

CONTRACT DOCUMENTS
and
TECHNICAL SPECIFICATIONS

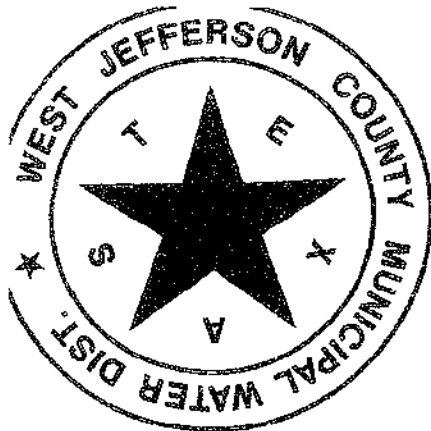
for

**WEST JEFFERSON CO. MUNICIPAL
WATER DISTRICT**

JEFFERSON COUNTY, TX.

**Construction Plans and Specifications for a Potable Water
Elevated Storage Facility**

ACE Job# 123-01A



BOARD MEMBERS

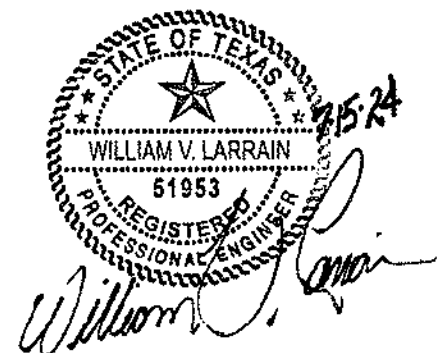
David Smith - President
James Broussard - Secretary
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Rufus Lavergne - Director
Gene Beebe - Director
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Josh Heins-Legal Counsel



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CONTRACT DOCUMENTS
and
TECHNICAL SPECIFICATIONS

**WEST JEFFERSON CO. MUNICIPAL WATER
DISTRICT**

JEFFERSON COUNTY, TX.

**Construction Documents for a Potable Water Elevated Storage
Facility**

ACE Job No. 123-01C

BOARD MEMBERS

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James Broussard - Secretary
Randy Lyday - Treasurer



Rufus Lavergne - Director
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Construction

Advertisement and Invitation for Bids

The West Jefferson County Municipal Water District will receive bids for Potable Water Storage Improvements until 10:00 AM on September 24, 2024 at the district office located at 7824 Glenbrook Dr., Beaumont, TX 77705. The bids will be publicly opened and read aloud thereafter on September 24, 2024 at 7824 Glenbrook Dr.

Bids are invited for several items and quantities of work as follows:

1. Construction and protective coating for one (1) District selected size, elevated potable water steel storage tank, of capacity based on proposals ranging from 250K, 300K, 400K, or 500K as received during this bidding process.

Bid/Contract Documents, including Drawings and Technical Specifications are on file at 7824 Glenbrook Dr., Beaumont, TX, 77705 and also locate on website, www.westjeffersoncountymwd.com (Notices Tab-Proposed projects).

Copies of the Bid/Contract Documents may be obtained through the office of West Jefferson County Municipal Water District the address referenced above by mail or by calling (409) 794-2338 or by email dhidalgo@westjeffersoncountymwd.com or by download from website above.

A bid bond in the amount of 5 percent of the bid issued by an acceptable surety shall be submitted with each bid. A certified check or bank draft payable to the West Jefferson County MWD or negotiable U.S. Government Bonds (as par value) may be submitted in lieu of the Bid Bond.

Attention is called to the fact that not less than, the federally determined prevailing (Davis-Bacon and Related Acts) wage rate, as issued by the and contained in the contract documents, must be paid on this project. In addition, the successful bidder must ensure that employees and applicants for employment are not discriminated against because of race, color, religion, sex age or national origin. West Jefferson County MWD reserves the right to reject any or all bids or to waive any informalities in the bidding.

Bids may be held by West Jefferson County MWD for a period not to exceed 30 days from the date of the bid opening for the purpose of reviewing the bids and investigating the bidders qualifications prior to the contract award.

All contractors/subcontractors that are debarred, suspended or otherwise excluded from or ineligible for participation on federal assistance programs may not undertake any activity in part or in full under this project.

West Jefferson County Municipal Water District, Daniel Hidalgo. District Manager

West Jefferson County Municipal Water District

INSTRUCTION TO BIDDERS FOR CONSTRUCTION

1. Use of Separate Bid Forms

These contract documents include a complete set of bid and contract forms which are for the convenience of the bidders and are not to be detached from the contract document, completed or executed. Separate bid forms are provided for your use.

2. Interpretations or Addenda

No oral interpretations will be made to any bidder. Each request for an interpretation shall be made in writing to the Grant Recipient or engineer no less than seven (7) days prior to the bid opening. Each interpretation made will be in the form of an Addendum to the contract documents and will be distributed to all parties holding contract documents no less than five (5) days prior to the bid opening. It is, however, the bidder's responsibility to make inquiry as to any addenda issued. All such addenda shall become part of the contract documents and all bidders shall be bound by such addenda, whether or not received by the bidders.

3. Inspection of Site

Each bidder should visit the site of the proposed work and fully acquaint himself with the existing conditions there and should fully inform himself as to the facilities involved, the difficulties and restrictions attending the performance of the contract. The bidder should thoroughly examine and familiarize himself with the drawings, technical specifications and all other contract documents. The contractor by the execution of the contract shall in no way be relieved of any obligation under it due to his failure to receive or examine any form or legal document or to visit the site or acquaint himself with the conditions there existing. The city/county will be justified in rejecting any claim based on lack of inspection of the site prior to the bid.

4. Alternate bid items

No alternate bids or bid items will be considered unless they are specifically requested by the technical specifications.

5. Bids

- a. All bids must be submitted on the forms provided and are subject to all requirements of the Contract Documents, including the Drawings.
- b. All bids must be regular in every respect and no interlineation, excisions or special conditions may be made or included by the bidder.
- c. Bid documents, including the bid, the bid bond, and the statement of bidders' qualifications shall be sealed in an envelope and clearly labeled with the words "Bid Documents", the project number, name of bidder and the date and time of bid opening.
- d. The Grant Recipient may consider as irregular any bid on which there is an alteration of or departure from the bid form and, at its option, may reject any irregular bid.

- e. If a contract is awarded, it will be awarded to a responsible bidder on the basis of the lowest/best bid and the selected alternate bid items, if any. The contract will require the completion of the work in accordance with the contract documents.

6. Bid Modifications Prior to Bid Opening

- a. Any bidder may modify his bid by telegraphic communication at any time prior to the scheduled closing time for receipt of bids, provided such telegraphic communication is received by the Grant Recipient prior to the closing time, and provided further, the Grant Recipient is satisfied that a written confirmation of the telegraphic modification over the signature of the bidder was mailed prior to the closing time. The telegraphic communication should not reveal the bid price but should provide the addition, subtractions or other modifications so that the final prices or terms will not be known by the Grant Recipient until the sealed bid is open. If written confirmation is not received within two (2) days from the closing time, no consideration will be given to the telegraphic modification.
- b. Likewise, any bidder may modify a bid by submitting a supplemental bid in person prior to the scheduled closing time for receipt of bids. Such supplemental bid should mention only additions or subtractions to the original bid so as to not reveal the final prices or terms to the Grant Recipient until the sealed bid is open.

7. Bid Bond

- a. A bid bond in the amount of 5% of the bid issued by an acceptable surety shall be submitted with each bid. A certified check or bank draft payable to the Grant Recipient or negotiable U.S. Government Bonds (as par value) may be submitted in lieu of the Bid Bond.
- b. The bid bond or its comparable, will be returned to the bidder as soon as practical after the opening of the bids.

8. Statement of Bidders Qualifications

Each bidder shall submit on the form furnished for that purpose a statement of the bidder's qualifications. The Grant Recipient shall have the right to take such steps as it deems necessary to determine the ability of the bidder to perform his obligations under the contract, and the bidder shall furnish the Grant Recipient all such information and data for this purpose as it may request. The right is reserved to reject any bid where an investigation of the available data does not satisfy the Grant Recipient that the bidder is qualified to carry out properly the terms of the contract.

9. Unit Price

The unit price for each of the several items in the bid shall include its pro rata share of overhead so that the sum of the products obtained by multiplying the quantity shown for each item by the unit price bid represents the total bid. Any bid not conforming to this requirement may be rejected as informal. Special attention is drawn to this condition, as the unit prices will be used to determine the amount of any change orders resulting from an increase or decrease in quantities.

10. Corrections:

Erasures or other corrections in the bid must be noted over the signature of the bidder.

11. Time for Receiving Bids

Bids received prior to the advertised hour of opening shall be kept securely sealed. The officer appointed to open the bids shall decide when the specified time has arrived and no bid received thereafter will be considered; except that when a bid arrives by mail after the time fixed for opening, but before the reading of all other bids is completed, and it is shown to the satisfaction of the Grant Recipient that the late arrival of the bid was solely due to delay in the mail for which the bidder was not responsible, such bid will be received and considered.

12. Opening of Bids

The Grant Recipient shall, at the time and place fixed for the opening of bids, open each bid and publicly read it aloud, irrespective of any irregularities therein. Bidders and other interested individuals may be present.

13. Withdrawal of Bids

Bidder may withdraw the bid before the time fixed for the opening of bids, by communicating his purpose in writing to the locally. Upon receipt of such notice, the unopened bid will be returned to the bidder. The bid guaranty of any bidder withdrawing his bid will be returned promptly.

14. Award of Contract/Rejection of Bids

- a. The contract will be awarded to the responsive, responsible Bidder submitting the lowest/best bid. The bidder selected will be notified at the earliest possible date. The Grant Recipient reserves the right to reject any or all bids and to waive any informality in bids received where such rejection or waiver is in its interest.
- b. The Grant Recipient reserves the right to consider as unqualified to do the work any bidder who does not habitually perform with his own forces the major portions of the work involved in construction of the improvements embraced in this contract.

15. Execution of Agreement/Performance and Payment Bonds

- a. Performance and Payment Bonds, Requires all prime contractors which enter into a formal contract in excess of \$25,000 with the State, any department, board, agency, municipality, county, school district or any division or subdivision thereof, to obtain a Payment Bond in the amount of the contract before commencing with work and a performance bond for public works contracts in excess of \$100,000.
- b. The failure of the successful bidder to execute the agreement and supply the required bonds within ten (10) days after the prescribed forms are presented for signature, or within such extended period as the Grant Recipient may grant, shall constitute a default and the Grant Recipient may, at its option either award the contract to the next lowest responsible bidder, or re-advertise for bids. In either case, the Grant Recipient may charge against the bidder the difference between the amount of the bid, and the amount for which a contract is subsequently executed irrespective of whether this difference exceeds the amount of the bid bond. If a more favorable bid is received through re-

advertisement, the defaulting bidder shall have no claim against the Grant Recipient for a refund.

16. Wages and Salaries

Attention is particularly called to the requirement of paying not less than the prevailing Davis Bacon Related Acts (DBRA) wage rates specified in the Contract Documents. These rates are minimums to be paid during the life of the contract. It is therefore the responsibility of the Bidder to inform themselves as to local labor conditions.

17. Equal Employment Opportunity

Attention is called to the requirements for ensuring that employees and applicants for employment are not discriminated against because of their race, color, creed, sex, gender, or national origin.

COUNTY OF JEFFERSON
STANDARD FORM OF AGREEMENT
FOR OWNER-CONTRACTOR PROJECTS

STATE of TEXAS }

Jefferson County}

THIS AGREEMENT, made and entered into this ____ day of _____, A.D. 2024, by and between West Jefferson County, MWD of the COUNTY of Jefferson in the STATE OF TEXAS, thereunto duly authorized so to do, Party of the First Part, hereinafter termed OWNER, and (Construction Firm) of the City of _____ County of _____ in the State of Texas, Party of the Second Part, hereinafter termed CONTRACTOR.

WITNESSETH: That for and inconsideration of the payments and agreements hereinafter mentioned, to be made and performed by the Party of the First Part (OWNER) and under the conditions expressed in the bond bearing even date herewith, the said Party of the Second Part (CONTRACTOR), hereby agrees with the said Party of the First Part (OWNER) to commence and complete the construction of certain improvements described as follow:

and all extra work in connection therewith, under the terms as stated in the General Conditions of the Agreement and at his (or their) own proper cost and expense to furnish all materials, supplies, machinery, equipment, tools, superintendence, labor, insurance, and other accessories and services necessary to complete the said construction, in accordance with the Notice to Contractors, General and Special Conditions of Agreement, Plans and other drawings and printed or written explanatory matter thereof, and the Specifications and addenda therefore, as prepared by Action Civil Engineers, PLLC, herein entitled the ENGINEER, each of which has been identified by the CONTRACTOR and the ENGINEER, together with the CONTRACTOR'S written proposal, the General Conditions of the Agreement, the Performance and Payment Bonds hereto attached; all of which are made a part hereof and collectively evidence and constitute the entire contract.

The CONTRACTOR hereby agrees to commence work within ten (10) calendar days after the date written notice to do so shall have been given to him, and to substantially complete within _____ consecutive calendar days after issuance of the "Notice to Proceed" and to be at Final Completion within _____ consecutive calendar days after the issuance of the "Notice to Proceed", subject to such extensions of time as are provided by the General and Special Conditions.

The OWNER agrees to pay the CONTRACTOR in current funds the price or prices shown in the proposal, which forms a part of this contract, such payments to be subject to the General and Special Conditions of the contract.

IN WITNESS WHEREOF, the parties to these presents have executed this Agreement in the year and day first above written.

Party of the First Part (OWNER)

Party of the Second Part (CONTRACTOR)

By: _____

By: _____

ATTEST: _____

ATTEST: _____

GENERAL CONTRACT CONDITIONS

1. Contract and Contract Documents

- (a) The project to be constructed pursuant to this contract will be financed with assistance from the American Rescue Plan Act of 2021 (ARPA) and is subject to all applicable Federal and State laws and regulations.
- (b) The Plans, Specifications and Addenda, hereinafter enumerated in Paragraph 1 of the Supplemental General Conditions shall form part of this contract and the provisions thereof shall be as binding upon the parties hereto as if they were herein fully set forth.

2. Definitions

Whenever used in any of the contract Documents, the following meanings shall be given to the terms here in defined:

- (a) The term "Contract" means the Contract executed between the (Name of Grant Recipient), hereinafter called the Owner and (Name of Construction Co.), hereinafter called Contractor, of which these GENERAL CONDITIONS, form a part.
- (b) The term "Project Area" means the area within which are the specified Contract limits of the Improvements contemplated to be constructed in whole or in part under this contract.
- (c) The term "Engineer" means (name of engineering firm), Engineer in charge, serving the Owner with architectural or engineering services, his successor, or any other person or persons, employed by the Owner for the purpose of directing or having in charge the work embraced in this Contract.
- (d) The term "Contract Documents" means and shall include the following: Executed Contract, Addenda (if any), Invitation for Bids, Instructions to Bidders, Signed Copy of Bid, General Conditions, Special Conditions, Technical Specifications, and Drawings (as listed in the Schedule of Drawings).

3. Supervision By Contractor

- (a) Except where the Contractor is an individual and gives his personal supervision to the work, the Contractor shall provide a competent superintendent, satisfactory to the Local Public Agency and the Engineer, on the work at all times during working hours with full authority to act for him. The Contractor shall also provide an adequate staff for the proper coordination and expediting of his work.
- (b) The Contractor shall lay out his own work and he shall be responsible for all work executed by him under the Contract. He shall verify all figures and elevations before proceeding with the work and will be held responsible for any error resulting from his failure to do so.

4. Subcontracts

- (a) The Contractor shall not execute an agreement with any subcontractor or permit any subcontractor to perform any work included in this contract until he has verified the subcontractor as eligible to participate in federally funded contracts.
- (b) No proposed subcontractor shall be disapproved by the city/county except for cause.
- (c) The Contractor shall be as fully responsible to the city/county for the acts and omissions of his subcontractors, and of persons either directly or indirectly employed by them.
- (d) The Contractor shall cause appropriate provisions to be inserted in all subcontracts relative to the work and required compliance by each subcontractor with the applicable provisions of the Contract.
- (e) Nothing contained in the Contract shall create any contractual relation between any subcontractor and the Owner.

5. Fitting and Coordination of Work

The Contractor shall be responsible for the proper fitting of all work and for the coordination of the operations of all trades, subcontractors, or material suppliers engaged upon this Contract.

6. Payments to Contractor

(a) Partial Payments

- 1) The Contractor shall prepare his requisition for partial payment as of the last day of the month and submit it, with the required number of copies, to the Engineer for his approval. The amount of the payment due the Contractor shall be determined by adding to the total value of work completed to date, the value of materials properly stored on the site and deducting (1) ten percent (10%) of the total amount, to be retained until final payment and (2) the amount of all previous payments. The total value of work completed to date shall be based on the estimated quantities of work completed and on the unit prices contained in the agreement. The value of materials properly stored on the site shall be based upon the estimated quantities of such materials and the invoice prices. Copies of all invoices shall be available for inspection of the Engineer.
- 2) Monthly or partial payments made by the Owner to the Contractor are moneys advanced for the purpose of assisting the contractor to expedite the work of construction. The Contractor shall be responsible for the care and protection of all materials and work upon which payments have been made until final acceptance of such work and materials by the Owner. Such payments shall not constitute a waiver of the right of the Owner to require the fulfillment of all terms of the Contract and the delivery of all improvements embraced in this Contract complete and satisfactory to the Owner in all details.

(b) Final Payment

- 1) After final inspection and acceptance by the Owner of all work under the Contract, the Contractor shall prepare his requisition for final payment which shall be based upon the careful inspection of each item of work at the applicable unit prices stipulated in the Agreement. The total amount of the final payment due the Contractor under this contract shall be the amount computed as described above less all previous payments.
- 2) The Owner before paying the final estimate, shall require the Contractor to furnish releases or receipts from all subcontractors having performed any work and all persons having supplied materials, equipment (installed on the Project) and services to the Contractor, if the Owner deems it necessary in order to protect its interest. The Owner may, if it deems such action advisable, make payment in part or in full to the Contractor without requiring the furnishing of such releases or receipts and any payments made shall in no way impair the obligations of any surety or sureties furnished under this Contract.

- 3) Any amount due the Owner under Liquidated Damages, shall be deducted from the final payment due the contractor.

(c) **Payments Subject to Submission of Certificates**

Each payment to the Contractor by the Owner shall be made subject to submission by the Contractor of all written certifications required of him and his subcontractors.

(d) **Withholding Payments**

The Owner may withhold from any payment due the Contractor whatever is deemed necessary to protect the Owner, and if so elects, may also withhold any amounts due from the Contractor to any subcontractors or material dealers, for work performed or material furnished by them. The foregoing provisions shall be construed solely for the benefit of the Owner and will not require the Owner to determine or adjust any claims or disputes between the Contractor and his subcontractors or material dealers, or to withhold any moneys for their protection unless the Owner elects to do so. The failure or refusal of the Owner to withhold any moneys from the Contractor shall in no way impair the obligations of any surety or sureties under any bond or bonds furnished under this Contract.

7. Changes in the Work

- (a) The Owner may make changes in the scope of work required to be performed by the Contractor under the Contract without relieving or releasing the Contractor from any of his obligations under the Contract or any guarantee given by him pursuant to the Contract provisions, and without affecting the validity of the guaranty bonds, and without relieving or releasing the surety or sureties of said bonds. All such work shall be executed under the terms of the original Contract unless it is expressly provided otherwise. Additionally, all such change orders must be approved by the Tidal Basin Group staff prior to execution of same.
- (b) Except for the purpose of affording protection against any emergency endangering health, life, limb or property, the Contractor shall make no change in the materials used or in the specified manner of constructing and/or installing the improvements or supply additional labor, services or materials beyond that actually required for the execution of the Contract, unless in pursuance of a written order from the Owner authorizing the Contractor to proceed with the change. No claim for an adjustment of the Contract Price will be valid unless so ordered.
- (c) If applicable unit prices are contained in the Agreement, the Owner may order the Contractor to proceed with desired unit prices specified in the Contract; provided that in case of a unit price contract the net value of all changes does not increase the original total amount of the agreement by more than twenty-five percent (25%) or decrease the original the total amount by eighteen percent (18%).
- (d) Each change order shall include in its final form:
 - 1) A detailed description of the change in the work.
 - 2) The Contractor's proposal (if any) or a confirmed copy thereof.
 - 3) A definite statement as to the resulting change in the contract price and/or time.
 - 4) The statement that all work involved in the change shall be performed in accordance with contract requirements except as modified by the change order.
 - 5) The procedures as outlined in this Section for a unit price contract also apply in any lump sum contract.

8. Claims for Extra Cost

- (a) If the Contractor claims that any instructions by Drawings or otherwise involve extra cost or extension of time, he shall, within ten days after the receipt of such instructions, and in any event before proceeding to execute the work, submit his protest thereto in writing to the Owner, stating clearly and in detail the basis of his objections. No such claim will be considered unless so made.
- (b) Claims for additional compensation for extra work, due to alleged errors in ground elevations, contour lines, or bench marks, will not be recognized unless accompanied by certified survey data, made prior to the time the original ground was disturbed, clearly showing that errors exist which resulted, or would result, in handling more material, or performing more work, than would be reasonably estimated from the Drawings and maps issued.
- (c) Any discrepancies which may be discovered between actual conditions and those represented by the Drawings and maps shall be reported at once to the Owner and work shall not proceed except at the Contractor's risk, until written instructions have been received by him from the Owner.
- (d) If, on the basis of the available evidence, the Owner determines that an adjustment of the Contract Price and/or time is justifiable, a change order shall be executed.

9. Termination, Delays, and Liquidated Damages

- (a) Right of the Owner to Terminate Contract.
- (b) In the event that any of the provisions of this contract are violated by the Contractor, or by any of his subcontractors, the Owner may serve written notice upon the Contractor and the Surety of its intention to terminate the contract. The notices shall contain the reasons for such intention to terminate the contract, and unless such violation or delay shall cease and satisfactory arrangement of correction be made within ten days, the contract shall, upon the expiration of said ten (10) days, cease and terminate. In the event of any such termination, the Owner shall immediately serve notice thereof upon the Surety and the Contractor. The Surety shall have the right to take over and perform the contract. Provided, however, that if the Surety does not commence performance thereof within ten (10) days from the date of the mailing to such Surety of notice of termination, the Owner may take over the work and complete the project by bid/contract or by force account at the expense of the Contractor and his Surety shall be liable to the Owner for any excess cost incurred. In such event the Owner may take possession of and utilize in completing the work, such materials, appliances, and plant as may be on the site of the work and necessary therefore.
- (c) Liquidated Damages for Delays.
- (d) If the work is not completed within the time stipulated in the applicable bid for Lump Sum or Unit Price Contract provided, the Contractor shall pay to the Owner as fixed, agreed, and liquidated damages (it being impossible to determine the actual damages occasioned by the delay) the amount of _____ for each calendar day of delay, until the work is completed. The Contractor and his sureties shall be liable to the Owner for the amount thereof.
- (e) Excusable Delays.
 - 1) The right of the Contractor to proceed shall not be terminated nor shall the Contractor be charged with liquidated damages for any delays in the completion of the work due to:
 - 2) Any acts of the Government, including controls or restrictions upon or requisitioning of materials, equipment, tools, or labor by reason of war, national defense, or any other national emergency;
 - 3) Any acts of the Owner;
 - 4) Causes not reasonably foreseeable by the parties to this Contract at the time of the execution of the Contract which are beyond the control and without the fault or negligence of the Contractor, including, but not restricted to, acts of God or of the public enemy, acts of another Contractor in the performance of some other contract with the Owner, fires, floods, epidemics, quarantine, restrictions, strikes, freight

embargoes, and weather of unusual severity such as hurricanes, tornadoes, cycloes and other extreme weather conditions.

- 5) Provided, however, that the Contractor promptly notifies the Owner within ten (10) days in writing of the cause of the delay. Upon receipt of such notification, the Owner shall ascertain the facts and the cause and extent of delay. If, upon the basis of the facts and the terms of this contract, the delay is properly excusable, the Owner shall extend the time for completing the work for a period of time commensurate with the period of excusable delay.

10. Assignment or Novation

The Contractor shall not assign or transfer, whether by an assignment or novation, any of its rights, duties, benefits, obligations, liabilities, or responsibilities under this Contract without the written consent of the Owner; provided, however, that assignments to banks or other financial institutions may be made without the consent of the Owner. No assignment or novation of this Contract shall be valid unless the assignment or novation expressly provides that the assignment of any of the Contractor's rights or benefits under the Contract is subject to a prior lien for labor performed, services rendered, and materials, tools, and equipment supplied for the performance of the work under this Contract in favor of all persons, firms, or corporations rendering such labor or services or supplying such materials, tools, or equipment.

11. Disputes

- (a) All disputes arising under this Contract or its interpretation except those disputes covered by FEDERAL LABOR STANDARDS PROVISIONS whether involving law or fact or both, or extra work, and all claims for alleged breach of contract shall, within ten (10) days of commencement of the dispute, be presented by the Contractor to the Owner for decision. Any claim not presented within the time limit specified in this paragraph shall be deemed to have been waived, except that if the claim is of a continuing character and notice of the claim is not given within ten (10) days of its commencement, the claim will be considered only for a period commencing ten (10) days prior to the receipt of the Owner.
- (b) The Contractor shall submit in detail his claim and his proof thereof.
- (c) If the Contractor does not agree with any decision of the Owner, he shall in no case allow the dispute to delay the work but shall notify the Owner promptly that he is proceeding with the work under protest.

12. Technical Specifications and Drawings

Anything mentioned in the Technical Specifications and not shown on the Drawings or vice versa, shall be of like effect as if shown on or mentioned in both. In case of difference between Drawings and Technical Specifications, the Technical Specifications shall govern. In case of any discrepancy in Drawings, or Technical Specifications, the matter shall be immediately submitted to the Owner, without whose decision, said discrepancy shall not be adjusted by the Contractor, save only at his own risk and expense.

13. Shop Drawings

- (a) All required shop drawings, machinery details, layout drawings, etc. shall be submitted to the Engineer in _____ copies for approval sufficiently in advance of requirements to afford ample time for checking, including time for correcting, resubmitting and rechecking if necessary. The Contractor may proceed, only at his own risk, with manufacture or installation of any equipment or work covered by said shop drawings, etc. until they are approved and no claim, by the Contractor, for extension of the contract time shall be granted by reason of his failure in this respect.
- (b) Any drawings submitted without the Contractor's stamp of approval will not be considered and will be returned to him for proper resubmission. If any drawings show variations from the requirements of the Contract because of standard shop practice or other reason, the Contractor shall make specific mention of such variation in his letter of transmittal in order that, if acceptable, suitable action may be taken for proper adjustment of contract price and/or time, otherwise the Contractor will not be relieved of the responsibility for executing the work in accordance with the Contract even though the drawings have been approved.

- (c) If a shop drawing is in accordance with the contract or involves only a minor adjustment in the interest of the Owner not involving a change in contract price or time; the engineer may approve the drawing. The approval shall not relieve the Contractor from his responsibility for adherence to the contract or for any error in the drawing.

14. Requests for Supplementary Information

It shall be the responsibility of the Contractor to make timely requests of the Owner for any additional information not already in his possession which should be furnished by the Owner under the terms of this Contract, and which he will require in the planning and execution of the work. Such requests may be submitted from time to time as the need approaches, but each shall be filed in ample time to permit appropriate action to be taken by all parties involved so as to avoid delay. Each request shall be in writing, and list the various items and the latest date by which each will be required by the Contractor. The first list shall be submitted within two weeks after Contract award and shall be as complete as possible at that time. The Contractor shall, if requested, furnish promptly any assistance and information the Engineer may require in responding to these requests of the Contractor. The Contractor shall be fully responsible for any delay in his work or to others arising from his failure to comply fully with the provision of this section.

15. Materials and Workmanship

- (a) Unless otherwise specifically provided for in the technical specifications, all workmanship, equipment, materials and articles incorporated in the work shall be new and the best grade of the respective kinds for the purpose. Where equipment, materials, articles or workmanship are referred to in the technical specifications as "equal to" any particular standard, the Engineer shall decide the question of equality.
- (b) The Contractor shall furnish to the Owner for approval the manufacturer's detailed specifications for all machinery, mechanical and other special equipment, which he contemplates installing together with full information as to type, performance characteristics, and all other pertinent information as required, and shall likewise submit for approval full information concerning all other materials or articles which he proposes to incorporate.
- (c) Machinery, mechanical and other equipment, materials or articles installed or used without such prior approval shall be at the risk of subsequent rejection.
- (d) Materials specified by reference to the number or symbol of a specific standard, shall comply with requirements in the latest revision thereof and any amendment or supplement thereto in effect on the date of the Invitation for Bids, except as limited to type, class or grade, or modified in the technical specifications shall have full force and effect as though printed therein.
- (e) The Owner may require the Contractor to dismiss from the work such employee or employees as the Owner or the Engineer may deem incompetent, or careless, or insubordinate.

16. Samples, Certificates and Tests

- (a) The Contractor shall submit all material or equipment samples, certificates, affidavits, etc., as called for in the contract documents or required by the Engineer, promptly after award of the contract and acceptance of the Contractor's bond. No such material or equipment shall be manufactured or delivered to the site, except at the Contractor's own risk, until the required samples or certificates have been approved in writing by the Engineer. Any delay in the work caused by late or improper submission of samples or certificates for approval shall not be considered just cause for an extension of the contract time.
- (b) Each sample submitted by the Contractor shall carry a label giving the name of the Contractor, the project for which it is intended, and the name of the producer. The accompanying certificate or letter from the Contractor shall state that the sample complies with contract requirements, shall give the name and brand of the product, its place of origin, the name and address of the producer and all specifications or other detailed information which will assist the Engineer in making a prompt decision regarding the acceptability of the

sample. It shall also include the statement that all materials or equipment furnished for use in the project will comply with the samples and/or certified statements.

- (c) Approval of any materials shall be general only and shall not constitute a waiver of the Owner's right to demand full compliance with Contract requirements. After actual deliveries, the Engineer will have such check tests made as he deems necessary in each instance and may reject materials and equipment and accessories for cause, even though such materials and articles have been given general approval. If materials, equipment or accessories which fail to meet check tests have been incorporated in the work, the Engineer will have the right to cause their removal and replacement by proper materials or to demand and secure such reparation by the Contractor as is equitable.
- (d) Except as otherwise specifically stated in the Contract, the costs of sampling and testing will be divided as follows:
 - 1) The Contractor shall furnish without extra cost, including packing and delivery charges, all samples required for testing purposes, except those samples taken on the project by the Engineer;
 - 2) The Contractor shall assume all costs of re-testing materials which fail to meet contract requirements;
 - 3) The Contractor shall assume all costs of testing materials offered in substitution for those found deficient;
 - 4) The Owner will pay all other expenses.

17. Permits and Codes

- (a) The Contractor shall give all notices required by and comply with all applicable laws, ordinances, and codes of the Local Government. All construction work and/or utility installations shall comply with all applicable ordinances, and codes including all written waivers. Before installing any work, the Contractor shall examine the drawings and technical specifications for compliance with applicable ordinances and codes and shall immediately report any discrepancy to the Owner. Where the requirements of the drawings and technical specifications fail to comply with such applicable ordinances or codes, the Owner will adjust the Contract by Change Order to conform to such ordinances or codes (unless waivers in writing covering the difference have been granted by the governing body or department) and make appropriate adjustment in the Contract Price or stipulated unit prices.
- (b) Should the Contractor fail to observe the foregoing provisions and proceed with the construction and/or install any utility at variance with any applicable ordinance or code, including any written waivers (notwithstanding the fact that such installation is in compliance with the drawings and technical specifications), the Contractor shall remove such work without cost to the Owner.
- (c) The Contractor shall at his own expense, secure and pay for all permits for street pavement, sidewalks, shed, removal of abandoned water taps, sealing of house connection drains, pavement cuts, buildings, electrical, plumbing, water, gas and sewer permits required by the local regulatory body or any of its agencies.
- (d) The Contractor shall comply with applicable local laws and ordinances governing the disposal of surplus excavation, materials, debris and rubbish on or off the Project Area and commit no trespass on any public or private property in any operation due to or connected with the Improvements contained in this Contract.
- (e) The Contractor will be required to make arrangements for and pay the water, electrical power, or any other utilities required during construction.
- (f) During construction of this project, the Contractor shall use every means possible to control the amount of dust created by construction. Prior to the close of a day's work, the Contractor, if directed by the Owner, shall moisten the bank and surrounding area to prevent a dusty condition.

18. Care of Work

- (a) The Contractor shall be responsible for all damages to person or property that occur as a result of his fault or negligence in connection with the prosecution of the work and shall be responsible for the proper care and protection of all materials delivered and work performed until completion and final acceptance.
- (b) The Contractor shall provide sufficient competent watchmen, both day and night, including Saturdays, Sundays, and holidays, from the time the work is commenced until final completion and acceptance.
- (c) In an emergency affecting the safety of life, limb or property, including adjoining property, the Contractor, without special instructions or authorization from the Owner is authorized to act at his discretion to prevent such threatened loss or injury, and he shall so act. He shall likewise act if instructed to do so by the Owner.
- (d) D The Contractor shall avoid damage as a result of his operations to existing sidewalks, streets, curbs, pavements, utilities (except those which are to be replaced or removed), adjoining property, etc., and he shall at his own expense completely repair any damage thereto caused by his operations.
- (e) The Contractor shall shore up, brace, underpin, secure, and protect as maybe necessary, all foundations and other parts of existing structures adjacent to, adjoining, and in the vicinity of the site, which may be in any way affected by the excavations or other operations connected with the construction of the improvements included in this Contract. The Contractor shall be responsible for the giving of any and all required notices to any adjoining or adjacent property owner or other party before the commencement of any work. The Contractor shall indemnify and save harmless the Owner from any damages on account of settlements or the loss of lateral support of adjoining property and from all loss or expense and all damages for which the Owner may become liable in consequence of such injury or damage to adjoining and adjacent structures and their premises.

19. Accident Prevention

- (a) No laborer or mechanic employed in the performance of this Contract shall be required to work in surroundings or under working conditions which are unsanitary, hazardous, or dangerous to his health or safety as determined under construction safety and health standards promulgated by the Secretary of Labor.
- (b) The Contractor shall exercise proper precaution at all times for the protection of persons and property and shall be responsible for all damages to persons or property, either on or off the site, which occur as a result of his prosecution of the work.
- (c) The Contractor shall maintain an accurate record of all cases of death, occupational disease, or injury requiring medical attention or causing loss of time from work, arising out of and in the course of employment on work under the Contract. The Contractor shall promptly furnish the Owner with reports concerning these matters.
- (d) The Contractor shall indemnify and save harmless the Owner from any claims for damages resulting from property damage, personal injury and/or death suffered or alleged to have been suffered by any person as a result of any work conducted under this contract.
- (e) The Contractor shall provide trench safety for all excavations more than five feet deep prior to excavation. All OSHA Standards for trench safety must be adhered to by the Contractor.
- (f) The contractor shall at all times conduct his work in such a manner as to insure the least possible inconvenience to vehicular and pedestrian traffic. At the close of the work each day, all streets where possible in the opinion of the Owner, shall be opened to the public in order that persons living in the area may have access to their homes or businesses by the use of the streets. Barricades, warning signs, and necessary lighting shall be provided to the satisfaction of the Owner at the expense of the Contractor.

20. Sanitary Facilities

The Contractor shall furnish, install and maintain ample sanitary facilities for the workmen. As the needs arise, a sufficient number of enclosed temporary toilets shall be conveniently placed as required. Drinking water shall be provided from an approved source, so piped or transported as to keep it safe and fresh and served from single service containers or satisfactory types of sanitary drinking stands or fountains. All such facilities and services shall be furnished in strict accordance with existing and governing health regulations.

21. Use of Premises

- (a) The Contractor shall confine his equipment, storage of materials, and construction operations to the contract limits as shown on the drawings and as prescribed by ordinances or permits, or as may be desired by the Owner, and shall not unreasonably encumber the site or public rights of way with his materials and construction equipment.
- (b) The Contractor shall comply with all reasonable instructions of the Owner and all existing state and local regulations regarding signs, advertising, traffic, fires, explosives, danger signals, and barricades.

22. Removal of Debris, Cleaning, Etc.

The Contractor shall, periodically or as directed during the progress of the work, remove and legally dispose of all surplus excavated material and debris, and keep the Project Area and public rights of way reasonably clear. Upon completion of the work, he shall remove all temporary construction facilities, debris and unused materials provided for work, and put the whole site of the work and public rights of way in a neat and clean condition.

23. Inspection

- (a) All materials and workmanship shall be subject to inspection, examination, or test by the Owner and Engineer at any and all times during manufacture or construction and at any and all places where such manufacture or construction occurs. The Owner shall have the right to reject defective material and workmanship or require its correction. Unacceptable workmanship shall be satisfactorily corrected. Rejected material shall be promptly segregated and removed from the Project Area and replaced with material of specified quality without charge. If the Contractor fails to proceed at once with the correction of rejected workmanship or defective material, the Owner may by contract or otherwise have the defects remedied or rejected materials removed from the Project Area and charge the cost of the same against any Monies which may be due the Contractor, without prejudice to any other rights or remedies of the Owner.
- (b) The Contractor shall furnish promptly all materials reasonably necessary for any tests which may be required. All tests by the Owner will be performed in such manner as not to delay the work unnecessarily and will be made in accordance with the provisions of the technical specifications.
- (c) The Contractor shall notify the Owner sufficiently in advance of back filling or concealing any facilities to permit proper inspection. If any facilities are concealed without approval or consent of the Owner, the Contractor shall uncover for inspection and recover such facilities at his own expense, when so requested by the Owner.
- (d) Should it be considered necessary or advisable by the Owner at any time before final acceptance of the entire work to make an examination of work already completed by uncovering the same, the Contractor shall on request promptly furnish all necessary facilities, labor, and material. If such work is found to be defective in any important or essential respect, due to fault of the Contractor or his subcontractors, the Contractor shall defray all the expenses of such examination and of satisfactory reconstruction. If, however, such work is found to meet the requirements of the Contract, the actual cost of labor and material necessarily involved in the examination and replacement, shall be allowed the Contractor and he shall, in addition, if completion of the work of the entire Contract has been delayed thereby, be granted a suitable extension of time on account of the additional work involved.
- (e) Inspection of materials and appurtenances to be incorporated in the improvements included in this Contract may be made at the place of production, manufacture or shipment, whenever the quantity justifies it, and such inspection and acceptance, unless otherwise stated in the technical specifications, shall be final, except as regards (1) latent defects, (2) departures from specific requirements of the Contract, (3) damage

or loss in transit, or (4) fraud or such gross mistakes as amount to fraud. Subject to the requirements contained in the preceding sentence, the inspection of materials as a whole or in part will be made at the Project Site.

- (f) Neither inspection, testing, approval nor acceptance of the work in whole or in part, by the Owner or its agents shall relieve the Contractor or his sureties of full responsibility for materials furnished or work performed not in strict accordance with the Contract.

