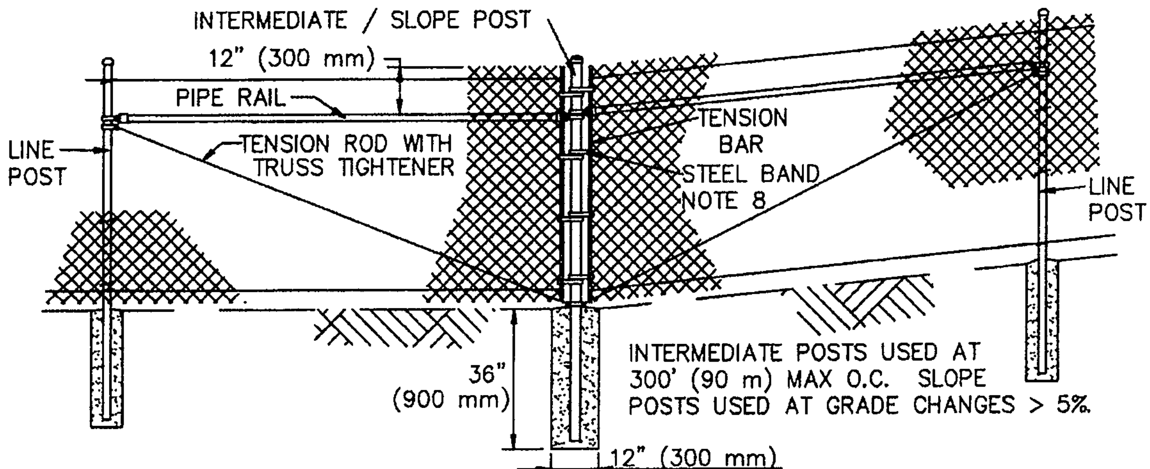
16. WHERE A PRESSURE MANHOLE SHAFT - 36" (900 mm) WITHOUT REDUCER IS SPECIFIED REFER TO SPPWC 329.

17. THE FOLLOWING SPPWC ARE INCORPORATED HEREIN:
324 MANHOLE SHAFT - WITH ECCENTRIC REDUCER
326 MANHOLE SHAFT - 36" (900 mm) WITHOUT REDUCER
328 PRESSURE MANHOLE SHAFT - WITH ECCENTRIC
329 PRESSURE MANHOLE SHAFT - 36" (900 mm) WITHOUT REDUCER
630 24" (610 mm) MANHOLE FRAME AND COVER
633 36" (900 mm) MANHOLE FRAME AND COVER
635 STEEL STEP
636 POLYPROPYLENE PLASTIC STEP

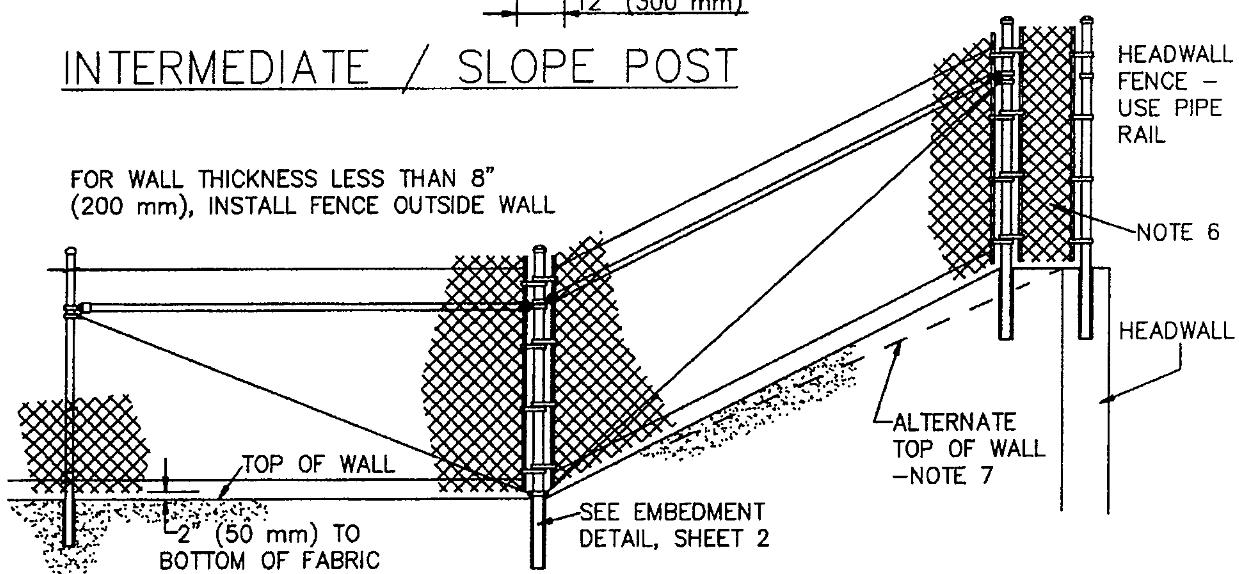


H	F
5' (1.50 m) OR LESS	30" (750 mm)
OVER 5' (1.50 m)	36" (900 mm)

TYPICAL FENCE



INTERMEDIATE / SLOPE POST



CHANNEL WALL AND WINGWALL AT HEADWALL

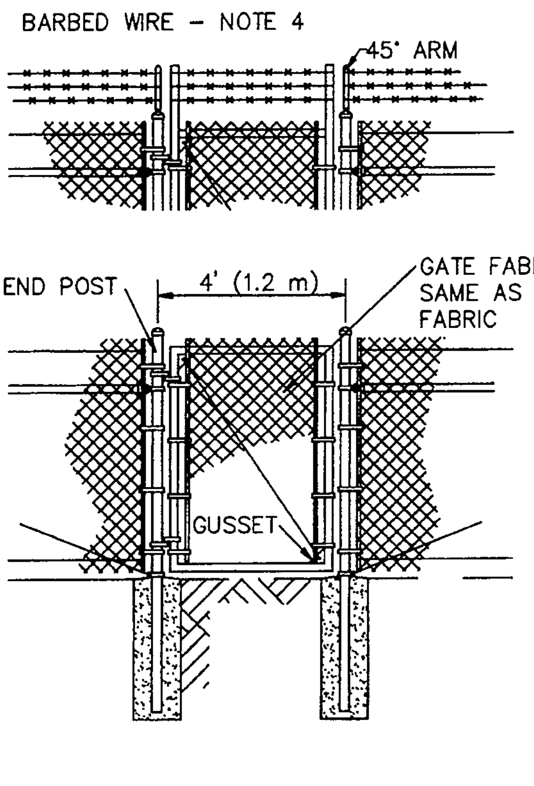
STANDARD PLANS FOR PUBLIC WORKS CONSTRUCTION