24. Review by Owner

The Owner and its authorized representatives and agents shall have access to and be permitted to observe and review all work, materials, equipment, payrolls, personnel records, employment conditions, material invoices, and other relevant data and records pertaining to this Contract, provided, however that all instructions and approval with respect to the work will be given to the Contractor only by the Owner through its authorized representatives or agents.

25. Final Inspection

When the improvements included in this Contract are substantially completed, the Contractor shall notify the Owner in writing that the work will be ready for final inspection on a definite date which shall be stated in the notice. The Owner will make the arrangements necessary to have final inspection commenced on the date stated in the notice, or as soon thereafter as is practicable.

26. Deduction for Uncorrected Work

If the Owner deems it not expedient to require the Contractor to correct work not done in accordance with the Contract Documents, an equitable deduction from the Contract Price will be made by agreement between the Contractor and the Owner and subject to settlement, in case of dispute, as herein provided.

27. Insurance

The Contractor shall not commence work under this contract until he has obtained all the insurance required under this paragraph and such insurance has been approved by the Owner.

- (a) Compensation Insurance: The Contractor shall procure and shall maintain during the life of this contract Worker's Compensation Insurance as required by the State of Texas for all of his employees to be engaged in work at the site of the project under this contract and, in case of any such work sublet, the Contractor shall require the subcontractor similarly to provide Worker's Compensation Insurance for all of the employees to be engaged in such work unless such employees are covered by the protection afforded by the Contractor's Worker's Compensation Insurance.
- (b) Contractor's Public Liability and Property Damage Insurance and Vehicle Liability Insurance: The Contractor shall procure and shall maintain during the life of this contract Contractor's Public Liability Insurance, Contractor's Property Damage Insurance and Vehicle Liability Insurance in the following amounts: (_____)
- (c) Proof of Insurance: The Contractor shall furnish the Owner with certificates showing the type, amount, class of operations covered, effective dates and date of expiration of policies. Such certificates shall also contain substantially the following statement: "The insurance covered by this certificate will not be canceled or materially altered, except after ten (10) days written notice has been received by the Owner."

28. Warranty of Title

No material, supplies, or equipment to be installed or furnished under this Contract shall be purchased subject to any chattel mortgage or under a conditional sale, lease-purchase or other agreement by which an interest is retained by the seller or supplier. The Contractor shall warrant good title to all materials, supplies, and equipment installed or incorporated in the work and upon completion of all work, shall deliver the same together with all improvements and appurtenances constructed or placed by him to the Owner free from any claims, liens, or charges. Neither the Contractor nor any person, firm, or corporation furnishing any material or labor for any work covered by this Contract shall have any right to a lien upon any improvement or appurtenance. Nothing contained in this paragraph, however, shall defeat or impair the right of persons furnishing materials or labor to recover under any law permitting such persons to look to funds due the Contractor in the hands of the Owner. The provisions of this paragraph shall be inserted in all subcontracts and material contracts and notice of its provisions shall be given to all persons furnishing materials for the work when no formal contract is entered into for such materials.

29. Warranty of Workmanship and Materials

Neither the final certificate of payment nor any provision in the Contract nor partial or entire use of the improvements included in this Contract by the Owner or the public shall constitute an acceptance of work not done in accordance with the Contract or relieve the Contractor of liability in respect to any express warranties or responsibility for faulty materials or workmanship. The Contractor shall promptly remedy any defects in the work and pay for any damage to other work resulting therefrom which shall appear within a period of _____ months from the date of final acceptance of the work.

30. Job Offices

- (a) The Contractor and his subcontractors may maintain such office and storage facilities on the site as are necessary for the proper conduct of the work. These shall be located so as to cause no interference to any work to be performed on the site. The Owner shall be consulted with regard to locations.
- (b) Upon completion of the improvements, or as directed by the Owner, the Contractors shall remove all such temporary structures and facilities from the site, and leave the site of the work in the condition required by the Contract.

31. Partial Use of Site Improvements

The Owner may give notice to the Contractor and place in use those sections of the improvements which have been completed, inspected and can be accepted as complying with the technical specifications and if in its opinion, each such section is reasonably safe, fit, and convenient for the use and accommodation for which it was intended, provided:

- (a) The use of such sections of the Improvements shall in no way impede the completion of the remainder of the work by the Contractor.
- (b) The Contractor shall not be responsible for any damages or maintenance costs due directly to the use of such sections.
- (c) The period of guarantee stipulated in the Section 29 hereof shall not begin to run until the date of the final acceptance of all work which the Contractor is required to construct under this Contract.

32. Contract Documents and Drawings

The Local Public Agency will furnish the Contractor without charge _____ copies of the Contract Documents, including Technical Specifications and Drawings. Additional copies requested by the Contractor will be furnished at cost.

33. Contract Period

The work to be performed under this contract shall commence within the time stipulated by the Owner in the Notice to Proceed, and shall be fully completed within _____ calendar days thereafter.

34. Liquidated Damages

Since the actual damages for any delay in completion of the work under this contract are impossible to determine, the Contractor and his Sureties shall be liable for and shall pay to the Owner the sum of Five Hundred _____ Dollars (\$ 500.00) as fixed, agreed and liquidated damages for each calendar day of delay from the above stipulated time for completion.

BID BOND

KNOW ALL MEN BY THESE PRESENTS, that we the undersigned, _____ as PRINCIPAL, and _____, as SURETY are held and firmly bound unto _____ hereinafter called the "Owner", in the penal sum of _____ Dollars, (\$_____), lawful money of the United States, for the payment of which sum well and truly to be made, we bind ourselves, our heirs, executors, administrators, successors, and assigns, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION IS SUCH, that whereas the Principal has submitted the Accompanying Bid, dated _____, for _____

NOW, THEREFOR, if the Principal shall not withdraw said Bid within the period specified therein after the opening of the same, or, if no period be specified, within thirty (30) days after the said opening, and shall within the period specified therefor, or if no period be specified, within ten (10) days after the prescribed forms are presented to him for signature, enter into a written contract with the Owner in accordance with the Bid as accepted, and give bond with good and sufficient surety or sureties, as may be required, for the faithful performance and proper fulfillment of such contract; or in the event of the withdrawal of said Bid within the period specified, or the failure to enter into such Contract and give such bond within the time specified, if the Principal shall pay the Owner the difference between the amount specified in said Bid and the amount for which the local Public Agency may procure the required work or supplies or both, if the latter be in excess of the former, then the above obligation shall be void and of no effect, otherwise to remain in full force and virtue.

IN WITNESS THEREOF, the above-bounded parties have executed this instrument under their several seals this _____ day of _____, the name and corporate seal of each corporate party being hereto affixed and these present signed by its undersigned representative, pursuant to authority of its governing body.

(SEAL)

Attest:

By: _____

(SEAL)
Affix
Corporate
Seal

Attest:

By: _____

Affix
Corporate
Seal

Attest:

By: _____

Countersigned

By _____

* Attorney-in-Fact, State of _____

CERTIFICATE AS TO CORPORATE PRINCIPAL

I, _____, certify that I am the _____, Secretary of the Corporation named as Principal in the within bond; that _____, who signed the said bond on behalf of the Principal was then _____ of said corporation; that I know his signature, and his signature thereto is genuine; and that said bond was duly signed, sealed, and attested to, for and in behalf of said corporation by authority of this governing body.

Corporate
Seal

Title: _____

* Power-of-attorney for person signing for surety company must be attached to bond.

Payment Bond

KNOW ALL MEN BY THESE PRESENTS: that

(Name of Contractor or Company)

(Address)

a _____, hereinafter called Principal,
(Corporation / Partnership)

and _____
(Name of Surety Company)

(Address)

hereinafter called Surety, are held and firmly bound unto

(Name of Recipient)

(Recipient's Address)

hereinafter called OWNER, in the penal sum of \$ _____

Dollars, \$ _____ in lawful money of the United States, for this payment of which sum well and truly to be made, we bind ourselves, successors, and assigns, jointly and severally, firmly by these presents. the said Principal and Surety bind themselves, and their heirs, administrators, executors, successors and assigns, jointly and severally, for a period of one (1) year beyond the date of approval by the engineer of Owner.

THE CONFIDENTIALITY OF THIS OBLIGATION is such that whereas, the Principal entered into a certain contract with the OWNER, dated the _____ day of _____, a copy of which is hereto attached and made a part hereof for the construction of:

(Project Name)

NOW, THEREFORE, if the Principal shall promptly make payment to all persons, firms, SUB-CONTRACTORS, and corporations furnishing materials for or performing labor in the prosecution of the WORK provided for in such contract, and any authorized extension or modification thereof, including all amounts due for materials, lubricants, oil, gasoline, coal and coke, repairs on machinery, equipment and tools, consumed or used in connection with the construction of such WORK, and all insurance premiums on said WORK, and for all labor, performed in such WORK whether by SUB-CONTRACTOR or otherwise, then this obligation shall be void; otherwise to remain in full force and effect.

Payment Bond

KNOW ALL MEN BY THESE PRESENTS: that

(Name of Contractor or Company)

(Address)

a _____, hereinafter called Principal,
(Corporation / Partnership)

and _____
(Name of Surety Company)

(Address)

hereinafter called Surety, are held and firmly bound unto

(Name of Recipient)

(Recipient's Address)

hereinafter called OWNER, in the penal sum of \$ _____

Dollars, \$ _____ in lawful money of the United States, for this payment of which sum well and truly to be made, we bind ourselves, successors, and assigns, jointly and severally, firmly by these presents. the said Principal and Surety bind themselves, and their heirs, administrators, executors, successors and assigns, jointly and severally, for a period of one (1) year beyond the date of approval by the engineer of Owner.

THE CONFIDENTIALITY OF THIS OBLIGATION is such that whereas, the Principal entered into a certain contract with the OWNER, dated the _____ day of _____, a copy of which is hereto attached and made a part hereof for the construction of:

(Project Name)

NOW, THEREFORE, if the Principal shall promptly make payment to all persons, firms, SUB-CONTRACTORS, and corporations furnishing materials for or performing labor in the prosecution of the WORK provided for in such contract, and any authorized extension or modification thereof, including all amounts due for materials, lubricants, oil, gasoline, coal and coke, repairs on machinery, equipment and tools, consumed or used in connection with the construction of such WORK, and all insurance premiums on said WORK, and for all labor, performed in such WORK whether by SUB-CONTRACTOR or otherwise, then this obligation shall be void; otherwise to remain in full force and effect.

PAYMENT BOND

KNOW ALL MEN BY THESE PRESENTS: that

(Name of Contractor or Company)

(Address)

a _____, hereinafter called Principal,
(Corporation / Partnership)

and _____
(Name of Surety Company)

(Address)
hereinafter called Surety, are held and firmly bound unto

(Name of Recipient)

(Recipient's Address)

hereinafter called OWNER, in the penal sum of \$ _____

Dollars, \$ _____ in lawful money of the United States, for this payment of which sum well and truly to be made, we bind ourselves, successors, and assigns, jointly and severally, firmly by these presents.

THE CONFIDENTIALITY OF THIS OBLIGATION is such that whereas, the Principal entered into a certain contract with the OWNER, dated the _____ day of _____, a copy of which is hereto attached and made a part hereof for the construction of:

(Project Name)

NOW, THEREFORE, if the Principal shall promptly make payment to all persons, firms, SUB-CONTRACTORS, and corporations furnishing materials for or performing labor in the prosecution of the WORK provided for in such contract, and any authorized extension or modification thereof, including all amounts due for materials, lubricants, oil, gasoline, coal and coke, repairs on machinery, equipment and tools, consumed or used in connection with the construction of such WORK, and all insurance premiums on said WORK, and for all labor, performed in such WORK whether by SUB-CONTRACTOR or otherwise, then this obligation shall be void; otherwise to remain in full force and effect.

PROVIDED, FURTHER, that the said Surety, for value received hereby stipulates and agrees that no change, extension of time, alteration or addition to the terms of the contract or to WORK to be performed thereunder or the SPECIFICATIONS accompanying the same shall in any way affect its

obligation on this BOND, and it does hereby waive notice of any such change, extension of time, alteration or addition to the terms of the contract or to the WORK or to the SPECIFICATIONS.

PROVIDED, FURTHER, that no final settlement between the OWNER and the CONTRACTOR shall abridge the right of any beneficiary hereunder, whose claim may be unsatisfied.

IN WITNESS WHEREOF, this instrument is executed in _____ counter-parts, each on of which shall be deemed an original, this the _____ day of _____ (Number)

ATTEST:

(Principal)

By _____ (s)

(Principal Secretary)

(SEAL)

(Witness as to Principal)

(Address)

(Address)

ATTEST:

(Surety)

By _____
(Attorney in Fact)

(Witness as to Surety)

(Address)

(Address)

NOTE: Date of BOND must not be prior to date of Contract. If CONTRACTOR is Partnership, all partners should execute BOND.

PERFORMANCE BOND

KNOW ALL MEN BY THESE PRESENTS: that

_____ (Name of Contractor or Company)

_____ (Address)

a _____ hereinafter called Principal, and

_____ (Name of Surety Company)

_____ (Address)

hereinafter called Surety, are held and firmly bound unto

_____ (Name of Recipient)

_____ (Recipient's Address)

hereinafter called OWNER, in the penal sum of \$ _____ Dollars (\$ _____) in lawful money of the United States, for the payment of which sum well and truly to be made we bind ourselves, successors, and assigns, jointly and severally, firmly in these presents.

THE CONDITION OF THIS OBLIGATION is such that whereas, the Principal entered into a certain contract with the OWNER dated the _____ day of _____, a copy of which is hereto attached and made a part hereof for the construction of:

NOW THEREFORE, if the Principal shall well, truly and faithfully perform its duties in all the undertakings, covenants, terms, conditions, and agreements of said contract during the original term thereof, and any extensions thereof which may be granted by the OWNER, with or without notice to the Surety and during the one year guaranty period, and if he shall satisfy all claims and demands incurred under such contract, and shall fully indemnify and save harmless the OWNER from all costs and damages which it may suffer by reason of failure to do so, and shall reimburse and repay the OWNER all outlay and expense which the OWNER may incur in making good any default, then this obligation shall be void, otherwise to remain in full force and effect.

PROVIDED FURTHER, that the said Surety, for value received hereby stipulates and agrees that no change, extension of time, alteration or addition to the terms of the contract or to WORK to be performed thereunder or the SPECIFICATIONS accompanying the same shall in any way affect its obligation on this BOND, and it does hereby waive notice of any such change, extension of time, alteration or addition to the terms of the contract or to the WORK or to the SPECIFICATIONS.

PROVIDED, FURTHER, that no final settlement between the OWNER and the CONTRACTOR shall abridge the right of any beneficiary hereunder, whose claim may be unsatisfied.

IN WITNESS WHEREOF, this instrument is executed in _____
counterparts, each one of which shall be deemed an original, this the _____ day
of _____.

ATTEST:

(Principal)

By _____ (s)

(Principal Secretary)

(SEAL)

(Witness as to Principal)

(Address)

(Address)

ATTEST:

(Surety)

By _____

(Witness as to Surety)

(Attorney in Fact)

(Address)

(Address)

NOTE: Date of BOND must not be prior to date of Contract. If CONTRACTOR is Partnership, all partners should execute BOND.

ATTORNEY'S REVIEW CERTIFICATION

I, the undersigned, _____, the duly authorized and acting legal representative of the _____, do hereby certify as follows:

I have examined the attached contract(s) and surety bonds and am of the opinion that each of the agreements may be duly executed by the proper parties, acting through their duly authorized representatives; that said representatives have full power and authority to execute said agreements on behalf of the respective parties; and that the agreements shall constitute valid and legally binding obligations upon the parties executing the same in accordance with terms, conditions and provisions thereof.

Attorney's signature: _____ Date: _____

Print Attorney's Name: _____

SPECIAL CONDITIONS OF THE AGREEMENT
INSURANCE REQUIREMENTS

The following minimum limits of insurance coverage will be required:

CONTRACTOR shall maintain, at his sole cost, at all times while performing work hereunder, the insurance coverage set forth below with companies satisfactory to the **OWNER** with full policy limits applying but not less than as stated. A Certificate evidencing the required insurance and specifically quoting the indemnification provision set forth in this agreement shall be delivered to the **OWNER** prior to commencement of the work and shall provide that any change restricting or reducing coverage or the cancellation of any policies under which certificates are issued shall not be valid as respects the **OWNER'S** interest therein until the **OWNER** has received 30 days notice in writing of such change or cancellation.

- (a) Workmen's Compensation Insurance as required by laws and regulations applicable to and covering employees of **CONTRACTOR** engaged in the performance of the work under the Agreement.
- (b) Employer's Liability Insurance protecting **CONTRACTOR** against common law liability, in the absence of statutory liability, for employee bodily injury arising out of the master-servant relationship with a limit of not less than \$100,000.00.
- (c) Comprehensive General Liability Insurance including products/completed operation with limits of liability of not less than: Bodily Injury \$100,000.00 each person, \$300,000.00 each occurrence/aggregate; Property Damage \$100,000.00 each occurrence/aggregate.
- (d) Automobile Liability Insurance including non-owner and hire vehicle coverage with limits of liability of not less than: Bodily Injury \$100,000.00 each person, \$300,000.00 each occurrence; Property Damage \$100,000.00 each occurrence.
- (e) Excess Liability Insurance - Comprehensive General Liability, Comprehensive Automobile Liability and coverage's afforded by the policies described above, with minimum limits of \$1,000,000.00 excess of the specified limits.
- (f) Builder's "All-Risk Insurance" protecting the respective interest of Company and **CONTRACTOR** and its "Field Subcontractors" covering loss or damage during the course of construction of the project described in this Agreement and all property at the job site or in transit thereto which shall become part of such project. Such insurance shall be terminated with respect to portions of such project when such portions are completed and accepted.

SPECIAL PROVISIONS

For a 500,000 GALLON ELEVATED STEEL STORAGE WATER TANK

ACE JOB NO. 123-01C

1. The selection of a **CONTRACTOR** for this project shall be determined by the low responsive, responsible bid for one (1) of the four (4) elevated tank proposals. (Single Pedestal Spheroid style) The price bid for each proposal should include the cost of all items outlined in the **scope of the work**. Only **one** steel elevated tank will be constructed. Bidders are asked to bid on one or all proposal options as well as proposal V, for owner logos applicable to the district or county.

Bidders are advised that in the event an addendum is issued, each Addendum must be recognized by signature and a copy of all signed Addenda must be submitted with the Bid.

The award of a contract will be made to one successful contractor based on two (2) considerations; the dollar amount indicated as a total price bid for each tank proposal, and the number of total calendar days bid to complete both projects. Please indicate the number of calendar days in the space provided on the **BID PROPOSAL FORMS**. It is the intent of these specifications to pay the contractor for the proposals selected by the **OWNER**.

2. The successful bidder for the elevated tank will be responsible for the tank design and the foundation design. The tank design, related welding, workmanship, fabrication, erection, inspection / testing etc., will be in keeping with the AWWA Standard D100-96 (or revisions thereto) for **Welded Steel Tanks for Potable Water Storage** and the T.C.E.Q. rules and requirements for Elevated Storage Tanks.
3. Supplemental Items proposal has been prepared for use when directed by the engineer. **BIDS ARE TO BE PREPARED USING PLANS AND BID SHEETS PREPARED BY ACTION CIVIL ENGINEERS, PLLC**. The elevated tank is to be designed for 150-mph winds following wind load standard ASCE 7-16.

No Pre-Bid Conference will be held. Any questions should be directed to the **ENGINEER**, in writing, prior to the bid opening.

4. The **CONTRACTOR** shall provide the **OWNER**, upon request, with a financial statement and experience record.
5. The **CONTRACTOR** is requested to use local workmen when possible.

6. The prevailing wage scale for this area must be paid.
7. When conflicts exist between Special Provisions and General Specifications, the Special Provisions shall control.
8. Where there is conflict of measurement designation between the specifications and the proposal, the unit of measure indicated on the proposal shall govern.
9. The **ENGINEER** shall furnish control lines for alignment and convenient benchmarks when required for the control of grades. Any additional stakes required by the **CONTRACTOR** shall be set at his expense. When necessary, work shall be suspended to permit this work, but such suspension will be as brief as practicable, and the **CONTRACTOR** shall be allowed no extra compensation therefore. The **CONTRACTOR** shall give the **ENGINEER** ample notice of the time and place where control lines and benchmarks will be needed. All control stakes, marks, etc., shall be carefully preserved by the **CONTRACTOR**, and in case of careless destruction or removal by him, or his employees, such control stakes, marks, etc., shall be replaced by the **ENGINEER** at the **CONTRACTOR'S** expense.
10. Safety Standards and Accident Prevention

With respect to all work performed under this contract, the **CONTRACTOR** shall:

- a) Comply with safety standard provisions of applicable laws, building and construction codes and the "Manual of Accident Prevention in Construction", published by the Associated General Contractors of America, the requirements of the Occupational Safety and Health Act of 1970 (Public Law 91-596), and the requirements of Title 29 of Code Federal Regulations, Section 1518 as published in the "Federal Register", Volume 36, No. 75, Saturday, April 17, 1971 and subsequent amendments thereto.
 - b) Always exercise every precaution for the prevention of accidents and the protection of people (including employees and property).
 - c) **ANY QUESTIONS ARISING ON THE PLANS AND SPECIFICATIONS MUST BE SUBMITTED TO THE ENGINEER IN WRITING PRIOR TO BID OPENINGS.**
11. Regardless of culpability, the **CONTRACTOR** shall not be allowed to take advantage of any errors or omissions in these plans and specifications or his work

orders. The **CONTRACTOR** is required to notify the **ENGINEER** of all errors or omissions as soon as he becomes aware of them. Suitable instructions will be given to the **CONTRACTOR** by the **ENGINEER** when such errors or omissions are discovered. No compensation for any delay or downtime, including time to receive the **ENGINEER'S** instructions or approval, shall be allowed. Further, any errors and/or omissions contained in the plans and/or specifications do not absolve the **CONTRACTOR** from ultimate and final responsibility for the successful completion of this project to the satisfaction of the **ENGINEER**. The degree of detail reflected in the plans or lack of same does not absolve the **CONTRACTOR** from the necessity of conducting an extensive investigation of the project area prior to submission of his/her bid. The **CONTRACTOR** will not be due any additional compensation for difficulties arising out of his/her failure to inspect or analyze the actual job site prior to submission of his/her bid.

12. The **CONTRACTOR** is expected to be completely familiar with the provisions contained in these specifications. The **CONTRACTOR** will not be allowed any additional payment or extension of time due to difficulties caused by his/her failure to acquaint himself/herself with this document.
13. All work which, in the opinion of the **ENGINEER**, is necessary to complete the project and which is neither specifically listed and/or identified in the bid proposal items not elsewhere in these specifications, shall be considered incidental to the work and the **CONTRACTOR** will not be due any additional payment for completion of said required work.
14. Liquidated damages for delay beyond specified time for completion is \$500.00 per day.

15. **Warranty**

The **CONTRACTOR** and/or his Surety will be required by the **OWNER** to repair, replace, restore, and/or to make to comply strictly in all things with the contract, and the plans and specifications, and any and all of said work and/or materials which within a period of **one year** from and after the date of the passing, approval, and/or acceptance of any such work or materials are found to be defective, or to fail in any way to comply with this contract or with the plans and specifications. **An anniversary inspection date will be established by the OWNER prior to issue a certificate of completion.**

16. Delete any references to Measurement and Payment in the Technical Specifications for steel water tanks.
17. The **OWNER** reserves the right to control the sequence of work. The **CONTRACTOR** shall submit a Construction Schedule for approval prior to beginning work.

18. Permits, Licenses and Laws

The **CONTRACTOR** shall obtain at his own expenses, all necessary permits and licenses from the proper authorities and shall give all notice required by law or ordinance and shall pay all fees and charges incidental to the due and lawful prosecution for the work and shall comply with all laws, ordinances and regulations relating thereto.

19. The **CONTRACTOR** shall arrange for electrical service from the Electrical Utility Company and shall provide all connections, etc., required to facilitate his operation.

20. Although trade names for materials may have been used in the Proposals and Plans for this project, it is intended that materials of equal quality will be acceptable on approval of the **ENGINEER** and the **OWNER**. Approval shall be obtained prior to receiving bids.

21. All materials for this project shall meet AWWA Specifications and requirements.

22. Pipe for this project shall be as indicated below: (a) Above ground installation pipe shall be ductile iron with flanges and shall conform to ANSI/AWWA C115/A21.5. Threads for flanges shall be taper pipe threads in conformity with ANSI B2.1; flanges are to meet all requirements of ANSI/AWWA C151/A21.51.

(b) Below ground installation of pipe connecting the new tank to the distribution system shall be C-900, DR18 PVC. Gaskets shall conform to ASTM F477; push on joints ASTM D3139, and PVC materials ASTM 1784.

24. Fittings "below ground" for this project shall be mechanical joint, ductile iron short body, AWWA-C153/A 21.53, cement-lined in accordance with AWWA-C104/A 21.4. The contractor shall furnish enough thrust blocking on all pipes fitting where applicable.

25. Gate valve for this project shall be resilient seat gate valve.

26. All pipes shall be installed in strict accordance with the manufacturer's recommendations in accordance with various related installation guides of handbooks, field representatives and as directed by the **ENGINEER**.

27. Waterlines underground will have a minimum cover of 36".

28. Disinfection of proposed facilities shall be performed by the **CONTRACTOR** and should comply with current AWWA Standards C651, C652 and C564, which

are for water mains, storage tanks and wells. Specifications are revised to concur with this Special Provision.

29. The Contract is issued by an organization which qualified for exemption pursuant to the provisions of Article 20.04 (F) of the Texas Limited Sales, Excise and Use Tax Act. The **CONTRACTOR** performing this Contract may purchase, rent or lease all material, supplies, equipment used or consumed in the performance of this Contract by issuing to his suppliers and Exemption Certificate in lieu of the tax, said Exemption Certificate complying with State Comptroller's ruling #95-0.07.
30. Bidders are advised that the **OWNER** reserves the right to reduce any proposal by any amount, in accordance with the General Conditions of the Agreement.
31. If a bidder desires to make qualifications in his bid, it shall be done in writing, attached to and submitted with his sealed bid.
32. The **CONTRACTOR** is responsible for any damage resulting from material entering or leaving the project site related to and during tank erection, cleaning, blasting, and painting operations. The **CONTRACTOR** will take the necessary steps to prevent these occurrences and damage to the owner's property or adjacent properties.
33. Water to fill the tanks one time for testing will be provided by the West Jefferson County Municipal Water District, as available, at no cost to the **CONTRACTOR**. The availability of water will be determined by the Manager, Mr. Daniel Hidalgo, to ensure the customer's needs are met. Additional water required beyond the one-time filling amount shall be purchased from the West Jefferson County Municipal Water District by the **CONTRACTOR**. West Jefferson County MWD staff will take bacteriological samples after the tank has been successfully tested and disinfected.
34. The outside ladder shall be painted the same as tank paint system and secured to tank with lugs from shell or leg. (Does not apply for single pedestal water spheroid.)
35. **Utilities**

It shall be the **CONTRACTOR'S** responsibility to contact public and private utility companies in advance of construction, allowing each their respective lead time to locate and to obtain adjustment as necessary, of water, electric, telephone and gas mains or service lines. The **CONTRACTOR** shall also notify various utility companies of proposed work and work schedule. The **CONTRACTOR** will verify the existing utility or pipelines horizontal and vertical locations prior to initiation of construction. No extra payment will be allowed for any extra

excavation incurred or downtime, which results from the required location of existing utilities. Any damage to utilities because of the **CONTRACTOR'S** negligence will be repaired to the satisfaction of the **OWNER** of the damaged utility with no compensation due the **CONTRACTOR**.

36. All surplus excavated materials shall become the property of the **CONTRACTOR**, to be disposed of as the **CONTRACTOR** wishes and as directed by the **ENGINEER**. Suitable material may be retained to facilitate site drainage about the tank as directed by the **ENGINEER**.
37. After the project is complete, all surplus construction materials are to be hauled off and the project site is to be cleaned of all debris and blast material by the **CONTRACTOR** and to the satisfaction of the **ENGINEER**.
38. The Electrical Scope of Work includes the labor and materials to install, configure and start-up for a Miltronics, Hydro Ranger 200 to control the plant transfer pumps to boost line pressure and fill proposed elevated potable water storage tank. The **CONTRACTOR** is to provide controls as manufactured by Miltronics Inc. or equal. The owner may elect not to include the Miltronics device in the contracted portion of the project.
39. All concrete for this project will be 4000 psi in 28 days.
40. Fill/discharge line entering tank riser can also enter from the bottom through center pier of a multi-leg ellipsoid tank.
41. Shop blast and prime will be permitted and must conform to "Specifications for Coating and Painting of New Steel Water Storage Tank", Page No. 08 of 11, under (Execution), Section 3.01., GENERAL "E".
42. West Jefferson County Municipal Water District, if necessary, will have any overhead electrical (O.H.E.) line Removed before tank construction begins.
43. **CONTRACTOR** is to install a new galvanized 3/8" diameter cable, OSHA approved safety climb system on the interior and exterior shell ladders. **CONTRACTOR** must submit safety sleeve and safety belt manufacturer's data sheets (SALA or equal) to **ENGINEER** for review and confirm cable length before ordering new S.C.S.
44. Subsurface soil investigation has been performed by: Tolunay Wong Laboratory and is **provided with this bid package** for bidding purpose. If the successful tank provider determines that additional boring depth is required or additional geotechnical tasks are required for foundation design, the successful contractor

will be required to notify the Owners Engineer so arrangements can be made to obtain the data required.

45. **The CONTRACTOR** shall furnish typical thrust blocking at all pipe fittings, reducers, etc., in keeping with the standard drawing provided.
46. **Fire Hydrants** for this project shall be **American darling B-84-B** or approved equal with mechanical joint end inlet. Depth of bury shall be a minimum 3 feet to the bottom of connecting pipe. Threads on nozzles and operating nuts shall be furnished in accordance with the standard drawing provided and conform to the standards of the Texas Fire Insurance Commission. Fire hydrants shall be connected to the main by means of a swivel (anchor) tee, mechanical joint gate valve with valve box, and a variable length fire hydrant gradelok anchoring device. The hydrant, valve, and valve box shall be set plum directly over the valve after connected.
47. Disinfectant of proposed facilities shall comply with current AWWA Standards C-651, C-652 and C-564, which are for water mains, storage tanks and wells. Specifications are revised to concur with this Special Provision.
48. Laboratory tests necessary to ensure proper batching and mixing of concrete shall be performed by a testing laboratory selected by the Districts Engineers.
49. House Bill 1859 provides that retainage can be withheld from payment due the **CONTRACTOR**, from monthly progress payments for completed work. A 5% retainage will be retained until final payment is made.
50. Cement stabilize sand when required for this project, shall contain 1 ½ sacks of cement per cubic yard of sand.
51. The contractor shall furnish temporary sanitary facilities at the site, as provided herein, for the needs of all construction workers and others performing work or furnishing services of the project. Sanitary facilities shall be of reasonable capacity, properly maintained throughout the construction and obscure from public view to the greatest practical extent. If toilets of the chemically treated type are used, at least one toilet will be furnished for each 20 workers and serviced at least once a week. **The CONTRACTOR** shall enforce the use of such sanitary facilities by all personnel at the site.
52. The cleanup at each respective tank site shall be included in the price bid for each tank and should include labor, materials, equipment, etc., required to complete work as directed by the **ENGINEER**. Included also should be the removal of all surplus materials and debris, final grading as required including the import of material required to raise grade to proper elevation following backfill settlement or excessive soil removal. Any

surface drainage ditch disturbed or rerouted by the construction shall be restored to their original grade.

53. Roadside ditches damage during the discourse of construction shall be restored to original shape and grade. No additional compensation will be made for restoring ditches disturbed during the construction of either proposed tank facility.
54. The **CONTRACTOR** shall notify the Jefferson County Sheriff's Department at 409-835-8411, Fire Department at 409-735-3539, and Mr. Daniel Hidalgo at the district manager's office at 409-794-2338, for the district, prior to closing any existing Street or roadway.
55. The **CONTRACTOR** shall maintain streets and roadways as directed by the **ENGINEER**. This maintenance shall be limited to the amount required to enable suitable traffic movement. Limestone or other suitable material shall be used to provide suitable surface for traffic on roadways, driveways, and shoulders. This task is considered incidental to the work and the contractor will not be due any additional payment for this required work. During construction, the **CONTRACTOR** will be required to maintain sanitary sewer service and to maintain the integrity of existing water services providing water to existing customers impacted by work activities. Coordination with the district manager or his designated representative during service interruption is required. Interruption of existing service due to contractors work or negligence will be repaired at the **CONTRACTORS** expense.
56. If disruption of the water system occurs because of construction activities, water line materials used in the repair of the Public Water System shall be new and meet current AWWA specifications and requirements. All newly installed pipe and related products must conform to American National Standards Institute/National Sanitation Foundation (ANSI/NSF) Standard 61 and must be certified by an organization accredited by ANSI. All plastic pipes installed in a public water system must also bear the National Sanitation Foundation seal of approval NSF-PW.
57. Gate valves for this project shall be resilient seat gate valves. Installation for various valves shall include valve boxes with concrete pads for valves located underground. Valves shall operate counterclockwise to open.



ACTION CIVIL ENGINEERS, PLLC

Firm Registration No. F-16376

SUMMARY OF WORK

FURNISH all labor, materials, equipment, insurance, payroll, taxes, permits and supervision for the construction of one Single Pedestal Elevated Spheroid tank, based on the selected size of tank the district elects to build, located at 21721 FM Highway 365 with altitude valve/gate valve arrangement and appurtenances, complete and in operation including concrete foundation, standard three coat interior and exterior paint systems, and mill thickness testing. Coordinates have been established for the physical address as 29° 55' 51.09" North; 94° 17' 0.79" West. High water level to be established at elevation 156.00 MSL. The contractor will be responsible for connecting the new elevated tank to the distribution system with a feed/return line dictated by the manager.

SITE DEVELOPMENT

Furnish all labor, materials, equipment, insurance, payroll, taxes, permits, and supervision at the site required to provide yard piping, valves, fittings, and tie-in to the district's main potable water line relative to the proposed elevated storage tank site. Contractor is to determine the horizontal and vertical location of existing utilities or pipelines at the proposed tank site, prior to initiation of construction.

A flexible base roadway for ingress and egress will be required to facilitate the delivery of materials for construction as well as to minimize rutting at the proposed tank site. Owners existing drinking water plant site located at 14026 FM Hwy 365 has adequate acreage for perspective contractor's laydown area and to provide storage for materials delivered to the site. The elevated tank site located at 21721 FM Highway 365 will require a proposed 15-foot-wide entry/exit roadway on an 8-inch-thick compacted limestone base with a 60-foot diameter cul-de-sac turnaround loop. Prior to completion of the project the contractor will provide a 2-inch-thick hot mix finish asphalt surface applied to the compacted base following any needed repair of the 8-inch-thick base.

ELECTRICAL

Furnish all labor, materials, equipment, insurance, payroll, taxes, permits, and supervision required to provide electrical wiring in conduit or as directed by the engineer at the proposed elevated tank site, to the obstruction light at the top of the tank with a 110 V weatherproof service outlet. The weatherproof service outlet shall be a weatherproof service outlet that is to be placed adjacent to the base cone near the personnel door, and an additional weatherproof service outlet near the access tube hatch at the top of the tank.

The contractor will also supply a Miltonic Hydro Ranger 200 level control from the elevated storage tank to communicate with the high service pump control panel at the districts water plant site. Tank grounding system, electrical service, and control wiring above and below ground will be in keeping with the applicable electrical codes and national electrical codes and standards.

Level controls will require an 8" dia. x 6" long flanged x PE spool piece cut in and welded to the roof of the tank. Spool piece is to be cut to roof slope; the flange is to be level with the horizontal. Install lights to illuminate the lettering (two each) including all appurtenances to produce a fully functional system.

FENCING

Furnish all labor, materials, equipment, insurance, payroll, taxes, permits, and supervision required to install new 6-foot climb proof chain-link fencing with three strands of barbed wire top around the entire property at the elevated tank site, in keeping with TCEQ requirements and the engineers' plan. Fencing shall be located 1 foot inside the property line for all sides. Provide a double swing gate with a 12-foot opening for entrance off Highway 365. **CONTRACTOR** is to coordinate with the **OWNER** to confirm the placement of the swing gate and a 3-foot employee access gate.

LETTERING and LOGO

The words "West Jefferson County MWD" and "County of Jefferson" are to be painted on the elevated storage tank in block style, with 7-foot-tall letters not to exceed two bays in length for either case. Letters are to be black

without a band. (The district may elect to have the Hampshire Fannett school district logo painted on the tank. If this is the case the district will provide a copy of the Hampshire Fannett Longhorn drawing as a guideline.

FINAL CLEANUP

CONTRACTOR is to level up all excess excavated materials and fill ruts to maintain drainage, remove all excess construction materials and leave surrounding area clean to the satisfaction of the **OWNER and the Engineer.**

Indemnification

(a) Definitions:

(1) "Indemnified party" or "indemnified parties" means the Owner, West Jefferson Co. Municipal Water District, Jefferson County, Texas and the Engineer, Action Civil Engineers, PLLC., the consultants, officers, directors, employees, agents and other consultants of each and any of the foregoing.

(2) "damages" means all claims, demands, causes of action, suits, damages, liabilities, fines, penalties, assessments, environmental responsibility costs or injunctive obligations, judgments, losses and expenses (including without limitation expenses, costs or attorney's fees incurred for any indemnified party's primary defense or for enforcement of its indemnification rights).

(b) Contractor: to the maximum extent permitted by law, agrees to and shall defend, protect, indemnify and hold harmless indemnified parties from and against any damages which may be incurred by or assessed against any indemnified party on account of:

(1) any personal injury, disease or death of any person(s), damage to or loss of any property caused by, arising out of or in any way connected with the performance of the work under this agreement, including without limitation damages caused by or attributable to (i) the sole negligence of contractor, its subcontractors, invitees or suppliers (including without limitation the respective employees or agents of the foregoing); (ii) the concurrent, contributory, active, passive or sole negligence of any indemnified party, contractor, contractor's subcontractors, contractor's invitees, contractor's suppliers, or third parties (including without limitation the respective employees or agents of the foregoing); or (iii) where liability with or without fault is strictly imposed upon contractor and/or any indemnified party, either solely, jointly, or concurrently, by operation of law; or

(2) any breach of any representation, warranty or covenant of contractor contained herein, including without limitation, any and all damages incurred by any indemnified party due to contractor's failure to fully comply with the insurance requirements set forth in exhibits a and b, herein.

(c) It is the express intention of the parties to this agreement that the indemnity obligations of contractor are without regard to whether the negligence, fault or strict liability of an indemnified party is a sole, concurrent, passive, active or contributory factor of the occurrence or occurrences in question, and such indemnity obligations of contractor are intended to protect the indemnified parties against the consequences of their own sole, joint, concurrent, passive, active or contributory negligence, fault or strict liability. The indemnified parties expressly reserve the right to participate in their defense with counsel of their own choosing. Contractor's indemnity obligations shall survive the final payment, completion and acceptance of the work and termination or completion of the agreement.