PROMULGATED BY THE PUBLIC WORKS STANDARDS INC. GREENBOOK COMMITTEE
1984
REV. 1996, 2005

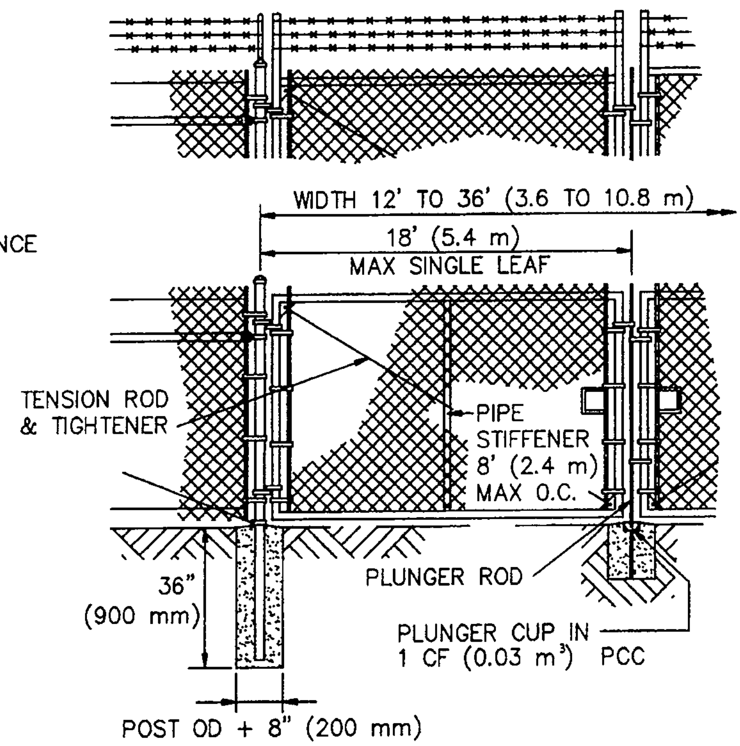
CHAIN LINK FENCE AND GATES

USE WITH STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION

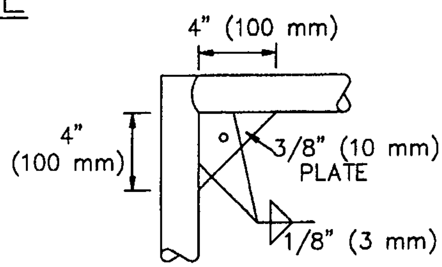
STANDARD PLAN
600–3
SHEET 1 OF 3



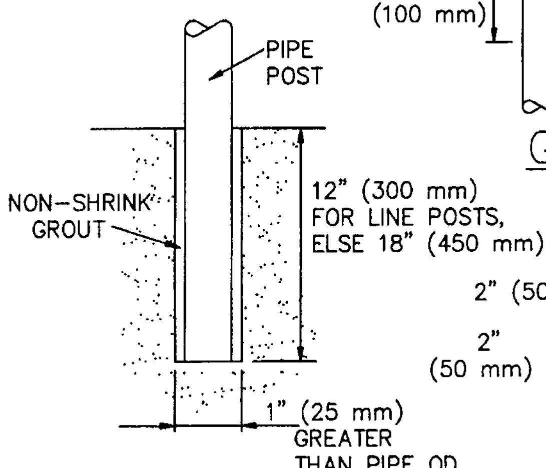
WALK GATE



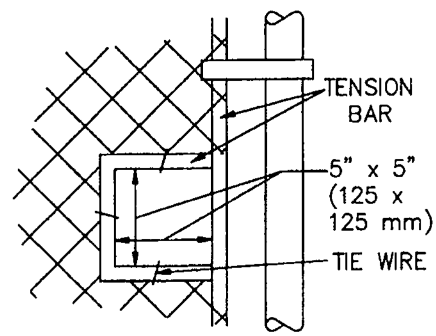
DRIVE GATE



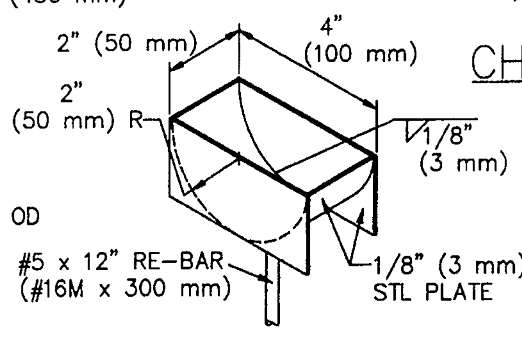
GUSSET



POST
EMBEDMENT



CHAIN AND LOCK
CUT-OUT

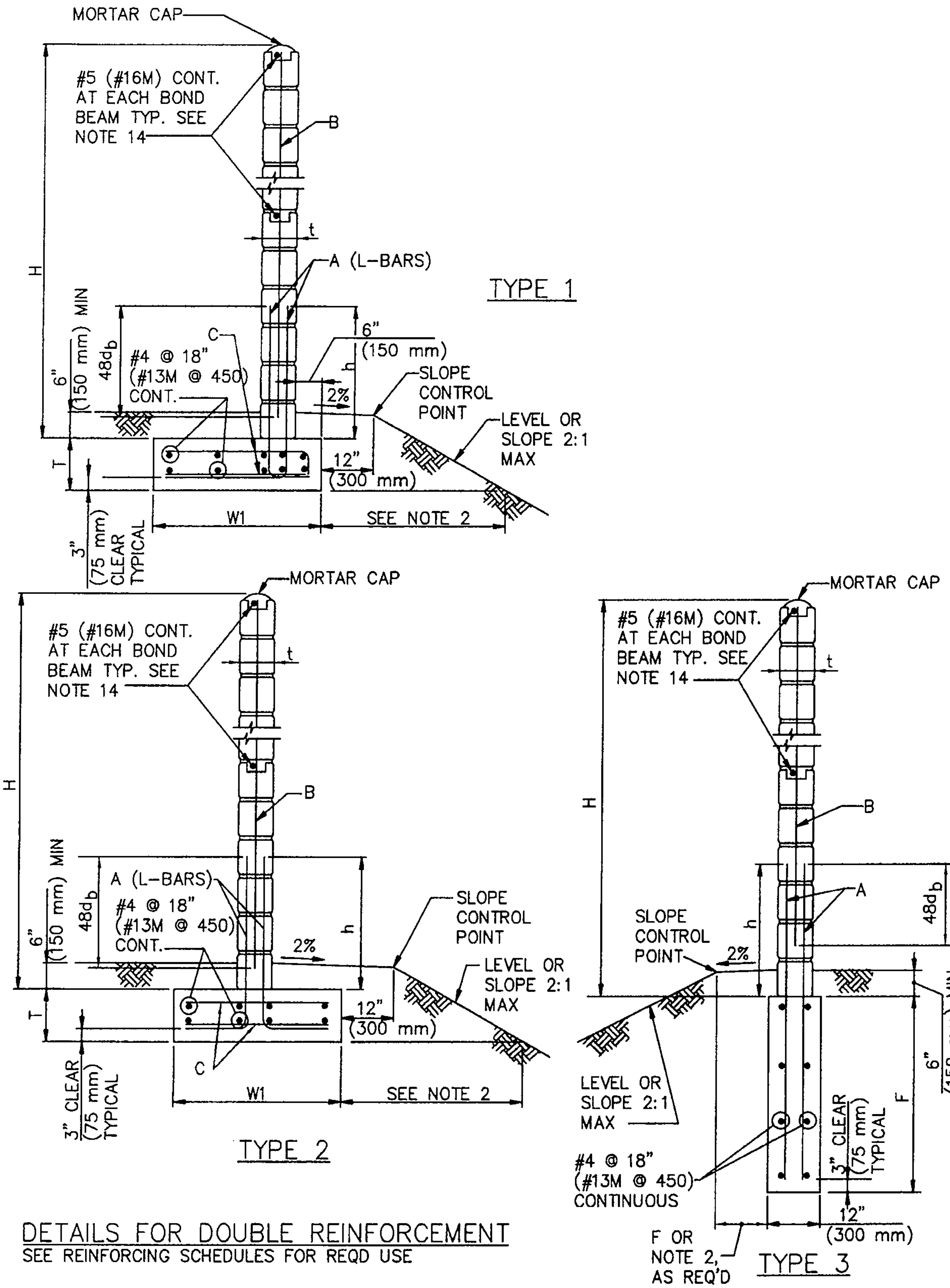


PLUNGER CUP
ISOMETRIC

STANDARD PLANS FOR PUBLIC WORKS CONSTRUCTION	STANDARD PLAN
CHAIN LINK FENCE AND GATES	**600–3** SHEET 2 OF 3

NOTES:

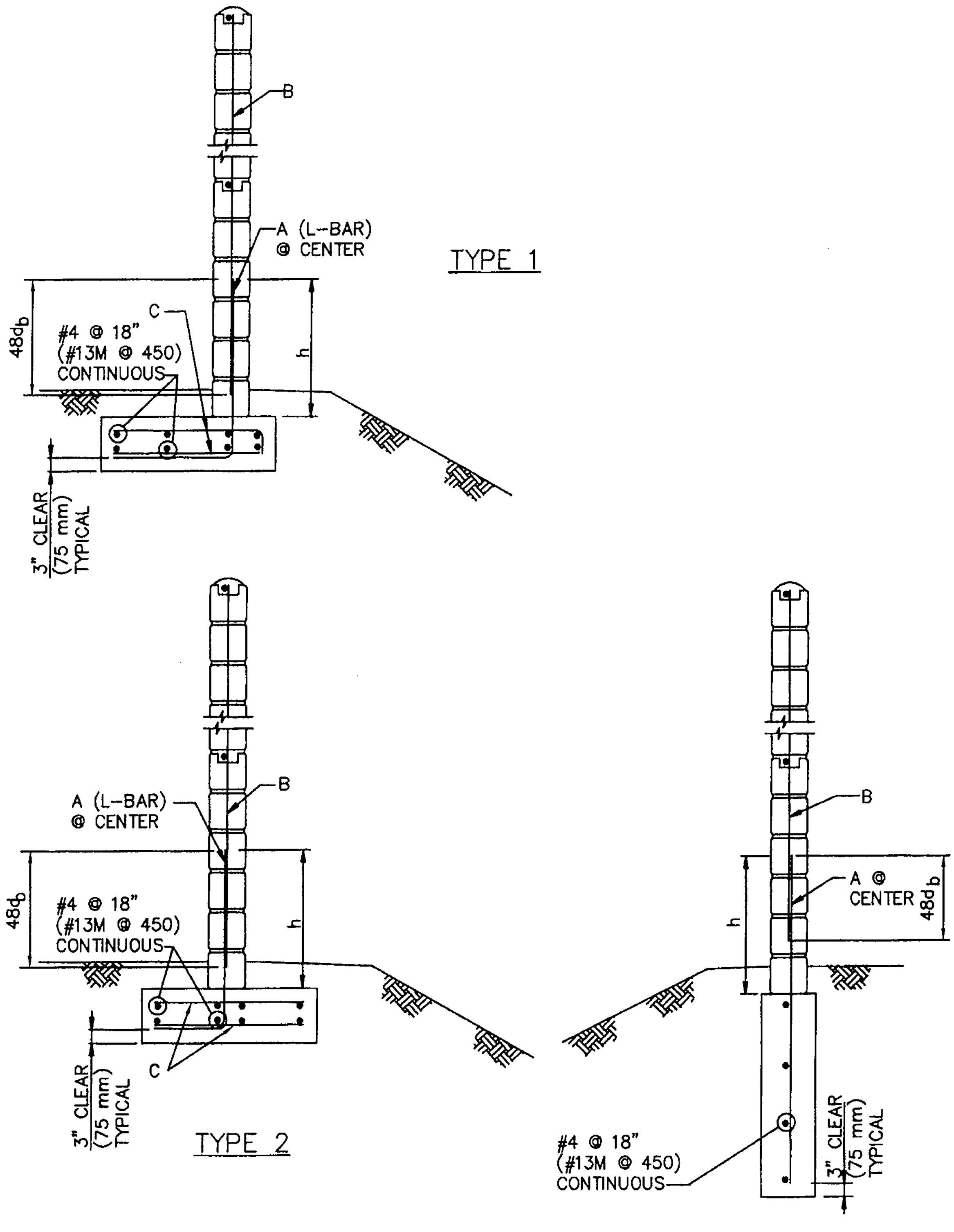
1. SECURE DRIVE-FIT GALVANIZED CAP TO POST WITH 1/4" (6 mm) ROUND-HEAD RIVET.
2. H DENOTES FABRIC WIDTH AND NOMINAL FENCE HEIGHT. H = 5' (1.5 m) UNLESS OTHERWISE NOTED.
3. IF FENCE WITH TOP RAIL IS SPECIFIED, DELETE STEEL TENSION WIRE AT TOP, AND PIPE RAILS AT INTERMEDIATE, SLOPE, END AND CORNER POSTS. EXTEND TENSION ROD TO TOP RAIL.
4. BARBED WIRE SHALL BE USED ONLY WHEN SPECIFIED.
5. POST SPACING IS MAXIMUM 10' (3.0 m).
6. FILL CLEAR OPENINGS GREATER THAN 3" (75 mm) WITH FABRIC. FOR OPENINGS LESS THAN 18" (450 mm), TIE FABRIC TO POSTS.
7. USE ONE POST FOR COMBINED SLOPE AND CORNER POST IF TOP OF CHANNEL WALL IS CONSTRUCTED AS SHOWN FOR "ALTERNATE".
8. STEEL BANDS AT TENSION BARS SHALL BE 1/8" x 1" (3 x 25 mm), MINIMUM, SPACED AT MAXIMUM 16" (400 mm).
9. SECURE TENSION WIRES TO EACH LINE POST WITH TIE WIRES.