- (d) Contractor shall defend, protect, indemnify and hold harmless the indemnified parties from and against damages arising out of, resulting from or otherwise connected to any failure by contractor to comply with, or violation by contractor, of any federal, state, county or municipal laws, rules, regulations, orders or ordinances, including without limitation, any and all federal, state and local environmental, health and safety laws, rules and regulations, which may otherwise be applicable to or imposed in connection with the performance of the work under this agreement, without regard to whether contractor may be negligent in the performance of the work, without regard to whether contractor's actions may have resulted in strict liability imposed by operation of law, and regardless of the sole, concurrent, active, passive or contributory negligence of any indemnified party or parties. contractor shall further protect, defend, indemnify and hold harmless the indemnified parties from and against any damages arising out of or resulting from contractor's failure to comply with applicable health and safety procedures of company.
- (e) Contractor shall defend, protect, indemnify and hold harmless the indemnified parties against any and all liens, claims and demands (including without limitation expenses, costs or attorney's fees incurred for any indemnified party's primary defense or for enforcement of its indemnification rights) which arise in connection with the work or materials supplied by contractor and/or contractor's subcontractors and/or materialmen, and, upon request by owner, contractor shall furnish owner with any affidavits, receipts, waivers, releases, statements or other evidence that owner may require to satisfy itself that all such claims, liens or demands have been paid and discharged.
- (f) Contractor's indemnity obligations shall not limit and shall not be limited by the insurance coverage's (including without limitation the indemnified party's or parties' additional insured status, if any, as set forth in this agreement.

1} **RIGHTS OF VARIOUS INTERESTS**

- 1.1 Where work is being done by the OWNER'S forces or other CONTRACTORS contiguous to work covered by this CONTRACT, the ENGINEER shall establish the respective rights of the various interests involved to establish harmony and to secure the completion of the various portions of the work involved.

2} **PROTECTION OF PROPERTY AND PUBLIC LIABILITY**

- 2.1 The CONTRACTOR shall be accountable for any damages resulting from his operations. CONTRACTOR shall be fully responsible for the protection of all persons including members of the public, employees of the OWNER, employees of the Resident Project Representative, employees of the ENGINEER, and employees of other CONTRACTORS or SUB-CONTRACTORS, and all public and private property, including structures, sewers and utilities above and below ground.

3) **LAWS AND REGULATIONS**

- 3.1 CONTRACTOR shall give all notices and comply with all Laws and Regulations applicable to furnishing and performance of the work. Except where otherwise expressly required by applicable Laws and Regulations, neither OWNER nor ENGINEER shall be responsible for monitoring CONTRACTOR'S compliance with any Laws and Regulations.

4) **ENGINEER'S STATUS DURING CONSTRUCTION**

- 4.1 The ENGINEER will be the OWNER'S representative during the construction period. The duties and responsibilities and the limitations of authority of ENGINEER as OWNER'S representative during construction are set forth in the CONTRACT DOCUMENT and shall not be extended without written consent of OWNER and ENGINEER.

5) **INSPECTION**

- 5.1 In addition to the inspection by the ENGINEER, the work under this CONTRACT shall be subject to the inspection by representatives of the OWNER. The cost of re-inspection by the ENGINEER due to the CONTRACTOR'S neglect in performance of his work shall be borne by the CONTRACTOR.

6) **CLAIMS/LIENS**

- 6.1 The OWNER shall have the express right to pay claims or liens and deduct that amount from the CONTRACT for any claims or liens originating from the actions of the CONTRACTOR relative to the project if said claims or liens are not settled within thirty (30) days of notification by the OWNER.

7) **COMPLIANCE**

- 7.1 Safety, Health, and Accident Prevention - CONTRACTOR shall be solely responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the work.

MOBILIZATION AND DEMOBILIZATION

1.0 GENERAL

1.1 MOBILIZATION

This section covers the mobilization of personnel, equipment, materials and supplies, and their transport to the job site, insurance, payment and, performance bonds. Also included is setting up the contractor's complete construction plant, field office and other construction facilities, as required for the Contractor's operation, all in adequate time for satisfactory performance of all Work under the Contract.

1.2 DEMOBILIZATION

Demobilization shall include the removal of all construction plant, equipment and accessories, materials, supplies, appurtenances, construction debris and the like from the job site upon completion of the Work.

2.0 MEASUREMENT AND PAYMENT

2.1 MEASUREMENT

No measurement for Work of this Section will be made.

2.2 PAYMENT

Payment for Mobilization and Demobilization Work of this Section will be made at the lump sum price for Bid Item No. 3, Mobilization and Demobilization, in the *Schedule of Quantities and Prices*, which shall not exceed 10 percent of the Bid Subtotal. Payment for mobilization will be made with the first progress payment and will be equal to 90% of the amount bid for Bid Item No. 1. The remaining 10% will be paid with the final project payment and will be proportional to the amount of the Contractor Use Areas that have been cleaned and restored to their original condition in a total amount of 10 (Ten)% of the amount bid.

CLEARING AND GRUBBING

1.0 SCOPE

The WORK under this Section includes providing all labor, materials, tools and equipment, supervision, payroll tax and insurance necessary for clearing, grubbing, removing, and disposing of all vegetation and debris (including earthen materials incidentally removed with vegetation and debris), and removing structures and obstructions located within the limits shown on the plans or designated by the ENGINEER.

2.0 CLEARING AND GRUBBING

Unless otherwise specified, all stumps, roots, and root clusters that have a diameter one inch or larger shall be grubbed out to a depth of at least two feet below subgrade for concrete structures and one foot below ground surface for embankment and other designated sites. All trees not marked for preservation, and all snags, logs, brush, shrubs, stumps, rubbish, and similar materials shall be cleared from within the limits of the marked areas.

3.0 DISPOSAL

All materials removed become the property of the Contractor and shall be disposed of in a proper manner. The contractor is responsible for complying with all applicable laws and regulations and the payment of all fees that may result from disposal of materials removed.

It will be the responsibility of the CONTRACTOR to adhere to local burning ordinances and make arrangements for burning on site. There will be no burial of stumps or unburned timber on the site. If burning is prohibited the CONTRACTOR will be responsible for the disposal of timber and stumps.

4.0 MEASUREMENT AND PAYMENT

Site clearing and grubbing will be measured for payment by the lump-sum method, acceptably performed and completed. Removal, salvage, or other disposition of existing facilities, structures, and site improvements will not be measured separately for payment but will be included in the lump-sum unit measurement for site clearing and grubbing.

Site clearing and grubbing will be paid for at the Contract lump-sum price, as indicated in the Bid Proposal schedule of items.

ANCHOR BOLTS AND EXPANSION ANCHORS

1. GENERAL

This section covers cast-in-place anchor bolts, anchor bolts and threaded rod anchors for epoxy grouting, and expansion anchors to be installed in hardened concrete and masonry.

Epoxy grouting of anchor bolts and threaded rod anchors is covered in the grout section.

Unless otherwise specified or indicated on the drawings, all anchor bolts shall be cast-in-place bolts, shall have a diameter of at least 3/4 inch, and shall be either headed or "L" shape. Expansion anchors and threaded rod anchors indicated or accepted in lieu of cast-in-place anchor bolts for equipment or structural framing shall have a diameter of at least 3/4 inch. All other expansion anchors shall have a diameter of at least 1/2 inch.

Anchor bolts and threaded rod anchors for buried service and in splash zones shall be hot-dip galvanized. Anchor bolts, threaded rod anchors, and expansion anchors for immersion service shall be stainless steel. Expansion anchors for buried service and in splash zones shall be stainless steel. All other anchor bolts, threaded rod anchors, and expansion anchors shall be carbon steel unless otherwise specified or indicated on the drawings.

2. MATERIALS

Anchor Bolts and Nuts

Carbon Steel	ASTM A307
Stainless Steel	IFI-104, Grade 304 or 316
Galvanized Steel	Carbon steel bolts & nuts; hot-dip galvanized, ASTM A153 and A385

Threaded Rod Anchors and Nuts

Carbon Steel	ASTM A307 or A36
Stainless Steel	IFI-104, Grade 304 or 316
Galvanized Steel	Carbon steel bolts & nuts; hot dip galvanized, ASTM A153 and A385

Flat Washers	ANSI B18.22.1; of the same material as anchor bolts and nuts
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Expansion Anchors

For Concrete	Fed Spec FF-S-325; wedge type, Group II, Type 4, Class 1 or 2; self-drilling type, Group III, Type 1; or non-drilling type, Group VIII, Type 1 or 2; Hilti ITW Ramset/Red Head, Rawi plug, or USM
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For Masonry	Fed Spec FF-S-325; lag shield (zinc) type, Group II, Type 1; or split shield type, Group II, Type 3, Class 3; Hilti ITW Ramset/Red Head, Rawi plug, or USM
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3. ANCHOR BOLTS

Anchor bolts shall be delivered in time to permit setting before the structural concrete is placed. Anchor bolts, which are cast-in-place in concrete, shall be provided with enough threads to permit a nut to be installed on the concrete side of the concrete form or supporting template. Installation of anchor bolts is covered in the cast-in-place concrete section.

Two nuts, a jam nut, and a washer shall be furnished for anchor bolts and threaded rod anchors indicated on the drawings to have locknuts; two nuts and a washer shall be furnished for all other anchor bolts.

Anti-seize thread lubricant shall be liberally applied to projecting, threaded portions of stainless-steel anchor bolts and threaded rod anchors immediately before final installation and tightening of the nuts.

4. EXPANSION ANCHORS

Expansion anchors shall be installed in conformity with the manufacturer's recommendations for maximum holding power, but in no case shall the depth of hole be less than four bolt hole diameters. The minimum distance between the center of any expansion anchor and an edge or exterior corner of concrete shall be at least 4-1/2 times the diameter of the hole in which the anchor is installed. Unless otherwise indicated on the drawings, the minimum distance between the centers of expansion anchors shall be at least eight times the diameter of the hole in which the anchors are installed.

Nuts and washers for expansion anchors shall be as specified for anchor bolts.

Anti-seize thread lubricant shall be liberally applied to threaded stainless steel components of expansion anchors immediately before installation.

PART 1-GENERAL

1.1 SUMMARY

A. Description of System and Work Included

1. This section specifies the qualifications and requirements for the construction of an AWWA D110 Type III wire or strand wound, prestressed, concrete circular tank with a flexible base. This includes all reinforcing, concrete work, prestressing, appurtenances, subgrade preparation, backfilling, disinfection and testing directly related to the tank, unless otherwise specified.
2. In the event of a discrepancy between this section of the Specifications and any other section of the Specifications, this section shall govern.

B. Related Work Described Elsewhere

1. Excavation
2. Piping

1.2 QUALITY ASSURANCE

A. Qualification and Experience

1. Singular Responsibility: It is the intent of this specification to require single party responsibility for the design and the construction of the tank. The tank design and construction shall be performed by an established Tank Contractor of recognized ability, having at least ten years of experience in the design and construction of tanks with an AWWA D110 Type III wire or strand wound prestressed concrete core wall as specified herein. The design and construction of all aspects of the foundation, floor slab, wall, prestressing, shotcrete and dome roof of the wire or strand wound circular prestressed tank shall be performed by the Tank Contractor. The Tank Contractor may subcontract labor for reinforcing steel installation and for concrete slab placement under the Tank Contractor's direct supervision.
2. All tank work shall be performed by a company that specializes in the design and construction of wire or strand wound prestressed concrete tanks using the method of circumferential prestress reinforcing and with proven capability of meeting all the requirements of these specifications. No company is considered qualified unless it has designed and built in its own name or under one of its divisions at least twenty AWWA D110 prestressed concrete tanks with a Type III core wall in the last ten years. Experience in the design and construction of tanks with a Type I, II or IV core wall is not acceptable.
3. The Tank Contractor shall have in its employ a design professional engineer with a minimum of ten years' experience, registered in the state where the tank is to be constructed.

The design engineer shall have been the engineer of record for a minimum of ten tanks with an AWWA D110 Type III core wall.

4. The Tank Contractor shall have in its employ for this project a team consisting of a tank superintendent, project manager, certified shotcrete foreman, prestressing foreman, and precast erection foreman, each of whom shall have constructed a minimum of three tanks with an AWWA D110 Type III core wall and a capacity of 1.0 MG or greater.
5. Experience in the design and construction of tanks with an AWWA D110 Type I, Type II or Type IV core wall, tanks having a fixed wall base, mild-steel reinforced tank core wall or tank core wall incorporating internal stressing systems is not acceptable.

B. Prequalification

1. All tank contractors are required to be prequalified. The bidder is required to state on the face of his sealed proposal the name of the prequalified tank contractor. Sealed proposals which do not state the name of the prequalified tank contractor will be returned to the bidder unopened.
2. All prospective bidders must be prequalified for the design and construction of wire or strand wound precast prestressed concrete tanks. Tank Contractors seeking prequalification shall make a complete submittal to the Engineer for review and approval no later than ten days prior to the date set for receipt of bid, in accordance with Section 1.03A. The submittal shall include detailed design drawings and calculations meeting the requirements of these specifications, the company's record of previous experience in the design and construction of AWWA D110 circular, wire or strand wound prestressed concrete tanks constructed in their own name, with a Type III core wall, including the experience of the design engineer meeting the requirements of Section 1.02 A.3 and a project team meeting the requirements of Section 1.02 A.4. Within five days prior to the date of receiving bids, the Engineer will publish a list of additional prequalified Tank Contractors.
3. Experience in the design and construction of tanks with an AWWA D110 Type I, Type II or Type IV core wall, tanks having a fixed wall base, mild-steel reinforced tank core wall or tank core wall incorporating internal stressing systems is not acceptable.
4. All Tank Contractors not prequalified in accordance with Section 1.02 will be rejected.

C. Codes and Standards - All Codes and Standards shall be considered the most current

1. ACI 301 Specifications for Structural Concrete
 2. ACI 305 Hot Weather Concreting
 3. ACI 306 Cold Weather Concreting
 4. ACI 309R Guide for Consolidation of Concrete
 5. ACI 318 Building Code Requirements for Reinforced Concrete and Commentary
 6. ACI 350 Code Requirements for Environmental Engineering Concrete Structures and Commentary
 7. ACI 350.3 Seismic Design of Liquid Containing Concrete Structures and Commentary
 8. ACI 372R Design and Construction of Circular Wire- and Strand Wrapped Prestressed Concrete Structures
 9. ACI 506R Guide to Shotcrete
 10. ASTM A123/A123M Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
 11. ASTM A416 Standard Specification for Steel Strand, Uncoated Seven-Wire for Prestressed Concrete
 12. ASTM A475 Standard Specification for Zinc-Coated Steel Wire Strand
 13. ASTM A615/A615M Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
 14. ASTM A706/A706M Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement
 15. ASTM A722/A722M Standard Specification for Uncoated High-Strength Steel Bar for Prestressing Concrete
 16. ASTM A1064/A1064M Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete
 17. ASTM C31 Standard Practice for Making and Curing Concrete Test Specimens in the Field
 18. ASTM C33 Standard Specification for Concrete Aggregates
 19. ASTM C39 Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
 20. ASTM C231 Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
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21. ASTM C618, Type F Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
22. ASTM D698 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 Ft. - lbf/ft³) 600 KN-M/M³)
23. ASTM C920 Specification for Elastomeric Joint Sealants
24. ASTM D1056 Standard Specification for Flexible Cellular Materials - Sponge or Expanded Rubber
25. ASTM C1116/C1116M Standard Specification for Fiber-Reinforced Concrete and Shotcrete
26. ASTM D1556 Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method
27. ASTM D1557 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 Ft. - lbf/ft³) 2700 KN-M/M³)
28. ASTM D2000 Classification System for Rubber Products in Automotive Applications
29. ASCE Standard 7 Minimum Design Loads for Buildings and Other Structures
30. AWWA C652 Standard for Disinfection of Water-Storage Facilities
31. AWWA D110 Wire and Strand Wound, Circular, Prestressed Concrete Water Tanks
32. TID-7024, Dynamic Pressure on Fluid Containers of Nuclear Reactors and Earthquakes
33. US Army Corps of Engineers Specification CRD-C-572, Specification for PVC Waterstop

D. Design Criteria

1. The prestressed concrete tank shall be designed and constructed in accordance with the provisions of AWWA D110 Standard for Wire or Strand Wound Circular Prestressed-Concrete Water Tanks: Type III; ACI 350, ACI 350.3, ASCE 7 and IBC.
2. Requirements and Loadings:
 - a. Capacity: ___million gallons.
 - b. Dimensions: ___feet inside diameter, ___ feet water depth.
 - c. Dead Load: shall be the estimated weight of all permanent imposed loads. Unit weight of concrete: 150 pcf; steel: 490 pcf.
 - d. Liquid Load: Unit weight of liquid: 62.4 pcf.

- e. Roof Live Load: 20 psf.
 - f. Additional Roof Dead Load: N/A psf.
 - g. Wind Loads: shall be as required by ASCE 7
 - h. Geotechnical information: Lateral earth pressure, backfill density, bearing pressures, anticipated settlements, subbase coefficient of friction, ground water elevation and seismic site class per Geotechnical Report
 - i. Seismic Criteria:
 - i. Seismic design shall be based on the applicable sections of AWWA D110, ASCE 7 and the local jurisdictional building code. Impulsive and convective forces, as well as fluid spectral velocity shall be calculated utilizing each code and the maximum value of each component shall be utilized.
 - ii. Risk Category: IV
 - iii. Sloshing: The sloshing height shall be calculated using AWWA D110 and ASCE 7. If sloshing wave interacts with the roof of the structure, the roof must be designed for the uplift pressures and the confined portion of the convective (sloshing) mass of water must be added to the impulsive force.
 - J. Vent Capacity Requirements:
 - i. Maximum Fill Rate: _____ cfm.
 - ii. Maximum Draw Down Rate: _____ cfm.
 - k. Overflow Design Capacity: _____ cfm.
3. The Type III tank core wall is based on the following design criteria and requirements:
- a. The prestressed tank wall shall be considered as a cylindrical shell with partial edge restraint and rest on a rubber bearing pad allowing free radial movement. A fixed base wall will not be allowed.
 - b. Core wall to be composite precast concrete with steel diaphragm and vertical mild steel reinforcement. Steel wall slot plates shall be utilized between precast panels on the exterior face of the wall along with a 1/2 inch thick shotcrete cover over the diaphragm and plates.
 - c. Minimum precast wall panel thickness shall be 4 inches.
 - d. Circumferential prestressing to be continuous except at wall penetrations.
 - e. Diaphragm steel may be considered as contributing to the vertical reinforcement of the wall.

- f. The core wall is that area of the wall interior to all circumferential prestressing.
- g. Shotcrete thickness shall provide a clear cover over the circumferential prestressing of at least 1/4 inch on intermediate layers. The minimum final shotcrete cover over the circumferential prestressing wire shall be 1 inches.
- h. For wire wound tanks, a stress plate shall be required at all above grade locations where prestress wires are displaced 24 inches or greater. The stress plate shall be designed to transfer stress across the opening.
- i. No reduction in ring compression or tension in the tank core wall will be taken due to restraint at the bottom.
- J. Tank wall systems based on jack-operated cable or rod type tendons, involving the circumferential movement of prestressing steel relative to the wall surface shall not be considered. Circumferential systems relying on strand cables placed inside of ducts (cast in the core wall or manually around the exterior) will not be accepted.
- k. Shotcrete, cast in place or other alternative core walls are not permitted.

4. Floor Slab

- a. The floor slab shall be designed as a membrane floor not less than 4 inches thick. Construction joints will only be allowed as shown on the shop drawings and as approved by the Engineer. Construction joints shall incorporate a continuous 6-inch horizontal PVC ribbed flat strip waterstop with a floor thickened section as necessary for proper placement.
- b. Membrane slab to have a minimum cross-sectional area ratio of reinforcement to concrete in accordance with the following when no SRA is utilized:
 - i. For tanks with diameters less than 100 feet, provide 0.5%.
 - ii. For tanks with diameters of 100 to 150 feet, provide 0.6%.
 - iii. For tanks with diameters greater than 150 feet, provide 0.8%
- c. For tanks with diameters larger than 100 feet, when the concrete shrinkage is less than 0.035% per ASTM C157 regardless of SRA, provide 0.5%.
- d. Polypropylene or cellulose fibers may be used at the Tank Contractor's discretion.

5. Wall Base

- a. Wall to foundation connection to utilize a continuous 9" minimum vertical PVC ribbed center bulb waterstop.

6. Roof System

- a. Roof to be a concrete dome. Dome to have a rise to span ratio within the range of 1:8 to 1:14. The dome shall be fixed to the tank wall. Columns or interior support will not be allowed. Dome design shall be based on elastic spherical shell analysis. The dome thickness shall be no less than 4 inches for precast or 3 inches for cast in place construction. The minimum cross sectional area ratio of dome reinforcement to concrete shall be 0.25% in both the circumferential and radial directions. If additional edge bending moments warrant, two layers of non-prestressed reinforcing shall be provided in the meridional direction at the edge region.

1.3 SUBMITTALS

A. Submittals Required with Bid

B. Design Submittals after Execution of Contract

1. Design calculations and drawings showing details and procedures of construction shall be sealed by a Professional Engineer licensed in the state of construction and electronically submitted to the Engineer for approval.
2. Approval by the Engineer of the drawings and calculations submitted by the Tank Designer will not in any way relieve the Tank Designer of full responsibility for the accuracy and completeness of the drawings and calculations.

C. Construction Submittals for Review Prior to Use

1. Design proportions for all concrete and shotcrete. Strengths of trial mixes. Admixtures to be used in concrete or shotcrete and their purpose.
2. Reinforcing steel shop drawings showing fabrication and placement.
3. Catalog cuts or shop drawings of all materials and appurtenances.

1.4 GUARANTEE

A. Warranty

1. The Tank Contractor shall guarantee the structure against defective materials or workmanship for a period of one year from the date of completion. If any materials or workmanship prove to be defective within one year, they shall be replaced or repaired by the Tank Contractor at the Tank Contractor's expense.

PART 2-MATERIALS

2.1 SUPPLIED BY TANK CONTRACTOR

A. Concrete and Shotcrete

1. Concrete and shotcrete shall conform to and be proportioned in accordance with ACI 301 and 506 respectively, except as modified herein.
 2. Cement shall be Portland cement Type I, Type II or Type I/II.
 3. Admixtures, other than air-entraining, superplasticizers, hydration stabilizers, shrinkage reducing and water reducing admixtures will not be permitted unless approved by the Engineer.
 4. If air entrainment is utilized, the total volumetric air content of the concrete or shotcrete before placement shall not exceed 7% ($\pm 1\%$) as determined by ASTM C173 or ASTM C231.
 5. Curing compound to be membrane forming and in accordance with ASTM C309.
 6. Concrete for tank wall and roof construction shall have a minimum compressive strength of 4,000 psi at twenty-eight days and a maximum water to cementitious ratio of 0.42.
 7. Concrete for the tank floor, footings, pipe encasement and all other work shall have a minimum compressive strength of 4,000 psi at twenty-eight days, shall not be air-entrained and shall have a maximum water to cementitious ratio of 0.42. The coarse and fine aggregate shall meet the requirements of ASTM C33. Coarse aggregate shall be No. 467 with 100% passing the 1½ inch sieve. Superplasticizers, water-reducing, and shrinkage reducing (if applicable) admixtures shall be incorporated into the floor concrete. If fibers are used, they shall be virgin polypropylene or cellulose fibers, Microfiber by Grace, Fibermesh 150-e3 by Propex, UltraFiber 500 by Buckeye, or equal. Fiber lengths shall be a maximum of ¾ inches. The amount of fibers added to the concrete mix shall conform to the Manufacturer's recommendations.
 8. Shotcrete used for prestressing wire cover shall consist of not more than three parts sand to one part Portland cement by weight. The final cover coat of shotcrete shall consist of not more than four parts sand to one part Portland cement by weight. Polypropylene fibers shall be included in the shotcrete used for the finish cover coat. Fibers shall be Fibercast 500 by Propex, Fibermesh or equal. Fibers shall be virgin polypropylene and comply with ASTM C1116 performance level I. Fiber length shall be ¼ inch. The amount of the fibers added to the shotcrete used for the finish cover coat shall conform to the Manufacturer's recommendations. Fly ash may be incorporated into the finish cover coat. If Fly ash is used, it shall conform to ASTM C618, Type F. Shotcrete shall have a minimum strength of 4,500 psi at twenty-eight days and have a maximum water to cementitious ratio of 0.42.
 9. Shotcrete Fine Aggregates:
 - a. The fineness modulus shall be between 2.7 and 3.4. A well-graded coarse sand shall be used for all shotcrete applications.
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- b. The gradation for the fine aggregates shall adhere to the "Grading No. 1" requirements listed in "Table 1.1 - Grading Limits for Combined Aggregates" of ACI 506.
10. All concrete and shotcrete for the tank wall and dome ring shall have a maximum water-soluble chloride ion concentration of 0.06% by weight of cement. All other concrete which has encased uncoated steel shall have a maximum water-soluble chloride ion concentration of 0.1% by weight of cement.
11. Shotcrete utilizing hydration stabilizing admixture may be applied after 90 minutes provided the w/c ratio is not exceeded and the slump and temperature remain consistent.
12. The wet mix process shall be utilized for shotcreting.
13. Rebound material shall not be reused in any form for shotcrete.

B. Reinforcing Steel

1. Reinforcing steel shall be new billet steel Grade 60, as shown on the Drawings, meeting the requirements of ASTM A615. Welded wire fabric and weldable reinforcing steel shall conform to ASTM A1064 and ASTM A706, respectively.
2. Reinforcing steel shall be accurately fabricated and shall be free from loose rust, scale, and contaminants, which reduce bond.
3. Rebar chair supports may be either steel with plastic tips, turned up legs, concrete dobies or plastic.
4. Galvanized rebar to be Class 1 coating in accordance with ASTM A767 without chromate.

C. Strand for Base Restraint Cables

1. Base restraint cables shall be hot-dip galvanized seven-wire strand and shall be manufactured in accordance with ASTM A416 prior to galvanizing, and ASTM A475 after galvanizing. Only seven-wire strand will be allowed. All strands shall have a minimum weight of zinc coating of 0.85 ounces per square foot.

D. Mortar Fill and Non-Shrink Grout

1. Mortar fill and non-shrink grout shall have a minimum compressive strength of 4,000 psi at twenty-eight days, have a maximum water to cementitious ratio of 0.42 and meet all requirements for concrete contained in this specification.

E. Steel Diaphragm and Wall Slot Steel

1. The steel diaphragm shall conform to ASTM A1 008 and shall be a minimum thickness of 0.017 inches. It shall be vertically ribbed with reentrant angles. The

back of the channels shall be wider than the front, providing a mechanical keyway anchorage with the concrete and shotcrete encasement.

2. Wall slot steel to be 10-gauge low carbon steel conforming to ASTM A569. Plate shall not be pickled or oiled.

F. Circumferential Prestressing Steel

1. Steel for prestressing shall either be cold drawn, high carbon wire or galvanized seven wire strand.
2. The wire shall meet the requirements of ASTM A821 and have a minimum ultimate tensile strength of 210,000 psi.
3. Prestressing strand shall be hot-dip galvanized seven-wire strand and shall be manufactured in accordance with ASTM A416 prior to galvanizing, and ASTM A475 after galvanizing. Only seven-wire strand will be allowed. All strands shall have a minimum weight of zinc coating of 0.85 ounces per square foot.
4. Splices for horizontal prestressing strand shall be ferrous material compatible with the reinforcement and shall develop the full strength of the strand. Strand splice and anchorage accessories shall not nick or otherwise damage the prestressing.

G. Elastomeric Materials

1. Floor to wall connection shall utilize a ribbed water stop with center bulb. Construction joints to utilize ribbed flat strip water stops. Waterstops shall be polyvinyl chloride meeting the requirements of the Corps of Engineers Specification CRD-C 572.
2. Bearing pads shall be neoprene or rubber.
 - a. Neoprene pads shall have a hardness of 40 durometer and shall meet the requirements of ASTM D2000 Line Call-Out M 2 BC 410 A1 4 B14 or M 2 BC 414 A14 C12 F17 for 40 durometer material.
 - b. Natural rubber bearing pads shall contain only virgin natural polyisoprene as the raw polymer and the physical properties shall comply with ASTM D2000 Line Call-Out M 4 AA 414 A1 3.
3. Neoprene Sponge filler shall be closed-cell neoprene rubber conforming to ASTM D1056, Type 2, Class A, and Grade 1 or 3.

H Sealants

1. Polyurethane filler and sealant shall conform to ASTM C290 Type S.
2. Polysulfide sealant will be a two or three component elastomeric compound meeting the requirements of ASTM C920 Type M. Sealants shall have permanent.

characteristics of bond to metal surfaces, flexibility, and resistance to extrusion due to hydrostatic pressure. Air cured sealants shall not be used.

I. Appurtenances

1. Roof Sleeves: (2) 6" 304 Stainless Steel Flange x Plain End Pipe.
2. Overflow Piping and Weir to be sized per overflow rate.
3. Floor Piping per drawings.
4. Roof Safety Tie Offs per OSHA to be provided at exterior ladders and hatches.
5. Access Roof Hatch: A 3'-6" minimum square aluminum hatch with lockable, hinged cover and curb frame. The hatch shall have a lift handle, padlock tab, padlock and a cover hold open mechanism. All hardware shall be stainless steel. Hatch to be aluminum USF SRRI or equal.
6. Access Manway: A circular 25 inch diameter Type 304 stainless steel wall manway with a hinged cover. A Type 304 stainless steel grab bar and an aluminum ladder shall be installed at the manway location.
7. Roof Ventilator: Fiberglass, with 316 stainless steel insect 20 x 20 screen, minimum diameter 2 feet.
8. Interior Ladder: The ladder shall extend from the floor to the access hatch. The ladder shall be FRP and have an OSHA-approved stainless steel fall prevention device consisting of a sliding, locking mechanism and safety belt.
9. Exterior Ladder: The ladder shall extend from the final grade to the tank roof. The ladder shall be 6061-T6 aluminum and have an OSHA-approved stainless steel fall prevention device consisting of a sliding, locking mechanism and safety belt.
10. Handrail: Provide 10 feet of handrail along roof perimeter on either side of exterior ladder and access hatch. Handrail material shall be made out of 6061-T6 aluminum and minimum 1.5" Sch. 40 pipe. Handrail joints to be Hollaender Speedrail. Handrail to have 4" high toe board attached to perimeter rail.

J Exterior Coatings

1. Exterior dome surface shall receive one coat of a cementitious based damp-proofing product such as "Tamoseal" or equal, and one coat of a non-cementitious, high build, 100% acrylic resin polymer such as "Tarnmscoat Smooth AR" textured protective coating, "Tnemec Envirocrete 156", "Sherwin Williams Loxon XP WP" or equal.
 2. Above grade exterior wall surfaces two coats of a non-cementitious, high build, 100% acrylic resin polymer such as "Tarnmscoat Smooth AR" textured protective coating, "Tnemec Envirocrete 156", "Sherwin Williams Loxon XP WP" or equal.
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PART 3 - CONSTRUCTION

3.1 FIELD QUALITY CONTROL

A. Safety

1. Tank Contractor to conform to and enforce all Local and Federal OSHA safety rules and regulations.

B. Constructability

1. The Site Work Contractor shall excavate to such depths and widths to provide adequate room for tank construction and as required in the geotechnical report. All trees, shrubs, brush, stumps, roots, and other unsuitable material shall be removed to a minimum distance of 12 feet outside the edge of the tank foundation, plus additional areas necessary for the tank construction. The working area surface shall be at an elevation of 12" below the top of foundation.
2. The excavation shall be dewatered as required during construction. The dewatering method used shall prevent disturbance of the tank foundation soils.
3. In the event the subgrade material is disturbed or over excavated by the Site Work Contractor during excavation, at the direction of the engineer, it shall be removed and replaced with compacted select fill at the Site Work Contractor's expense.
4. Subbase to be prepared per geotechnical report.
5. A leveling base material consisting of a minimum 6-inch-thick layer of compacted select fill shall be placed beneath the entire tank foundation. Select fill shall consist of a clean, well graded, angular or sub-angular, ¾" (maximum) base material. The base material shall permit free drainage without the loss of fines or intermixing with subgrade material by limiting the amount of material that passes the No. 200 sieve to a maximum 8 percent by weight of the total base material. Select fill shall be placed in layers not exceeding 6 inches and compacted to a minimum density equal to 95% of the maximum laboratory density in accordance with ASTM D1557. Field testing for density achieved shall be in accordance with ASTM D1556 or D2922. In lieu of select fill, a uniformly graded ¾ inch minus crushed stone may be used as the leveling base material. The crushed stone shall be ¾ inch sieve size with 100% passing the 1 inch. If uniformly graded crushed stone is used for the leveling base material, compaction performance criteria shall be used to gauge the degree of compaction. Crushed stone shall be placed in layers not exceeding 9 inches and compacted with at least two passes in each direction with vibratory roller compaction equipment. Compaction shall be inspected, and verification of compaction effort shall be documented by an approved testing agency hired by the owner. The surface elevation of the leveling base shall be fine graded to a tolerance of plus zero inches to minus ½ inch over the entire foundation areas. Fine grading tolerances for floor pipe encasements shall be plus zero inches to minus 6 inches.

6. All fill materials for backfill shall be approved by the Engineer and/or Owner and Geotechnical Engineer.
 - a. Rock or concrete spoils (greater than 6 inches) shall not be used in backfill within 2 feet of the tank wall.
 - b. Earth moving equipment limits for tank backfill installation.
 - i. Within 5 ft of tank wall, only hand operated equipment.
 - ii. Between 5 and 15 feet: Maximum weight of 40,000 lbs for non-vibratory and maximum weight of 20,000 lbs for vibratory machinery.

3.2 INSTALLATION

A. Floor

1. Prior to placement of the floor reinforcing, a 6 mil polyethylene moisture barrier shall be placed over the leveling base material. Joints in the polyethylene shall be overlapped a minimum of 6 inches.
2. Prior to placement of the floor concrete, all piping that penetrates the floor shall be set and encased in concrete.
3. The vertical water stop shall be placed and supported so that the bottom of the center bulb is at the elevation of the top of the footing. The water stop shall be supported without puncturing any portion of the water stop other than pre-manufactured holes, grommets or hog rings for tying at 12 inches o.c.. The water stop shall be spliced using a thermostatically controlled sealing iron and each splice shall be inspected using a penknife prior to encasement in concrete. Spark testing of the welded joint shall not be permitted.
4. The floor shall be cured using blankets, flooding with water or curing compound. The floor shall remain saturated for a minimum of seven days if curing compound is not utilized.

B. Wall

1. The precast wall panel shall be constructed with a continuous waterproof steel diaphragm embedded in the exterior of the precast panel. Horizontal joints in the diaphragm will not be allowed.
2. No holes for form ties, nails, or other punctures will be permitted in the wall.
3. Temporary wall openings may be provided for access and removal of construction materials from the tank interior subject to the approval of the Engineer.
4. Polyethylene sheeting shall be placed between successive pours to provide a high moisture environment and a long slow cure for the concrete.

5. Joints between precast wall panels shall be bridged with a steel plate edge sealed with polysulfide or polyurethane and filled with mortar as shown on the drawings. No through-wall ties will be permitted.
6. The steel diaphragm shall extend to within 1 inch of the full height of the wall panel with no horizontal joints. Vertical joints within a wall panel shall be roll seamed or otherwise fastened in a fashion that results in a firm mechanical lock.

C. Roof

1. Precast panels to have polyethylene sheeting placed between successive pours to provide a high moisture environment and a long slow cure for the concrete.
2. Removal of roof shoring shall be done at the direction of the Tank Design Engineer.

D. Concrete and Shotcrete

1. All concrete and shotcrete shall be conveyed, placed, finished, and cured as required by pertinent ACI standards.
 2. Reinforcing steel shall be accurately positioned on supports, spacers, hangers, or other reinforcements and shall be secured in place with wire ties or suitable clips.
 3. Weather Limitations
 - a. Unless specifically authorized in writing by the Engineer, concrete and shotcrete shall not be placed without special protection during cold weather when the ambient temperature is below 35 degrees F, below 40 degrees F and falling or when the concrete is likely to be subjected to freezing temperatures before initial set has occurred and the concrete strength has reached 500 psi. The temperature of the concrete shall be maintained in accordance with the requirements of ACI 301 and ACI 306. All methods and equipment for heating and for protecting concrete in place shall be subject to the approval of the Engineer.
 - b. During hot weather, concreting and shotcreting shall be in accordance with the requirements of ACI 301, ACI 305 and ACI 506.
 4. Finishes
 - a. The floor slab shall receive a fresno or bullfloat at the option of the contractor. The top of the wall footing, exterior to the waterstop, shall receive a steel trowel or magnesium trowel finish.
 - b. The interior surface of the tank wall shall receive a horizontal light broom finish.
 - c. The top surface of the roof shall receive a light broom finish and a form finish on the bottom and edge surfaces.
 - d. Exterior shotcrete shall receive a natural gun/nozzle finish.
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- e. For all formed concrete surfaces, all irregularities that project greater than 1/4" from the surface shall be ground off. All holes greater than 3/4" wide or 1/2" deep should be patched.
5. Concrete shall be cured using water methods, sealing materials, or curing compounds. Curing compounds shall not be used on surfaces to which decorative coatings, mortar, or shotcrete is to be applied.
6. Each prestress wire or strand shall be individually encased in shotcrete.
7. Finish cover coat shotcrete shall be applied as soon as practical after the last application of strand coat.
8. Manually applied shotcrete shall be applied by an ACI 506 certified nozzleman.
9. Unless applied by an automated shotcrete process, total cover coat thickness shall be controlled by shooting guide wires. Vertical wires shall be installed under tension and spaced no more than two feet apart to establish uniform and correct coating thickness. Monofilament line (100 lb. test) or 18 or 20 gauge high tensile strength steel wire shall be used. Guide wires shall be removed after placement of the cover coat.
10. Testing
 - a. For concrete placed in the precast panels or wall slots, a set of three cylinders shall be made for each truck load of concrete placed. For concrete placed in the floor, dome ring or dome slots, two sets of five cylinders for the first 50 cubic yards, and one set of five cylinders for every 100 cubic yards thereafter placed in the same day. Two cylinders shall be tested at seven days, two at twenty-eight days, and one held as a spare.
 - b. Slump, air content and temperature testing shall be performed on each truck where cylinders are taken.
 - c. Testing of shotcrete shall be in accordance with ACI 506, except as specified herein. One test panel shall be made for each of the following operations: core wall, wire or strand cover, and cover coat. Test panels shall be made from the shotcrete as it is being placed. The method of making a test sample shall be as follows: A frame of wire fabric (1 foot square, 3 inches in depth) shall be secured to a plywood panel and hung or placed in the location where shotcrete is being placed. This form shall be filled in layers. After twenty-four hours, the fabric and plywood backup shall be removed and the sample slab placed in a safe location at the site.
 - d. The shotcrete sample slab shall be moist cured in a manner identical with the regular surface application. The sample slab shall be sent to the testing laboratory. Nine 3 inch cubes shall be cut from the sample slab and subjected to compression tests in accordance with current ASTM Standards. Three cubes

shall be tested at the age of seven days, three shall be tested at the age of twenty-eight days, and three shall be retained as spares.

- e. All concrete and shotcrete testing shall be in accordance with ASTM C31 and C39 at the expense of the General Contractor and shall be conducted by an independent testing agency approved by the Engineer.

E. Circumferential Prestressing

1. Prestressing wire or strand shall be placed on the wall with a machine capable of consistently producing a stress in the wire or strand within a range of minus 7% to plus 7% of the stress required by the design. No circumferential movement of the prestressing along the tank wall will be permitted during or after stressing. Stressing may be accomplished by drawing the wire through a die or by another process that results in uniform stress throughout its length.
2. Ends of individual coils shall be joined by suitable steel splicing devices capable of developing the full strength of the prestressing wire/strand.
3. Circumferential stressing systems based on jack-operated cable or rod-type tendons will not be allowed.
4. Minimum clear distance between prestressing wire or strands is 5/16 inch or 1.5 wire or strand diameters, whichever is greater.
5. The Tank Contractor shall furnish a calibrated stress recording device, which can be recalibrated, to be used in determining the wire or strand stress on the wall during and after the prestressing process. At least one stress reading per vertical foot or one stress reading for every roll of prestressing, whichever is greater, shall be taken after the wire or strand has been applied on the wall. The Tank Contractor shall keep a written record of stress readings. All stress readings shall be made on straight lengths of wire/strand. If applied stresses fall below the design stress in the steel, additional wire or strand will be provided to bring the force on the core wall up to the required design force. If the stress in the steel is more than 7% over the required design stress, the wrapping operation should be discontinued, and satisfactory adjustment made to the stressing equipment before proceeding.

F. Exterior Coatings

1. All Work shall be performed by workmen skilled in the application of these types of products. The Manufacturer's application instructions shall be submitted to the Engineer for approval. The Contractor shall confer with the Manufacturer's representatives regarding application techniques and shall follow the Manufacturer's instructions implicitly.
2. The concrete surface to be coated shall be clean, free of all laitance, dirt, grease, or other foreign materials. All defective surfaces shall be filled and/or repaired.

Application shall be in full accordance with the manufacturer's instructions or as amended by the Engineer.

3.3 CLOSEOUT

A. *Disinfection*

1. The Contractor shall, at the completion of tank construction, thoroughly clean the interior of the tank.
2. The Contractor shall notify the Engineer prior to disinfecting the tank. Disinfection of the tank floor and interior wall shall be by method 3 of AWWA C652.
3. Prior to placing the tank in service, a bacteriological test shall be taken, and successful results received. Testing shall be by an independent testing laboratory at the expense of the owner.

B. *Watertightness*

1. Upon completion, the tank shall be tested to determine watertightness. The tank shall be filled with potable water to the maximum level. Water will be furnished to the tank by the owner. The test shall consist of measuring the liquid level over the next twenty-four hours to determine if any change has occurred. If a change is observed and exceeds the maximum allowance, the test shall be extended to a total of five days. If at the end of five days the average daily change has not exceeded the maximum allowance, the test shall be considered satisfactory.
2. The liquid volume loss for a period of twenty-four hours shall not exceed 1/20th of 1% of the tank capacity, $0.0005 \times \text{tank volume}$. If the liquid volume loss exceeds this amount, it shall be considered excessive, and the tank shall be repaired and retested.
3. Damp spots will not be permitted at any location on the tank wall. Damp spots are defined as spots where moisture can be picked up on a dry hand.
4. Damp spots on the footing are permissible so long as measurable flow or standing water on the wall footing are not observed.

- 5.03 Tank Walls – Tank walls shall be properly designed to resist the maximum anticipated dead and live loads, both when the tank is empty and when filled with water having a specific gravity of 1.0. Design live loads shall not be less than the wind, snow, earthquake, and other live loads, for the area in which the tank is to be located as specified in ASA A58.1.
- 5.04 Tank Roofs – Minimum thickness of tank roof sheets shall be 12 gauge.
- 5.05 Roof Supports – Roof structures shall be designed to support the minimum design loads as specified in ASA A58.1. Allowable design stresses shall be in accordance with the ASIC Code for rolled structural members of the ASIC Code for cold formed members.
- 5.06 Anchor Bolts – Anchor bolts are recommended to be set outside of the tank bottom with suitable lugs to be attached to the tank wall.
- 5.07 Shell Manway – One flush type shell manway shall be so designed that manway cover plates may be removed and replaced without entering the tank. The size will be 30" X 46".
- 5.08 Tank Connections – Tank connections shall conform to the sizes and locations specified on the plans and consists of:
- a. 18" Fill Line
 - b. 18" Pump Suction Line
- 5.09 Overflow – A 6" overflow at centerline elevation as shown on plans.
- 5.10 Tank Drain Sump – A tank drain sump with 12" discharge shall be provided.
- 5.11 Vent – The vent shall be of the roof ventilator type protected to prevent possible entry of dust, birds, insects or any contaminants, with the opening protected by 16-mesh or finer corrosive resistant screening (monel screen).
- 5.12 Indicator – One (1) board, water level indicator graduated in inches and feet shall be installed at location on the plans.
- 5.13 Roof Hatch – The roof hatch opening shall have a raised curbing of at least 4 inches in height, and the cover shall overlap and terminate in a downward direction of at least 2 inches, with arrangements for keeping it locked in place. A lock with 2 keys shall be provided for each opening. Openings shall consist of one 30" X 30" and one 24" diameter. Locks shall be provided.
- 5.14 Inside and Outside Ladders – Both ladders shall be to ground level and located as shown on the plans. OSHA standards will prevail.
- 5.15 Accessories – AWWA standard.

6. TESTING AND STERILIZATION

- 6.01 Sterilization – Clean, sweep, and wash down wall. Remove foreign matter from reservoir. Spray interior of reservoir with chlorine solution of one pound of HTH compound to one hundred gallons of water. Fill reservoir with water for test for tightness. Allow standing for minimum of twelve hours. Draw reservoir down part way. **ENGINEER** to take sample for bacteriological test. Repeat sterilization procedure if necessary, until satisfactory sterile sample is secured. Reservoir not accepted until water samples approved by Texas Department of Health.

6.02 Testing – During sterilization, examine tank for leaks and make all joints tight. If necessary, to enter tank, resterilize.

7. SHOP DRAWINGS

Submit eight (8) sets of shop drawings showing all special details and features.

8. FOUNDATION

The foundations shall be constructed in accordance with the plans at the location and grade established by the **ENGINEER**. All grass and vegetable and other matter unsuitable for foundation shall be removed.

9. GUARANTEES

The **CONTRACTOR** guarantees the structure he furnished under these specifications for one year from the date of acceptance of his work to the extent that he will repair any defects which may appear in the structure during that period because of faulty design, workmanship or material furnished by him.

This guarantee does not cover any chemical or electrolytic action that may take place between the material stored and the tank itself.

500,000 gallon - ELLIPSOID or PEDESHERE ELEVATED WATER STORAGE TANK

1.01 GENERAL REQUIREMENTS

A. Scope

The Contractor shall be responsible for all labor, materials and equipment necessary for the design, fabrication, construction, painting, disinfection and testing of an elevated multi-leg ellipsoid, or a single pedestal "Pedesphere", welded carbon steel water storage tank supported by a steel support pedestal. Design and construction of the Elevated Tank shall conform to all requirements of AWWA D100 Standard for Welded Carbon Steel Tanks for Water Storage, except as modified by the requirements of these contract documents.

B. Qualification of Manufacturer

- 1) The design and construction of the "Pedesphere" style or multi-leg ellipsoid water storage tank shall only be undertaken by a Contractor with a minimum of five years experience with elevated tank construction. The Contractor must be able to demonstrate experience through the design and construction of at least five "Pedesphere" or multi-leg Ellipsoid style water tanks. The Contractor shall not subcontract the design or erection of the steel tank, pedestal and base cone support structure.
- 2) As providing a safe work environment is critical for this project, other contractors, and the community, to be approved to bid on this project, given the complexity, and risk associated with the work, all tank contractors are required to have an Experience Modification Rate (EMR) below 0.75 and a Total Recordable Incident Rate (TRIR) below 2.5 for the last three (3) years. Bidders are required to verify the above requirement by providing with their proposal a statement from their insurance carrier confirming the EMR requirement, and their last three (3) years of OSHA 300 Logs to confirm the TRIR requirement.

C. Submittals

No bid will be considered unless this information is provided with the proposal:

- 1) A list of five "Pedesphere" or multi-leg Ellipsoid style elevated tanks constructed within the last five years, including the name of the Owner, tank capacity and the Consulting Engineer.
- 2) A preliminary drawing of the tank showing major dimensions and plate thickness upon which the bid is based, the high and low water levels and the dimensions of the supporting pedestal and base cone.
- 3) A foundation design drawing showing preliminary dimensions and approximate quantities of concrete and reinforcing steel.

D. Standard Specifications

All work on the water storage tank shall fully conform to the requirements of the latest

published editions of the following Standard Specifications and adopted modifications:

- 1) AWWA (American Water Works Association) D100 Standard for Welded Carbon Steel Tanks for Water Storage.
- 2) AWWA D102 - Standard for Painting Steel Water Storage Tanks
- 3) AWWA C652 - Standard for Disinfection of Water Storage Facilities.
- 4) AWS (American Welding Society) D1.1
- 5) NSF (National Sanitation Foundation) 61 - Materials in contact with Potable Water.
- 6) Steel Structures Painting Council Manual - Volume 1 - Good Painting Practice.
- 7) Steel Structures Painting Council Manual - Volume 2 - Systems and Specifications.
- 8) ACI 318 - Building Code Requirements for Reinforced Concrete
- 9) ACI 301 - Specifications for Structural Concrete

E. Tank Details

The elevated tank shall be all-welded construction of the most economical design. All members of structural steel or of reinforced concrete shall be designed to safely withstand the maximum stresses to which they may be subjected during erection and operation.

- 1) The minimum operating capacity of the storage tank will be 500,000 US gallons.
- 2) The capacity of the tank, low to high water level, shall be contained within a maximum operating range of _____ feet.
- 3) The height of the tank, top of foundation to High Water Level, shall be 142 feet.
- 4) Top of foundation elevation shall be _____.
- 5) The existing ground elevation is _____.
- 6) The finished ground elevation shall be _____.

F. Permits, Easements, Electrical Lines and Utilities

Permits, licenses, airspace authority approval and easements required for the construction of the tank and associated work shall be provided by the Owner.

The site plan or specifications shall clearly indicate the approximate location of all overhead or underground electrical lines and other utilities and piping. The Owner is responsible for relocating or de-energizing any electrical or utility lines that may interfere with the safe construction of the foundation or structure(s). In general, no overhead lines, or supports, shall pass or be located within 50 feet of any part of the structure or the footprint of the tank. A minimum vertical clearance of 15 feet shall be provided along any access routes.

G. Working Drawings

After contract award and prior to construction, the Contractor shall provide engineering drawings and design calculations for the elevated steel tank and the foundation. Drawings shall show the size and location of all structural components and the foundations along with reinforcement details, the required strength and grade of all materials and the size and arrangement of principle piping and equipment. The drawings and calculations shall bear the certification of a professional Engineer licensed in the State of Texas. The design coefficients and resultant loads for snow,

wind and seismic forces, and the methods of analysis shall be documented.

2.01 DESIGN

A. General

The structural design of the elevated storage tank shall conform to the following design standards except as modified or clarified as follows:

- 1) Foundations – AWWA D100 and ACI 318 – Building Code Requirements for Reinforced Concrete.
- 2) Steel Tank - AWWA D100
- 3) Steel Tank Painting – AWWA D102.

B. Environmental Loads – AWWA D100 and ASCE 7

- 1) Wind Load – Wind pressure shall be determined in accordance with AWWA D100, Section 3.1.4. Basic wind speed used in the Wind Pressure formula shall be determined using the mapped site location and Figure 1 of AWWA D100. For tanks located in coastal regions, the Owner's Engineer shall consider the use of an increased basic wind speed as appropriate.

$$\text{Basic Wind Speed (BWS)} = 100 \text{ MPH}$$

- 2) Seismic Load – Seismic loads shall be determined in accordance with AWWA D100, Section 13.
 - a) Region Dependent Transition Period (T_L) = _____ (Fig. 19)
 - b) Site Class _____ (Table 25)
 - c) MCE Spectral Response Acceleration at 0.2sec (S_s) and 1sec (S_1) (Fig's. 5-18)
 $S_s =$ _____
 $S_1 =$ _____
Longitude = _____ (at tank center)
Latitude = _____ (at tank center)
 - d) Importance Factor (I_E) = _____ (Table 24)
- 3) Snow Load – Snow load shall be determined in accordance with AWWA D100, Section 3.1.3.1.

C. Foundation

A Geotechnical investigation has been carried out at the site and a copy of the report is included with the Contract Documents. Recommendations for the foundation and allowable bearing capacities are defined in this report. The Owner shall retain the services of the Geotechnical consultant to verify the adequacy of the bearing stratum after the Contractor has carried out the excavation and before any concrete or reinforcement is placed. The concrete foundation for the elevated tank shall be designed by the Contractor based upon the recommendations in the geotechnical report. The concrete foundation for the ground storage tank will be provided as part of these specifications. The report must provide the allowable soil bearing pressure with appropriate factors of safety, the active and passive earth pressure coefficients, the angle of soils internal friction, its cohesion, unit weight and recommendations for

bearing depth and backfill requirements.

D. Steel Tank

1) General

- a) The tank and supporting structure shall be of all-welded steel design and construction. All materials, design, fabrication, erection, welding, testing and inspection of the steel tank shall be in accordance with the applicable sections of AWWA D100 except as modified in this document. The tank shall have a spherical shape for capacities of 500,000 gallons and less, and a spheroidal shape for capacities 200,000 gallon and greater.
- b) As The supporting structure shall be a butt-welded single pedestal having a minimum shaft diameter adequate for the capacity and height of tower. Transition sections at the top and bottom of the pedestal shall be in accordance with the manufacturer's standard. The transition from the base to the pedestal shall be a truncated cone with a compression ring. The transition from pedestal to tank shall be a compression ring with truncated cone for tank capacities 150,000 gallons and less. The transition from pedestal to tank shall be a double-curved smooth knuckle for tank capacities of more than 150,000 gallons.

2) Minimum Plate Thickness

The minimum thickness for any part of the structure shall be 3/16 inch for parts not in contact with water and 1/4 inch for parts in contact with water. At junctions in plates where meridional forces are discontinuous such as cone to cylinder junctions or cone to base plate junctions, a tension or compression ring may be required to resist radial forces generated by the discontinuous membrane forces. In these regions, allowable stresses shall not exceed the following stress:

- a) Tension ring stress shall not exceed the lesser of 15,000 PSI or one half of the minimum specified yield of the plate material.
- b) Compression ring stresses shall not exceed 15,000 PSI.
- c) The overturning moment used in designing the pedestal and foundation shall include the moment due to eccentricity of the gravity loads caused by deflection of the structure under wind or seismic conditions (i.e. P-delta effect).

3.01 CONSTRUCTION

A. Concrete Foundation

The foundation shall be designed and constructed to safely and permanently support the structure. The basis of the foundation construction shall be consistent with the soils investigation data included herein at the end of these specifications. Appropriate changes to construction schedule and price will be negotiated if, during excavation, soil conditions are encountered which differ from those described in geotechnical report. The concrete foundation shall be constructed in accordance with ACI 301.

Minimum concrete compressive strength shall be 4000 psi, "Cast-In-Place Concrete".

B. Steel Tank Construction

- 1) **General**
The erection of the steel tank shall comply with the requirements of Section 10 of AWWA D100 except as modified by these documents.
- 2) **Welding**
All shop and field welding shall conform to AWS and AWWA D100, Section 10. The contractors shall ensure that the welders or welding operators are qualified in accordance with ASME Section IX or ANSI/AWS B2.1.
- 3) **Fabrication**
All fabrication and shop assembly shall conform to the requirements of AWWA D100, Section 9, Shop Fabrication.
- 4) **Erection**
Plates subjected to stress by the weight or pressure of the contained liquid shall be assembled and welded in such a manner that the proper curvature of the plates in both directions is maintained. Plates shall be assembled and welded together by a procedure that will result in a minimum of distortion from weld shrinkage.
- 5) **Inspection and Testing**
Inspection of shop and field welds shall be in accordance with AWWA D100, Section 11, Inspection and Testing. All inspection shall be performed prior to interior and exterior field painting. Radiographic inspection shall be performed by an independent testing agency with all costs included in the Contractor's bid and paid by the Contractor.
- 6) **Roof Lap Joints**
All interior lap joints shall be sealed by means of caulking or continuous seal welding. This shall include penetrations of roof accessories.
- 7) **Painting and Disinfection**
Surface preparation and coating of all steel surfaces shall be in accordance with "New Water Tank Coating and Painting" spec.

4.01 ACCESSORIES

A. General

The following accessories shall be provided in accordance with these specifications. All items shall be in full conformity with the current applicable OSHA safety regulations and the operating requirements of the structure.

B. Ladders

Access ladders shall be provided at the following locations:

- 1) Grade to upper platform.

- 2) Upper platform to tank floor manhole.
- 3) Upper platform to steel tank roof mounted on access tube interior.
- 4) Exterior of access tube to provide access from the roof manhole to the tank floor.

[Note: This ladder shall not be provided in northern climates where freezing may occur.]

Ladder side rails shall be a minimum 3/8 inch by 2 inches with a 16 inch clear spacing. Rungs shall not be less than 3/4 inch, round or square, spaced at 12 inch centers. The surface of the rungs shall be knurled, dimpled or otherwise treated to minimize slipping. At platforms or landings, the ladder shall extend a minimum 4 feet above the platform. Ladders shall be secured to adjacent structures by brackets located at intervals not exceeding 10 feet. Brackets shall be of sufficient length to provide a minimum distance of 7 inches from the center of the rung to the nearest permanent object behind the ladder.

C. Fall Protection

Ladders shall be equipped with a fall arrest system meeting OSHA regulations. The system shall be supplied complete with safety harnesses, locking mechanisms, lanyards and accessories for two persons.

D. Upper Platform

An upper platform shall be located at the top of the support pedestal to provide access from the pedestal ladder to the roof access ladder located on the interior of the access tube. Platform shall include a 24" x 36" access hatch with opening to allow ladder and safety device to continue 48" minimum above the platform floor.

E. Roof Handrail

A roof handrail shall be provided surrounding the roof manholes, vents and other roof equipment. Handrail shall comply with OSHA requirements.

F. Condensate Ceiling

Steel condensate ceiling located at the junction of the pedestal shaft and base cone complete with drain and 24" x 36" access hatch with opening to allow ladder and safety device to continue 48" minimum above the platform floor.

G. Openings

1) Roof Hatches

- a) Provide two access hatches on the roof of the tank. One hatch shall be 30 inch diameter and allow access from the roof to the interior of the tank. The hatch will be hinged and equipped with a hasp for locking. The hatch cover shall have a 2 inch downward edge. The second hatch will be 24 inch diameter and flanged with a removable cover so constructed that an exhaust fan may be connected for ventilation during painting operations. The openings shall have a minimum 4 inch curb.
- b) Provide one 30 inch diameter hinged access hatch on the access tube roof. The hatch cover shall have a 2 inch downward edge.

2) **Tank Vent**

The tank vent should be centrally located on the tank roof above the maximum weir crest elevation. The tank vent shall have an intake and relief capacity sufficiently large that excessive pressure or vacuum will not be developed during maximum flow rate. Maximum flow rate should be based on a break in the inlet/outlet pipe when the tank is full. The vent shall be designed, constructed and screened so as to prevent the ingress of wind driven debris, insects, birds and animals. The vent should be designed to operate when frosted over or otherwise clogged. The screens or relief material shall not be damaged by the occurrence and shall return automatically to operating position after pressure or vacuum is relieved.

3) **Tank Floor Manhole**

A minimum 18 x 24 inch elliptical access manhole shall be provided in the tank bottom accessible from the upper platform or from a ladder that extends from the platform to the opening. The hatch shall open inward.

4) **Pedestal Hatch**

A 24" diameter manhole shall be located near the top of the pedestal for access to the exterior painter's rail located near the tank/pedestal interface. This opening shall be accessible from the upper pedestal platform.

H. **Access Tube**

A minimum 36" diameter access tube shall be provided for tanks with capacities of 150,000 gallons and less, or 42" diameter access tube on tanks with capacities 200,000 gallons and greater. The access tube will be provided from the top of the pedestal to the tank roof.

I. **Rigging**

Interior and exterior rigging devices shall be provided for painting, inspecting and maintaining the structure and accessories. A continuous bar or tee rail near the top of the exterior support structure shall be provided. The rail may be attached to the support column or steel tank. A painter's rail attached to the roof, pipe couplings with plugs in the roof or other attachments that provide complete access for painting of tank interior shall be furnished.

J. **Piping**

1) **General**

Exterior of pipes exposed to stored water shall be coated with tank interior wet system. Exterior of pipes in the pedestal and base cone shall be coated with tank interior dry system.

2) **Inlet/Outlet Piping**

Provide a _____ inch diameter standard weight steel inlet/outlet pipe that extends vertically from the base of the pedestal to the bottom of the tank. An expansion joint shall be provided in the vertical section of pipe. The expansion joint should be constructed to accommodate any differential movement caused by settlement or thermal expansion and contraction. Inlet/Outlet pipe shall not extend above the LWL.

3) **Overflow**

The overflow pipe shall be designed to carry the maximum design flow rate of _____ GPM. The steel overflow pipe will be _____ inch in diameter and shall have a minimum wall thickness of ¼". A suitable weir shall be provided with the crest at High Water Level. The overflow pipe shall extend down from the weir box through the tank, pedestal, and base cone. [Note: Consider routing the overflow inside the access tube in northern climates where freezing is a concern.] The overflow pipe shall penetrate the base cone wall approximately 1 to 2 feet above grade and discharge onto a concrete splash pad. The point of discharge shall have a 45 degree elbow and be equipped with a stainless steel screened end.

K. **Interior Floor**

A concrete slab-on-grade shall be provided inside the base cone. The floor shall be a minimum of 6 inches thick, and reinforced with 6x6/W2.9 x W2.9 WWF. Isolation joints shall be provided at junctions with walls, columns, equipment or piping foundations.

L. **Personnel Door**

A 36" by 80" access door with a flush threshold shall be located in the base of the pedestal cone. A step over threshold is not acceptable. The door shall be fabricated from steel plate with adequate stiffening and specifically designed for use with the tank. The access door will be equipped with handle, drip cover and dead bolt lock. Commercial hollow metal doors and frames are not acceptable.

M. **Identification Plate**

A tank identification plate shall be mounted near the personnel door. The identification plate shall be corrosion resistant and contain the following information.

- 1) Tank Contractor
- 2) Contractor's project or file number
- 3) Tank capacity
- 4) Height to High Water Level
- 5) Date erected

5.01 Guarantee

- A. The tank Contractor shall guarantee its work for a period of one year from the completion date defined in the contract documents to the extent that it will repair any defects caused by faulty design, workmanship or material furnished under the specifications. If Contractor is not advised of any defects within 30 days of end of guarantee period, guarantee shall be considered fulfilled and complete. Defects caused by damaging service conditions such as electrolytic, chemical, abrasive or other damaging service conditions are not covered by this guarantee.
- B. All guarantees obtained by the tank Contractor from the manufacturer or installer of paint, equipment or accessories not manufactured by tank Contractor shall be obtained for the benefit of the Purchaser.

**SPECIFICATIONS FOR
COATING & PAINTING
STEEL WATER STORAGE TANKS**

GENERAL

1. SCOPE

- A. The work of this section includes the coating of all interior surfaces, and the painting of all exterior surfaces.

2. RELATED WORK SPECIFIED ELSEWHERE (If Applicable)

- A. Coating and painting of all other surfaces is specified in Section 9. – “Special Surface Preparation”.

3. REFERENCE SPECIFICATIONS AND STANDARDS

- A. Without limiting the general aspects of other requirements of these specifications, all surface preparation, coating and painting of interior and exterior surfaces and inspection shall conform to the applicable requirements of the Steel Structures Painting Council, NACE International, ASTM (American Society for Testing and Materials), AWWA D102-97 and the manufacturer's printed instructions.
- B. The **ENGINEER'S** decision shall be final as the interpretation and/or conflict between any of the referenced specifications and standards contained herein.

4. CONTRACTOR

- A. The **CONTRACTOR** shall have three years or greater practical experience and a successful history in the application of specified product to surfaces of steel elevated water tanks. Upon request, he shall substantiate this requirement by furnishing a list of references and job completions.
- B. The **CONTRACTOR** shall submit with his bid a written statement by the coating's manufacturer stating that the **CONTRACTOR** is familiar with the materials specified and has workers capable of performing the work specified herein.
- C. The personnel performing the work shall be knowledgeable and have the required experience and skill to adequately perform the work for this project, in accordance with SSPC-PA1, “Shop, Field and Maintenance Painting”, and AWWA D102-96.

5. QUALITY ASSURANCE

- A. **General:** Quality assurance procedures and practices shall be utilized to monitor all phases of surface preparation, application and inspection throughout the duration of the project. Procedures or practices not specifically defined herein may be utilized provided they meet recognized and accepted professional standards and are approved by the **ENGINEER**.
- B. **Surface Preparation:** Surface preparation will be based upon comparison with: "Pictorial Surface Preparation Standards for Painting Steel Surfaces: SSPC-VIS 1-89", ASTM Designation D2200-95, "Standard Methods of Evaluating Degree of Rusting on Painted Surfaces", ASTM D 4417-91, Method A and/or Method C or NACE Standard RP0287-87, and ASTM Designation D610 "Visual Standard for Surfaces of New Steel Airblast Cleaned with Sand Abrasive". In all cases the written standard shall take precedence over the visual standard. In addition, NACE Standard RP0178-91, along with the Visual Comparator, shall be used to verify the surface preparation of welds.
- C. **Application:** No coating or paint shall be applied when: 1) the surrounding air temperature or the temperature of the surface to be coated or painted is below the minimum surface temperature for the products specified herein, 2) rain, snow, fog or mist is present, 3) the surface temperature is less than 5F above the dew point, 4) the air temperature is expected to drop below the minimum temperature for the products specified within six hours after application of coating. Dewpoint shall be measured by use of an instrument such as a Sling Psychrometer in conjunction with U.S. Department of Commerce Weather Bureau Psychrometric Tables. If any of the above conditions are prevalent, coating or painting shall be delayed or postponed until conditions are favorable. The day's coating or painting shall be completed in time to permit the film sufficient drying time prior to damage by atmospheric conditions.
- D. **Thickness and Holiday Checking:** Thickness of coatings and paint shall be checked with a non-destructive, magnetic-type thickness gauge, as per SSPC-PA 2 "Measurement of Dry Film Thickness with Magnetic Gages". References in PA 2, which allow 80% of the minimum thickness specified are not acceptable. Use an instrument such as a Tooke Gauge if a destructive test is deemed necessary by the **ENGINEER**.

The integrity of interior coated surfaces shall be checked with a low voltage holiday detector in accordance with NACE Standard RP0188. Non-destructive holiday detector shall not exceed 67.5 volts, nor shall destructive holiday detector exceed the voltage recommended by the manufacturer of the coating system. A solution of 1 ounce non-sudsing type wetting agent, such as Kodak Photo-Flo, and 1 gallon of tap water shall be used to perform the holiday testing. All pinholes and/or holidays shall be marked and repaired in accordance with the

manufacturer's printed recommendations and retested. No pinholes or other irregularities will be permitted in the final coating.

- E. **Inspection Devices:** The **CONTRACTOR** shall furnish, until final acceptance of coating and painting is accepted, inspection devices in good working condition for detection of holidays and measurement of dry film thickness of coating and paint. The **CONTRACTOR** shall also furnish U.S. Department of Commerce, National Bureau of Standards certified thickness calibration plates and/or plastic shims, depending upon the thickness gauge used, to test the accuracy of dry film thickness gauges and certified instrumentation to test the accuracy of holiday detectors. Dry film gauges and holiday detectors shall always be made available for the **ENGINEER'S** use until final acceptance of application. Holiday detection devices shall be operated in the presence of the **ENGINEER**.
- F. **Inspection:** Inspection for this project shall consist of 'hold point' inspections. The **ENGINEER** or his representative shall inspect the surface prior to abrasive blasting, after abrasive blasting but prior to application of coating materials, and between subsequent coats of material. Final inspection shall take place after all coatings are applied, but prior to placing the tank in service. **CONTRACTOR** will insure that sufficient rigging is in place so that the **ENGINEER** or his representative shall be able to conduct the required inspections.
- G. **Warranty Inspection:** Warranty inspection shall be conducted during the eleventh month following acceptance of all coating and painting work. All defective work shall be repaired in accordance with this specification and to the satisfaction of the **ENGINEER** and/or **OWNER**.

6. **SAFETY AND HEALTH REQUIREMENTS**

- A. **General:** In accordance with requirements set forth by regulatory agencies applicable to the construction industry and manufacturer's printed instructions and appropriate technical bulletins and manuals, the **CONTRACTOR** shall provide and require use of personal protective lifesaving equipment for persons working on or about the project site.
- B. **Head and Face Protection and Respiratory Devices:** Equipment shall include protective helmets, which shall be worn by all persons while in the vicinity of the work. In addition, workers engaged in or near the work during sandblasting shall wear eye and face protection devices and air purifying half mask or mouthpiece respirators with appropriate filters. Barrier creams shall be used on any exposed areas of skin.

- C. **Ventilation:** Where ventilation is used to control hazardous exposure, all equipment shall be explosion-proof. Ventilation shall reduce the concentration of air contaminants to a degree a hazard does not exist. Air circulation and exhausting of solvent vapors shall be continued until coatings have fully cured.
- D. **Sound Levels:** Whenever the occupational noise exposure exceeds maximum allowable sound levels, the **CONTRACTOR** shall provide and require the use of approved ear protection devices.
- E. **Illumination:** Adequate illumination shall be provided while work is in progress, including explosion-proof lights and electrical equipment. Whenever required by the **ENGINEER**, the **CONTRACTOR** shall provide additional illumination and necessary supports to cover all areas to be inspected. The inspector shall determine the level of illumination for inspection purposes.
- F. **Temporary Ladders and Scaffolding:** All temporary ladders and scaffolding shall conform to applicable safety requirements. They shall be erected where requested by the **ENGINEER** to facilitate inspection and be moved by the **CONTRACTOR** to locations requested by the **ENGINEER**.

7. **PRODUCT DELIVERY, STORAGE & HANDLING**

- A. All materials shall be brought to the jobsite in original sealed containers. They shall not be used until the **ENGINEER** has inspected the contents and obtained data from information on containers or label. Materials exceeding storage life recommended by the manufacturer shall be rejected.
- B. All coatings and paints shall be stored in enclosed structures to protect them from weather and excessive heat or cold. Flammable coatings and paints must be stored to conform to City, County, State and Federal safety codes for flammable coating or paint materials. At all times coatings and paints shall be protected from freezing.

MATERIALS

1. **ACCEPTABLE MANUFACTURERS**

- A. Materials specified are those that have been evaluated for the specific service. Products of the Tnemec Company, Inc. are listed to establish a standard of quality. Equivalent materials of other manufacturer's may be submitted on written approval of the **ENGINEER**. As part of the proof of quality, the **ENGINEER** will require at the cost of the **CONTRACTOR**, certified test reports from a nationally known, reputable and independent testing laboratory.

- B. Requests for substitution shall include manufacturer's literature for each product giving name, product number, generic type, descriptive information, solids by volume, recommended dry film thickness and certified lab test reports showing results to equal the performance criteria of the products specified herein. In addition, a list of five projects shall be submitted in which each product has been used and rendered satisfactory service.
- C. All requests for product substitution shall be made at least 10 days prior to the bid date.
- D. Any material savings shall be passed to the **OWNER** in the form of a contract dollar reduction.
- E. Manufacturer's color charts shall be submitted to the **ENGINEER** at least 30 days prior to coating and/or paint application. General Contractor and Painting Contractor shall coordinate work so as to allow sufficient time (normally seven to ten days) for paint to be delivered to the job site.

2. **GENERAL REQUIREMENTS**

- A. All materials shall be lead-free as defined by the Consumer Product Safety Act, Part 1303.
- B. All zinc dust pigment contained in any zinc-rich material shall meet the requirements of ASTM D 520 Type III as regards zinc content and purity.
- C. All materials for the interior wetted portion of the tank shall meet the requirements of ANSI/NSF Standard 61 for potable water contact.
- D. All high gloss clear coat products shall incorporate the use of a fugitive dye to aid in the proper application and coverage of such coats.

3. **MATERIAL PREPARATION**

- A. Mix and thin materials according to manufacturer's latest printed instructions.
- B. Do not use materials beyond manufacturer's recommended shelf life.
- C. Do not use mixed materials beyond manufacturer's recommended pot life.

4. **TANK INTERIOR COATING SYSTEMS**

A. **Premier Three Coat System:**

1. **Surface Preparation Prior to Abrasive Blast Cleaning:** Weld flux and spatter shall be removed by power tool cleaning. Sharp projections shall be ground to a smooth contour. All welds shall be ground to a smooth contour as per NACE Standard RP0178 and herein.

2. **Surface Preparation:** SSPC-SP10 Near-White Metal Blast Cleaning. Anchor profile shall be 1.5 to 2.5 mils as per ASTM D 4417, Method C or NACE Standard RP0287.

3. **Coating System:**

Stripe Coat: Tnemec Series 91-H2O Hydro-Zinc 2000 applied by brush and scrubbed into all weld seams. In addition to weld seams, all edges, corners, bolts, rivets, pits shall receive a stripe coat.

1st Coat: Tnemec Series 91-H2O Hydro-Zinc 2000 applied at 2.5 to 3.5 dry mils. Thin only with approved thinner, Tnemec 41-2 or 41-3 Thinner.

2nd Coat: Tnemec Series 20-1255 Beige Pota-Pox applied at 4.0 to 6.0 dry mils. Thin only with approved thinner, Tnemec 41-4 Thinner.

3rd Coat: Tnemec Series 20-WH02 Tank White Pota-Pox applied at 4.0 to 6.0 dry mils. Thin only with approved thinner, Tnemec 41-4 Thinner.

Total dry film thickness shall be a minimum of 12.0 mils per SSPC-PA 2 dry film inspection standards, with exception as noted in this specification.

For cold weather applications, substitute Tnemec Series FC20 in lieu of Series 20.

B. **Standard Three Coat System:**

1. **Surface Preparation Prior to Abrasive Blast Cleaning:** Weld flux and spatter shall be removed by power tool cleaning. Sharp projections shall be ground to a smooth contour. All welds shall be ground to a smooth contour as per NACE Standard RP0178 and herein.

2. **Surface Preparation:** SSPC-SP10 Near-White Metal Blast Cleaning. The anchor profile shall be 1.5 to 2.5 mils as per ASTM D 4417, Method C or NACE Standard RP0287.

3. **Coating System:**

Stripe Coat: Tnemec Series 20-1255 Beige Pota-Pox applied by brush and scrubbed into all weld seams. In addition to welding seams, all edges, corners, bolts, rivets, pits shall receive a stripe coat.

1st Coat: Tnemec Series 20-WH02 Tank White Pota-Pox applied at 3.0 to 5.0 dry mils. Thin only with approved thinner, Tnemec 41-4 Thinner.

2nd Coat: Tnemec Series 20-1255 Beige Pota-Pox applied at 4.0 to 6.0 dry mils. Thin only with approved thinner, Tnemec 41-4 Thinner.

3rd Coat: Tnemec Series 20-WH02 Tank White Pota-Pox applied at 4.0 to 6.0 dry mils. Thin only with approved thinner, Tnemec 41-4 Thinner.

Total dry film thickness shall be a minimum of 12.0 mils per SSPC-PA 2 dry film inspection standards, with exception as noted in this specification.

For cold weather applications, substitute Tnemec Series FC20 in lieu of Series 20.

5. **TANK INTERIOR COATING SYSTEMS - DRY AREAS**

- A. **Zinc/Epoxy System:**

1. **Surface Preparation Prior to Abrasive Blast Cleaning:** Weld flux and spatter shall be removed by power tool cleaning. Sharp projections shall be ground to a smooth contour. All welds shall be ground to a smooth contour as per NACE Standard RP0178 and herein.
2. **Surface Preparation:** SSPC-SP10 Near-White Metal Blast Cleaning. Anchor profile shall be 1.5 to 2.5 mils as per ASTM D 4417, Method C or NACE Standard RP0287.

3. **Coating System:**

Stripe Coat: Tnemec Series 91-H2O Hydro-Zinc 2000 applied by brush and scrubbed into all weld seams. In addition to weld seams, all edges, corners, bolts, rivets, pits shall receive a stripe coat.

1st Coat: Tnemec Series 91-H2O Hydro-Zinc 2000 applied at 2.5 to 3.5 dry mils. Thin only with approved thinner, Tnemec 41-2 or 41-3 Thinner.

2nd Coat: Tnemec Series 20-1255 Beige Pota-Pox applied at 4.0 to 6.0 dry mils. Thin only with approved thinner, Tnemec 41-4 Thinner.

Total dry film thickness shall be a minimum of 8.0 mils per SSPC-PA 2 dry film inspection standards, with exception as noted in this specification.

For cold weather applications, substitute Tnemec Series FC20 in lieu of Series 20.

B. **Epoxy System:**

1. **Surface Preparation Prior to Abrasive Blast Cleaning:** Weld flux and spatter shall be removed by power tool cleaning. Sharp projections shall be ground to a smooth contour. All welds shall be ground to a smooth contour as per NACE Standard RP0178 and herein.

2. **Surface Preparation:** SSPC-SP10 Near-White Metal Blast Cleaning. Anchor profile shall be 1.5 to 2.5 mils as per ASTM D 4417, Method C or NACE Standard RP0287.

3. **Coating System:**

Stripe Coat: Tnemec Series 20-1255 Beige Pota-Pox applied by brush and scrubbed into all weld seams. In addition to weld seams, all edges, corners, bolts, rivets, pits shall receive a stripe coat.

1st Coat: Tnemec Series 20-WH02 Tank White Pota-Pox applied at 3.0 to 5.0 dry mils. Thin only with approved thinner, Tnemec 41-4 Thinner.

2nd Coat: Tnemec Series 20-1255 Beige Pota-Pox applied at 4.0 to 6.0 dry mils. Thin only with approved thinner, Tnemec 41-4 Thinner.

Total dry film thickness shall be a minimum of 8.0 mils per SSPC-PA 2 dry film inspection standards, with exception as noted in this specification.

For cold weather applications, substitute Tnemec Series FC20 in lieu of Series 20.

6. **TANK EXTERIOR COATING SYSTEMS**

A. **Premier Three Coat System Where Extended Color and Gloss Retention are desired:**

1. **Surface Preparation Prior to Abrasive Blast Cleaning:** Weld flux and spatter shall be removed by power tool cleaning. Sharp projections shall be ground to a smooth contour. All welds shall be ground to a smooth contour as per NACE Standard RP0178 and herein.

2. **Surface Preparation:** SSPC-SP6 Commercial Blast Cleaning. Anchor profile shall be 1.5 to 2.0 mils as per ASTM D 4417, Method C or NACE Standard RP0287.