DETAILS FOR DOUBLE REINFORCEMENT
SEE REINFORCING SCHEDULES FOR REQD USE

STANDARD PLANS FOR PUBLIC WORKS CONSTRUCTION

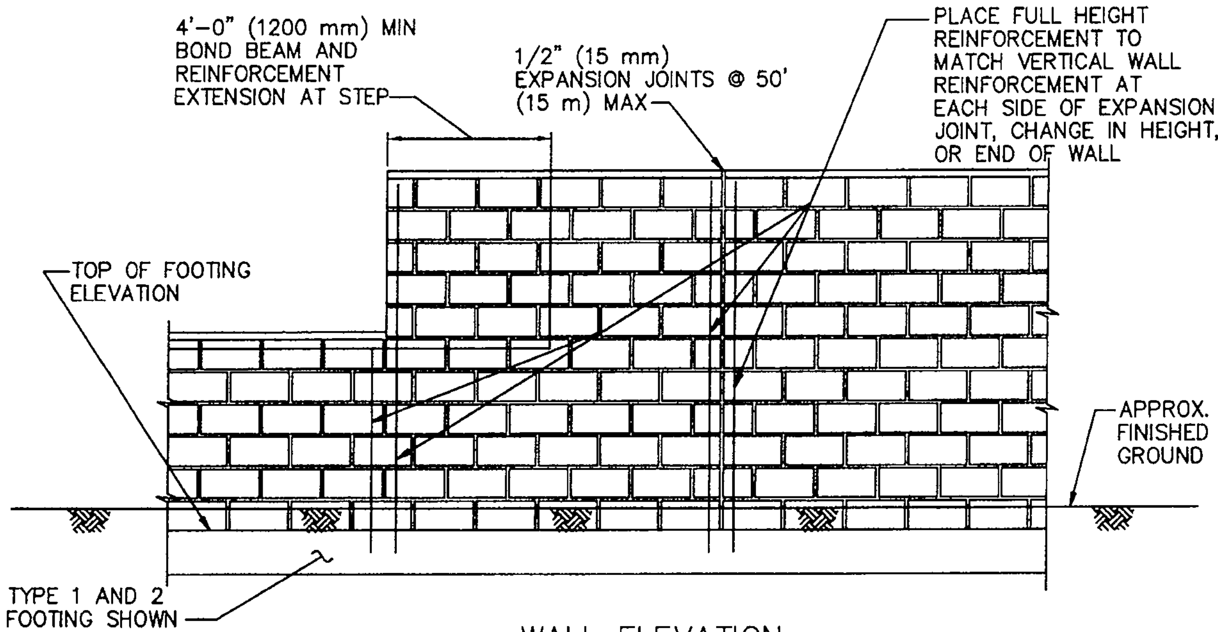
PROMULGATED BY THE PUBLIC WORKS STANDARDS INC. GREENBOOK COMMITTEE 1993 REV. 1996, 2005, 2009	**REINFORCED CONCRETE BLOCK WALL**	STANDARD PLAN **601–3**
	USE WITH STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION	SHEET 1 OF 6



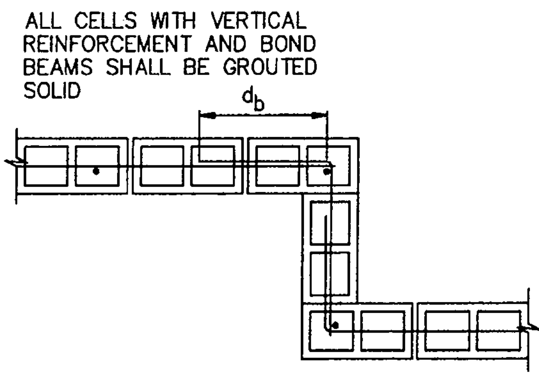
DETAILS FOR SINGLE REINFORCEMENT

SEE REINFORCING SCHEDULES FOR ALLOWED USE
SEE SHEET 1 FOR OTHER DIMENSIONS AND DETAILS

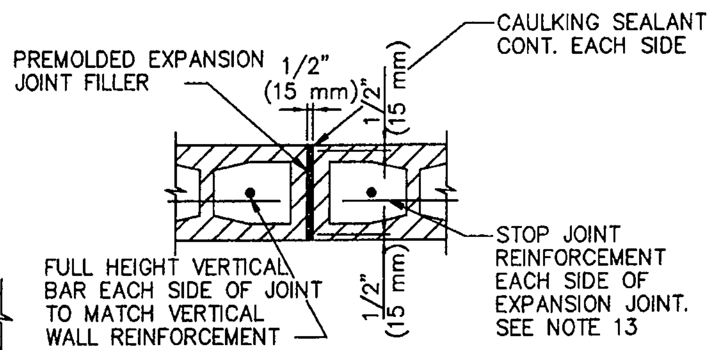
STANDARD PLANS FOR PUBLIC WORKS CONSTRUCTION	STANDARD PLAN
REINFORCED CONCRETE BLOCK WALL	**601–3**
	SHEET 2 OF 6



WALL ELEVATION

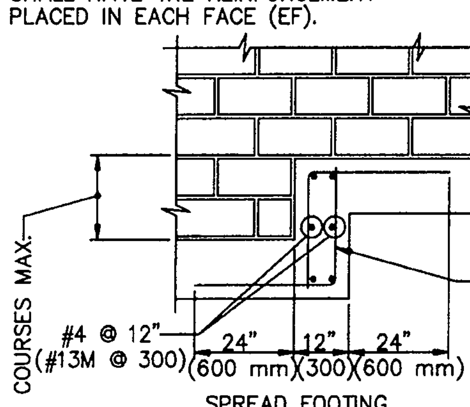


CORNER DETAIL

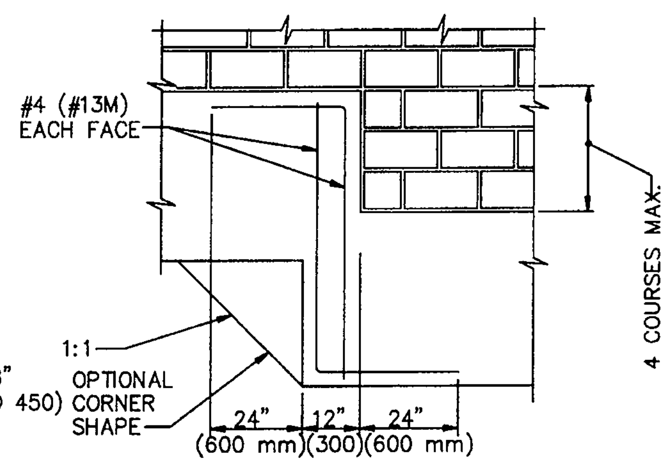


EXPANSION JOINT DETAIL

NOTE:
SINGLE VERTICAL REINFORCING BARS SHALL BE CENTERED IN CELLS. DOUBLE ROWS OF VERTICAL REINFORCING BARS SHALL HAVE THE REINFORCEMENT PLACED IN EACH FACE (EF).



SPREAD FOOTING
TYPE 1 AND 2



TRENCH FOOTING
TYPE 3

FOOTING STEP DETAILS

STANDARD PLANS FOR PUBLIC WORKS CONSTRUCTION	STANDARD PLAN
REINFORCED CONCRETE BLOCK WALL	**601–3**
	SHEET 3 OF 6

LATERAL LOAD = 15 PSF (720 Pa)									
STEM		FOOTING				REINFORCING BARS			
						CUTOFF	SPACING, O.C.		
H	t	T	W1 (TYPE 1)	W2 (TYPE 2)	F (TYPE 3)	h	A	B	C
6'-0" (1.8 m)	6" (150 mm)	12" (300 mm)	2'-3" (675 mm)	2'-3" (675 mm)	2'-9" (825 mm)	30" (750 mm)	#4 @ 48"* (#13M@1200*)	#4 @ 48" (#13M@1200)	#4 @ 48"* (#13M@1200*)
8'-0" (2.4 m)	8" (200 mm)	12" (300 mm)	2'-9" (825 mm)	2'-6" (750 mm)	3'-3" (975 mm)	30" (750 mm)	#4 @ 32"* (#13M@800*)	#4 @ 32" (#13M@800)	#4 @ 32"* (#13M@800*)
10'-0" (3.0 m)	8" (200 mm)	12" (300 mm)	3'-9" (1125 mm)	3'-0" (900 mm)	3'-9" (1125 mm)	30" (750 mm)	#4 @ 32"EF (#13M@800EF)	#4 @ 32" (#13M@800)	#4 @ 32" (#13M@800)

LATERAL LOAD = 20 PSF (960 Pa)									
STEM		FOOTING				REINFORCING BARS			
						CUTOFF	SPACING, O.C.		
H	t	T	W1 (TYPE 1)	W2 (TYPE 2)	F (TYPE 3)	h	A	B	C
6'-0" (1.8 m)	6" (150 mm)	12" 300 mm	2'-9" (825 mm)	2'-6" (750 mm)	3'-3" (975 mm)	30" (750 mm)	#5 @ 32"* (#16M@800*)	#4 @ 32" (#13M@800)	#4 @ 32"* (#13M@800*)
8'-0" (2.4 m)	8" (200 mm)	12" 300 mm	3'-3" (975 mm)	3'-0" (900 mm)	3'-9" (1125 mm)	30" (750 mm)	#4 @ 32"EF (#13M@800EF)	#4 @ 32" (#13M@800)	#4 @ 32" (#13M@800)
10'-0" (3.0 m)	8" (200 mm)	12" 300 mm	4'-3" (1275 mm)	3'-6" (1050 mm)	4'-3" (1275 mm)	42" (1050 mm)	#5 @ 32"EF (#16M@800EF)	#4 @ 32" (#13M@800)	#5 @ 32" (#16M@800)

LATERAL LOAD = 25 PSF (1200 Pa)									
STEM		FOOTING				REINFORCING BARS			
						CUTOFF	SPACING, O.C.		
H	t	T	W1 (TYPE 1)	W2 (TYPE 2)	F (TYPE 3)	h	A	B	C
6'-0" (1.8 m)	6" (150 mm)	12" (300 mm)	3'-0" (900 mm)	2'-9" (825 mm)	3'-6" (1050 mm)	30" (750 mm)	#5 @ 16"* (#16M@400*)	#4 @ 32" (#13M@800)	#4 @ 32" (#13M@800)
8'-0" (2.4 m)	8" (200 mm)	12" (300 mm)	3'-9" (1125 mm)	3'-3" (975 mm)	4'-0" (1200 mm)	30" (750 mm)	#4 @ 16"EF (#13M@400EF)	#4 @ 32" (#13M@800)	#4 @ 32" (#13M@800)
10'-0" (3.0 m)	8" (200 mm)	12" (300 mm)	4'-9" (1425 mm)	4'-0" (1200 mm)	4'-9" (1425 mm)	50" (1250 mm)	#5 @ 16"EF (#16M@400EF)	#4 @ 32" (#13M@800)	#5 @ 32" (#16M@800)

NOTE

SINGLE VERTICAL REINFORCING BARS SHALL BE CENTERED IN CELL.
* FOR SINGLE A-BARS IN FOUNDATION, SEE SHEET 2.
DOUBLE ROWS OF VERTICAL REINFORCING WHERE INDICATED SHALL BE PLACED AT EACH FACE (EF).