3. **Coating System:**

1st Coat: Tnemec Series 90-97 Tneme-Zinc applied at 2.5 to 3.5 dry mils. Thin only with approved thinner, Tnemec 41-2 or 41-3 Thinner.

2nd Coat: Tnemec Series 20-1255 Beige Pota-Pox applied at 4.0 to 6.0 dry mils. Thin only with approved thinner, Tnemec 41-4 Thinner.

3rd Coat: Tnemec Series 73-Color Endura-Shield applied at 2.0 to 3.0 dry mils. Thin only with approved thinner, Tnemec 41-42 Thinner for spray, 41-39 for brush or roller.

Total dry film thickness shall be a minimum of 10.0 mils per SSPC-PA 2 dry film inspection standards, with exception as noted in this specification.

B. **Three Coat System Where Extended Color and Gloss Retention are desired:**

1. **Surface Preparation Prior to Abrasive Blast Cleaning:** Weld flux and spatter shall be removed by power tool cleaning. Sharp projections shall be ground to a smooth contour. All welds shall be ground to a smooth contour as per NACE Standard RP0178 and herein.

2. **Surface Preparation:** SSPC-SP6 Commercial Blast Cleaning. Anchor profile shall be 1.5 to 2.0 mils as per ASTM D 4417, Method C or NACE Standard RP0287.

3. **Coating System:**

1st Coat: Tnemec Series 66-1255 Hi-Build Epoxoline applied at 3.0 to 5.0 dry mils. Thin only with approved thinner, Tnemec 41-4 Thinner.

2nd Coat: Tnemec Series 73-Color Endura-Shield applied at 3.0 to 5.0 dry mils. Thin only with approved thinner, Tnemec 41-42 Thinner for spray, 41-39 for brush or roller.

3rd Coat: Tnemec Series 76-0076 Endura-Clear applied at 1.0 to 2.0 dry mils. Thin only with approved thinner, Tnemec 41-2 Thinner.

Total dry film thickness shall be a minimum of 8.5 mils per SSPC-PA 2 dry film inspection standards, with exception as noted in this specification.

C. **Dry-Fall Three-Coat System:**

1. **Surface Preparation Prior to Abrasive Blast Cleaning:** Weld flux and spatter shall be removed by power tool cleaning. Sharp projections shall be ground to a smooth contour. All welds shall be ground to a smooth contour as per NACE Standard RP0178 and herein.

2. **Surface Preparation:** SSPC-SP6 Commercial Blast Cleaning. Anchor profile shall be 1.5 to 2.0 mils as per ASTM D 4417, Method C or NACE Standard RP0287.

3. **Coating System:**

1st Coat: Tnemec Series 91-H2O Hydro-Zinc 2000 applied at 2.5 to 3.5 dry mils. Thin only with approved thinner, Tnemec 41-2 or 41-3 Thinner.

2nd Coat: Tnemec Series 26-Color Ty-Cryl applied at 2.0 to 3.0 dry mils. Thin with clean water.

3rd Coat: Tnemec Series 30-Color Spra-Saf EN applied at 3.0 to 4.0 dry mils. Thin with clean water.

Total dry film thickness shall be a minimum of 8.5 mils per SSPC-PA 2 dry film inspection standards, with exception as noted in this specification.

D. Standard Three-Coat System:

1. **Surface Preparation Prior to Abrasive Blast Cleaning:** Weld flux and spatter shall be removed by power tool cleaning. Sharp projections shall be ground to a smooth contour. All welds shall be ground to a smooth contour as per NACE Standard RP0178 and herein.
2. **Surface Preparation:** SSPC-SP6 Commercial Blast Cleaning. Anchor profile shall be 1.5 to 2.0 mils as per ASTM D 4417, Method C or NACE Standard RP0287.
3. **Coating System:**
 - 1st Coat: Tnemec Series 66-1255 Hi-Build Epoxoline applied at 3.0 to 5.0 dry mils. Thin only with approved thinner, Tnemec 41-4 Thinner.
 - 2nd Coat: Tnemec Series 66-Color Hi-Build Epoxoline applied at 4.0 to 6.0 dry mils. Thin only with approved thinner, Tnemec 41-4 Thinner.
 - 3rd Coat: Tnemec Series 74-Color Endura-Shield applied at 3.0 to 5.0 dry mils. Thin only with approved thinner, Tnemec 41-42 Thinner for spray, 41-39 for brush or roller.

Total dry film thickness shall be a minimum of 11.0 mils per SSPC-PA 2 dry film inspection standards, with exception as noted in this specification.

E. Standard Two Coat System:

1. **Surface Preparation Prior to Abrasive Blast Cleaning:** Weld flux and spatter shall be removed by power tool cleaning. Sharp projections shall be ground to a smooth contour. All welds shall be ground to a smooth contour as per NACE Standard RP0178 and herein.
2. **Surface Preparation:** SSPC-SP6 Commercial Blast Cleaning. Anchor profile shall be 1.5 to 2.0 mils as per ASTM D 4417, Method C or NACE Standard RP0287.
3. **Coating System:**

1st Coat: Tnemec Series 66-1255 Hi-Build Epoxoline applied at 3.0 to 5.0 dry mils. Thin only with approved thinner, Tnemec 41-4 Thinner.

2nd Coat: Tnemec Series 74-Color Endura-Shield applied at 3.0 to 5.0 dry mils. Thin only with approved thinner, Tnemec 41-42 Thinner for spray, 41-39 for brush or roller.

Total dry film thickness shall be a minimum of 8.0 mils per SSPC-PA 2 dry film inspection standards, with exception as noted in this specification.

EXECUTION

1. GENERAL

- A. All surface preparation, coating and painting shall conform to applicable standards of the Steel Structures Painting Council, NACE International and the manufacturer's printed instructions. Materials applied to the surface prior to the approval of the **ENGINEER** shall be removed and re-applied to the satisfaction of the **ENGINEER** at the expense of the **CONTRACTOR**.
- B. All work shall be performed by skilled craftsmen qualified to perform the required work in a manner comparable with the best standards of practice. Continuity of personnel shall be coordinated with the **ENGINEER**.
- C. The **CONTRACTOR** shall provide a supervisor at the work site during cleaning and application operations. The supervisor shall have the authority to sign and change orders, coordinate work and make decisions pertaining to the fulfillment of the contract.
- D. Dust, dirt, oil, grease or any foreign matter that will affect the adhesion or durability of the coating or paint must be removed by washing with clean rags dipped in an approved cleaning solvent and wiped dry with clean rags.
- E. Coating and painting systems include surface preparation, prime coating and finish coatings. Unless otherwise approved in writing by the **ENGINEER**, prime coating shall be field applied. Where prime coatings are shop applied, the **CONTRACTOR** shall instruct suppliers to provide the prime coat compatible with the specified finish coat. Any off-site work which does not conform to this specification, is subjected to damage during transportation, construction or installation shall be thoroughly cleaned and touched-up in the field as directed by the **ENGINEER**. The **CONTRACTOR** shall use repair procedures, which insure the complete protection of all adjacent primer. The specified repair method and equipment may include wirebrushing, hand or power tool cleaning, or dry air blast cleaning. In order to prevent injury to surrounding painted surfaces, blast cleaning

may require use of lower air pressure, smaller nozzle and/or abrasive blast particles, or shorter blast nozzle distances from surface shielding and masking. If damage is too extensive or uneconomical to touch-up, the entire item shall be blasted and then coated or painted as directed by the **ENGINEER**.

- F. The **CONTRACTOR'S** coating and painting equipment shall be designed for the application of materials specified and shall be maintained in first class working condition. Compressors shall have suitable traps and filters to remove water and oils from the air. **THE CONTRACTOR'S** equipment shall be subject to approval of the **ENGINEER**.
- G. Application of the first coat shall follow immediately after surface preparation and cleaning and stripe coat, if applicable, before rust bloom occurs or the same day, whichever is less. Any cleaned areas not receiving first coat within this period shall be re-cleaned prior to application of first coat. Use of dehumidification equipment shall be first reviewed by the **ENGINEER** and coatings manufacturer prior to deviating from this provision.
- H. Prior to assembly, all surfaces made inaccessible after assembly shall be prepared as specified herein and shall receive the coating or paint system specified.

2. **SURFACE PREPARATION**

- A. The latest revision of the following surface preparation specifications of the Steel Structures Painting Council (SSPC) shall form a part of this specification. The summaries listed below are for informational purposes; consult the actual SSPC specification for full detail.
 - 1. **Solvent Cleaning (SSPC-SP1):** Removal of oil, grease, soil and other contaminants by use of solvents, emulsions, cleaning compounds, steam cleaning or similar materials and methods that involve a solvent or cleaning action.
 - 2. **Hand Tool Cleaning (SSPC-SP2):** Removal of loose rust, loose mil scale and other detrimental foreign matter to a degree specified by hand chipping, scraping, sanding and wirebrushing
 - 3. **Power Tool Cleaning (SSPC-SP3):** Removal of loose rust, loose mil scale and other detrimental foreign matter by power wirebrushing, power impact tools or power sanders.
 - 4. **White Metal Blast Cleaning (SSPC-SP5/NACE No. 1):** Air blast cleaning to a gray-white uniform metallic color until each element of surface area is free of all visible residues.

5. **Commercial Blast Cleaning (SSPC-SP6 NACE No. 3):** Air blast cleaning until at least two-thirds of each element of surface area is free of all visible residues.
 6. **Brush-Off Blast Cleaning (SSPC-SP7 NACE No. 4):** Air blast cleaning to remove loose rust, loose mil scale and other detrimental foreign matter to a degree specified.
 7. **Near-White Metal Blast Cleaning (SSPC-SP10 NACE No. 2):** Air blast cleaning until at least 95% of each element of surface area is free of all visible residues.
 8. **Power Tool Cleaning to Bare Metal (SSPC-SP11):** Differs from SSPC-SP3 in that it requires more thorough cleaning and a surface profile not less than 1 mil.
- B.** Slag, weld metal accumulation and spatters not removed by the Fabricator, Erector or Installer shall be removed by chipping and/or grinding. All sharp edges shall be peened, ground or otherwise blunted as required by the **ENGINEER**. All grinding and finishing of welds, edges, etc. shall be performed prior to solvent cleaning and abrasive blasting. Welds shall be prepared as per NACE Standard RP0178 for all interior and exterior surfaces:
1. **Butt Welds:** Shall be ground smooth and free of all defects, designation "D".
 2. **Lap Welds:** Shall be ground smooth and blended., designation "D".
 3. **Fillet Welded Tee Joint:** Shall be ground smooth and blended, designation "D"
- C.** Field blast cleaning for all surfaces shall be by dry method unless otherwise directed. Blast nozzles shall be venturi-type nozzles with a minimum pressure at the nozzle of 90 psi.
- D.** Particle size of abrasives used in blast cleaning shall be that which will produce a 1.5- 2.5 mil (37.5 microns - 65.0 microns) surface profile or in accordance with recommendations of the manufacturer of the specified coating or paint system to be applied.

If the profile of the blasted steel exceeds the profile specified above, the **CONTRACTOR** shall be required to do one or both of the following:

1. Reblast the surface using a finer aggregate in order to produce the required profile.

2. Apply a thicker prime coat, if possible, given the limitations of the products being applied, in order to adequately cover the blast profile
- E. Abrasive used in blast cleaning operations shall be new, washed, graded and free of contaminants that would interfere with adhesion of coating or paint and shall not be reused unless specifically approved in writing by the **ENGINEER**.
- F. During blast cleaning operations, caution shall be exercised to insure, that existing coatings or paint are not exposed to abrasion from blast cleaning.
- G. The **CONTRACTOR** shall keep the area of his work and the surrounding environment in a clean condition. He shall not permit blasting materials to accumulate as to constitute a nuisance or hazard to the accomplishment of the work, the operation of the existing facilities or to the surrounding environment.
- H. Blast cleaned surfaces shall be cleaned prior to application of specified coatings or paint. All surfaces shall be free of dust, dirt, and other residue resulting from the abrasive blasting operation. No coatings or paint shall be applied over damp or moist surfaces.
- I. All welds shall be neutralized with a suitable chemical compatible with the specified coating or paint.
- J. **Specific Surface Preparation:** Surface preparation for the specific system shall be as noted in Sections 2.04, 2.05 and 2.06.

3. **APPLICATION, GENERAL**

- A. Coating and paint application shall conform to the requirements of the Steel Structure Painting Council Paint Application Specification SSPC-PA1, latest revision, for "Shop, Field and Maintenance Painting".
- B. Thinning shall be permitted only as recommended by the manufacturer and approved by the **ENGINEER**, and utilizing the thinners stated in Sections 2.04, 2.05 and 2.06.
- C. Each application of coating or paint shall be applied evenly, free of brush marks, sags, runs, with no evidence of poor workmanship. Care shall be exercised to avoid lapping on glass or hardware. Coatings and paints shall be sharply cut to lines. Finished surfaces shall be free from defects or blemishes.
- D. Protective coverings or drop cloths shall be used to protect floors, fixtures and equipment. Care shall be exercised to prevent coatings or paints from being

spattered onto surfaces that are not coated or painted. Report to the **ENGINEER** surfaces from which materials cannot be satisfactorily removed.

- E. When two coats of coating or paint are specified, where possible, the first coat shall contain enough approved color additive to act as an indicator of coverage or the two coats must be of contrasting color.
- F. Film thickness per coat as specified in Sections 4, 5 and 6 is the minimum required. If roller application is deemed necessary, the **CONTRACTOR** shall apply additional coats to achieve the specified thickness.
- G. All material shall be as specified.

4. COATING SYSTEMS APPLICATION

- A. After completion of surface preparation as specified for the specific system, materials shall be applied as noted in Sections 4, 5 and 6.
- B. Care shall be taken to eliminate overspray and dry spray on the tank interior. Where such conditions are encountered, the surface shall be cleaned of all over spray and dry spray prior to the application of the succeeding coat.

5. DISINFECTION

- A. Disinfection of interior surfaces shall be performed in the presence of the **ENGINEER** in accordance with all the requirements of applicable AWWA Standard C652 Method "3" and regulatory agencies.
- B. Disinfection shall be performed after protective coatings have been applied to the interior surfaces and allowed to thoroughly cure.
- C. Prior to disinfecting, the complete interior shall be washed down with clean water and thoroughly flushed out.
- D. All interior surfaces shall be thoroughly washed with a solution having minimum chlorine content of 50 PPM. Chlorine solution accumulated on the bottom shall be drained to waste. Rinsing with clean water is not required.

6. SOLVENT VAPOR REMOVAL

- A. All solvent vapors shall be completely removed by suction-type exhaust fans and blowers before placing tank in operating service.

- B. All solvent vapors will be exhausted both during and after coating application at a minimum rate of one air change every four hours to allow the proper curing of the coating material. High rates of production may require an increase in ventilation.
- C. Ventilation shall be continued until such time as the coating has reached "full cure" as specified by the coating manufacturer.

7. **CLEAN UP**

- A. Upon completion of the work, all staging, scaffolding and containers shall be removed from the site or destroyed in a manner approved by the **ENGINEER**. Coating or paint spots or oil stains upon adjacent surfaces shall be removed and the jobsite cleaned. All damage to surfaces resulting from the work of this section shall be cleaned, repaired or refinished to the satisfaction of the **ENGINEER** at no cost to the **OWNER**.

8. **ONE YEAR ANNIVERSARY INSPECTION**

- A. **OWNER** shall set a date for a one-year inspection.
- B. The inspection will be attended by an **OWNER'S** representative, **ENGINEER**, and painting contractor.
- C. Any deficiencies in the coatings system will be repaired at the **CONTRACTOR'S** expense.

9. **SPECIAL SURFACE PREPARATION**

- A. The surface preparation and materials application shall conform to the specifications and recommendations of the Steel Structures Painting Council.
 - 1. **Piping, Valves and Fittings:** Yard piping, valves and fittings, hand or power tool cleaned to bare metal.
 - 2. **Yard Piping, Valves and Fittings**
 - A. **Exposed Exterior Surfaces***
 - 1st Coat: Tnemec Series 20-1255 Beige Pota-Pox applied at 4.0 to 6.0 dry mils. Thin only with approved thinner, Tnemec 41-4 Thinner.
 - 2nd Coat: Tnemec Series 73-Color Endura-Shield applied at 2.0 to 3.0 dry mils. Thin only with approved

thinner, Tnemec 41-42 Thinner for spray, 41-39 for brush or roller.

3rd Coat: Tnemec Series 76-0076 Endura-Clear applied at 1.0 to 2.0 dry mils. Thin only with approved thinner, Tnemec 41-2 Thinner.

*** Total dry film thickness shall be a minimum of 8.0 mils per SSPC-PA 2 dry film inspection standards, with exception as noted in this specification.**

Surface preparation and application of coating shall be in strict accordance with painting direction and instruction as supplied by coating manufacturer.

* Color in accordance with requirements of the Texas Department of Health.

Other manufacturers of paint equal to specified paint will be considered upon submittal.

EARTHWORK

1 GENERAL

The work under this section consists of furnishing all material and equipment and performing all necessary labor for excavating, back-filling, and grading, including all incidental work as indicated on the drawings, specified herein, or as required for the satisfactory completion of the work in accordance with the drawings and specifications. The work shall include the handling and disposing of all material required to be excavated in the performance of the work, regardless of the type, character, or composition of such material encountered.

The construction of the work specified above shall be performed in harmony with all other work being done at the site. In the event of interference or conflict of any phase of the work with other work being executed at the same time, it shall be referred to the **ENGINEER** whose decision shall be final.

2 DEFINITION

The term "**excavation**" shall refer to any and all material excavated, for whatever purpose, in accordance with the terms of the specifications and drawings, and shall include all subsequent handling and disposing of such material, together with the preparation of all subgrades.

Work which includes excavation shall cover the removal of the specified material and all subsequent handling thereof and shall include:

- a. Cleaning and preparation of the excavation site.
- b. All sheeting, shoring, bracing, protection of adjacent property, preparation of all subgrades, storage of excavated materials, when necessary, backfilling, tamping, compacting of embankments, grading and surfacing.
- c. Moving, hauling, otherwise transporting excavated materials from whatever source and wasting excess excavated materials where and as required by the drawings and specifications, or as directed by the **ENGINEER**.

3 EXCAVATION

3.01 Site Preparation -- All sites to be occupied by permanent construction or embankments shall be cleared of all logs, trees, roots, brush, tree trimmings, and other objectionable materials and debris. Subgrades for fills and embankments shall be cleaned and stripped of all surface vegetation, sod, and organic topsoil. All **soft** soils within the site area

shall be removed to the level of firm materials as determined by the **ENGINEER** or otherwise indicated by the drawings.

3.02 Structures — All excavation shall be done to exact line and grade as indicated on the drawings or otherwise specified. The **CONTRACTOR** shall plan the work in advance of operations so that it will not be necessary to make excavation in new fill. The excavation shall be made to and within vertical planes or lines three (3) feet outside the outside surfaces of walls or structures measured at the side surfaces of walls or structures measured at the junction of the wall with wall footings or base of the structures; however, if required by the drawings or if, in the opinion of the **ENGINEER**, it is considered desirable, excavation may be limited to the outside face of the footing or wall lines and concrete may be placed directly against the face of the excavated wall. Where footings extend more than three (3) feet outside wall surface at junction with footings, excavation will be extended to and between vertical planes or lines, passing through the outside edges of the footings. The footings shall be excavated to the depth shown on the drawing unless additional depths are required by the **ENGINEER**, in order to obtain a firm surface for footings.

Unauthorized excavation below slabs on fill shall be filled with material used for subgrade. Unauthorized excavation below grade beams or footings shall be filled with concrete at the expense of the **CONTRACTOR** at the same time the beams or footings are poured. In making such concrete fill, all loose material shall be removed before concrete is placed to provide a solid and undisturbed condition of the subgrade.

Where excavation occurs, as directed by the **ENGINEER**, to remove objectionable materials the excavated area shall be backfilled to the proper line and grade with a select material that has been approved by the **ENGINEER**.

The **CONTRACTOR** shall exercise extreme care in excavating to avoid damaging existing utilities. In case any of the utilities are damaged due to the **CONTRACTOR'S** operations, such damages shall be promptly repaired at his expense, as directed by the **ENGINEER**.

4

EXCESS EXCAVATED MATERIAL

All material which is not acceptable or necessary for backfilling or filling, shall be removed in an approved manner as directed by the **ENGINEER**.

5. REMOVAL OF WATER

The CONTRACTOR shall at all times during the construction of the work provide and maintain ample equipment to remove and dispose of all water entering the excavation or other parts of the work and keep said excavations dry until the structures to be built therein are completed. No reinforcing steel shall be placed in water, and no water shall be allowed to rise over any reinforcing steel before the concrete has been placed. No water shall be allowed to come in contact with any concrete within twenty-four (24) hours after placing unless specifically required by the drawings or specifications or authorized by the ENGINEER. Any sewer drains or other conduits or pipelines, which may be used for drainage purposes, shall be clean and free from all sediment.

6. FILLING AND BACKFILLING

6.01 Structures — If the drawings require that a fill be made beneath a concrete floor, the concrete floor to rest thereon, or where the drawings show piping, conduits, or other work installed in trenches beneath concrete or masonry structures or floors, which are not encased in concrete and which require a backfill, all such backfilling between the original ground surface and the floor or footing subgrades shall be made with granular material such as sand, gravel, rock screenings, or other approved material that is free from clay or other substances that would prevent the free passage of water through the backfill. This backfill shall be made after the concrete walls of the substructures have been completed.

Where mechanical compacting is permitted, the backfill shall be deposited and spread and thoroughly compacted by tamping or by rolling with a heavy roller. The ground surface at the site of any floor, which is to be supported on a fill, shall be cleared of all vegetation and debris prior to starting excavation for any wall or other footings adjacent to or beneath such floor.

Prior to making the backfill, the ground surface shall be thoroughly compacted. Backfilling outside the structures may be compacted by tamping. Consolidation of backfill by puddling with water will not be permitted.

6.02 After the structures have been constructed and all backfilling and embankments completed and settled, all areas on the side of the work which are to be graded shall be brought to the true grade at the specified elevations and slopes. All slopes shall be trimmed and dressed by hand, and all surfaces so graded that effective drainage is secured. All grading and surfacing shall be completed to the satisfaction of the ENGINEER.

NOTE: ALL STRUCTURAL FILLS AND BACKFILLS ARE TO BE COMPACTED TO A DENSITY OF 95% USING THE STANDARD PROCTOR TEST. BACKFILLS OUTSIDE OF WALLS SHALL BE COMPACTED TO A DENSITY OF 85% USING THE STANDARD PROCTOR TEST

CONCRETE CONSTRUCTION

1. DESCRIPTION

Extent of work: This item governs the construction of concrete structures and incidental repairs to concrete pavement, sidewalks, curbs, driveways, etc. **CONTRACTOR** assumes responsibility for design of concrete.

2. QUALITY ASSURANCE

2.01 Submittals – Mix designs for strength.

2.02 Tests – Make test specimens to maintain check on concrete strength throughout job.

a. Water-Soluble Chloride Ion – Water-soluble chloride ion testing shall be performed in accordance with ASTM C1218.

b. Compression Tests – One set of four concrete compression test cylinders shall be made each day when 25 to 50 cubic yards of concrete are placed. One additional set of test cylinders shall be made from each additional 50 cubic yards or major fraction thereof, placed in any one day. Two cylinders of each set shall be tested at an age of 7 days and the remaining cylinders shall be tested at an age of 28 days.

Test cylinders shall be 6 inches in diameter by 12 inches high and shall be made, cured, stored, and delivered to the laboratory in accordance with ASTM C31 and tested in accordance with ASTM C39.

Each set of compression test cylinders shall be marked or tagged with the date and time of day the cylinders were made, the location in the work where the concrete represented by the cylinders was placed, the number of the delivery truck or batch, the air content, the slump, the unit weight, and the concrete temperature.

Compression tests will be evaluated in accordance with ACI 318. The strength level of the concrete will be considered satisfactory when the averages of all sets of three consecutive strength tests equal or exceed the specified compressive strength, and no individual strength test result falls below the specified compressive strength by more than 500 psi (3.5 MPa). A strength test shall be the average of the compressive strengths of two cylinders made from the same concrete sample tested at 28 days.

Concrete strength will be only one of the criteria used for evaluation and acceptance of the concrete. The results of all tests performed on the concrete and other data and information concerning the procedures used for handling, placing, and curing will be used to evaluate the concrete for compliance with the specified requirements.

c. Shrinkage Tests – Concrete shrinkage tests shall be performed once for each 1,000 cubic yards of concrete with controlled shrinkage that is placed and shall be made on concrete from a batch of concrete from which concrete compression test cylinders are made. Shrinkage testing shall be conducted as specified for the preliminary trial mixes.

The average drying shrinkage of each set of test specimens cast in the field from concrete delivered to the site as measured at the 21 days' drying age shall not exceed 0.048 percent for concrete to be used in liquid-containing structures and 0.064 percent for concrete to be used for other structural concrete.

- d. Test Reports -- Two copies of each test report shall be prepared and distributed by the testing laboratory to the **ENGINEER** and the **CONTRACTOR**, in accordance with the quality control section.

3. MATERIALS

3.01 Concrete -- Ready mixed conforming to ASTM-C94 or site mixed.

- a. Cement -- ASTM-C150, Type 1; no caked cement; one brand for one structure; deliver in bags for site mixing.
- b. Water -- Free from oils, acids, alkalis, organic matter, salts, or other deleterious substances.
- c. Coarse Aggregate -- ASTM-C33; maximum size ½ inch.
- d. Fine Aggregate - Natural sand meeting requirements of ASTM-C33.
- e. Admixtures -- Combination of admixtures, which cause premature or local dehydration, or post-compaction settlement of the concrete surface shall not be used. If any such undesirable characteristics are observed, the use of the mix shall be discontinued and an alternate mix design used.

Unless otherwise specified, a water-reducing admixture shall be included in all concrete. Unless otherwise specified, a superplasticizer shall also be used in all concrete in liquid-containing structures, concrete containment structures, all concrete in contact with the earth and, at the option of the **CONTRACTOR**, may be used in all other concrete. When a superplasticizer is used, the admixture manufacturer shall recommend to the **ENGINEER** in writing the type of superplasticizer to be used with the required water-reducing admixture to achieve the specified initial set times. Superplasticizers may be dispensed into the concrete at the plant or on the jobsite and shall be mixed in accordance with the admixture manufacturer's recommendations. Each superplasticizer dose, when dispensed at the site, shall be easily verifiable. The superplasticizer for each load shall be accurately proportioned into a separate container prior to dispensing the admixture into the concrete. When truck-mounted dispensers are used, the system shall not be flushed or cleaned with water until after the entire load of concrete has been discharged. When permitted by the **ENGINEER**, redosing of concrete with superplasticizer shall be done only once. Redosing procedures shall be as recommended by the admixture manufacturer.

1. Air-entraining admixture conforming to requirements of ASTM-C260.
2. Water-reducing and retarding admixture in accordance with ASTM-C494, Type A or Type D.
3. High range water-reducing admixture (superplasticizer) in accordance with ASTM-C494, Type F or Type G.

f. Classification –

Class	Type	Min. 28-day Compressive Strength (Lbs. per Square In.)	Max. Water Content per Bags of Cement (Gal.)	Min. Cement (Bags per Cu. Yd.)	Consistency Range in Slump (In.)	Air Content (%)
A	Structural	3,000	6.25	5.25	2½ to 4½	2½ to 4½
B	Slope Paving or Fill	2,000	8.5	4.25	2½ to 4	2½
C	Pipe Blocking	1,500	11.0	3.0	3 to 5	3 to 6
D	Seal Slab	--	--	4.0	6 to 8	As needed

Include in maximum water, free water in aggregate minus absorption of aggregate based on a thirty-minute absorption period.

3.02 Reinforcing Steel

- a. Bars – ASTM-A615, Grade 60 (deformed).
- b. Welded Wire Fabric – ASTM-A185.

3.03 Expansion Joint – Preformed rubber or cork in accordance with ASTM-D1752.

3.04 Curing Material

- a. Water – Free from oils, acids, alkalis, salts, or other deleterious materials.
- b. Cotton Mats – Filling material of cotton “bat” (min. 12 oz. Per sq. yd.) with unsized cloth covering (min. 6 oz. Per sq. yd.)

3.05 Timber – Seasoned, of good quality, and free from loose or unsound knots, knot holes, twists, shakes, or decay.

3.06 Nonshrinking Grout – Premixed grout, which is nonmetallic, noncorrosive, and nonstaining; containing specifically selected silica sands, cement, shrinkage compensating agents, plasticizing and water reducing agents.

- a. Conform to requirements of Corps of Engineers CRD-C621-82B.
- b. Yield of 0.9 cubic foot to 1.0 cubic foot per 100 pounds.
- c. Mixing water per 100 pounds.
 1. Stiff – 2 gallons
 2. Plastic – 2-¼ gallons
 3. Flowable – 2-½ gallons
- d. Minimum 28-day compressive strength of 8,000 psi.

- e. Maintain grout temperature during placement between 50°F and 90°F.
- 3.07 Polyethylene Film for Permanent Moisture Barriers – Minimum thickness .006 inches (six mils) and high impact-strength rating.
- 3.08 Concrete Bonding Agent – “Daraweld-C” as manufactured by W.R. Grace and Co., or “Bond Crete-S” as manufactured by Burke Concrete Accessories, Inc.

4. CONSTRUCTION

4.01 Forms

- a. Timber – Mortar tight; smooth surface; true to line and grade, and adequately braced.
- b. Provide plywood or masonite surfaces for concrete faces to be rub finished.

4.02 Mixing Concrete

- a. Mix and deliver in accordance with ASTM-C94.
- b. Clean and maintain equipment for good operation.
- c. Job-mix concrete in approved type mixer for minimum of 1½ minutes for 1 cubic yard batch. Add 15 seconds for each half-yard increase over 1 cubic yard batch.
- d. Do not mix when air temperature is 40° F and falling.

4.03 Structural Concrete – Unless otherwise specified, all concrete shall be structural concrete that conforms to all specified limiting requirements and this specification.

- a. Structural Pea Gravel Concrete – Structural pea gravel concrete shall be used in all areas where the clear distance between reinforcement, conduit, or embedded items is less than the least dimension of coarse aggregate particles in the structural concrete. Structural pea gravel concrete shall conform to all specified limiting requirements, except maximum nominal size of coarse aggregate. Maximum nominal size of coarse aggregate shall be ½ inch (12 mm) for concrete mixes to be placed and consolidated in portions of structures congested with reinforcing steel, conduits, and embedded items.
- b. Concrete for Pipe Blocking, Pipe Encasement, Concrete Fill, and Duct Banks – Concrete for buried pipe blocking, pipe encasement, concrete fill, and duct banks shall have a minimum compressive strength of 3,000 psi (21 MPa) at 28 days, a minimum cement content of 520 pounds per cubic yard (308 kg/m³), a maximum coarse aggregate size of 1 inch (25 mm), and a maximum slump of 6 inches (150 mm). Air entraining, water reducing, and superplasticizing admixtures may be omitted.

All reinforcement and other magnetic materials installed in duct banks shall be installed parallel to the individual ducts, unless they enclose all the ducts of the duct bank.

4.04 Placing Concrete

a. General Requirements

1. Give 24 hours notice before placement.
2. Place in daylight hours.
3. Discharge within one hour after start of mixing.

b. Handling and Transporting

1. Use method to prevent segregation.
2. Use buckets, chutes, buggies, pipes, or troughs.
3. Protect against sun and wind, to prevent loss of slump and workability.
4. Use of aluminum equipment not permitted.

5. Placement Sequence – To minimize the effect of shrinkage in producing cracks, the concrete for the ground storage tanks, solids contact clarifiers, filters, clearwells, and chlorine dioxide basins shall be placed as follows:

a. Bottom Slab – Each bottom slab shall be divided into sections by the construction joints as indicated on the drawings and, when not indicated on the drawings, into approximately square sections not greater than 60 feet (18m) in their longest dimension. Bottom slabs with radial and circumferential reinforcement patterns may be divided into pipe-shaped segments with the longest dimension not greater than 60 feet (18 m). A section near the center of each structure shall be placed first. Sections shall be placed alternately, first on one side and then on the other side of previously placed sections. Placement shall be scheduled so that two adjacent sides of each section are free, except at closures.

b. Walls – Walls shall be divided into sections by the construction joints as indicated on the drawings and, when not indicated on the drawings, into sections not greater than 60 feet (18 m) in length. A section near the center of each wall shall be placed first. Sections shall be placed alternately, first on one side and then on the other side of the previously placed section. Placement shall be scheduled so that one end of each section is free, except at corner closures.

c. Top Slab – Each top slab shall be placed in the manner described for the bottom slab.

No two abutting sections shall be placed within a period of 72 hours, unless otherwise authorized by the ENGINEER.

c. Depositing

1. Continuous horizontal layer 12 inches thick.

2. Limit free fall to 5 feet.
3. Use tremies for free fall over 5 feet.
4. The minimum temperature of all concrete at time of placement to be not less than 50° F.
5. Concrete temperature at time of placement not to exceed 85° F, plus a maximum tolerance of 5° F.
6. Use retarding agent for air temperatures above 85° F.
7. Provide a thermometer for temperature verification.
8. Concrete temperatures outside of limits specified will be rejected.

4.07 Curing Concrete

- a. Cure for six consecutive curing days.
- b. Cure high-early-strength concrete for three consecutive curing days.
- c. "Curing Day" is a calendar day whose temperature is above 50° F for at least 19 hours.

4.08 Form Removal

- a. Remove forms under slabs, beams, or girders after seven days.
- b. Remove all other forms after two days.

4.09 Patching Concrete – Patch honeycomb and tie holes.

4.10 Defective Work – Repair or replace immediately after form removal at **CONTRACTOR'S** expense.

4.11 Slab Finish – Wood float, or steel trowel, if designated on PLANS.

4.12 Rub-Finished Surfaces

- a. Rub-finish exposed vertical and battered surfaces from 6 inches below final ground line or low water to top.
- b. No rubbing is required for structures extending 12 inches or less above ground or water.
- c. Provide two rubbings.
 1. First with No. 16 carborundum stone.
 2. Second with No. 30 carborundum stone.
- d. Finish provides clean, smooth, uniform surface.

4.13 Grout – One part Portland cement to two parts sand.

4.14 Construction Joints – As shown or as approved.

4.15 Reinforcing Steel

- a. Bend, clean, place, and tie in accordance with ACI Standards.
- b. Splice bars with calculated stress in accordance with table shown on PLANS.
- c. Lap all bars not carrying design stress 30 diameters, but not less than 12 inches.

4.16 Cleanup – Clean area from time to time during construction, and clean area completely after completion of work.

5. MEASUREMENT AND PAYMENT

5.01 No separate measurement and payment for work performed under this item. Include cost of same in Contract price bid for items of which this work is a component part.

5.02 “Extra Concrete”, when approved by **ENGINEER**, to be measured by cubic yard of concrete, complete in place. Pay to be at Contract unit price per cubic yard for classes of “Extra Concrete” used.

5.03 “Extra Reinforcing Steel”, when approved by **ENGINEER**, to be measured by pound of calculated weight of steel actually placed. Pay to be at Contract unit price per pound of “Extra Reinforcing Steel” used.

REINFORCING STEEL

1. WORK INCLUDED

This item shall provide for the furnishing and placing of reinforcing steel of the type, size and quantity designated for use in paving and structures as shown on the plans and in accordance with these specifications.

2. MATERIAL

- 2.01 All bar reinforcement shall be open hearth new billet steel of structural or intermediate grade.
- 2.02 New billet steel shall conform to the requirements of the Standard Specifications for Billet Steel Concrete Reinforcement Bars, ASTM Designation A615, Grade 60.
- 2.03 Unless otherwise shown on the plans, all reinforcing bars shall be deformed bars.
- 2.04 Wire for fabric reinforcement shall be cold drawn from rods hot rolled from open-hearth billets. Wire shall conform to the requirements of the Standard Specifications for cold drawn Wire for Concrete Reinforcements, ASTM Designation A82.
- 2.05 Throughout this item, when the Standard Specifications of the American Society for Testing Materials (ASTM) are specified, the latest standard or tentative specifications issued by the Society prior to the date or receipt of bids on which the contract is awarded shall govern.
- 2.06 In cases where the provisions of this item are in conflict with the provisions of the ASTM designations to which reference is made, the provisions of this item shall govern.
- 2.07 The nominal size and area and the theoretical weight of reinforcing steel bars covered by these specifications are standard according to ASTM designations.
- 2.08 Reinforcing bars shall comply with ASTM A-615, Grade 60.
- 2.09 Welded wire fabric shall conform to ASTM A185 or A497.
- 2.10 Bar supports shall be CRSI Class 1, plastic protected; or Class 2, stainless steel protected.
- 2.11 Mechanical connections shall be Erico Products "Cadweld T-Series" or "Lenton", or Richmond "Dowel Bar Splice System".
- 2.12 Protective tape wrap shall be Tapecoat, "Tapecoat 20" or equal.

3. BENDING

- 3.01 The reinforcement shall be bent cold to shapes indicated on the plans. Bends shall be true to the shapes indicated and irregularities in bending shall be cause for rejection.
- 3.02 Unless otherwise shown on the plans, the bends for stirrups and ties shall be made around a pin having a diameter of not less than two (2) times the minimum thickness of the bar.

4. STORING

Steel reinforcements shall be stored above the surface of the ground upon platforms, skids, or other supports and shall be protected as far as practicable from mechanical injury and surface

deterioration caused by exposure to conditions producing rust. When placed in the work, it shall be free from dirt, scale, dust, paint, oil or other foreign material.

5. SPLICES

5.01 No splicing of bars, except when shown on the plans, will be permitted without the written approval of the **ENGINEER**. Splices, which are permitted, shall be as indicated on the plans. If not indicated on the plans, all splices shall be in accordance with the provisions of ACI Building Code, latest revision, except in the case of welded splices, and shall be well distributed or else located at points of low tensile stress. No splices other than welded splices will be permitted at points where the section is not sufficient to provide a minimum distance of two (2) inches between the splice and the nearest adjacent bar or the surface of concrete. The bars shall be rigidly clamped or wired at all splices in a manner approved by the **ENGINEER**.

5.02 Where shown on the plans or required by the provisions of this item or other pertinent specifications, welded bar splices shall be used. In general, such splices shall be so located that not more than two (2) bars in any twelve (12) inch width of the member shall be placed side by side and a fillet weld made on each side for the length of the splice. The welded splice shall be such as to develop two times the tensile strength of the smaller reinforcing bar being joined.

6. PLACING

6.01 All methods and material used in placing reinforcing steel shall be subject to approval by the **ENGINEER**. Steel reinforcements shall be placed in the exact position as shown on the plans and held securely in place during the placing of the concrete. Vertical stirrups shall always pass around the main tension members and be securely attached thereto. The reinforcing steel in all concrete walls shall be spaced in its proper distance from the face of the forms by means of approved galvanized metal spacers or approved precast concrete blocks. Reinforcement in floors over earth shall be supported by saddles manufactured for the purpose or by precast concrete blocks as approved by the **ENGINEER** of suitable height to hold the reinforcement at the proper level.