DESIGN CRITERIA:

MATERIALS DESIGN DATA:

REINFORCING STEEL .... fy = 60 KSI (400 MPa)

CONCRETE 28TH-DAY STRENGTH:
FOOTING .... f 'c = 2,500 PSI (17 MPa)

CONCRETE MASONRY:
PARTIALLY GROUTED .... f 'm = 1,500 PSI (10 MPa)

DESIGN CODE:.......... GOVERNING BUILDING CODE

DESIGN METHOD:

CONCRETE .... ULTIMATE STRENGTH METHOD
CONCRETE MASONRY .... WORKING STRESS METHOD

FOUNDATION:

ALLOWABLE SOIL BEARING PRESSURE .... 1,000 PSF (48 kPa)
ALLOWABLE LATERAL SOIL BEARING PRESSURE .... 100 PSF / FT OF DEPTH (157 kPa / m OF DEPTH)
LATERAL SLIDING RESISTANCE AT CONTACT AREA.......... 130 PSF (6.2 kPa) BUT NOT TO EXCEED 0.40 X DL
SOIL DENSITY .... 110 PCF (1760 kg/m^3)
FACTORS OF SAFETY FOR SPREAD FOOTING (BASED ON SERVICE LOAD CONDITIONS):
OVERTURNING .... 1.75 MINIMUM
SLIDING .... 1.5 MINIMUM

1/3 INCREASE IS ALLOWED FOR SHORT TERM LOADS.

GENERAL NOTES:

1. CONSULT WITH LOCAL GOVERNING AGENCY FOR DETERMINATION OF LATERAL LOAD AND WALL TYPE LISTED IN TABLES, FOR PROJECT-SPECIFIC USE.

2. DISTANCE OF THE FOOTING FROM DESCENDING SLOPE SHALL BE PER LATEST GOVERNING BUILDING CODE OR PER AGENCY REQUIREMENTS.

3. SPECIAL INSPECTION IS NOT REQUIRED FOR WALLS.

4. GROUND LINE TO BE AT THE SAME ELEVATION ON BOTH SIDES OF THE WALL. WALL SHALL NOT BE USED TO RETAIN EARTH.

5. USE TABULAR INFORMATION FOR THE NEXT HIGHER H FOR INTERMEDIATE WALL HEIGHTS THAT ARE BETWEEN THE H'S GIVEN.

6. CONCRETE SHALL BE 500-C-2500 (295-C-17) PER SSPWC 201-1.1.2.

7. REINFORCING SHALL BE LAPPED A MINIMUM 48 BAR DIA. GRADE 60 UNLESS NOTED OTHERWISE PER SSPWC SECTION 201-2, 303-4.1.3, JOINT REINFORCING WIRE: ASTM A82.

8. ALL REINFORCED CONCRETE CONSTRUCTION SHALL BE IN ACCORDANCE WITH SSPWC 303.

9. FOR TYPE OF BLOCKS, BOND PATTERN AND JOINT FINISH, SEE PROJECT PLANS.

10. ALL MASONRY CONSTRUCTION TO BE IN ACCORDANCE WITH SSPWC 303-4.

11. HOLLOW MASONRY UNITS...ASTM C-90. TYPE I. NORMAL WEIGHT UNITS.

    MORTAR ...1:1/2:3, PORTLAND CEMENT – LIME – SAND RATIO, 1800 PSI (13 MPa) PER SSPWC 202-2.2.1.

    GROUT .....1:3:2 PORTLAND CEMENT – SAND – PEA GRAVEL RATIO, 2,000 PSI (14 MPa) PER SSPWC 202-2.2.2.

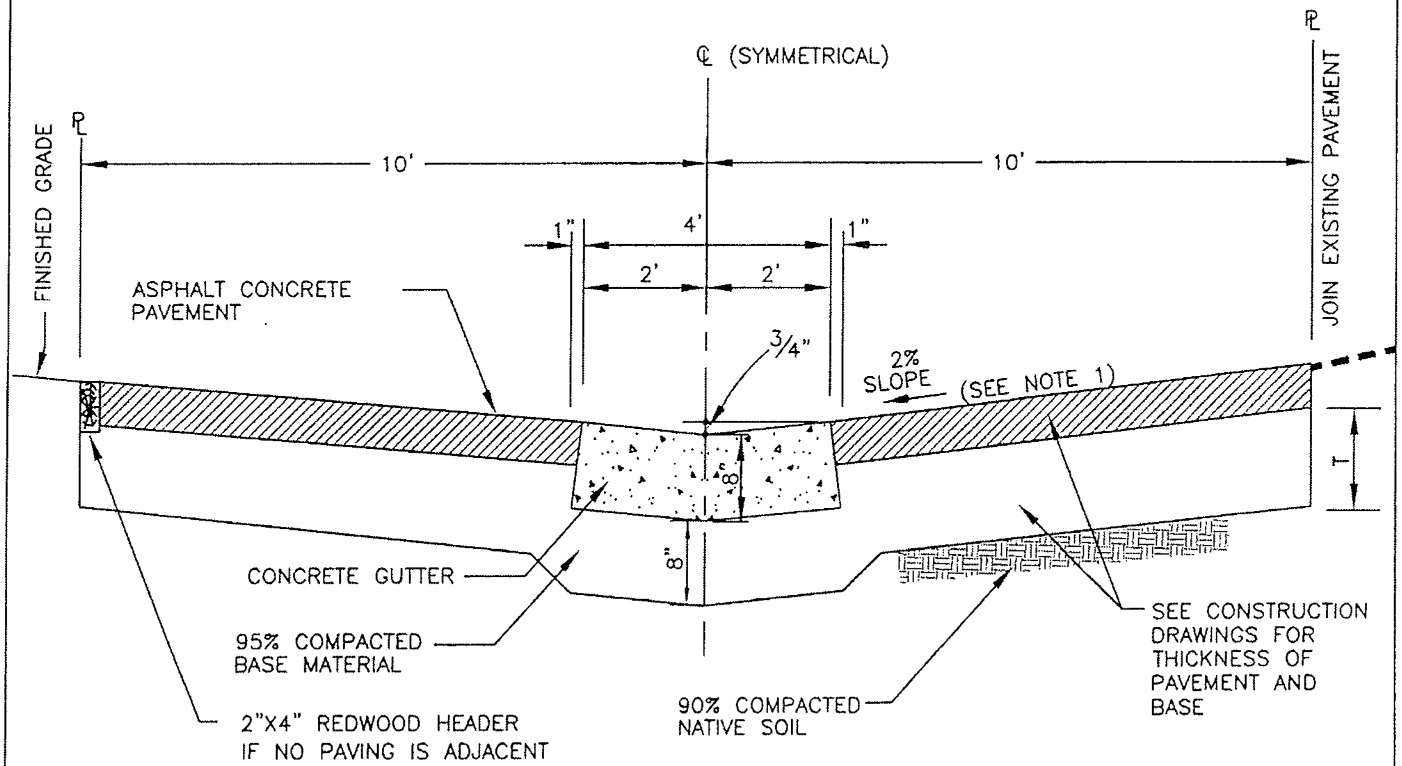
12. PROVIDE FULL MORTAR BED AT THE BOTTOM OF THE FIRST COURSE AND OMIT MORTAR BETWEEN VERTICAL JOINTS OF LOWEST EXPOSED COURSE.

13. WHEN BLOCKS ARE LAID IN STACKED BOND, CONTINUOUS HORIZONTAL JOINT REINFORCEMENT SPACED AT 4'-0" (1200 mm) OC SHALL BE PROVIDED IN ADDITION TO THE BOND BEAM REINFORCEMENT PER SSPWC 303-4.1.2, LOCATE REINFORCEMENT IN JOINTS THAT ARE APPROXIMATE MIDPOINT BETWEEN BOND BEAMS.

14. BOND BEAMS SHALL BE PLACED AT TOP OF WALL AND SUBSEQUENTLY SPACED NOT TO EXCEED 4'-0" (1200 mm) O.C. BELOW.

15. ONLY CELLS WITH REINFORCING BARS SHALL BE GROUTED PER SSPWC 303-4.1.3.

16. HORIZONTAL JOINTS SHALL BE TOOLED CONCAVE OR WEATHERED. VERTICAL JOINTS SHALL BE TOOLED CONCAVE OR RAKED. WEATHERED AND RAKED JOINTS ARE NOT PERMITTED FOR SLUMPED BLOCKS.



TYPICAL SECTION

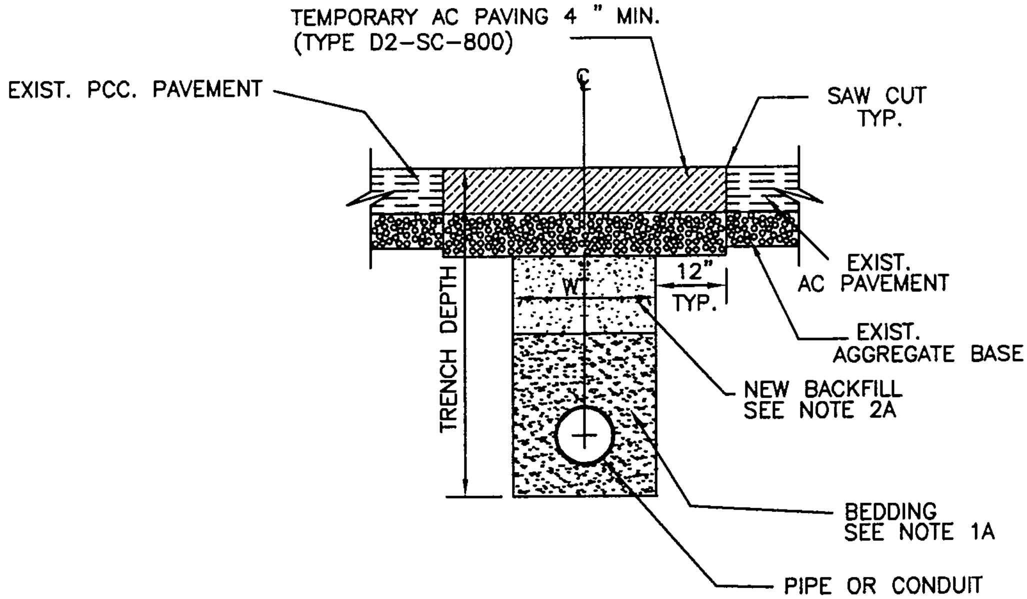
NOT TO SCALE

NOTES:

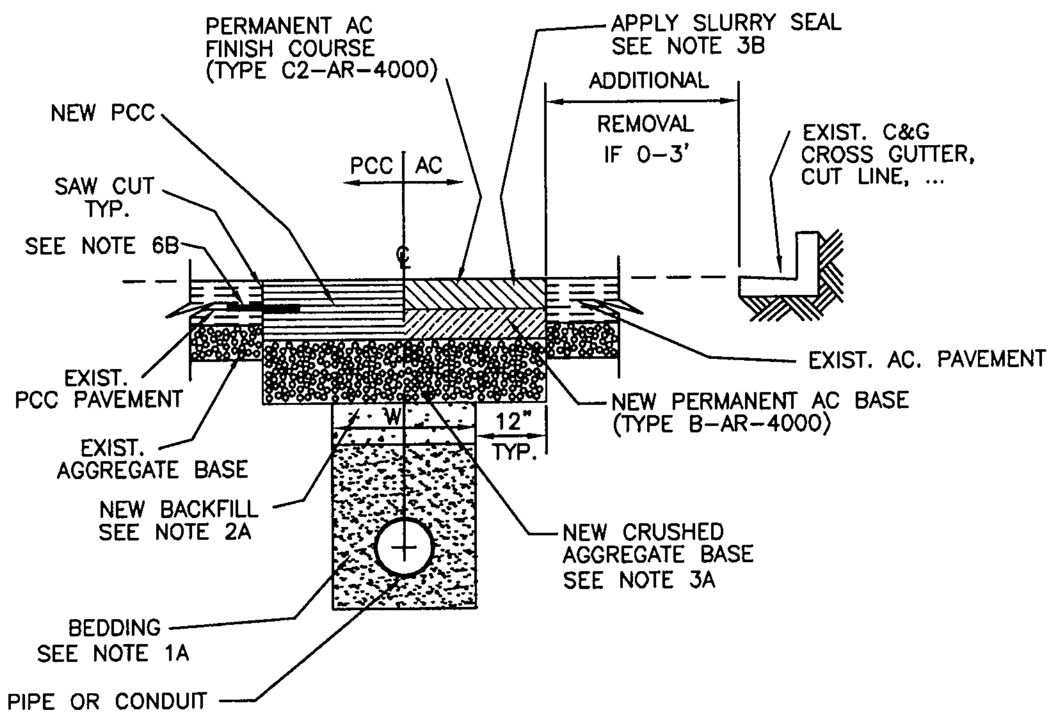
1. IF APPROVED BY THE COMMUNITY DEVELOPMENT DIRECTOR OR PUBLIC WORKS DIRECTOR SLOPE MAY VARY FROM 1% MIN. TO 5% MAX. TO MATCH EXISTING CONDITIONS AND TO FACILITATE JOINS. IF MIN. AND MAX. SLOPES CAN NOT BE MET, OFFSET THE FLOW LINE FROM CENTERLINE.
2. SMOOTH TROWEL 8" WIDE FLOWLINE IN CONCRETE GUTTER.
3. EXPANSION JOINTS IN GUTTER SHALL BE INSTALLED AT 40'–50' INTERVALS WITH FOUR NO.4 SMOOTH DOWELS (18" LONG).
4. WEAKENED PLANE JOINTS IN GUTTER SHALL BE INSTALLED AT 20'–25' INTERVALS.
5. T: THICKNESS OF CRUSHED AGGREGATE BASE (CAB) OR CRUSHED MISCELLANEOUS BASE (CMB).

CITY OF TORRANCE		
DATE ISSUED	TYPICAL SECTION ALLEY	STANDARD NO.
SEPT 2006	ROBERT J. BESTE PUBLIC WORKS DIRECTOR R.C.E. NO. 50737	T101 SHEET 1 OF 1

TT/T101



TEMPORARY ASPHALT REPAIR



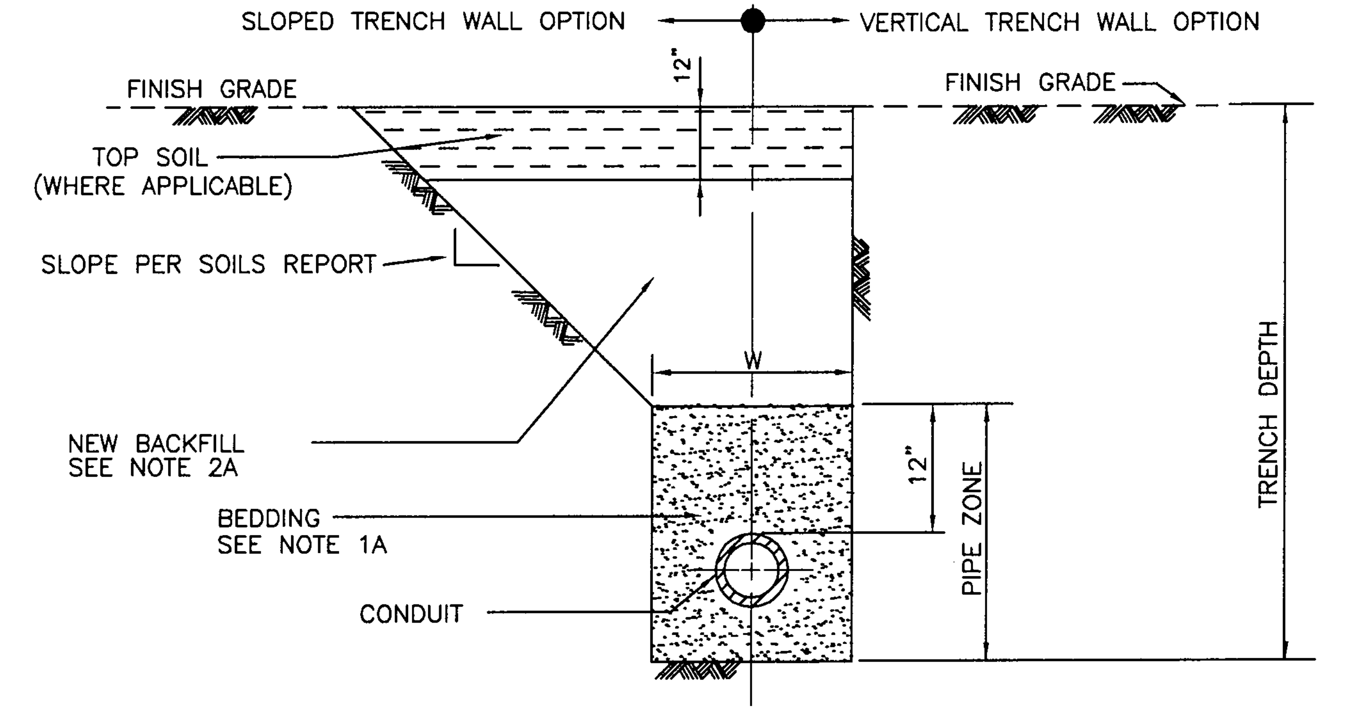
PERMANENT TRENCH REPAIR

TYPICAL TRENCH SECTION WITHIN ROADWAY

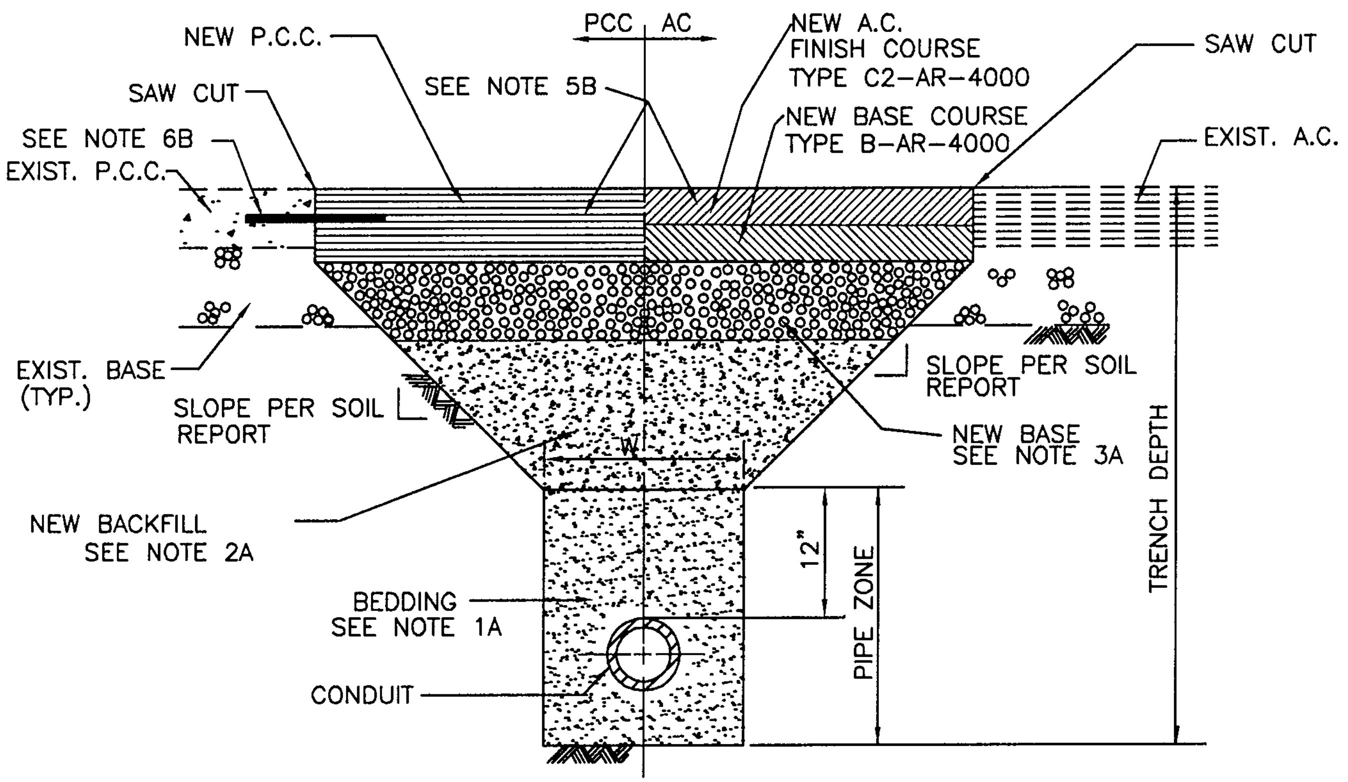
(SEE NOTE 8C FOR EXCEPTION)

CITY OF TORRANCE - ENGINEERING DEPARTMENT		
DATE ISSUED 10 SEP 2002	TRENCH BACKFILL & PAVEMENT REPAIRS RICHARD W. BURTT ENGINEERING DIRECTOR R.C.E. NO. 32862 R.T.E. NO. 1538	STANDARD NO. **T116-2** SHEET 1 OF 4

TT\T116-2



TYPICAL TRENCH SECTION OUTSIDE ROADWAY



TYPICAL TRENCH SECTION WITHIN ROADWAY
SLOPED TRENCH WALL OPTION

CITY OF TORRANCE - ENGINEERING DEPARTMENT		
DATE ISSUED: 10 SEP 2002	**TRENCH BACKFILL & PAVEMENT REPAIRS**	STANDARD NO. **T116-2**
	RICHARD W. BURTT ENGINEERING DIRECTOR R.C.E. NO. 32862 R.T.E. NO. 1538	SHEET 2 OF 4

TT\T116-2

NOTES:

BELOW GROUND:

1A. SEE STD. PLAN NO'S T204, T302, AND T701 FOR BEDDING REQUIREMENTS.