6.02 Unless provision for welding is made, all reinforcing steel shall be wired together at all intersections using annealed iron wire of not less than eighteen (18) gauge or suitable metal clips. Before any concrete is placed, all mortar shall be cleaned from the reinforcement. Saddles or concrete blocks to be used for holding steel in positions adjacent to formed surfaces. Blocks in the form of a frustum of a cone or pyramid are preferred. A suitable tie wire shall be provided in each block, such wire to be used for anchoring the block to the steel to avoid displacement in placing the concrete. Except in unusual cases, and when specifically, otherwise authorized by the **ENGINEER**, the size of the surface to be placed adjacent to the forms shall not exceed two and one half (2½) inches square, or the equivalent thereof in cases where circular or rectangular areas are provided. Blocks shall be accurately cast to the thickness required and the surface to be placed adjacent to the forms shall be true plane free of surface imperfections.

6.03 Sheets of wire mesh or fabric shall overlap with each other sufficiently to maintain a uniform strength and shall be securely fastened at the ends and edges.

6.04 No concrete shall be deposited until the **ENGINEER** shall have inspected the placing of the reinforcing steel and given permission to place concrete.

6.05 Reinforcement cover shall be stated in ACI 318.

CHAIN LINK FENCE

1. GENERAL

It is the intent and purpose of this item to cover the furnishing and erecting of chain link fences and gates of size and location as indicated on the plans and these specifications.

2. HEIGHT

Fencing shall be constructed with fabric specified on plans or bid proposals and have a three (3) wire climb-proof universal arm set at a forty-five (45) degree angle placed on each post and gates with three (3) strands of barbed wire attached thereto.

3. FABRIC

The fabric shall be chain link wire with nominal diameter of 0.148 inches, hot dip galvanized after weaving with a minimum 1.2 ounces of zinc per square foot of uncoated wire. The fabric shall be made of No. 9 gauge wire, woven in two (2) inch mesh with breaking load greater than 1290 pounds. Top and bottom selvages are to have a twisted and barbed finish to be done by cutting the wire on a bias, thus creating sharp points.

4. LINE POSTS

Hot-dip galvanized "H" columns or 2.375 inches O.D. galvanized pipe shall be used for line posts. "H" columns are to be approximately two (2) inch by two (2) inch and shall weigh not less than 4.1 pounds per lineal foot. If galvanized pipe is used, it shall have an O.D. of two to 2.375 inches and weigh not less than 3.65 pounds per lineal foot.

5. TERMINAL POSTS

End, corner, and pull posts shall be hot-dip galvanized pipe 2.875 inches O.D. and weighing not less than 5.75 pounds per lineal foot.

6. GATES AND GATE POSTS

All gates shall be on a hot-dip galvanized pipe 1.900-inch O.D. frame. For single gates up to six (6) feet and double to twelve (12) feet, galvanized pipe 2.875 inches O.D., weighing not less than 5.79 pounds per lineal foot shall be used for posts. For single gates over six (6) feet to thirteen (13) feet and double over twelve (12) feet to twenty-six (26) feet galvanized pipe four (4) inches O.D., weighing not less than 9.10 pounds per lineal foot shall be used.

7. SPACING AND SETTING

Posts are to be spaced in line of fence no farther apart than ten (10) foot centers. Posts in six (6) foot fence are to be set twenty-four (24) inches deep in concrete footings of minimum size of forty-two (42) inches by ten (10) inches diameter. Terminal posts (end, corner, pull, and gate) are to be set thirty-six (36) inches deep in concrete footings of minimum size and forty-two (42) inches by twelve (12) inches diameter. All concrete shall have a minimum of four (4) sacks of cement to the cubic yard.

8. TOP RAIL

All fencing shall have a top rail of hot dip galvanized pipe 1.660 inches O.D. of "H" section, weighing not less and 2.57 pounds per lineal foot provided with couplings approximately every twenty (20) feet. Couplings are to be outside sleeve type and at least seven (7) inches long. Top

rail shall pass through base of line post top and form a continuous brace from end to end of stretch of pressed steel connections.

9. CENTER RAIL

When specifically called for in plans, a center rail will be used. It shall be constructed of hot-dip galvanized pipe having an O.D. of 1.660 inches and weighing not less than 2.27 pounds per lineal foot.

10. POST BRACES

Post brace material shall be provided for each gate, corner, pull, or end post and shall be the same as top rail. Braces shall be securely fastened to posts by suitable pressed steel connection then trussed from line post back to the terminal post with three eighths (3/8) inch round rod.

11. UNIVERSAL ARM

Extension arms are to be hot dip galvanized. Line post arms are to be of pressed steel riveted to heavy malleable or cast-iron base; end and corner post arms of malleable iron; and gate post to have ball or dome tops. Three (3) lines of galvanized wire of four (4) point pattern are to be fixed to the extension arms. Topmost barbed wire shall be approximately twelve (12) inches above top of the fence. All barbed wire shall be securely fastened in slots by heavy wire pins.

12. FASTENERS

Fabric shall be fastened to line posts with fabric bands spaced approximately fourteen (14) inches apart, and to top rail with tie wires approximately twenty-four (24) inches apart. Fence is to follow ground line. Where fence is erected on concrete sidewalks, bottom of mesh is between one (1) and three (3) inches above sidewalk to permit cleaning.

13. GATES

Gates are to be the size and type indicated on the plans. Frames are to be made of 1.900-inch O.D. hot-dip galvanized pipe weighing not less than 2.72 pounds per lineal foot. Corner fittings are to be heavy casting. Gates shall be complete with malleable iron ball and socket hinges, catch, stop hasps, and center rest to be furnished with a padlock (Corbin No. 2882 or approved equal). All padlocks shall use the same key.

14. GATE FRAME CONSTRUCTION

Galvanized steel frames shall be constructed of round members welded at all corners or may be assembled with corner fittings. When corner fittings are used, gates shall be 3/8" nominal diameter truss rod. Welds shall be painted with zinc base paint. Each gate leaf shall have vertical interior bracing as required, so spaced that no members are more than 8 feet apart. Gate leaves 10 feet or over shall have a horizontal brace or one 3/8" diagonal galvanized steel truss rod. The end members of the gate frame shall extend one foot above the top horizontal member; three strands of barbed wire shall be uniformly spaced on this one-foot extension and shall be attached by hook bolts or bands. Fabric for the gate shall be same as specified for the fence and shall be attached securely inside gate frame on both sides by means of tension bars and tension bands. Top and bottom of fabric shall be attached to gate frame by 11 gauge galvanized or 9-gauge aluminum ties at intervals not to exceed 15 inches. Zinc coating on gate pipe shall be to same specifications as posts and top rail.

Swing gates shall be hinged to swing 180 degrees from closed to open.

15. HINGES

Post and gate hinges shall be galvanized steel, heavy patterns, of adequate strength for the gate and with large bearing surfaces for clamping or bolting in position. The hinge action shall be such that gates may be opened and closed easily by one person. Zinc coating shall be the same as of the fabric.

16. LATCHES, STOPS AND KEEPERS

All latches shall be galvanized steel. Single gate latches may be of fork-type or plunger-bar-type of full gate height. Latches for double drive gates shall be a combination fork-type latch and center drop rod or the plunger-bar-type of full gate height arranged to engage the gate stop or a positive locking gravity device. Locking devices shall be designed in such a manner so that center drop rod or plunger bar cannot be raised when lock. Center gate stops shall be provided for all double drive gates and shall be of a device arranged to be set in concrete with anchors for the center drop rod or plunger bar. Galvanized steel gate keepers shall be provided for each leaf over five feet wide. Gate keepers shall consist of a mechanical device for securing the free end of the gate when in full open position. Zinc coating shall be same as of the fabric.

17. FITTINGS AND ACCESSORIES

Ties or clips shall be provided for attaching chain link fabric to top rail at intervals of not more than 24 inches and online posts at intervals of not more than 14 inches. Ties may be of steel 11 gauge (galvanized) or aluminum 9 gauge.

18. BOLTS AND NUTS

Tension and brace bands to be fitted with hot-dip galvanized carriage bolts and nuts.

19. TENSION WIRE

Galvanized tension wire shall be used along bottom of fabric. This wire shall be of coil spring wire 0.177 (± 0.003) inches in diameter and shall have a zinc coating of not less than 0.40 ounces per square foot. Galvanized hog rings shall be provided for attaching tension wire to fabric at intervals not exceeding 24 inches.

20. TENSION BARS

Galvanized steel bars shall be not less than 3/16" X 3/4" and equivalent to fabric height. Bars are to be threaded through fabric and attached to posts by means of tension bands spaced not to exceed 14 inches. One bar shall be provided for each end and gate post and two bars for pull and corner posts.

21. TENSION BANDS

Galvanized steel tension bands shall be provided with tension bars at each end, gate, or corner post. These bands shall be of flat steel 1/8" X 3/4". Spacing on post shall be at not more than 14-inch intervals.

22. SLEEVES

Sleeves shall be round and of galvanized steel in length not less than six inches. They shall allow for expansion and contraction of top rail.

23. BRACE BANDS

Galvanized steel brace bands shall be provided where top rail or bracing is required on end, gate, corner, or pull posts. These bands shall be securely fastened to posts and used with a rail-end. Bands shall be of 1/8" X 3/4" flat steel.

24. RAIL ENDS

Galvanized rail-ends shall be provided with each brace band where top rail or bracing is required.

25. TRUSS RODS

A galvanized 3/8" truss rod to be provided for each gate, corner, pull or end post. This truss rod shall extend to each adjacent line post back to the base of the braced post with a turnbuckle or other equivalent providing for adjustment.

26. ZINC COATED FITTINGS

Miscellaneous steel fittings and hardware shall be of commercial grade steel or better quality, wrought or cast as appropriate to the article, and sufficient in strength, and other properties, to provide a balanced design when used in conjunction with fabric, posts, and wires of the qualities specified herein. The weight of zinc coating on above listed steel fittings shall be 1.2 ounces per square foot.

27. CONSTRUCTION METHODS

All work shall be done according to the best practices generally accepted. Any change or deviation requested of these specifications must be explained in detail by a letter and suitable drawings.

28. WORKMANSHIP

Fabric shall be free from poorly formed mesh or frozen joints. The surface of zinc coatings produced by hot-dip galvanizing is not always smooth and devoid of irregularities. Such irregularities ordinarily do not warrant rejection of zinc-coated fabric. Barbs on barbed wire shall be sharp and spaced approximately even. Gate parts shall be accurately formed to dimension and shall be assembled into strong, rigid units. All accessories, except barbed wire, shall be free of sharp edges.

29. APPLICABLE STANDARDS

The following specification shall govern: (ASTM) American Society for Testing and Materials (ASTM Publications):

- A 53 Welded and Seamless Steel Pipe
- A 90 Weight of Coating on Zinc-Coated (Galvanized) Iron or Steel Articles
- A 116 Zinc Coated (Galvanized) Iron or Steel Farm Field and Railroad Right-Of-Way Wire Fencing
- A 120 Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Ordinary Uses
- A 153 Zinc Coating (Hot-Dip) on Iron and Steel Hardware
- A 392 Zinc-Coated Steel Chain-Link Fence Fabric
- B 6 Slab Zinc

30. FENCE CONSTRUCTION

The installed fence shall conform to the alignment and finish grade indicated. All posts shall be plumb. Unless otherwise indicated on the drawings, posts shall be spaced approximately 10 feet apart for plant perimeter fencing. Where necessary, the fence grade shall be adjusted to fit the ground contour by slipping the fence fabric links. Ground surface irregularities shall be graded as required to maintain not more than 2-inch clearance below the bottom of the fence fabric.

Where the fencing is supported by a concrete structure, posts shall be set in sleeves that provide at least ¼ inch clearance all around. Sleeves shall be fabricated from Schedule 40 black steel pipe and hot dip galvanized after fabrication. Sleeves shall be 5 inches long unless otherwise indicated on the drawings. Sleeves shall be rigidly supported in accurate alignment in the forms and shall be positioned vertically so that the top of the sleeve is approximately ½ inch below the finished concrete surface. Posts shall be wedged in accurate alignment and the annular space between posts and sleeves shall be filled with handrail-setting cement to the top of the steel sleeve. Filling of the remaining space with sealant, as indicated on the drawings, is covered in the caulking section.

Each gate and terminal post for 6-foot-high fencing shall be braced by a horizontal pipe brace and an adjustable truss extending to an adjacent line post. Corner posts shall be braced in both directions.

Fabric shall be stretched taut and anchored so that a pull of 150 pounds at the middle of a panel will not lift the bottom of the fabric more than 6 inches.

31. DRAWINGS AND DATA

Complete detail and specifications for the fence, gates, and accessories shall be submitted in accordance with the submittals section.

32. MEASUREMENT

Completed chain link fence shall be measured in accordance with Bid Proposal unit, usually by the linear foot of fence of designated height, in place from center line of beginning and ending post.

33. PAYMENT

Payment for completed and acceptable fence, shall be made at the unit price bid, which payment shall be full compensation for all items, materials, labor, equipment, etc., required for fence construction.

DISINFECTION

1. GENERAL

The disinfection work shall not be performed until after all required hydrostatic testing and cleaning of the structures and pipelines has been completed.

All water used in disinfecting the structures and pipelines shall be wasted and disposed of in a manner acceptable to the **ENGINEER** and shall not be allowed enter other parts of the system.

All disinfection work shall be performed in accordance with the requirements of the Texas National Resource Conservation Commission, and any and all requirements thereof which may be in conflict with the provisions of this specification shall govern.

The **CONTRACTOR** shall provide the necessary apparatus for conducting the chlorine residual tests by the drop dilution methods in accordance with AWWA C651. Tests will be monitored by the **OWNER'S** representative.

Prior to starting any disinfection work, the **CONTRACTOR** shall submit to the **ENGINEER** a detailed outline of the procedure proposed, the coordination and sequence of operations, manner of filling and flushing disinfected lines, and the disposal of wasted water. All procedures shall be acceptable to the **ENGINEER**.

Water shall be wasted in accordance with AWWA, C651, C652, C653, and as directed by the **ENGINEER**.

The interior surfaces of the new ground storage tanks shall be sprayed or brushed with a well mixed solution of calcium hypochlorite (HTH) using not less than one ounce of the hypochlorite in 26 gallons of water. After walls, columns, and ceilings have been treated, the same treatment shall be given the floor. All interior surfaces shall then be flushed with clear water. Forced draft fans shall be used to provide adequate ventilation while the solution is being applied. All water remaining in the structure after the disinfection work has been completed shall be removed.

2. DISINFECTION OF PIPELINES

All plant water and pipelines conveying treated water (all pipelines downstream from the filters) shall be disinfected in accordance with the requirements of AWWA C651.

During disinfection, all valves shall be operated to ensure that all appurtenances are disinfected.

Following chlorination, all treated water shall be flushed from the entire length between extremities of each line until the replacement water throughout its entire length, on test, is satisfactory to the **ENGINEER**.

Should the initial treatment fail to produce the required residual content, the original chlorination procedure shall be repeated until satisfactory results are obtained.

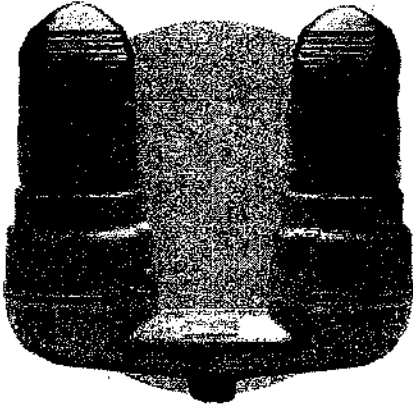
SHROUDING

GENERAL

- A. All spent abrasive blast products, rust, and other debris generated from the blast cleaning operations must be fully contained and brought to ground level within a shroud/curtain or similar type device designed specifically for containment purposes. The containment must meet all requirements of current TCEQ regulations.
- B. The shroud/curtain material shall be specifically designed for dust containment and shall have a retention capacity (shade factor) of not less than ninety-five percent 95%. Impervious tarps or other similar materials are not acceptable. Windows for air passage or other openings in the shroud are also not acceptable.
- C. The **DISTRICT** or the **ENGINEER will not be** responsible for the structural integrity of the tank in regard to the support of the containment device.
- D. **CONTRACTOR** will be allowed to install permanent anchoring lugs for support of the containment device on the steel tank.
- E. **CONTRACTOR** must install the anchoring system at ground level so as to not damage any new or existing underground piping and/or utilities.

BYMB SERIES

OBSTRUCTION LIGHTS



Features

- For use as obstruction indicator for buildings and towers
- Available in single or twin version
- Uses a steady burning incandescent lamp, not included
- Lens mounted in cast aluminum ring and secured with SS thumb screw and safety chain
- Twin unit can operate both lamps simultaneously
- Relay accessory provides switching when lamp on first luminaire fails
- Traffic signal lamp 116A-21/TS has rated life of 8,000 hours on 120 volt, and 22,000 hours on 130 volt
- Mounting hub is 1" NPS
- Housing - Heavy duty cast aluminum
- Glass - Fresnel lens in clear or selected colors



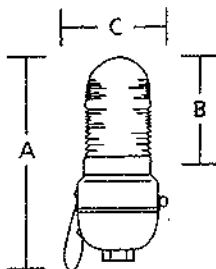
Ordering Information

Order Number	Description	Dimensions	Wattage
BYMB-3600-AHQ	Incandescent single units - less lens	5 1/8" x 14"	0.82
BYMB-36002-AHQ	Incandescent twin units - less lenses	14 3/4" x 14"	0.82 or 1.6
7AP53	Clear lens	—	—
7AP53B	Blue lens	—	—
7AP53G	Green lens	—	—
7AP53R ¹	Red lens	—	—
7AP53Y	Amber lens	—	—
7AP3A	Internal relay to change lamps on twin unit	—	—

¹ ETL verified to FAA specification AC No. 150/5343-43E

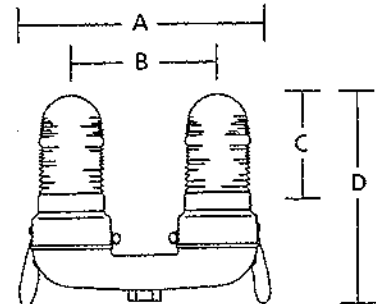
Dimensions

Single



	A	B	C	D
Twin	14 3/4"	9 5/8"	6 5/8"	14"
	375 mm	244 mm	168 mm	356 mm
Single	14"	6 5/8"	5 1/8"	-
	356 mm	168 mm	130 mm	-

Twin



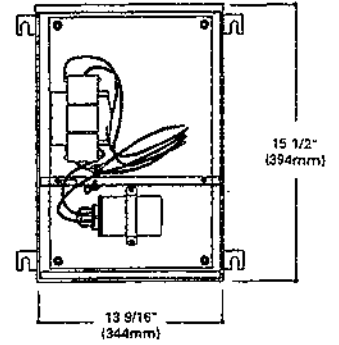
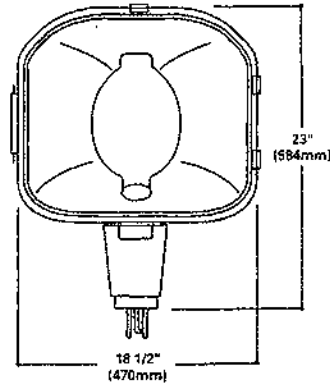
Industrial Lighting

COOPER LIGHTING - LUMARK®

DESCRIPTION

The Lumark Knight Light is designed to light painted bulletins efficiently and effectively. The reflector housing is anodized aluminum with a die-cast door frame and impact-resistant glass lens. Remote ballast box is available for single or dual lamp applications. Knight Light delivers consistent photometrics and mounting versatility for any sign lighting application.

DIMENSIONS



SLS KNIGHT LIGHT

175 - 400 W
Super Metal Halide

SIGN LIGHT

- Hinged door provides easy access for relamping
- Tempered glass lens
- Anodized aluminum reflector
- Die-cast aluminum door frame with toolless entry
- Easy access wiring chamber with captive cover. Suitable for 1 1/4" threaded conduit
- Remote ballast housing has 1/2" and 3/4" knockouts on three sides for mounting versatility
- Approximate net weight: 10 lbs. (4 kgs.)

ORDERING INFORMATION

SAMPLE NUMBER: SLS17R

Series SLS=Knight Light	Lamp Wattage 17=175/250W 40=400W	Lamp Type R=Super Metal Halide	Weather-Proof Ballast Boxes ¹ OA1082=175W Super Metal Halide, Multi-Tap, 1 Lamp OA1083=175W Super Metal Halide, Multi-Tap, 2 Lamp OA1140=250W Super Metal Halide, Multi-Tap, 1 Lamp OA1141=250W Super Metal Halide, Multi-Tap, 2 Lamp OA1084=400W Super Metal Halide, Multi-Tap, 1 Lamp OA1085=400W Super Metal Halide, Multi-Tap, 2 Lamp
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NOTES: 1 Will also accept Mercury Vapor and standard Metal Halide lamps. 2 For complete product data, reference the Lumark Specification binder. 3 Specifications and dimensions subject to change without notice. 4 Products also available in non-US voltages and frequencies for international markets. 5 Consult your Cooper Lighting Representative for availability and ordering information.



21. FLUSHING VALVES

21.01 DESCRIPTION - This item shall govern for the furnishing and setting of flushing valves at the locations shown on Plans, as directed by the **ENGINEER**.

21.02 MATERIALS

- a. Flushing valves - Flushing Valves shall be **American Darling B-84-B**, with mechanical joint end inlet, or approved equal, as shown on the Proposal. Depth of bury shall be a minimum 3.0' to the bottom of connecting pipe. Treads on nozzles and operating nut shall be furnished in accordance with the standard drawing provided and conform to the standards of the Texas Fire Insurance Commission.
- b. Valves, Fittings, Etc. - Valves fitting, etc. to be used in the completed installation shall be as specified in Main Water Lines.

21.03 CONSTRUCTION METHODS

- a. The setting of the Flushing Valve shall be performed in conformity with applicable portions of Main Water Lines Specifications Section.
 - b. Hydrants shall be placed at the locations shown on the Plans and in conformity with details thereon, unless otherwise directed by the **ENGINEER**. Flushing Valves, valves, and valve boxes shall be set plum with valve boxes placed directly over the valves after they have been connected.
 - c. Flushing Valves shall rest on a concrete block or base not less than 4 inches thick and 15 inches square, and the back side opposite the pipe connection shall be firmly wedged between the Flushing Valves and vertical wall of the trench to prevent the Flushing Valves from blowing off the line. Flushing Valves shall be located as directed by the **ENGINEER**. Flushing Valves shall be set truly vertical.
 - d. A six-inch gate valve and valve box shall be installed on the lead.
 - e. Sand or gravel to ensure the complete drainage of the Flushing Valves when closed. All backfill around Flushing Valves shall be thoroughly compacted at the surface of the ground.
 - f. Before installing any Flushing Valves or valves, care shall be taken to see that all foreign material is removed from the interior of the valve or barrel. Stuffing boxes shall be tightened and the Flushing Valves of valve opened and closed to see that all parts are in working order.
- 21.04 MEASUREMENT - Hydrants installed in accordance with the above Specifications and accepted by the **ENGINEER** will be measured as each Flushing Valves set, complete in place, including valve, box, cast iron tee from main to lead, 6-inch cast iron lead from main to the Flushing Valve.



ACTION CIVIL ENGINEERS, PLLC

Firm Registration No. F-16376

21.05 PAYMENT - Payment for work performed and materials furnished as specified for this item, measured as provided above, will be paid at the contract unit price for each hydrant set, complete in place. Payment thus made shall be full compensation for furnishing and installing all pipe, fittings, Flushing Valves, valves, valve boxes, and leads, and for all other incidental work, equipment and materials required for a complete installation.

22. WET CONNECTION OR CUT-INS

22.01 DESCRIPTION - This item shall govern the connection of new mains with existing water mains, at the locations shown on the Plans or designated by the **ENGINEER** and as described in the Specifications. A wet connection is defined as one that is made under pressure.

22.02 MATERIALS - Cast iron fittings, valves and valve boxes shall be as specified in Paragraph "B" Item No. 2, Main Water Lines.

22.03 CONSTRUCTION METHODS - Wet connections or cut-ins shall be performed in conformity with the applicable provisions of Item No. 2, Main Water Lines. The **CONTRACTOR** shall do the excavation, cut the existing main, remove the section of old pipe, rework the trench, connect the new pipe with the old and set necessary specials and valves as shown on the plans. At the cut-ins of existing mains, all new mains shall be at such depth as will permit the sitting of valves in the valve boxes, and such that the top of the valve box will flush with the pavement when the valves are in paved streets. Where cut-ins are made immediately adjacent to valves which are under pressure, the **CONTRACTOR** shall take all necessary precaution to brace such valves and to prevent blow-outs of the mains under pressure. Where cut-ins are made, new valves as shown in the connection details shall be set.

22.04 COMPLETION OF WET CONNECTIONS - When the existing mains have been cut or a plug removed for a connection, then the work of making the connection shall progress without interruption until complete. No additional compensation shall be granted for making connections at night or for having to complete a connection under unfavorable working conditions.

22.05 OPERATING OF VALVES AND CONTROLS - Completion of the work involves the shutting off, wholly or partially, of existing gate valves on the distribution system. This work will be done by the **OWNER** upon reasonable notice by the **CONTRACTOR** requesting the same. Shut-offs will be made at such time as will be convenient to the greatest number of customers affected by the shut-off, and this information will be supplied by the **OWNER** after a canvass of the customers in the territory affected.

Whenever the **CONTRACTOR** desires to proceed with a wet connection without a complete shut-off, there will not be extra compensation for damages or extra work resulting from the incomplete shut-off.



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- 22.06 MEASUREMENT - Wet connections or cut-ins installed in accordance with the above specifications and accepted by the **ENGINEER** will be measured by each "Wet Connection" complete in place for the various sizes. Pipe, fittings, valves, valve boxes, etc., will be measured as specified in Paragraph "D" of Item No. 2, Main Water Lines.
- 22.07 PAYMENT - Work performed and materials furnished as specified in this item, measured as provided above, will be paid for at the contract unit price bid for the various sizes of each "Wet Connection". Pipe, fittings, valves, valve boxes, will be paid for as specified in Item No. 2, Main Water Lines. Payment thus made shall be full compensation for furnishing and installing all incidental work, labor, tools, equipment and materials necessary to complete the work.

RESILIENT-SEATED GATE VALVES

1. GENERAL

This section covers resilient-seated AWWA gate valves for water service.

1.01 Governing Standard – Except as modified or supplemented herein, all resilient-seated gate valves shall conform to the applicable requirements of ANSI/AWWA C509.

2. MATERIALS

Except as modified or supplemented herein, materials used in the manufacture of resilient-seated gate valves shall conform to the requirements of ANSI/AWWA C509.

2.01 Gaskets – Gasket material shall be sheet paper or elastomer, free from asbestos and corrosive ingredients.

2.02 Stem Seals – Valves with nonrising stems and all buried valves shall be provided with O-ring stem seals.

3. EXTENSION STEMS & VALVE BOXES

Extension stems and valve boxes shall conform to the specifications for extension stems and valve boxes under the Eccentric Plug Valve section.

4. INSTALLATION

Valves shall be handled and installed in accordance with the recommendations set forth in the appendix to ANSI/AWWA C509 and the recommendations of the manufacturer.

5. GATE VALVE SCHEDULE

Shall be provided where indicated on the drawings.

6. DRAWINGS AND DATA

Complete drawings, details, and specifications covering the valves and their appurtenances shall be submitted in accordance with the submittals section.

Submittal drawings shall clearly indicate the country of origin of all cast gray iron or ductile iron valve components. When required by the **ENGINEER**, certified copies of physical and chemical test results shall be submitted for the materials of construction of valve components.

All valves shall be tested in accordance with Section 6 of ANSI/AWWA C509. Certified copies of the results of all tests, together with an affidavit of compliance as indicated in Section 1.5, shall be furnished to the **ENGINEER** before the valves are shipped.

Specifications for Hot-Mix Asphaltic Concrete Pavement

1.0 DESCRIPTION

This specification shall consist of a surface coat composed of a compacted mixture of mineral aggregate and asphaltic materials. The pavement shall be placed on an approved subgrade; base or wearing surfaces in accordance with details shown on the Plans.

MATERIALS

All materials, mineral aggregate, asphaltic materials, prime coat tack coat and additives shall be in accordance with Item 340 Texas Department of Transportation Standard Specification for Construction of Highways, Streets and Bridges.

PLACING

Materials shall be placed in accordance with Item 340, TxDOT and compacted as set out in Item 340 and as directed by the ENGINEER.

MEASUREMENT

Measurement shall be in units designated on Bid Proposal of specified thickness.

PAYMENT

Payment for completed and acceptable surface coat shall be made at the unit price bid on Bid Proposal and the unit price bid shall be full compensation for tack coat, prime coat, materials, rolling, all equipment, labor machinery, supervision required for completion of work.

Specifications for Cement Stabilized Sand Backfill

1.0 DESCRIPTION

This item shall govern the material, basis for payment, and measurement of cement stabilized sand.

MATERIALS

Cement stabilized sand shall be composed of River sand (P.I. of 4 or less) or equal and not less than one and one-half (1 1/2) sacks of Portland Cement per cubic yard thoroughly mixed, in a mill type mixer.

BASIS OF PAYMENT

Basis of payment shall be at the unit price bid for designated unit as it appears on bid proposal. The unit price bid of specified unit shall be full compensation for all materials, labor, machinery, or other operations required to place cement stabilized sand.

MEASUREMENT

Measurement will be made by weight ticket showing pounds of material per truckload and shall be acknowledged by the OWNER'S representative on the job.

Specifications for Crushed Limestone Flexible Base

1.0 DESCRIPTION

This item shall consist of a foundation course for surface course; and shall be composed of crusher-run broken stone; and shall be constructed as herein specified in courses not over 6" thick after compaction in conformity with the typical sections shown on the plans and to lines and grades as established by the ENGINEER.

MATERIALS

2.1 The material shall be obtained from an approved source, shall be crushed, shall consist of durable particles of crushed stone graded from coarse to fine; shall be screened or otherwise manipulated prior to crushing to remove all soil, clay, or other objectionable material, and shall contain approved binding material produced in the crushing process.

2.2 When properly slaked and tested by current standard laboratory methods, materials shall meet the following requirements:

Retained on 1 3/4" screen	0%
Retained on 3/4" screen	15-45%
Retained on 1/4" screen	45-75%
Retained on 40 mesh sieve	60-85%

2.3 When tested by current standard laboratory methods, the soil binder (material passing the 40 mesh sieve) shall meet the following requirement:

The liquid limit shall not exceed	40
The PlastiDistrict index shall not exceed	10

2.4 When tested by the Wet Ball Method for determining disintegration of Flexible Base Material, the material shall not have a wet ball mill wear exceeding 40%.

CONSTRUCTION METHODS

3.1 Preparation of Subgrade — The area to be surfaced shall be excavated and shaped to conform with the typical sections shown on the plans and to the lines and grades established by the ENGINEER. All unstable or otherwise objectionable material shall be removed from the subgrade and replaced with approved material. All holes, ruts, and depressions shall be filled with approved material, and if required, the subgrade shall be thoroughly wetted and reshaped and rolled to the extent directed in order to place the subgrade in an acceptable condition to receive the base material. The surface of the subgrade shall be finished to line and grade within a tolerance of 1/2" in cross section, and 1/2" in a length of 16" longitudinally. Material excavated in preparing the subgrade shall be utilized in filling adjacent areas, or otherwise disposed of as directed.

- 3.2 First Course — The material shall be delivered in vehicles of an approved capacity District, and it shall be the responsibility of the CONTRACTOR that the required amount of material shall be delivered and spread to provide the required compacted thickness. Material deposited on the subgrade shall be spread the same day. The material shall be sprinkled, if the moisture content is less than the optimum required for compaction, and shall then be bladed, and shaped to conform to the typical section shown on the plan. Sufficient moisture shall be added to the material to minimize segregation of the coarse or fine aggregate, and any "nests" of segregated coarse or fine material shall be corrected or removed and replaced with well graded material. If additional binder is necessary after the material is spread and shaped, it shall be furnished and applied in the amounts required to fill the voids of the coarser aggregate. Additional binder material shall be carefully and evenly incorporated with the material in place by blading, scarifying, harrowing, or other approved methods. The course shall be sprinkled as required and rolled until an uniformed compaction is secured. Irregularities, depressions or weak spots which develop shall be corrected immediately by scarifying the areas affected, adding suitable material as required, reshaping and re-compacting by sprinkling and rolling. Blading and rolling shall continue until the base is compacted to a minimum of 95% of Standard Proctor Density.
- 3.3 Rollers shall be pneumatic tired rollers with not less than nine (9) pneumatic tired wheels, running on axles in such a manner that the rear group of tires will not follow in the tracks of the forward group, and mounted in a rigid frame provided with a platform or body suitable for ballast loading. The pneumatic tired roller shall have an effective rolling width of approximately 60" and shall be so designed that by ballast loading, the load may be varied uniformly from 100 pounds to 325 pounds per inch of width of tire tread. The pneumatic tired roller may be either the self-propelled type, or towed type roller drawn by a pneumatic tired tractor. Rollers shall be maintained in good repair and operating condition and shall be approved by the ENGINEER.
- 3.4 Succeeding Courses — Construction methods and requirements shall be the same for succeeding courses as prescribed for the first course, except that the surface of the final course shall be finish rolled with a steel wheeled roller, if required, to obtain a smooth and uniform surface.

MEASUREMENT

Measurement shall be made in the units designated on the bid proposal, usually by the square yard, in place, and compacted.

PAYMENT

Payment shall be made at the unit price bid for designated unit on Bid Proposal and the unit price bid and shall be full compensation for all materials, labor, machinery, equipment, preparation shaping, compaction, etc., necessary to meet Plans and Specifications, in accordance with and acceptable to, the ENGINEER.

PILE DRIVING

1. SCOPE

This section covers pile driving in general.

2. GENERAL

2.01 Codes and Regulations – All pile driving shall conform to applicable codes of Jefferson County, Texas, and regulations of the State of Texas which pertain to this work. In case of conflict between the specifications set forth in this section and any law or ordinance of the State or County, the latter shall govern.

3. MEASUREMENT AND PAYMENT

3.01 Basis for Bids – The basis for bids shall be as specified in the Measurement and Payment Section.

The number and length of piles to be provided shall be based on furnishing and installing piling placed at the locations indicated on the drawings and measured from cutoff elevations indicated to the tip elevations indicated on the drawings.

3.02 Pay Length – Pay lengths of permanent piles will be determined by the **ENGINEER** from daily driving records kept by the **CONTRACTOR**.

No payment will be made for the following items:

- a. Pile footage which results from overdriving the piling to avoid cutoff expense or otherwise for the convenience of the **CONTRACTOR**.
- b. Pile sections extending above the cutoff elevation of the piles as indicated on the drawings.
- c. Piles not driven to design tolerances or for piles damaged beyond acceptance, withdrawn, or collapsed.

4. DRIVING EQUIPMENT

The pile driving equipment shall operate at the efficiency and capacity required herein at all times. The hammer or other equipment required to drive piles shall be adequate in size, strength, and capacity to drive piles to the required penetration and resistance without damage to the piles or reduction in their strength.

4.01 Hammer – The pile driving hammer shall be steam, air, or diesel operated and shall develop at least 36,000 foot-pounds of energy per blow. The maximum energy per blow shall not exceed that which can be used without damaging the pile. The weight of the striking parts of the hammer shall be at least one-third the weight of the pile.

Air or steam supply equipment shall have sufficient capacity to operate the hammer at its rated capacity.

4.02 Capblocks – Cushions or capblocks shall consist of one solid block of dry, seasoned oak of proper shape and dimensions to fit the hammer, enclosed in a steel band. The grain of the block shall be parallel to the axis of the pile. If laminated materials are used, the strength and rigidity of such material shall be equal to or greater than hardwood as specified. The use of wood chips, rope, small wood blocks, shavings or any similar

cushioning materials will not be permitted. All capblocks used shall be of the same material and construction.

- 4.03 Driving Heads – Driving heads shall be designed for use with the type of pile being driven and shall be of cast iron, cast steel, or structural steel construction.

Bottoms of driving heads shall be provided with conical recesses or grooves as required to fit the head of the pile being driven. The top surface of each driving head shall have a shallow recess to receive the cushion or capblock.

- 4.04 Followers – Followers shall be so designed and used as to minimize loss of energy and damage to the pile. Followers shall be provided with caps or bands as required to fit the head of the pile.

- 4.05 Leads – Pile driven heads leads shall be of the fixed type, designed and arranged to hold the pile firmly in position and alignment and to keep the pile hammer axially aligned. Swinging or hanging type leads will not be permitted.

The length of leads shall be at least equal to the length of pile to be driven plus the length required to provide adequate space for the hammer and appurtenances.

5. INSPECTION EQUIPMENT

The **CONTRACTOR** shall provide all inspection equipment necessary to determine whether the pile has been started in its planned location, is vertical or at the prescribed batter, and is within the allowable tolerance for position after driving.

6. PILE HANDLING AND STORAGE

All piles shall be carefully handled, hauled, unloaded, and stored as required to prevent damage to the piles thereon.

When raising or transporting piles, the **CONTRACTOR** shall provide slings or other equipment to prevent breaking, chipping, cracking, and overstressing during handling. Piles shall not be handled in a manner that will cause large deflections or distortions during handling. Piles that are damaged, in the opinion of the **ENGINEER**, shall be removed from the site.

Piles shall not be dropped during handling and shall be protected from impact of any kind. During storage, piles shall be stacked on blocks carefully placed at the lift points.

All piles that are damaged or defective in any way, which, in the opinion of the **ENGINEER**, affects adversely the strength or serviceability of the unit, it will be rejected and shall be removed from the site.

7. PREPARATION

- 7.01 Pile Length Markings – Before driving is started, each pile shall be marked so that the depth of the point can be readily determined.

8. INSTALLATION

Piles shall be driven by methods and equipment that will ensure their installation to the required tip elevations as verified by load testing. Care shall be taken to ensure that the leads and driver are firmly supported and that the driving rig is level.

The continuous or frequent introduction of cushion or capblock materials to cushion the hammer blows is prohibited. Capblocks shall be replaced only at the beginning or conclusion of driving a pile.

- 8.01 Tolerances – All piles shall be accurately spaced and driven plumb or at the designated batter angle at the locations indicated on the drawings or directed by the **ENGINEER**. Templates or other means acceptable to the **ENGINEER** shall be used to maintain the tolerances specified herein. The maximum variation of any pile from its location shall be not more than 2 inches at its cutoff elevation. No vertical pile shall be out of plumb more than 2 percent of the pile length. Batter piles shall be aligned with their designated batter angle within a tolerance of ¼ inch per foot.

Driven piles that do not meet these requirements shall make the **CONTRACTOR** liable for the cost of redesign and extra construction of the pile cap or replacement of the pile at the discretion of the **ENGINEER**.