2A. FOR TRENCHES WITH "W" GREATER THAN 2' OR IF TRENCH WALLS ARE SLOPED, BACKFILL SHALL BE CRUSHED AGGREGATE BASE, OR NATIVE OR OTHER EXCAVATION MATERIAL WITH AN SE VALUE OF 30 OR GREATER. BACKFILL MATERIAL SHALL BE DENSIFIED TO A RELATIVE COMPACTION OF 95% IN THE UPPER 3 FEET AND TO 90% BELOW THE UPPER 3 FEET. FOR TRENCHES LONGER THAN 200' OR LARGER THAN 1,000 SQUARE FEET A LICENSED SOILS ENGINEER SHALL BE PRESENT TO MONITOR THE NATIVE OR IMPORTED BACKFILL OPERATION AND TEST FOR COMPACTION AT 100' OR 200 SQUARE FOOT MAXIMUM INTERVALS

FOR TRENCHES WITH "W" LESS THAN OR EQUAL TO 2' IN THE ROADWAY, A SAND-CEMENT SLURRY (100-E-100) BACKFILL SHALL BE USED. SLURRY SHALL CURE 16 HOURS MINIMUM PRIOR TO BASE PLACEMENT. RAPID SET CEMENT SLURRY SHALL CURE 1 HOUR MINIMUM PRIOR TO BASE PLACEMENT.

IN AREAS NOT IN EXISTING ROADWAY, BACKFILL SHALL BE COMPACTED TO A RELATIVE COMPACTION OF 90%.

3A. NEW CRUSHED AGGREGATE BASE SHALL BE 2" THICKER THAN EXISTING BASE, BUT NOT LESS THAN 8" THICK.

4A. EXCAVATED MATERIAL NOT APPROVED FOR USE IN TRENCH BACKFILL SHALL BE REMOVED FROM JOB SITE UNLESS OTHERWISE USED IN THE WORK.

5A. WHERE WET, UNSTABLE OR RUNNING SOIL IS ENCOUNTERED, SOLID SHEATHING IS REQUIRED FOR ALL VERTICAL TRENCH WALLS.

6A. ANY SHORING REQUIRED SHALL BE DESIGNED BY A REGISTERED CIVIL OR STRUCTURAL ENGINEER.

7A. "W" SHALL BE MEASURED AT TOP OF BEDDING.

VISIBLE SURFACE:

1B. IF REMAINING AC PAVEMENT BETWEEN EDGE OF TRENCH AND EXISTING GUTTER, CURB, CROSS GUTTER, OR CUT LINE IS LESS THAN 3 FEET IN WIDTH, THEN THIS AC SHALL BE REMOVED AND REPLACED WITH NEW AC PAVEMENT.

2B. THE ENGINEER MAY REQUIRE WIDER REMOVAL AREA THAN THAT SHOWN ABOVE TO SUIT FIELD CONDITIONS.

3B. CRACKS SHALL BE SEALED AND A TYPE 2 SLURRY SEAL COATING WITH 2% LATEX SHALL BE APPLIED FROM LANE LINE TO LANE LINE FOR LONGITUDINAL TRENCHES GREATER THAN 200' IN LENGTH FOR ANY LANE AFFECTED.

4B. THE THICKNESS OF REPLACEMENT ASPHALT SHALL BE A MINIMUM OF 1" GREATER THAN EXISTING AC (2" GREATER IF EXISTING STREET IS PAVED WITH RUBBERIZED AC) BUT NOT LESS THAN 4" (5" FOR RUBBERIZED AC). IF EXISTING PAVEMENT IS PCC, REPLACEMENT CONCRETE SHALL BE AS PER SECTION 201.1 OF THE STANDARD SPECS AND 1" THICKER THAN EXISTING.

5B. THE NEW FINISH COURSE SHALL BE PLACED FLUSH WITH THE EXISTING ADJACENT PAVING SURFACE – MAXIMUM VARIANCE FROM FLUSH IS 1/8". NEW AC PAVEMENT ADJACENT TO EXISTING EDGE OF PCC GUTTER SHALL BE 3/8" HIGHER THAN EDGE OF GUTTER.

6B. FOR PCC ROADWAY PAVEMENT, DOWEL AT 24" O.C., #4 DEFORMED BAR, 6" EMBEDMENT, AND CENTERED IN EXISTING SLAB WITH 1-1/2" MINIMUM CONCRETE COVER. DOWEL SHALL BE EPOXIED IN EXISTING SLAB AND CAST IN NEW SLAB.

METHODOLOGY:

1C. AT THE END OF EACH WORK DAY, ANY TRENCH IN AN ARTERIAL OR IN ROLLING HILLS ROAD, MAPLE/235TH ST. OR ARLINGTON AVE. SHALL BE COVERED BY NON-SKID STEEL PLATES OR BE PAVED WITH TEMPORARY OR PERMANENT PAVEMENT FLUSH WITH ADJACENT PAVEMENT SURFACES. WHEN NON-SKID STEEL PLATES ARE USED, THEY SHALL BE WELDED, SECURED IN PLACE, RAMPED WITH AC, AND NOT USED FOR MORE THAN 48 CONSECUTIVE HOURS ON THE SAME SEGMENT OF TRENCH. "PLATE AHEAD" SIGN SHALL BE PROPERLY INSTALLED WHEN PLATES ARE IN USE. OTHER CITY STREETS MAY HAVE LESSER REQUIREMENTS AND WILL BE CONSIDERED ON A CASE BY CASE BASIS.

2C. ALL TRAFFIC LANES SHALL BE CLEANED AND RESTORED FOR USE IMMEDIATELY UPON PLACEMENT OF TEMPORARY AC PAVEMENT, TRENCH PLATES AND/OR FINAL AC PAVEMENT.

3C. ALL TRAFFIC STRIPING AND/OR MARKINGS REMOVED OR DAMAGED DURING CONSTRUCTION SHALL BE REPLACED IN KIND AS DIRECTED BY THE ENGINEER.

4C. TRAFFIC CONTROL SHALL BE PER CITY OF TORRANCE "CONSTRUCTION TRAFFIC CONTROL PROCEDURES ON CITY STREETS" AVAILABLE FROM THE ENGINEERING DEPARTMENT PERMIT COUNTER.

5C. MORITORIUM FOR CUTTING NEW OR RECONSTRUCTED STREETS IS 5 YEARS WITHOUT SPECIAL APPROVAL FROM THE ENGINEERING DIRECTOR. NEW UTILITY SERVICE CONNECTIONS AND SERVICE LINE REPAIRS ARE EXCEPTED IF NOT ABLE TO BE FORSEEN AT THE TIME THE ROADWAY WAS RECONSTRUCTED. APPROVED LONGITUDINAL EXCAVATIONS IN NEW STREETS SHALL REQUIRE THE FULL LANE TO BE GROUND AND OVERLAID.

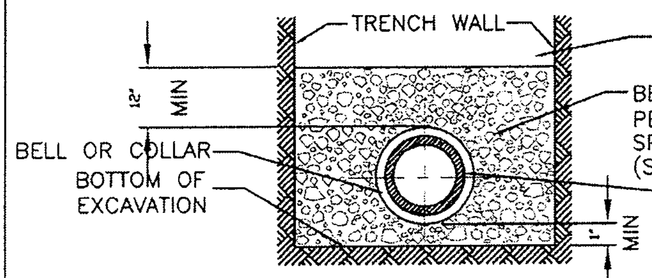
6C. SLURRY SEALING OF TRENCH AREA MAY BE OMITTED IF PROJECT IS COORDINATED WITHIN ONE YEAR OF A CITY STREET REHABILITATION OR SLURRY SEAL PROJECT.

7C. A COLLECTION DEVICE SHALL BE USED TO COLLECT SEDIMENTS GENERATED DURING SAWCUTTING OPERATION.

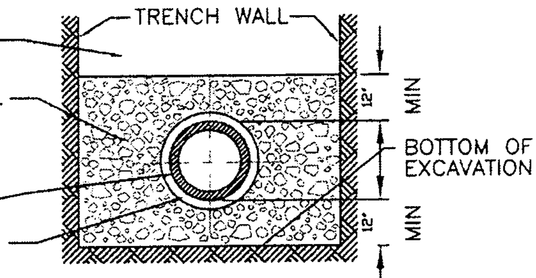
8C. TRENCHES WITH "W" LESS THAN 8" WIDE AND LESS THAN OR EQUAL TO 24" DEEP ARE NOT REQUIRED TO USE T-SECTION PAVEMENT CONSTRUCTION, OR APPLY SLURRY SEAL.

9C. ALL PAVEMENT REMOVALS SHALL USE STRAIGHT LINE SAW CUTS A MINIMUM OF 1.5" DEEP.