- 8.02 Lateral Displacement and Heave – Observations shall be made during driving to detect lateral movement and heaving of piles. Accurate level marks shall be put on the first pile driven in a group and on others as soon as they are installed; level readings shall be recorded on the soil in the area. Elevation and location shall be checked against distant reference marks as additional piles are installed. Any pile heaving more than ¼ inch shall be reseat. Observed lateral movement shall be brought to the attention of the **ENGINEER**.

- 8.03 Obstructions – Point reinforcement shall be considered for use in all cases where the pile is driven through soft materials directly on the solid soils. Consideration shall also be given to use of point reinforcement where debris or other obstructions might cause distortion of the pile and driving out of plan location.

- 8.04 Rejected Piling – Damaged piling, and piles driven outside the required driving tolerances will be rejected. Piles, which are rejected, shall be withdrawn, or abandoned and replaced.

Withdrawn rejected piles shall be replaced with new piles.

Rejected piles, which are abandoned, shall be cut off below the specified cutoff elevation. Abandoned rejected piles will not be allowed any bearing value and shall be replaced by new piles at the locations designated by the **ENGINEER**.

When the pile is rejected because its location after driving exceeds the specified tolerance, the true loading of the pile will be determined by the **ENGINEER** and additional piles shall be driven as may be required to keep the load on any pile from exceeding 110 percent of its design capacity.

Spaces left by withdrawn piles and which are not filled by new piles shall be filled and compacted with reusable excavated soils.

- 8.05 Cutoff – After pile driving for each structure has been completed, the **CONTRACTOR** shall cut off each pile at the elevation indicated on the drawings. Cuts shall be perpendicular to the axis of the pile.

After each pile has been installed, the top of each pile shall be sawed to the cutoff line indicated in the drawings for each pile group.

9. DRIVING RECORDS

Driving records shall be kept by the **CONTRACTOR** and submitted in sets of five (5) on forms satisfactory to the **ENGINEER**.

9.01 Data Recorded – Data recorded shall include the following:

- a. Project name and number.
- b. Name of piling contractor.
- c. Date of driving.
- d. Pile number and location.
- e. Pile size and type.
- f. Point elevation.
- g. Top elevation before cutoff.
- h. Top elevation after cutoff.
- i. Deviation from theoretical location.
- j. Hammer characteristics:
 - 1) Make and model.
 - 2) Energy rating.
- k. Type cushion or capblock.
- l. Rebound observed.
- m. Unusual occurrences during driving.

The **ENGINEER** shall have access to reports and records at all times during piling installation.

All reports shall be signed daily in ink by the **CONTRACTOR'S** superintendent and submitted to the **ENGINEER** not later than two (2) days after the piles in question have been driven.

9.02 Certifications Required – All data recorded shall be certified correct.

Specifications for Care of Streets and Utilities

1. DESCRIPTION

- a) It is the purpose and intent of these specifications to govern and to control existing traffic signs, street markers, streets, and utilities, etc., both above ground and underground that exist in the construction area.
- b) Where these traffic signs, street markers, etc., are encountered in the line of construction, they are to be removed and replaced in their original positions insofar as it is practical to do so.
- c) Extreme care must be used when working on streets. The CONTRACTOR shall be held liable for any damage to these streets. Where such damage is incurred, the CONTRACTOR shall be required to place the streets back into as good a condition as they were originally. The OWNER or his authorized representative will be the sole judge of the extent of such damage.
- d) The CONTRACTOR shall exercise extreme caution to avoid damaging existing utilities.
- e) Information relative to the existing utilities is approximate only and may be subject to discrepancies and errors. The data generally is based on scaled dimensions. It shall be the responsibility of the CONTRACTOR to locate accurately all utilities as the work progresses and to provide the immediate cutting off of gas or water lines damaged and the immediate repair of any breakage in lines that may occur due to his operations during construction. The CONTRACTOR shall be responsible for any delays in the work caused by utility lines or by the adjustment of the same.

2. PAYMENT

All work required as described in this item will not be paid for directly but shall be considered subsidiary work pertaining to the various contract items and such costs shall be included in the unit price bid.

NOTE:

During the course of construction where streets and alleys are damaged and request to have the same repaired is not complied with in a reasonable period of time, the OWNER reserves the right to repair same and deduct the cost from the CONTRACTOR'S estimate.

MAN HOURS AND EQUIPMENT TIME

1. DESCRIPTION

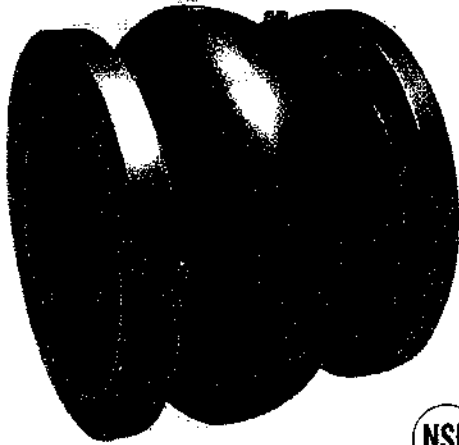
It is the intent and purpose of these specifications to govern the use of man time and equipment time where required and authorized by the **ENGINEER**.

- 1.01 Man Hours – The labor of one able-bodied man working for one (1) hour.
- 1.02 Truck Hours – A truck in good and acceptable repair rated at 2 ½ tons but capable of hauling a minimum of three (3) cubic yards of material, with a competent driver and with all necessary fuel, lubricating oil and grease furnished, operating on the work for one hour.
- 1.03 Bulldozer Hours – A bulldozer in good and acceptable repair, having a minimum rated capacity of 35 HP with a competent operator and with all necessary fuel, lubricating oil and grease furnished, operating on the work for one hour.
- 1.04 Loader/Backhoe Hours – A rubber tired Loader/Backhoe in good and acceptable repair, with a minimum size loader of 1 ¼ C.Y. and backhoe bucket of a minimum size of 24” with a competent operator and with all necessary fuel, lubricating oil and grease furnished, operating on the work for one hour.
- 1.05 Motor Grader Hours – A motor grader in good and acceptable repair, having a mould-board or blade twelve (12) feet in length, with a competent operator and with all necessary fuel, lubricating oil and grease furnished, operating on the work for one hour.
- 1.06 Measurement – Measurement for the above personnel and equipment will be made by the hour.
- 1.07 Payment – Payment for the above equipment and personnel will be made at the unit price bid per hour for each item which price shall be full compensation for furnishing the above described items, which includes all supervisory personnel, including foremen, all Social Security, Old Age Benefits, Insurance, Overhead, Profit, Fuel, Lubrication, and Maintenance required to efficiently operate man and equipment. Insurance requirements shall meet or exceed State and other governing agency requirements.



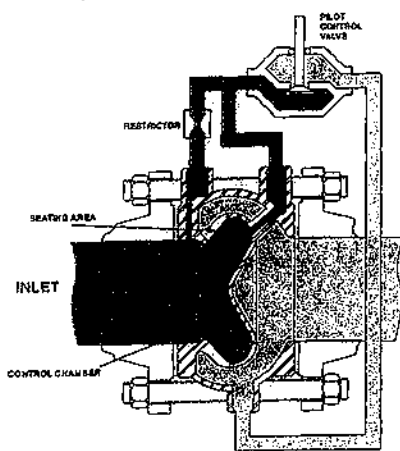
— MODEL — **100-42**
700 SERIES
ROLL SEAL

- Compact Design, Proven Reliable
- Light Weight Materials
- High Pressure Rating Availability
- Easy Installation and Maintenance



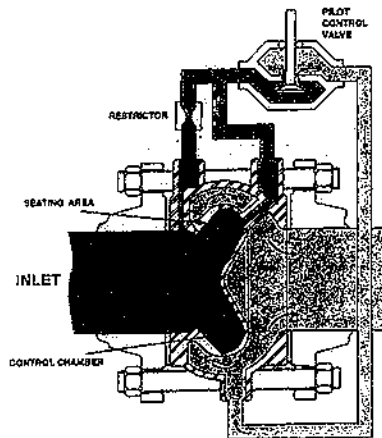
The Cla-Val Model 100-42 Roll Seal valve is a hydraulically operated valve used to control liquid flow by means of a flexible control element: the liner. The basic valve consists of only two parts: a one piece, investment cast body and an elastomeric liner. The valve body is constructed with internal ribs and slots forming a grillwork which surrounds the liner to provide support. A normally closed type valve is formed by the installed liner which covers the grillwork and seats against the raised seating surface in the valve body. Upstream pressure actuates the valve to produce valve opening by rolling the liner off the seating surface and the slotted grillwork. The valve is actuated by upstream pressure as the loading pressure (pressure supplied to the control chamber) is varied by an external pilot control system. A typical pilot control system used to operate the Model 100-42 valve consists of a restriction and a suitable pilot connected to the valve.

Principle of Operation



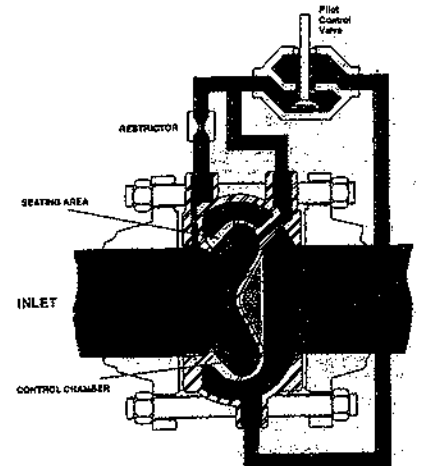
**Model 100-42 Valve
in Closed Position**

Upstream pressure is introduced to the control chamber (the chamber formed behind the liner) of the Cla-Val Model 100-42 Roll Seal valve through the control piping and restrictor. When the pilot is closed, full inlet pressure is supplied to the control chamber, thus balancing the force developed by inlet pressure acting on the upstream face on the liner. Under these conditions, the liner remains in the fully closed position. Since the operating pressure in the control chamber is greater than the outlet pressure, an additional closing force is developed across the liner, pressing the liner against the surrounding slotted grillwork area and seating surface.



**Model 100-42 Valve
in Partially Open Position**

As loading pressure is lowered slightly below inlet pressure, the central portion of the liner is forced to invert and come to rest against the tip of the control chamber cavity. Reducing the loading pressure further (but still higher than outlet pressure) causes the liner to drape over the cone shaped portion of the control chamber cavity. This action causes the outer section of the liner to roll off the seating surface and a portion of the grillwork to partially open the valve.



**Model 100-42 Valve
in Fully Open Position**

The valve is fully opened when loading pressure is sufficiently reduced to allow the liner to roll back completely and expose the full slot area. Restoring loading pressure reverses the liner rolling action to return the liner to the fully closed position.



Design Specification

Sizes:	2, 3, 4, and 6 inch wafer style 6, 8, 10, and 12 inch flanged 6, 8, 10, 12 inch Victaulic® Ends
I Detail Wafer:	Fits ANSI 816.5 class 125, 150, 250, and 300 flanges
End Detail Flanged:	ANSI 816.5 class 150 (fits class 125) or ANSI 816.5 class 300 (fits class 250)
End Detail Victaulic™:	Fits standard steel pipe
Operating Pressure:	720 psi maximum Victaulic™ Ends - 300 psi max.
Maximum Differential:	150 psid continuous, 225 psid intermittent*
Reverse Pressure:	125 psid maximum
Temperature Range:	32 to 160 degrees F*
Flange Operating Pressure:	Class 125-175 psi maximum Class 150-275 psi maximum Class 250-300 psi maximum Class 300-720 psi maximum
Victaulic™ Ends Rating:	300 psi maximum

*Standard natural rubber 65 durometer in water service.
Temperature range depends on liner material. Higher differential pressure ratings available.

For other than standard ANSI flanges consult factory

Din drilling available on all sizes

Dimensions (100-42 Main Valve)

Valve Size (Inches)	2	3	4	6	8	10	12
A	2 1/4	3 3/4	4 1/4	5 1/4	--	--	--
B	--	--	--	10 1/4	14 1/4	18	21 1/2
BB	4 3/4	5 3/4	7 1/4	9 3/4	--	--	--
C	--	--	--	9	11	13	15 1/4
CC	2 1/2	3 1/4	4	5 1/4	--	--	--
D (ANSI 150)	--	--	--	11	13 1/2	16	19
D (ANSI 300)	--	--	--	12 1/2	15	17 1/2	20 1/2
Ports) NPT	--	--	--	1/4	1/4	1/2	1/2
Approx. Wt. (150 lbs.)	4	7 1/2	14	58	115	190	290
Approx. Wt. (300 lbs.)	4	7 1/2	14	87	155	250	375
Max. Continuous Flow (qpm)	224	469	794	1787	3177	4964	7148

Valve Size (mm for ANSI)	50	80	100	150	200	250	300
A	73	90	105	133	--	--	--
B	--	--	--	276	356	457	549
BB	111	149	187	249	--	--	--
C	--	--	--	229	279	330	387
CC	64	83	102	140	--	--	--
D (ANSI 150)	--	--	--	279	343	406	483
D (ANSI 300)	--	--	--	318	381	445	521
E (Ports) NPT	--	--	--	1/4	1/4	1/2	1/2
Approx. kg. (150 lbs.)	1.81	3.63	6.35	30	54.43	89	151.5
Approx. kg. (150 lbs.) with Studs & Nuts	2.72	4.54	10	--	--	--	--
Approx. kg. (300 lbs.)	1.81	3.63	6.35	41.73	72.57	116.57	191
Approx. kg. (300 lbs.) with Studs & Nuts	5	6.35	11.8	--	--	--	--
Max. Continuous Flow (l/s.)	14	30	50	113	200	301	451

NSF Approved 2" thru 12"

Performance Specification

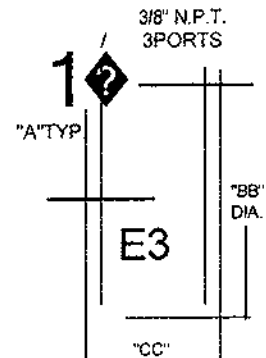
Capacity:	See Technical Data Sheet
Ct Factor:	0.9
Cavitation:	See Technical Data Sheet
Rangeability:	500:1
Bearing Friction:	No friction from slip-type bearings

Material Specification

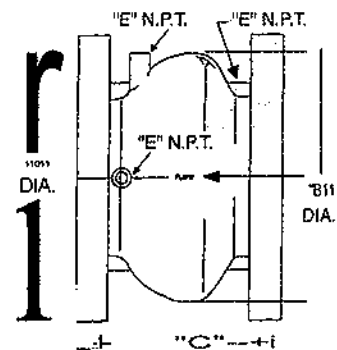
Body:	316L Stainless Steel
Flanges: (Slip on)	Carbon Steel/Clear Cad. Plated
Bolt Kit:	Carbon Steel/Zinc Plated
Liner:	Natural Rubber, 65 duro (standard) Viton, EPDM, Nitrile, Silicone (available)
Liner Retainer:	316 Stainless Steel

Optional Materials

Escoloy 45D
Duplex Stainless Steel
Super Duplex Stainless Steel
Nickel Aluminum Bronze
Titanium



2", 3", 4" and 6" Wafer Style



6", 8", 10" and 12" Flanged Style

When Ordering Please Specify:

- Catalog No. 100-42
- Valve Size
- Fluid Being Handled
- Fluid Temperature Range
- Inlet Pressure Range
- Outlet Pressure Range
- Maximum Differential Pressure
- Minimum Differential Pressure
- Maximum Flow Rate

CLA-VAL

PO Box 1325 Newport Beach CA 92659-0325
Phone: 949-722-4800 • Fax: 949-548-5441

CLA-VAL CANADA

4687 Christie Drive
Beamsville, Ontario
Canada LOR 1R4
Phone: 905-563-4963
Fax: 905-563-4040

CLA-VAL EUROPE

Chemin des Mesanges 1
CH-1032 Romanel/
Lausanne, Switzerland
Phone: 41-21-643-15-55
Fax: 41-21-643-15-50

Represented By:

CLA-VAL™

E-100-42 (R-3/2011)

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Specifications subject to change without notice.

www.cla-val.com

Project Related Drawings

DESIGNED BY	_____
DRAWN BY	_____
CHECKED BY	_____
DATE	_____

FOUNDATION PLAN AND NOTE

SHEET 5-1

GENERAL NOTES:

THE FOUNDATION IS DESIGNED FOR THE FOLLOWING LOADING CONDITIONS:

DESIGN WIND SPEED: 100 MPH
 WIND LOAD ON THE TANK: 15 PSF
 WIND LOAD ON THE ROOF: 10 PSF

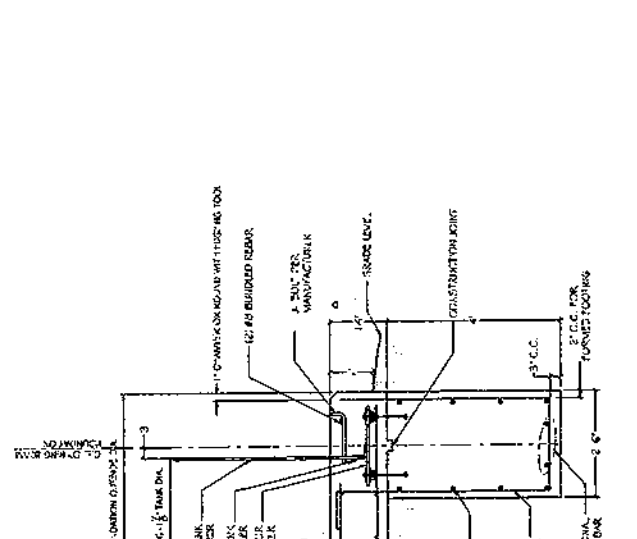
DESIGN LIVE LOAD: 100 PSF
 WIND LOAD ON THE ROOF: 15 PSF

DESIGN EARTH QUAKE: 0.15g
 WIND LOAD ON THE ROOF: 15 PSF

DESIGN SEISMIC CATEGORY: B
 SEISMIC IMPORTANCE CATEGORY: B
 SEISMIC SAFETY FACTOR: 1.25

EXAMINATION NOTES:

- SOIL BEARING CAPACITY: 2.75 TFS PER 1.5 FEET BEARING CAPACITY AND THE SOIL BEARING CAPACITY REPORT SHOULD BE REFERRED TO.
- THE FOUNDATION SHALL BE CONSTRUCTED WITH TANK MANUFACTURING DRAWINGS AND THE GEOTECHNICAL REPORT.
- CONCRETE SHALL BE 3000 PSI COMPRESSIVE STRENGTH PER GEOTECHNICAL REPORT SECTION 3.0.3.
- FULLY REINFORCED CONCRETE SHALL BE PER GEOTECHNICAL REPORT SECTION 3.0.3.
- FORMING BRACKETS SHALL BE PROVIDED AND STRICTLY ENFORCED. THE BRACKETS SHALL BE CONSTRUCTED AS SHOWN TO MAINTAIN THE CORNER STRENGTH OF THE CONCRETE. THE BRACKETS SHALL BE CONSTRUCTED PER GEOTECHNICAL REPORT SECTION 3.0.3.
- REINFORCING STEEL SHALL CONFORM WITH ASTM A615, GRADE 60. IT SHALL BE CLEAN AND FREE OF OIL, GREASE, AND RUST. THE REINFORCING STEEL SHALL BE PROTECTED BY A MINIMUM OF 2 INCHES OF CONCRETE COVER. THE REINFORCING STEEL SHALL BE PLACED IN ACCORDANCE WITH THE GEOTECHNICAL REPORT SECTION 3.0.3.
- CONCRETE SHALL HAVE A MINIMUM COMPRESSIVE STRENGTH OF 1000 PSI AT 28 DAYS.
- CONCRETE PLACEMENT NOTES:
- PLACE CONCRETE IN ACCORDANCE WITH AC 308.14 AND AC 309.
- CURE CONCRETE FOLLOWING AC 308.16. GUDD TO EXTRA. CURING OF CONCRETE.



SECTION A-A: FOOTING
SCALE: 3/4" = 1'-0"

GENERAL NOTES:

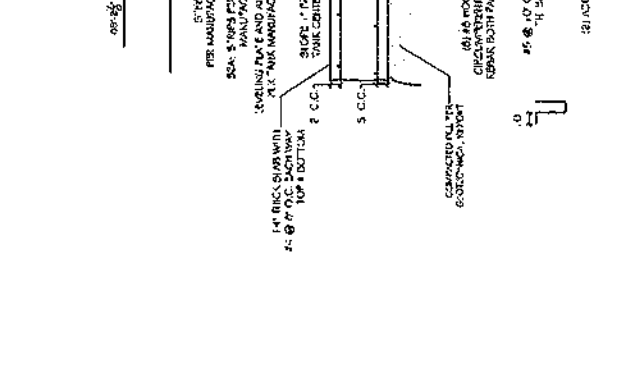
THE FOUNDATION IS DESIGNED FOR THE FOLLOWING LOADING CONDITIONS:

DESIGN WIND SPEED: 100 MPH
 WIND LOAD ON THE TANK: 15 PSF
 WIND LOAD ON THE ROOF: 10 PSF

DESIGN LIVE LOAD: 100 PSF
 WIND LOAD ON THE ROOF: 15 PSF

DESIGN EARTH QUAKE: 0.15g
 WIND LOAD ON THE ROOF: 15 PSF

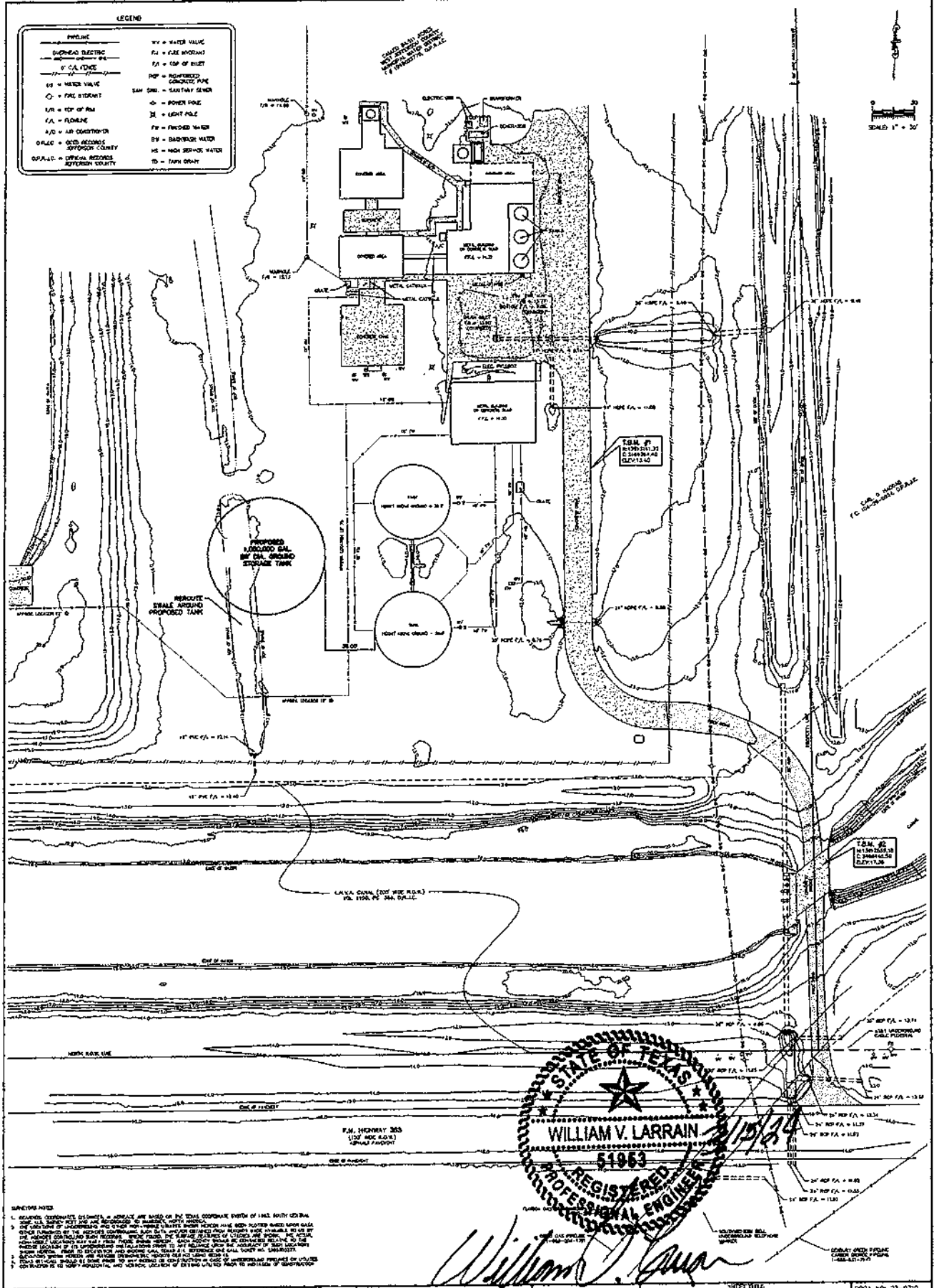
DESIGN SEISMIC CATEGORY: B
 SEISMIC IMPORTANCE CATEGORY: B
 SEISMIC SAFETY FACTOR: 1.25



FOUNDATION PLAN
SCALE: 3/4" = 1'-0"

LEGEND

PIPELINE	WV = WATER VALVE
OVERHEAD ELECTRIC	FA = FIRE ALARM
CONCRETE PILE	FA = TOP OF BUILT
CONCRETE PILE	POP = REINFORCED CONCRETE PILE
WV = WATER VALVE	SAN SW = SANITARY SENDER
FA = FIRE ALARM	PO = POWER POLE
FA = TOP OF BUILT	LI = LIGHT POLE
FA = FLOWLINE	FW = FRESH WATER
AW = AIR CONDITIONER	SW = SEWER WATER
ORALC = ORIGIN RECORDS JEFFERSON COUNTY	MS = MICHIGAN SERVICE WATER
ORALC = OFFICIAL RECORDS JEFFERSON COUNTY	TD = TANK DRAIN



William V. Larrain

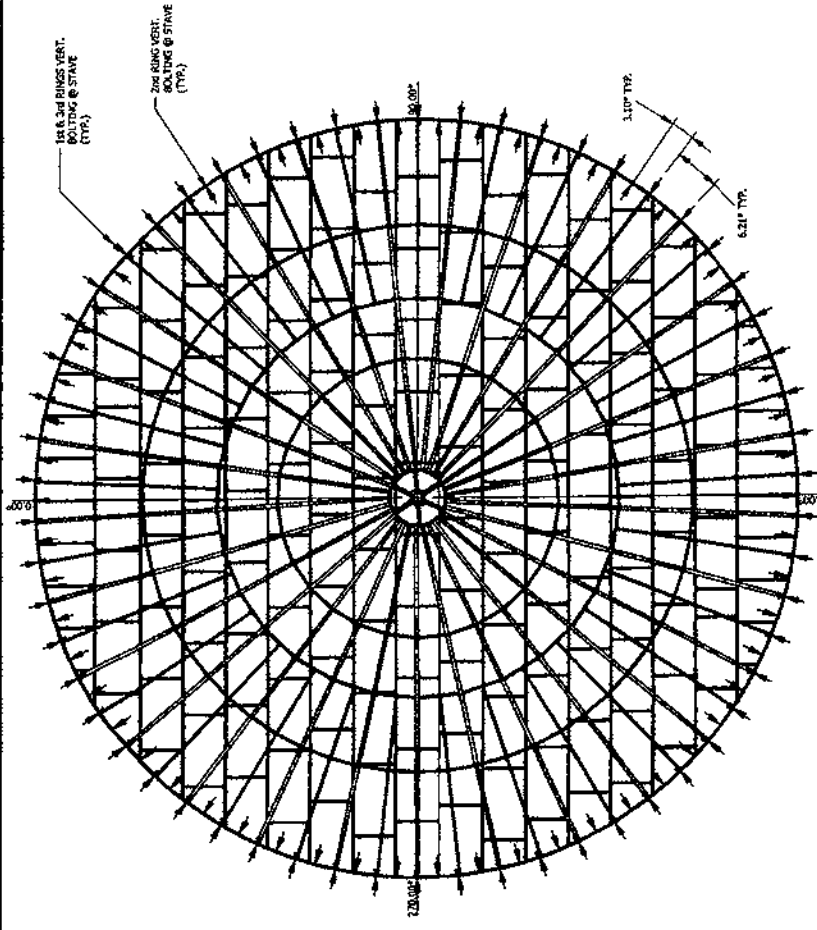
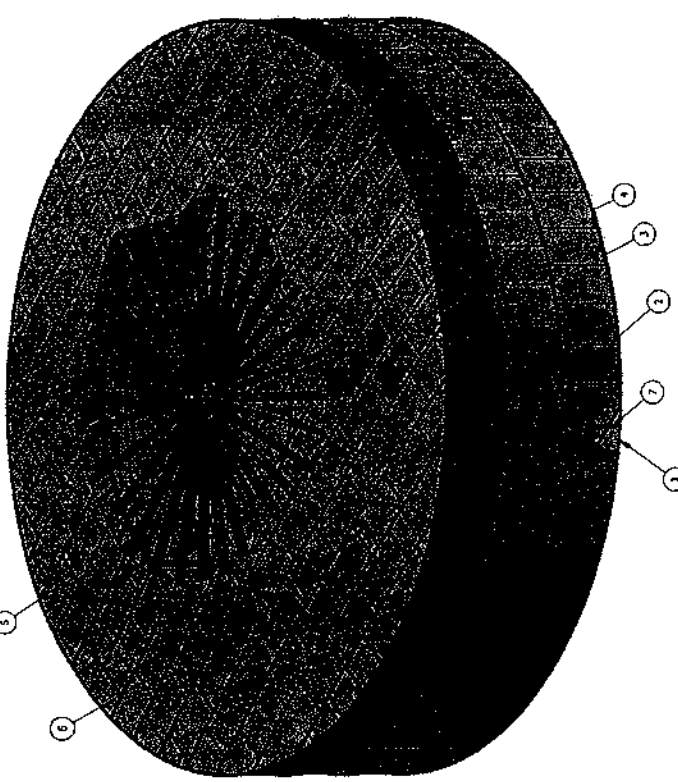
NOTICE:

- ALL DIMENSIONS SHOWN ON THIS PLAN ARE BASED ON THE TOTAL COORDINATE SYSTEM OF 1983. SOUTH OF THE...
- THESE PLANS HAVE BEEN PREPARED BY THE ENGINEER AND THE ENGINEER HAS CONDUCTED A VISUAL CHECK OF THE...
- THESE PLANS HAVE BEEN PREPARED BY THE ENGINEER AND THE ENGINEER HAS CONDUCTED A VISUAL CHECK OF THE...
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<p>SOUTEX SURVEYORS & ENGINEERS</p>	<p>3737 Doctor Drive Port Arthur, Texas 77642 Tel. 409.983.2004 Fax 409.983.2003 soutexsurveyors.com</p>	<p>SHEET TITLE:</p> <p>1 MILLION GALLON PORTABLE WATER STORAGE TANK WEST JEFFERSON MUNICIPAL WATER DISTRICT WATER TREATMENT FACILITY 14026 FAL HIGHWAY 363, JEFFERSON COUNTY, TEXAS</p>	<p>PROJ. NO: 23-0710 SCALE: 1" = 30' DRAWN BY: TC PRINT DATE: 3/11/24 CHECKED BY: AME APPROVED BY: JAA</p>
		<p>AGRON CIVIL ENGINEERS, PLLC PORT ARTHUR, TEXAS</p>	<p>SHEET 1 OF 1</p>

REV	ECO	DESCRIPTION	DATE	DESIGNER	CHECKED	APPROVED
1	00554	CHG TO 2 BAR TO GR. SD	02/15/10	E. ARDA	AB	GB

STG REVISION HISTORY



ITEM	PART NUMBER	DESCRIPTION	QTY	UOM
8	6624-001-HWK	HARDWARE KIT, 86-1 7/8" x 24x1 1/2" HIGH (ANYWA)	1	EA
7	9998-639-109	Z BAR, 2x4, THK. x 7x11 1/2" LG. GR. SD	58	EA
6	6624-001-001	12GA, 86-1 7/8" DIA. SQ. BECN. ASSY	1	EA
5	9012-116-001	ROOF STRUCTURE 86-1 7/8" DIA. x 1 1/2" HIGH w/ 1/8" SQ. GAGE, #8 COLL. ROLLED WAFER MAT.	1	EA
4	8804-001-199	86-1 7/8" DIA. GA. GR. 40, SR. 90° STAVE	58	EA
3	8804-001-198	86-1 7/8" DIA. 1/4" THK. A-36, CR. 60° STAVE	58	EA
2	8804-001-194	86-1 7/8" DIA. 5/16" THK. CR. 50, TR. 62° STAVE	58	EA
1	6624-001-001	12GA, 86-1 7/8" DIA. 87RA ASSY	1	EA

BILL OF MATERIALS

ALL MATERIALS MANUFACTURED BY:

APPROVALS:

DESIGNED BY: [Signature]

CHECKED BY: [Signature]

DRAWN BY: [Signature]

DATE: 02/15/10

PROJECT: 86-1 7/8" DIA. x 24' x 1 1/2" HIGH BOXED STEEL TANK, ANVISA, D. 052-97 (FPC)

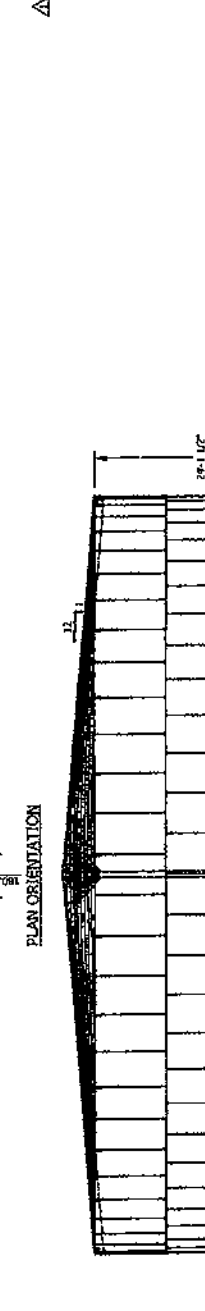
NO. OF SHEETS: 1

SHEET: 1

PROJECT: 8624-001-002

DATE: 02/15/10

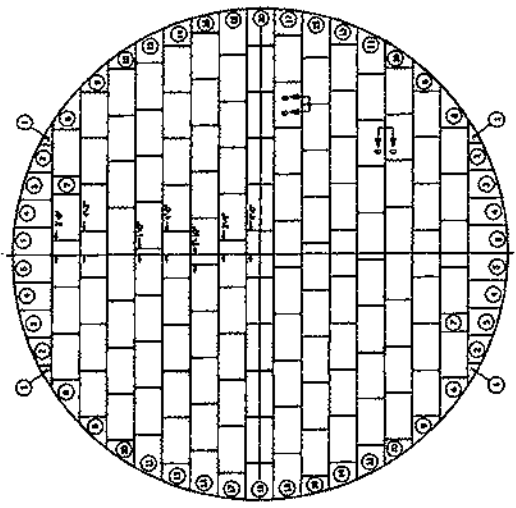
SCALE: 1/8" = 1'-0"



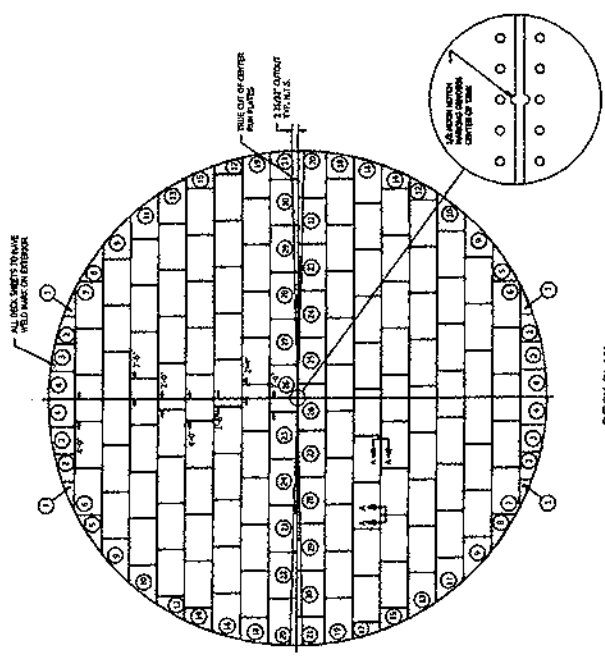
PLAN ORIENTATION

ELEVATION

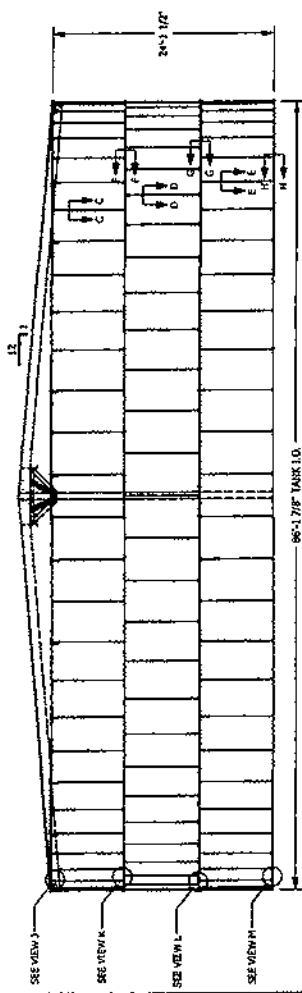
86-1 7/8" TANK I.D.