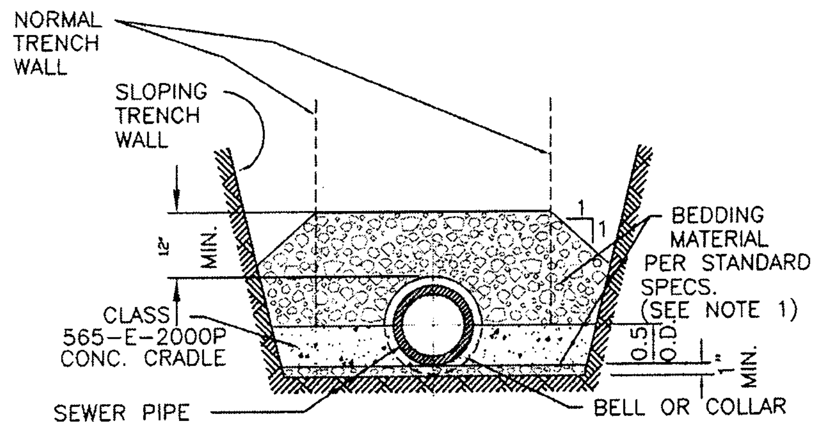
10C. BORING SHALL BE CONSIDERED AS A CONTINUOUS TRENCH AS FAR AS EXCAVATION REPAIR. POTHOLES LOCATED INTERMITTENTLY WILL NOT BE TREATED AS SEPARATE EXCAVATIONS BUT AS A CONTINUOUS EXCAVATION. THE CITY SHALL RESERVE THE RIGHT TO REQUIRE BORING OR OPEN TRENCH AS THE SITUATION MAY ARISE.



CASE 1: NORMAL TRENCH



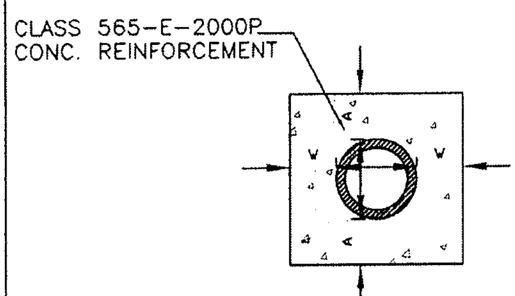
CASE 2: WET, SPONGY GROUND, FILLED GROUND
(LESS THAN 90% COMPACTION)



CASE 3: BOTTOM TRENCH WIDTH EXCEEDS THE WIDTH SPECIFIED IN STD. SPECIFICATIONS

NOTE 1: NATIVE MATERIAL AND SAND ARE UNSUITABLE FOR BEDDING OF 8" OR LARGER PIPES.

CONCRETE REINFORCEMENT FOR SEWER PIPE

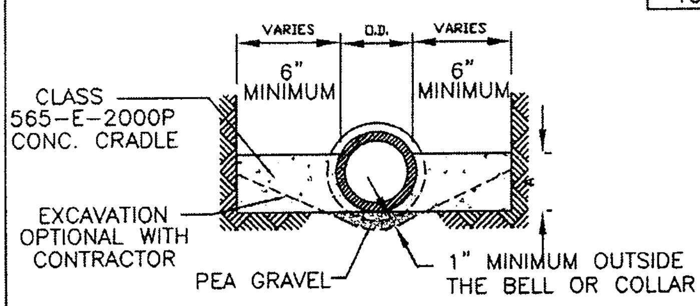


TYPE "X"

TABLES BELOW INDICATE DIMENSIONS OF CONCRETE FOR DIFFERENT SIZES OF PIPE

TYPE "X"						
			CLAY PIPE		CONCRETE PIPE	
SIZE	W	A	STANDARD STRENGTH	EXTRA STRENGTH	STANDARD STRENGTH	EXTRA STRENGTH
6"	4"	4"	0.051	0.051	0.050	0.050
8"	4"	4"	0.063	0.063	0.063	0.063
10"	4"	4"	0.074	0.074	0.074	0.074
12"	4"	4"	0.086	0.086	0.086	0.091
15"	4"	4"	0.107	0.108	0.107	0.114
18"	5"	5"	0.158	0.166	0.159	0.171

SEE NOTE 2



TYPE "Z"

CONCRETE REINFORCEMENT MUST EXTEND TO SOLID BANK

TYPE "Z"					
		CLAY PIPE		CONCRETE PIPE	
SIZE	A	STANDARD STRENGTH	EXTRA STRENGTH	STANDARD STRENGTH	EXTRA STRENGTH
6"	5"	0.017	0.017	0.017	0.017
8"	7"	0.024	0.024	0.024	0.024
10"	9"	0.032	0.032	0.032	0.032
12"	10"	0.037	0.037	0.037	0.037
15"	13"	0.050	0.050	0.050	0.050
18"	16"	0.063	0.064	0.063	0.064

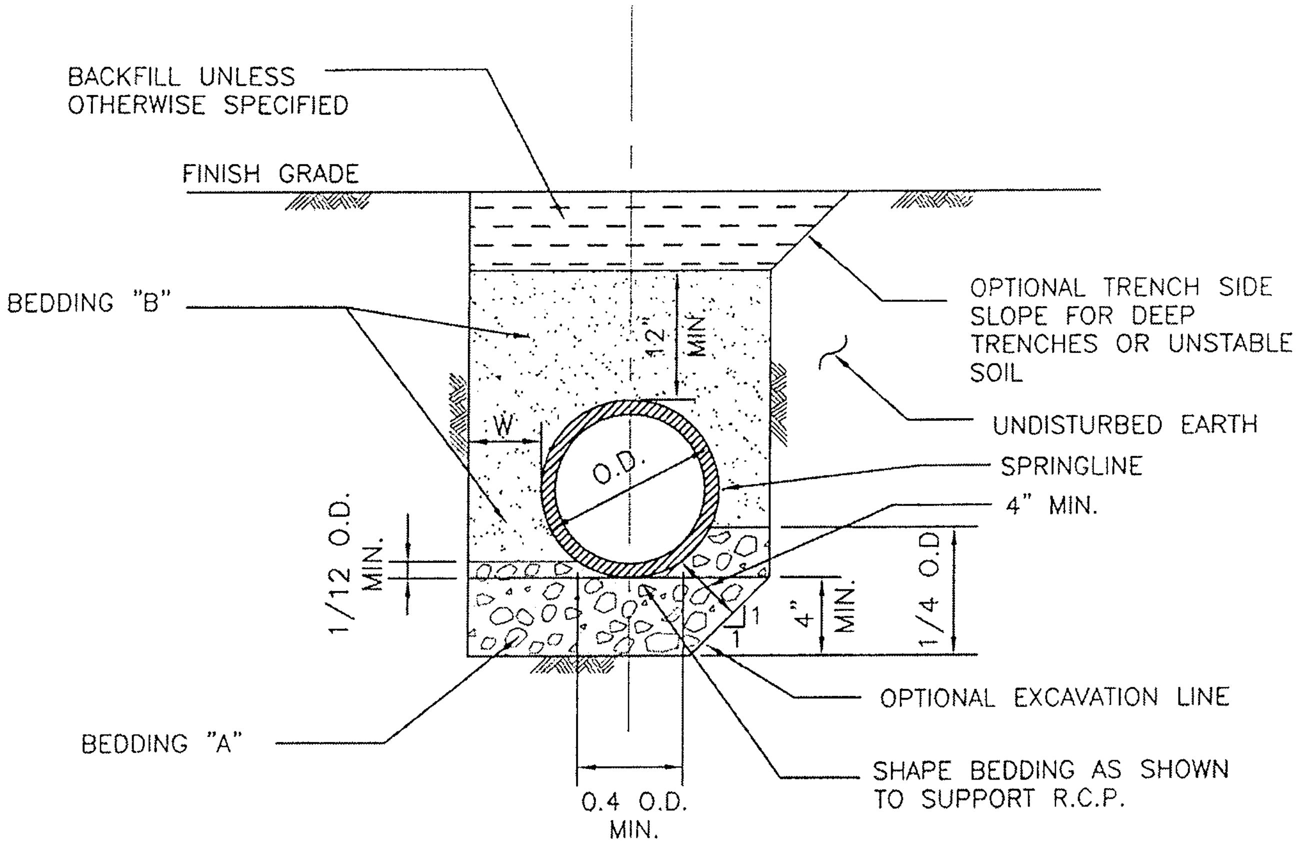
SEE NOTE 2

NOTE 2: COLUMNS INCLUDED BETWEEN ARROWS IN THE TABLES ABOVE INDICATE CUBIC YARDS OF CONCRETE PER LINEAR FT. OF PIPE.

CITY OF TORRANCE

DATE ISSUED	BEDDING FOR SEWER PIPE	STANDARD NO.
23 SEP 2009	ROBERT J. BESTE PUBLIC WORKS DIRECTOR R.C.E. NO. 50737	T204 SHEET 1 OF 1

TT/T204



1. BEDDING "A" SHALL BE COMPOSED OF EITHER SAND, NO. 3 OR NO. 4 CRUSHED ROCK OR GRAVEL PER STANDARD SPECIFICATIONS. OTHER GRANULAR MATERIAL WITH A SAND EQUIVALENT OF 30 OR GREATER MAY BE USED WHEN APPROVED BY THE COMMUNITY DEVELOPMENT/PUBLIC WORKS DIRECTOR.

2. BEDDING "B" SHALL BE COMPOSED OF SAND OR OTHER GRANULAR MATERIAL WITH A SAND EQUIVALENT OF 30 OR GREATER AS APPROVED BY THE COMMUNITY DEVELOPMENT/PUBLIC WORKS DIRECTOR AND SHALL CONFORM TO SECTION 306-1.2.1 OF THE STANDARD SPECIFICATIONS, EXCEPT BEDDING FOR PLASTIC PIPE SHOULD CONFORM TO SECTION 306-1.2.13.

3. BEDDING "B" SHALL BE COMPACTED TO A RELATIVE COMPACTION OF NOT LESS THAN 90 PERCENT UNLESS OTHERWISE SPECIFIED.

4. BEDDING "B" SHALL BE PLACED IN TWO OR MORE LIFTS FOR PIPES WITH AN O.D. GREATER THAN 60 INCHES.

CITY OF TORRANCE

DATE ISSUED	BEDDING FOR STORM DRAIN	STANDARD NO.
02 JUL 2008	ROBERT J. BESTE PUBLIC WORKS DIRECTOR R.C.E. NO. 50737	T302 SHEET 1 OF 2

TT\T302

5. BACKFILL SHALL BE PER SECTION 306-1.3 OF THE STANDARD SPECIFICATIONS.

6. WHERE THE COVER IS 8 FEET OR LESS, "W" MUST BE A MINIMUM OF 6 INCHES. WHERE THE COVER IS GREATER THAN 8 FEET, "W" MUST BE BETWEEN 6 AND 10 INCHES INCLUSIVE FOR PIPES UP TO AND INCLUDING 96 INCHES IN DIAMETER. FOR PIPES OVER 96 INCHES IN DIAMETER, "W" MUST BE BETWEEN 6 AND 12 INCHES INCLUSIVE.

7. "W" SHALL INCLUDE THE THICKNESS OF ANY SHORING.

8. SHORING SHALL BE A MINIMUM OF 6 INCHES FROM THE PIPE AT SPRINGLINE.

CITY OF TORRANCE		
DATE ISSUED	BEDDING FOR STORM DRAIN	STANDARD NO.
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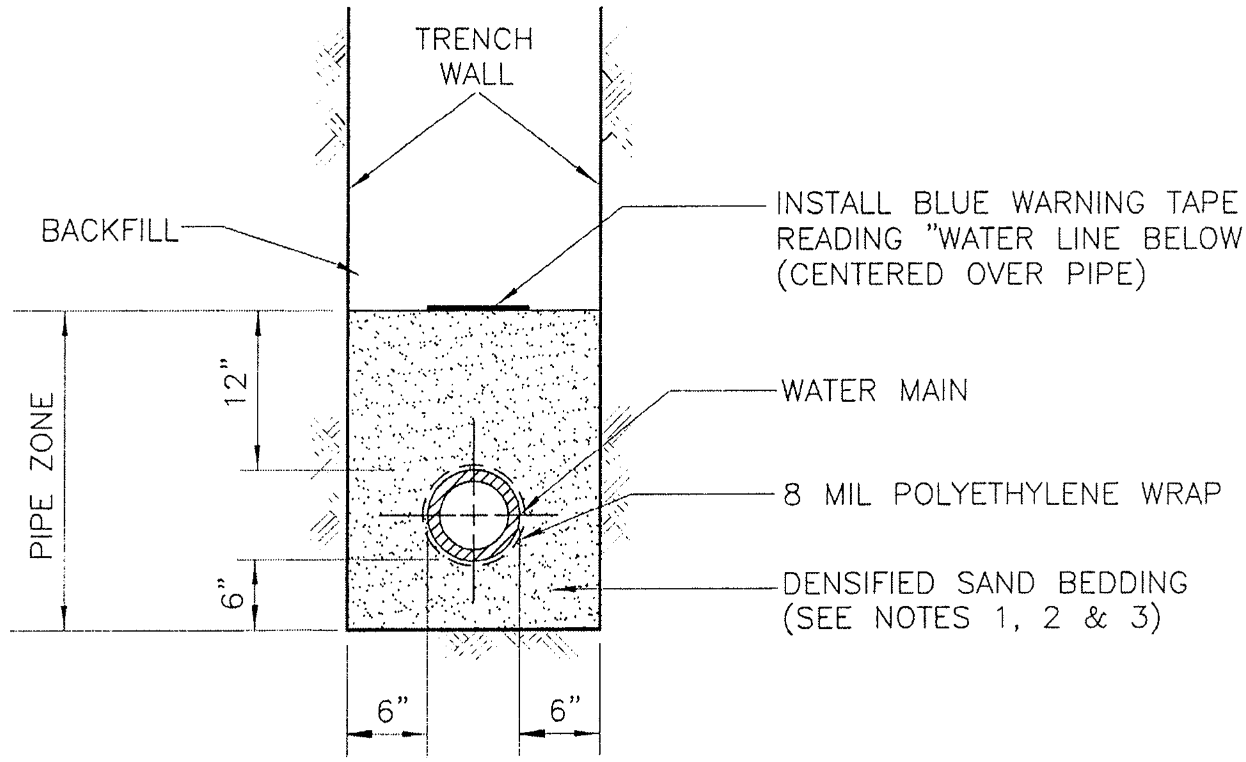


NOTES:

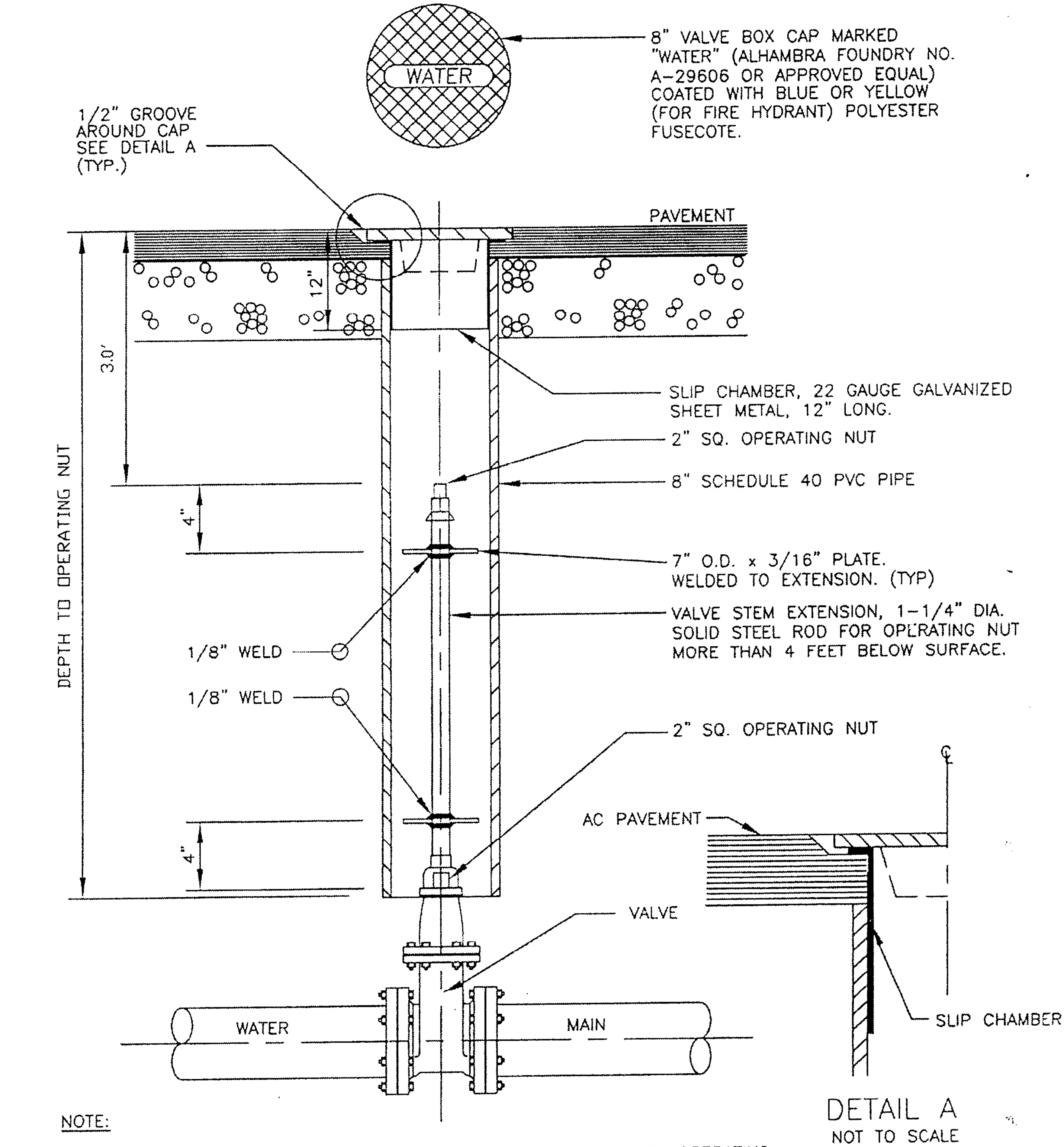
1. SAND BEDDING SHALL CONFORM TO SECTIONS 200–1.5.3 AND 200–1.5.5 OF THE STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION (LATEST EDITION).
2. DENSIFICATION OF BEDDING SHALL BE ACCOMPLISHED IN CONFORMANCE WITH 306–1.2.1 OF THE STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION (LATEST EDITION).
3. BEDDING SHALL BE COMPACTED TO 95% OF MAXIMUM DENSITY UNDER STRUCTURES AND 90% ELSEWHERE.

ACCOMPANYING STD.'S T700 AND T116

CITY OF TORRANCE

DATE ISSUED	BEDDING FOR WATER PIPE	STANDARD NO.
JAN 2011	ROBERT J. BESTE PUBLIC WORKS DIRECTOR R.C.E. NO. 50737	T 701 SHEET 1 OF 1

DV/EM/T701-1



NOTE:

VALVE STEM EXTENSION SHALL BE PROVIDED WHERE DEPTH TO OPERATING NUT EXCEEDS 4'-0".

ACCOMPANYING STD. T700 AND T701

CITY OF TORRANCE

DATE ISSUED	VALVE BOX ASSEMBLY	STANDARD NO.
11 DEC 2006	ROBERT J. BESTE PUBLIC WORKS DIRECTOR R.C.E. NO. 50737	T712 SHEET 1 OF 1

EM/T712-3

APPENDIX III

CONSTRUCTION AND DEMOLITION

DEBRIS RECYCLING SUMMARY

CONSTRUCTION AND DEMOLITION DEBRIS RECYCLING SUMMARY

Project Type: Roadway and/or Bridge/Structure — Water/Sewer
Traffic Signal/Street Lighting — Other ______________

Project Name: ________________________________ Date: ______________

City Contract No.____

Project Location: ____

Thomas Guide Page/Grid No(s): ________________________________

Contractor Name: ____

Contractor Address: ______________________________________

Contractor License #: ______________________________________

Project Duration: From: ____________________ To: ____________________

Demolition and Recycling Cost: $________________________________

Type(s) of Debris Generated	Total Quantity Generated (tons, c.y. or units)	Reuse /Recycling		Disposal	
		Total Quantity (tons, c.y. or units)	Name of Reuse/Recycling Facility/Site	Total Quantity (tons, c.y. or units)	Name of Disposal Facility
Asphalt					
Brick					
Concrete					
Green Waste					
Metal (ferrous)					
Metal (non-ferrous)					
Mixed Debris					
Rock					
Soil					
Wood Waste					
Other:					
Total					

Notes:

- Other debris types may include, but are not limited to, Ash, Cardboard, Carpeting, Glass, Gravel, Land Clearing Debris, Non-friable Asbestos, Paper, Plastic, Porcelain, Roofing Material, Sand, and Tires. Attach additional sheets if necessary.
- If the debris is taken to a transfer station solely for the purpose of reuse/recycling, then list the transfer station as the reuse/recycling facility/site.
- If the debris is taken to a transfer station solely for the purpose of transfer to a disposal facility, then list the transfer station as the disposal facility.

Prepared by ______________________ Signature ________________________

Phone #:____________