BOTTOM PLAN



DECK PLAN



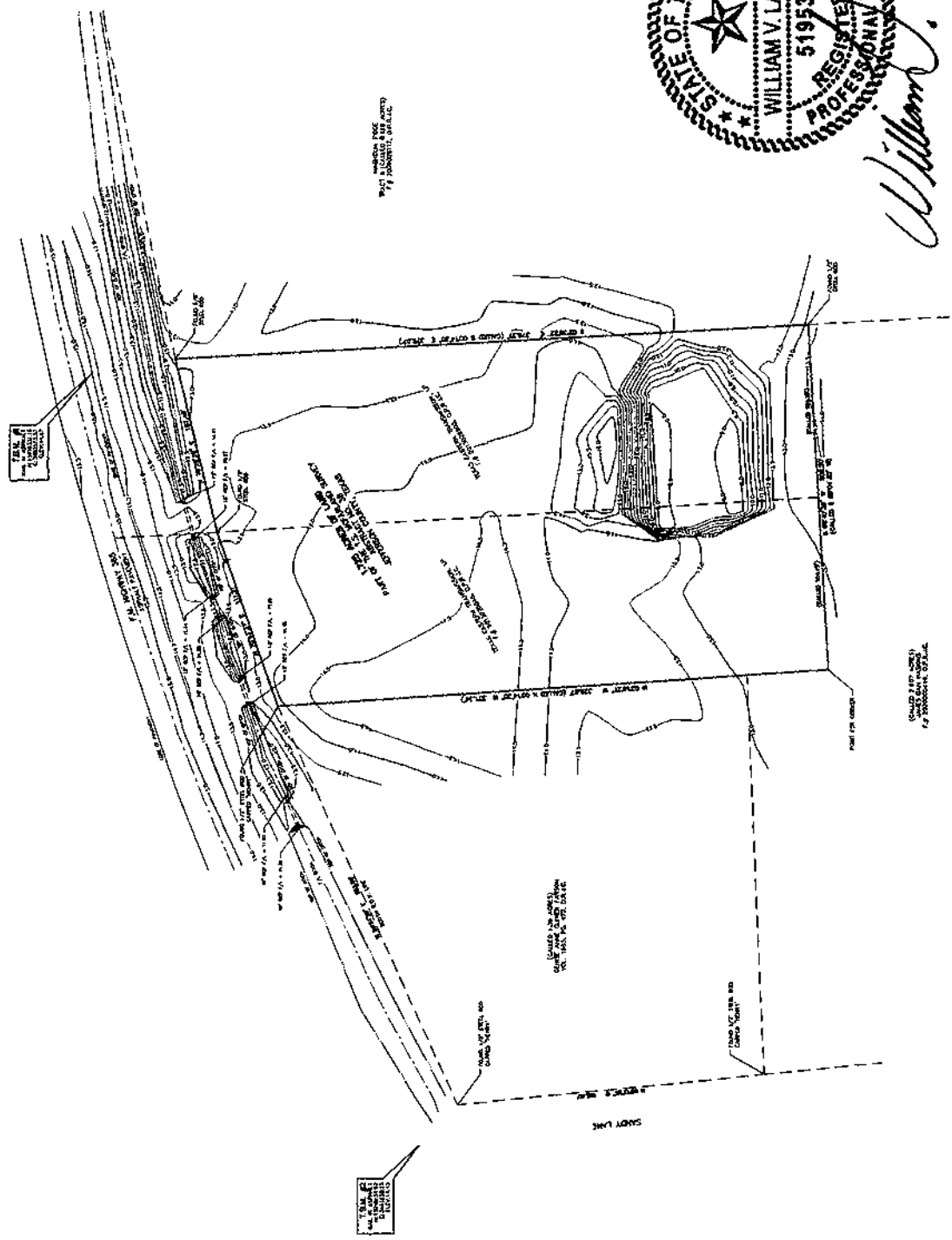
3 RING ELEVATION

COMPANY INC.
 6500 LUCAS RANCH RD.
 RANCHO CUCAMONGA, CA. 91730
 Phone: (909) 912-4480
 Fax: (909) 912-9855

TANK: 86'-1 7/8" DIA x 24'-1 1/2" HIGH
 SKEL. PRODUCT: BOLTED STEEL TANK ANWW D.103-97 (FPC)

SHEET: 1
 TOTAL SHEETS: 1
 DRAWING NO: 8674-001-002
 DATE: 3.06.3

SCALE: 1" = 30'



<p>PROJECT NO. 24-0709 SCALE: 1" = 30'</p>	<p>PROPOSED 30000 GALLON REVENUE STORAGE WHITE STRUCTURE WITH TANKAGE AND 2000 G.P.G. CAPACITY FOR WASHINGTON COUNTY, TEXAS LARRY G. GIBSON, PROJECT MANAGER PORT ARTHUR, TEXAS</p>	<p>3737 Deaton Drive Port Arthur, Texas 77048 Tel. 409-983-3004 Fax 409-983-3005 sou@stoutex.com</p>	<p>SOOUTEX SURVEYORS & ENGINEERS</p>	<p>PROPOSED WORKS THESE PLANS AND SPECIFICATIONS ARE THE PROPERTY OF SOOUTEX SURVEYORS & ENGINEERS. THEY ARE TO BE USED ONLY FOR THE PROJECT AND SITE SPECIFICALLY IDENTIFIED HEREON. ANY REUSE OR MODIFICATION OF THESE PLANS WITHOUT THE WRITTEN CONSENT OF SOOUTEX SURVEYORS & ENGINEERS IS STRICTLY PROHIBITED. SOOUTEX SURVEYORS & ENGINEERS SHALL NOT BE RESPONSIBLE FOR ANY ERRORS OR OMISSIONS IN THESE PLANS OR FOR ANY DAMAGE TO PERSONS OR PROPERTY CAUSED BY THE USE OF THESE PLANS.</p>	<p>THESE PLANS REPRESENT THE PROFESSIONAL JUDGMENT OF THE ENGINEER AND ARE TO BE USED ONLY FOR THE PROJECT AND SITE SPECIFICALLY IDENTIFIED HEREON. ANY REUSE OR MODIFICATION OF THESE PLANS WITHOUT THE WRITTEN CONSENT OF SOOUTEX SURVEYORS & ENGINEERS IS STRICTLY PROHIBITED. SOOUTEX SURVEYORS & ENGINEERS SHALL NOT BE RESPONSIBLE FOR ANY ERRORS OR OMISSIONS IN THESE PLANS OR FOR ANY DAMAGE TO PERSONS OR PROPERTY CAUSED BY THE USE OF THESE PLANS.</p>
--	---	--	---	---	--

- 10" Water Main
- Proposed Hydrant
- Proposed Altitude Valve with 2 Isolation valves and bypass
- Proposed Elevated Tank
- Proposed Road Bore w/ air releases
- Untitled
- Untitled

10" Water Main / T w/ 3 valves

Hwy 365

Proposed Road Bore w/ air releases

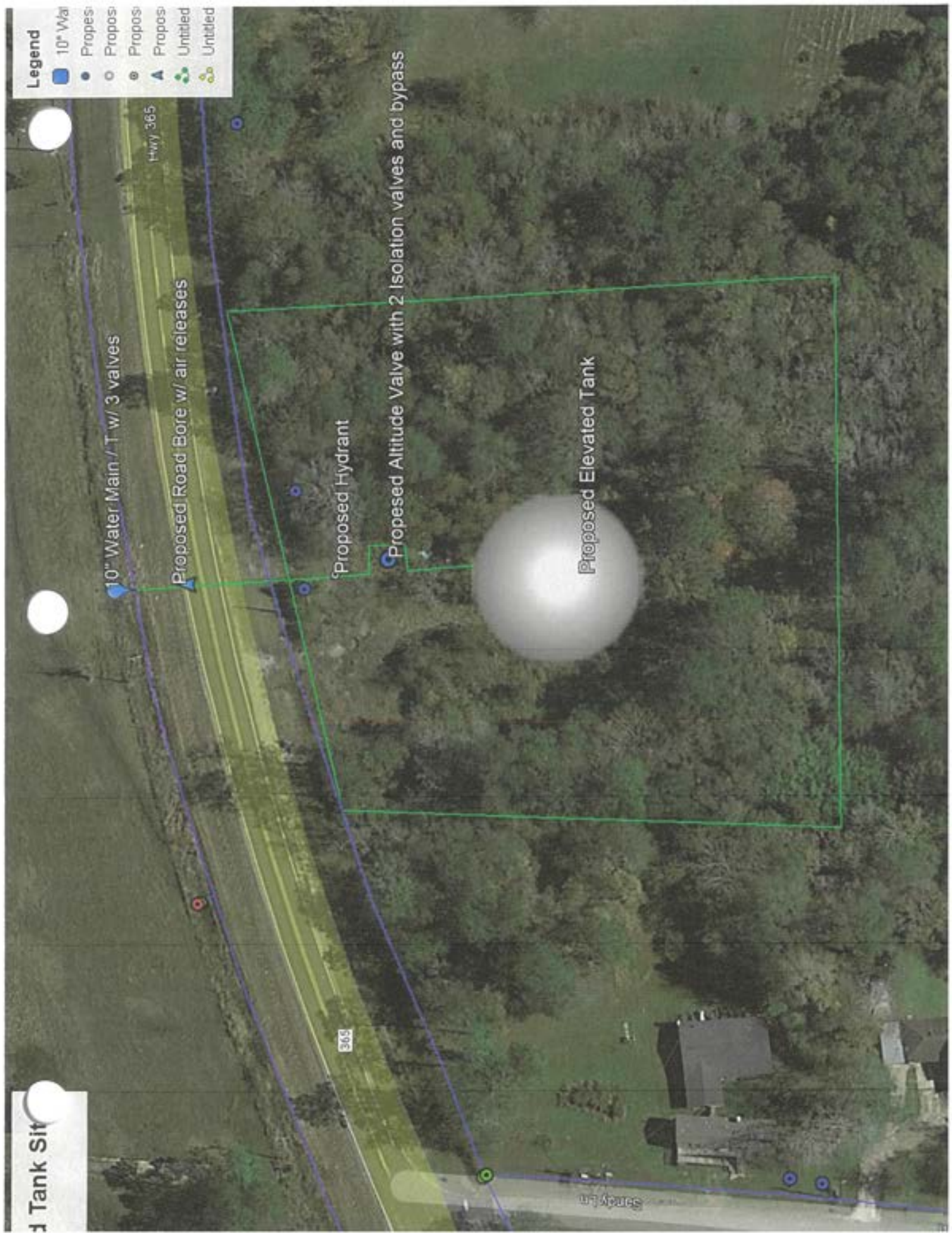
Proposed Hydrant

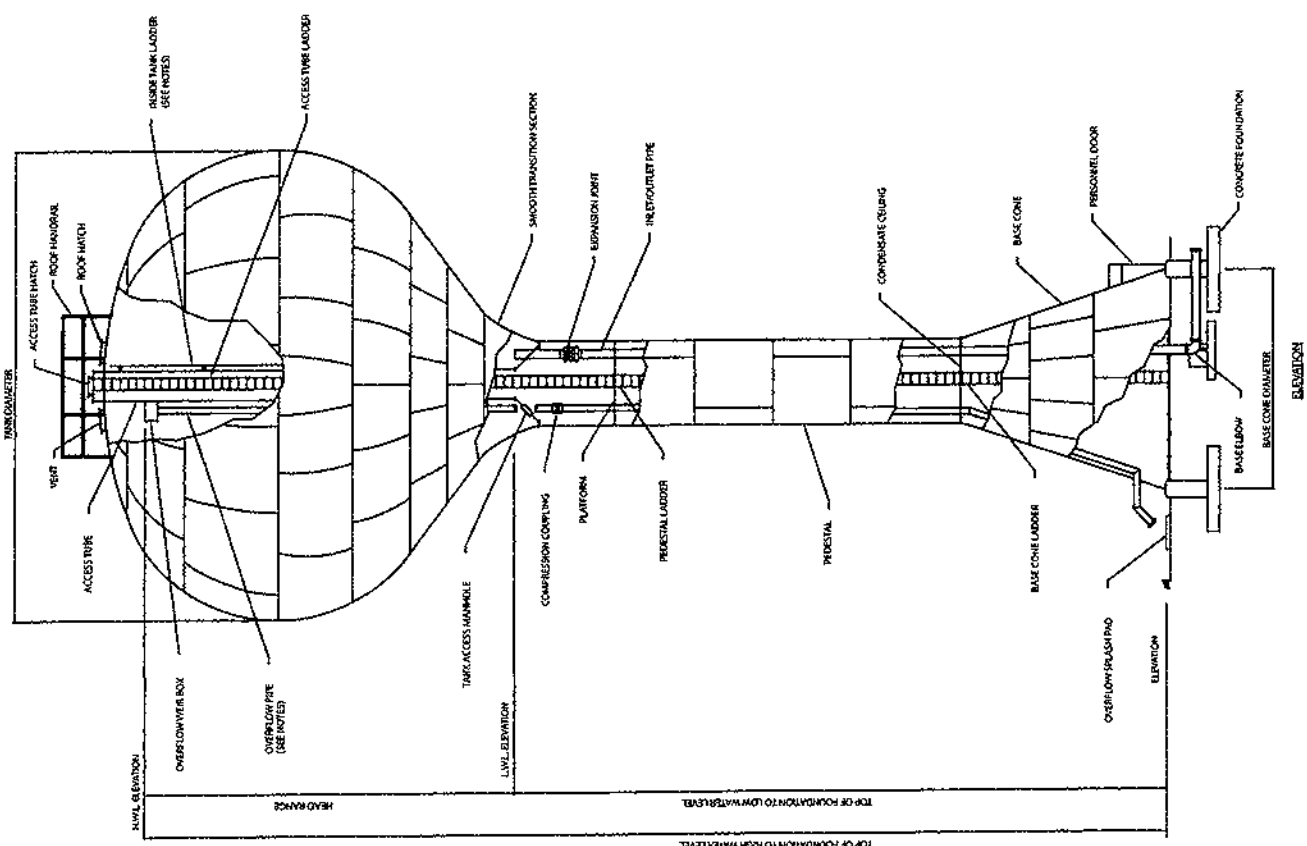
Proposed Altitude Valve with 2 Isolation valves and bypass

Proposed Elevated Tank

365

Sandy Ln





NOTES:

DESIGN:
TANK AND SUPPORT STRUCTURE SHALL BE DESIGNED, FABRICATED AND ERECTED IN ACCORDANCE WITH AWWA D100-96 AND THE PROJECT SPECIFICATIONS.

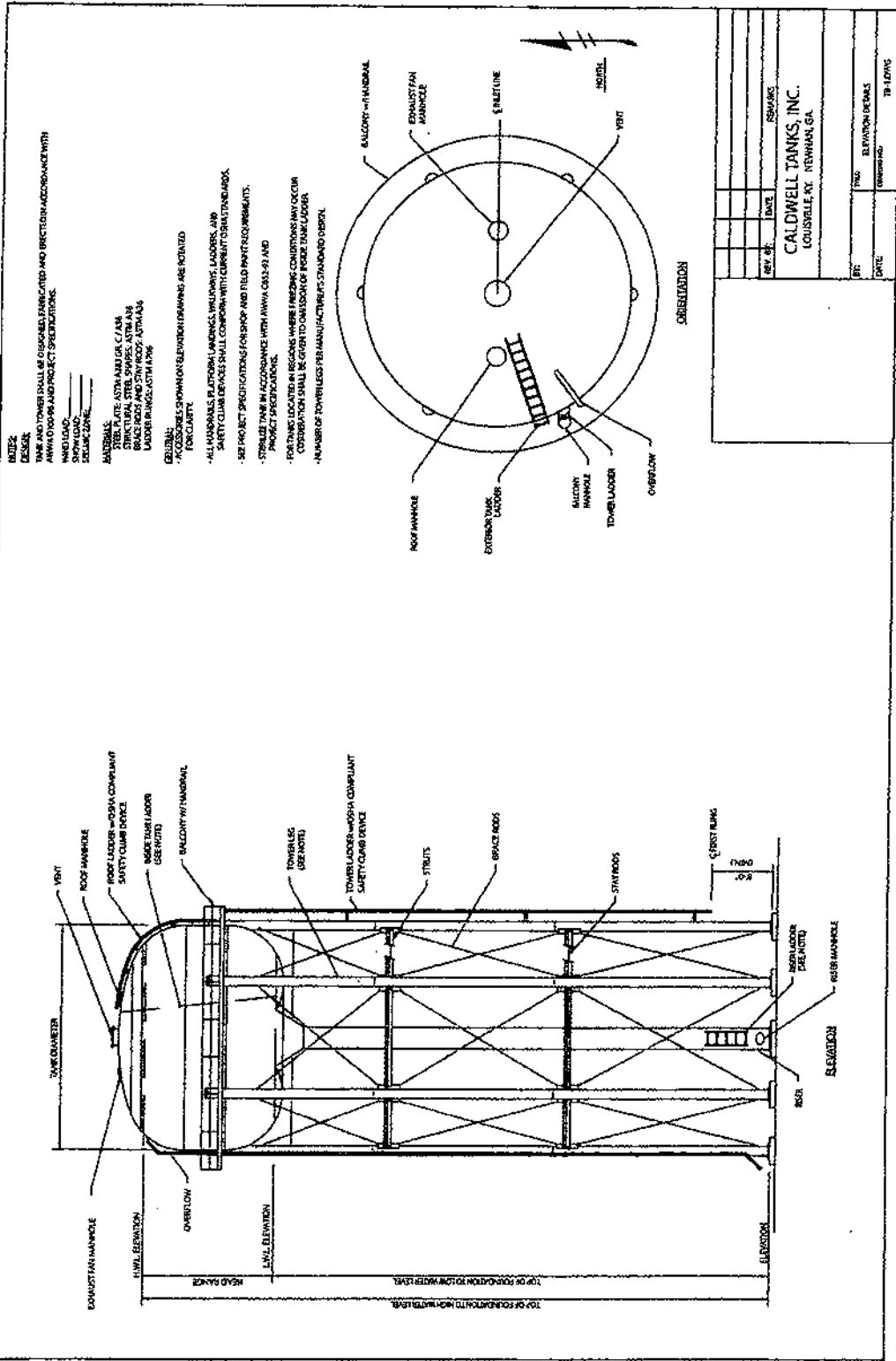
WIND LOAD: _____
 SNOW LOAD: _____
 SEISMIC ZONE: _____

TANK ERECTOR SHALL GROUT UNDER BASE PLATE RING.

MATERIALS:
 STEEL PLATE: ASTM A283 GR C / A36
 STRUCTURAL STEEL SHAPES: ASTM A36
 LADDER RUNGS: ASTM A706

GENERAL:
 - ACCESSORIES SHOWN ON ELEVATION DRAWING ARE ROTATED FOR CLARITY.
 - ALL HANDRAILS, PLATFORM LANDINGS, WALKWAYS, LADDERS, AND SAFETY CLIMB DEVICES SHALL CONFORM WITH CURRENT OSHA STANDARDS.
 - SEE PROJECT SPECIFICATIONS FOR SHOP AND FIELD PAINT REQUIREMENTS.
 - STERILIZE TANK IN ACCORDANCE WITH AWWA C652-92 AND PROJECT SPECIFICATIONS.
 - FOR TANKS LOCATED IN REGIONS WHERE FREEZING CONDITIONS MAY OCCUR, CONSIDERATION SHALL BE MADE TO ROUTE OVERFLOW PIPE INSIDE ACCESS TUBE AND OMIT INSIDE TANK LADDER.

REV. BY:	DATE:	REMARKS:
CALDWELL TANKS, INC.		
LOUISVILLE KY NEWNAN GA		
BY:	TITLE:	
DATE:	ORIG. NO.:	REV. 1 DWG



- NOTES:**
- TANK AND TOWER SHALL BE CONSIDERED FRAMED AND BRACKETED ACCORDANCE WITH APPLICABLE CODES AND PROJECT SPECIFICATIONS.
 - WIND LOAD: _____
 - SEISMIC ZONE: _____
 - MATERIALS:**
 - STEEL PLATE ASTM A572 GR. C 48
 - PIPE AND FITTINGS ASTM A106
 - BRASS BRACKETS ASTM A318
 - WELDS AS SHOWN
 - LAZERS IN ACCORDANCE WITH PROJECT SPECIFICATIONS.
 - GENERAL:**
 - ACCESSORIES SHOWN ON ELEVATION DRAWINGS ARE INDICATED FOR CLARITY.
 - ALL ACCESSIBLE INTERNAL MATERIALS, WELDS, LADDERS, AND SAFETY CLIMB DEVICES SHALL COMPLY WITH CURRENT CODES AND PROJECT SPECIFICATIONS.
 - SEE PROJECT SPECIFICATIONS FOR SHOP AND FIELD PAINT REQUIREMENTS.
 - STABILIZED TANK IN ACCORDANCE WITH API 650-9.1 AND PROJECT SPECIFICATIONS.
 - FOR TANK LOCATED IN REGIONS WHERE FREEZING CONDITIONS MAY OCCUR COORDINATION SHALL BE GIVEN TO OWNER OF INLET TANK LADDER.
 - NUMBER OF TOWER Ladders PER MANUFACTURER'S STANDARD DESIGN.

REV. NO.	DATE	REVISIONS
CALDWELL TANKS, INC. LOUISVILLE, KY NEWHAN, GA.		
DATE	NO.	ELEVATION ITEMS

Geotechnical Engineering Report



TOLUNAY-WONG
ENGINEERS



**Geotechnical Engineering Report
Proposed New Storage Tanks
West Jefferson County Municipal Water District
Jefferson County, Texas**

Prepared for:

**Action Civil Engineers, PLLC
8460 Central Mall Drive
Port Arthur, Texas 77642**

Prepared by:

**Tolunay-Wong Engineers, Inc.
2455 West Cardinal Drive
Beaumont, Texas 77705**

TWE Project No. 23.23.170 / Report No. 148649

Date:

January 26, 2024

January 26, 2024

Action Civil Engineers, PLLC
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Attn: Mr. Will Larrain
wlarrain@accivilengineers.com

Ref: Geotechnical Engineering Report
Proposed New Storage Tanks
West Jefferson County Municipal Water District
Jefferson County, Texas
TWE Project No. 23.23.170 / Report No. 148649

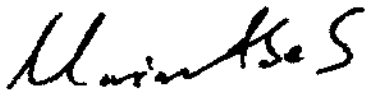
Dear Mr. Larrain,

Tolunay-Wong Engineers, Inc. (TWE) is pleased to submit this report of our geotechnical engineering study for the referenced project. This report contains a detailed description of the field and laboratory work performed for our study, the subsurface soil and groundwater conditions encountered and our geotechnical design and construction recommendations for support of the project.

We appreciate the opportunity to work with you on this phase of the project and we look forward to the opportunity to provide additional services as the project progresses. If you have any questions regarding this report or if we can be of further assistance, please contact us.

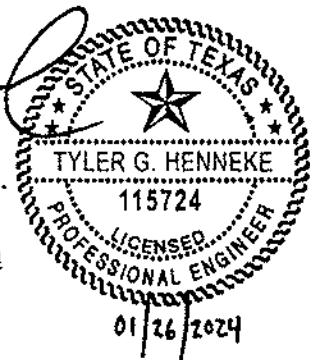

Sincerely,

TOLUNAY-WONG ENGINEERS, INC.
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1 INTRODUCTION/PROJECT DESCRIPTION

1.1 Introduction

This report presents the results of our geotechnical engineering study performed for the proposed new storage tanks for West Jefferson County Municipal Water District (WJCMWD) in Jefferson County, Texas. Our study was conducted in general accordance with TWE Proposal No. P23-B111 dated October 16, 2023 and authorized by execution of our proposal on October 18, 2023.

1.2 Project Description

The project includes one (1) 1,000,000-gal capacity ground storage tank at 14026 FM 365 and one (1) 500,000-gal capacity elevated water storage tank at 21721 FM 365. We understand the ground storage tank will have a diameter of about 86-ft with a height of about 24-ft. We anticipate this tank will be supported on a shallow foundation system such as a concrete ringwall with an improved interior soil pad or on a monolithic mat or slab-on-grade. We understand the elevated tank will be a pedesphere or multi-column design whereby individual shallow or deep foundations are anticipated beneath each pedestal or column. Preliminary conceptual tank exhibits were provided by the Client for reference and are attached herein. No additional project information was provided at the time of this report.

2 PURPOSE/SCOPE OF SERVICES

The purposes of our geotechnical study were to provide the geotechnical information and recommendations needed to assist the Client with the design and construction of suitable foundation systems for support of the proposed tanks. Our scope of services for the project consisted of:

1. Drilling and sampling one (1) test boring (TB) at the center of each tank and three (3) perimeter cone penetration tests (CPTs) at the 1,000,000-gal capacity ground storage tank site to evaluate subsurface stratigraphy and groundwater conditions;
2. Performing geotechnical laboratory tests on the recovered TB samples to evaluate the physical and engineering properties of the subsurface materials encountered;
3. Preparing a synopsis of our findings including existing project site conditions and subsurface soil and groundwater conditions as illustrated by the TB and CPT logs;
4. Providing geotechnical design recommendations for shallow foundation systems including suitable type and depth, allowable soil bearing capacity, lateral resistance, uplift resistance, resistance to overturning moments and settlement estimates;
5. Providing geotechnical design recommendations for deep foundation systems including suitable types and depths, ultimate axial compression and tension capacities, recommended factors of safety, lateral pile analysis soil design parameters, pile group considerations and settlement estimates; and,
6. Providing geotechnical construction recommendations including site development, subgrade preparation, excavation considerations, dewatering and groundwater control, fill and backfill placement, compaction requirements, foundation installation and quality control guidelines.

Our scope of services did not include any environmental assessments for the presence or absence of wetlands or of hazardous or toxic materials within or on the soil, air or water at this site. Any statements in this report or on the logs regarding odors, colors, and unusual items and conditions are strictly for the information of the Client.

3 FIELD PROGRAM

TWE conducted explorations of subsurface conditions by performing one (1) TB at the center of each tank to a depth of 100-ft below existing grade. At the location of the ground storage tank, we also performed three (3) CPTs along the perimeter of the proposed tank footprint to a depth of 75-ft below existing grade. The TBs were performed on November 15 and 16, 2023. The CPTs were performed on November 17, 2023. The exploration locations are shown on the location plans provided in Appendix B of this report.

3.1 Test Borings (TBs)

3.1.1 Drilling Methods

The test borings were performed in general accordance with the Standard Practice for Soil Investigation and Sampling by Auger Boring (ASTM D1452) using conventional buggy-mounted drilling equipment. The test borings were advanced using dry-auger drilling methods until groundwater was encountered. Following static groundwater level measurements, the borings were completed to depth using wash-rotary drilling methods. Soil samples were obtained continuously to a depth of 12-ft, at the 13-ft to 15-ft depth range and at 5-ft depth intervals thereafter until the boring completion depths were reached.

3.1.2 Sampling Methods

Fine-grained, cohesive soil samples were recovered from the test borings by hydraulically pushing a 3-in diameter, thin-walled tube a distance of about 24-in. The field sampling procedures were conducted in general accordance with the Standard Practice for Thin-Walled Tube Sampling of Soils (ASTM D1587). Our Geotechnician visually classified the recovered soils and obtained field strength measurements of the recovered soils using a calibrated pocket penetrometer and/or hand torvane device. The tube samples were extruded in the field, wrapped in foil, placed in moisture-sealed plastic bags and protected from disturbance prior to transport to the laboratory. The recovered soil sample depths and pocket penetrometer measurements are presented on the boring logs in Appendix C.

Cohesive soils thought to be coarse-grained during drilling, as well as cohesionless and semi-cohesionless soils, were collected with the Standard Penetration Test (SPT) sampler driven 18-in by blows from a 140-lb hammer falling 30-in in accordance with the Standard Test Method for Standard Penetration Test (SPT) and Split-Barrel Sampling of Soils (ASTM D1586). The number of blows required to advance the sampler three (3) consecutive 6-in depths are recorded for each corresponding sample on the boring logs. The N-value, in blows per foot, is obtained from SPTs by adding the last two (2) blow count numbers. The consistency of cohesive soils and the relative density of cohesionless and semi-cohesionless soils can be inferred from the N-value. The samples obtained from the split-barrel sampler were visually classified, placed in moisture-sealed plastic bags and transported to our laboratory. SPT sampling intervals and blow counts are presented on the project boring logs in Appendix C.

3.1.3 Boring Logs

Our interpretations of general subsurface soil and groundwater conditions at the test boring locations are included on the project boring logs in Appendix C. The interpretations of the soil types throughout the boring depths and the locations of strata changes were based on visual classifications during field sampling and laboratory testing using the Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System) [ASTM D2487] and the Standard Practice for Description and Identification of Soils (Visual-Manual Procedure) [ASTM D2488]. A key to the symbols and terms used on the boring logs is also included in Appendix C.

3.1.4 Groundwater Measurements

Groundwater level measurements were attempted in the open boreholes during dry-auger drilling. Measurements were taken initially during dry-auger drilling when groundwater was first encountered and at 5-min intervals thereafter over a 15-min time period. The groundwater measurements observed within the soil boring are described in Section 5.3 of this report.

3.2 Cone Penetration Tests (CPTs)

CPT soundings were performed in accordance with Standard Test Method for Electronic Friction Cone and Piezocone Penetration Testing of Soils (ASTM D5778) utilizing a track-mounted rig with a minimum capacity of 20-tons. The CPT soundings were performed to a depth of 75-ft. The probed holes were backfilled to the caved depth with cement-bentonite grout upon completion.

CPT soundings were performed by hydraulically pushing a series of cylindrical rods, with an instrumented probe at the base, into the soil at a constant rate of approximately 2-cm/s. The probe consists of a cone tip, a side-friction sleeve, and a porous filter element. Continuous measurements of penetration resistance at the cone tip (q_c), friction on the cone sleeve (f_s) and pore water pressure (u_2) are recorded during penetration. These parameters are processed through published correlations and comparisons with laboratory testing and geotechnical borings to provide soil properties such as soil type, undrained shear strength, unit weight, over-consolidation ratio, relative density, soil friction angle and equivalent "N" values.

These properties, when correlated with data from test borings, provide a more complete understanding of the subsurface conditions. The locations and depths penetrated of the subsurface explorations performed for this project are illustrated in Appendix B. CPT sounding logs are presented in Appendix D.

4 LABORATORY SERVICES

A laboratory testing program was conducted on selected soil samples from the TBs to assist in classification and evaluation of the physical and engineering properties of the soils encountered within each tank site. Geotechnical laboratory tests were performed in general accordance with ASTM International standards. The types and brief descriptions of the geotechnical laboratory tests performed are presented in Table 4-1 below. Standard geotechnical laboratory test results are provided on the test boring logs presented in Appendix C.

Table 4-1 Geotechnical Laboratory Testing Program	
Test Description	Test Method
Amount of Material Finer than No. 200 Sieve	ASTM D1140
Water (Moisture) Content	ASTM D2216
One-Dimensional Consolidation	ASTM D2435
Unconsolidated-Undrained Triaxial Compression	ASTM D2850
Liquid Limit, Plastic Limit and Plasticity Index	ASTM D4318
Density (Unit Weight)	ASTM D7263

4.1 Consolidation Testing

Results of one-dimensional consolidation tests performed on selected cohesive soil samples from the TBs are summarized in Table 4-3 on the following page. The test reports for each test are included in Appendix E.

Sample disturbance issues related to consolidation test results are discussed in detail in published literature for soft clays (Anderson and Kolstad, 1979, DeGroot et al., 2005) as well as for over-consolidated clays (Sabatini et al., FHWA Circular No. 5, 2002). According to the referenced FHWA publication, sample disturbance can occur during handling and transportation to laboratory despite best efforts put in to maintain structural integrity and moisture condition of the samples.

Anderson and Kolstad (1979) suggest the volumetric strain required to consolidate the sample back to its in-situ vertical effective stress is a relative indicator of sample quality. Table 4-2 below presents the Sample Quality Designations (SQD) suggested by Anderson and Kolstad (1979) which were used for screening of the consolidation samples.

Table 4-2 Sample Quality Designation	
Volumetric Strain (%)	Sample Quality Designation (Description)
< 1	A (Very Good to Excellent)
1 - 2	B (Good)
2 - 4	C (Fair)
4 - 8	D (Poor)
> 8	E (Very Poor)

Actual SQD determinations for each sample tested are provided in Table 4-3 below. Tabulated compressibility parameters derived from the consolidation tests are also presented in Table 4-3.

Table 4-3 Summary of One-Dimensional Consolidation Test Data								
Boring	Depth Interval (ft)	Soil Classification	e_0	P_c (tsf)	C_c	C_R	OCR	SQD
TB-1	6 - 8	CH	0.61	2.9	0.18	0.031	5.4	A
TB-1	33 - 35	CH	1.17	5.6	0.40	0.050	3.8	A
TB-2	6 - 8	SC	0.58	1.3	0.10	0.013	3.1	A

e_0 = Initial Void Ratio

C_r = Recompression Index

P_c = Pre-consolidation Pressure

SQD = Sample Quality Designation

C_c = Compression Index

OCR = Overconsolidation Ratio

5 PROJECT SITE CONDITIONS

Our interpretations of soil and groundwater conditions within the project sites are based on information obtained from the referenced explorations. This information was used as the basis for our geotechnical conclusions and recommendations provided herein. Subsurface conditions could vary in areas not investigated by the project explorations. Significant variations in subsurface conditions encountered during construction at areas not investigated by the project explorations could require reassessment of our recommendations.

5.1 Site Description/Surface Conditions

The project sites for the ground storage tank and the elevated storage tank are located at 14026 FM 365 and 21721 FM 365, respectively, in Jefferson County, Texas. The existing ground surfaces at the proposed tank locations were relatively flat and grass-covered at the time of our field program. Drainage across the sites appeared to be adequate as no areas of ponded water were observed at the time of our field program. TWE utilized conventional track or highland buggy-mounted equipment to conduct the field explorations.

5.2 Subsurface Soil Stratigraphy

The generalized subsurface soil conditions within the project sites were interpreted from the logs presented in Appendices C and D herein. The generalized subsurface soil profiles considered for the project sites are summarized in Table 5-1 and 5-2 below.

Depth Range (ft)		Strata Description
0	8	Firm to Stiff Clay
8	43	Stiff to Very Stiff Clay
43	58	Medium Dense Sand
58	68	Dense Sand
68	78	Very Dense Sand
78	100	Very Stiff to Hard Clay

Depth Range (ft)		Strata Description
0	4	Loose to Medium Dense Sand
4	6	Stiff to Very Stiff Clay
6	18	Very Loose Sand
18	33	Very Soft to Soft Clay
33	48	Firm to Stiff Clay
48	83	Stiff to Hard Clay
83	100	Very Dense Sand

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5.3 Groundwater Observations

Groundwater level measurements were attempted in the open TB boreholes when groundwater was first encountered during dry-auger drilling and at 5-min intervals over a 15-min time period. At TB-1 within the ground storage tank site, groundwater was first encountered at a depth of 18.0-ft during dry-auger drilling with static water levels rising to a depth of 15.8-ft after 15-min. Groundwater was not encountered during dry auger drilling of TB-2 at the elevated storage tank site due to borehole instability. Caving of the borehole was measured at 7.8-ft below exiting grade.

Design groundwater levels of 16-ft and 6-ft were considered for the borings associated with the ground storage tank and elevated storage tank sites, respectively. However, the groundwater levels at the sites can fluctuate with climatic and seasonal variations and should be verified before construction. Accurate determination of static groundwater levels is typically made with standpipe piezometers. Installation of piezometers to evaluate long-term groundwater conditions within the project sites was not included in our scope of work.

5.4 Design Soil Parameters

Plots of design soil strength and unit weight interpreted from our field measurements and laboratory testing are presented in Appendix F. These design parameters were used as the basis of our engineering analyses and were selected using the subsurface data from the TBs and CPTs performed for this project, published references and our local experience. Please note the generalized design soil stratification and soil types along with depth, assumed for engineering analysis purposes, can vary in areas not investigated by the project explorations.

A line indicating the ratio of undrained cohesion to effective overburden pressure (c/p) equaling 0.22 is also superimposed on the undrained shear strength plot in Appendix F. This line represents the minimum value of undrained shear strength with depth according to the SHANSEP (Soil Stress History and Normalized Soil Engineering Properties) relation (Ladd and Foote, 1974).

5.5 Soil Shrink/Swell Potential

The tendency for soils to shrink and swell with change in moisture content is a function of clay content and type. These properties are generally defined by the Atterberg Limits. A generalized relationship between shrink/swell potential and the soil plasticity index is shown in Table 5-3 below.

Plasticity Index Range	Shrink/Swell Potential
0 - 10	Very Low
10 - 15	Low
15 - 25	Medium
25 - 35	High
> 35	Very High

Based on Table 12-2 of the International Code Council (ICC) Geotechnical Engineers Handbook (2nd Edition).

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The amount of expansion which could occur with increases in moisture content is inversely related to the overburden pressure. Therefore, the larger the overburden pressure, the smaller the amount of expansion. Near-surface soils are thus susceptible to shrink/swell behavior because they experience low amounts of overburden unless subjected to a sustained load from external sources. The zone of seasonal moisture variation (active zone) at these project sites is believed to be limited to the upper 6-ft depth range of existing grade.

We estimated potential shrink/swell movements using the Texas Department of Transportation (TxDOT) Method TEX-124-E for determination of Potential Vertical Rise (PVR). Considering the plasticity characteristics of the existing subgrade soils encountered at the project sites, the ground storage tank site appears to possess very high shrink/swell potential with PVR estimates on the order of 1.5-in to 3.5-in for wet to dry conditions, respectively. The upper soils within the elevated storage tank site appear to possess low to medium shrink/swell potential with anticipated PVR movements less than 1-in. No consideration was given for any sustained loads or external pressures on the native site soils, removal or replacement of existing soils with non-expansive structural fill or site grade raise with non-expansive structural fill.

Lightly-loaded shallow foundations constructed near grade or slabs-on-grade founded directly on expansive soils are typically sensitive to shrink/swell movements greater than about 1-in. Although movements caused by shrink/swell behavior are not anticipated to be a critical design concern for the ground storage tank site, a 3-ft deep removal of the native site soils and replacement with properly-compacted structural clay fill could be considered to mitigate potential shrink/swell movements to 1-in or less. Based on the upper soil conditions within the elevated storage tank site, removal and replacement with structural fill is not considered necessary for mitigation of potential shrink/swell movements.

6 GROUND STORAGE TANK DESIGN

Based on the information provided by the Client, we understand the new 1,000,000-gal capacity ground storage tank will have a diameter of 86-ft and sidewall height of 24-ft. We anticipate this tank will be supported on a shallow foundation system such as a concrete ringwall with an improved interior soil pad or on a monolithic mat or slab-on-grade.

The proposed tank foundation should be designed to distribute the tank loads to the foundation soils without causing bearing capacity failures and excessive total and differential movements. Also, settlement of the foundation soils due to hydrotest and sustained service loads should be within tolerable limits. Recommendations for conventional shallow concrete ringwall and monolithic mat/slab-on-grade foundations options for the ground storage tank are discussed in the following report sections.

6.1 Reinforced-Concrete Ringwall Foundation

A reinforced-concrete ringwall foundation will distribute the concentrated loads of the tank shell as well as provide a level and solid surface for tank shell construction. The tank foundation should be designed and constructed with applicable standards and guidelines determined by the Civil/Structural Engineer and Tank Manufacturer.

Based on the subsurface conditions encountered at the ground storage tank project site, a conventional concrete ringwall foundation with an improved interior soil pad is considered feasible for this site. We recommend the ringwall footing be placed at a minimum depth of 3-ft below existing grade. The width of the ringwall should be a minimum of 18-in to facilitate placement of reinforcing steel. Ultimately, the design ringwall depth and width should be selected by the Civil/Structural Engineer and Tank Manufacturer.

We recommend a controlled low-strength material (CLSM) seal slab be placed beneath the concrete ringwall and over the exposed subgrade bearing surface to protect the underlying soils from effects of weathering during foundation construction. Additional considerations pertaining to CLSM are provided in Section 8.2.2 of this report.

6.1.1 Lateral Earth Pressures

Ringwall foundations should be designed to resist direct hoop stress created by internal lateral earth pressure resulting from tank loads and the weight of the backfill confined within the ringwall. For tank ringwall design, TWE considers an at-rest (K_0) lateral earth pressure coefficient since the ringwall will be restrained and unable to move outward in response to lateral stress. To compute the lateral earth pressures due to the weight of the confined fill material, a triangular lateral stress distribution should be assumed.

Based on available published literature (Foundation Engineering Handbook, H-Y Fang, 2004), an at-rest lateral earth pressure coefficient (K_0) of 0.60 is recommended for properly-compacted structural clay fill material. This coefficient is considered a lower bound value based on proper compaction techniques and the assumption the backfill material within the tank ringwall will be normally-consolidated. The referenced literature indicates K_0 values are dependent on soil-stress history where over-consolidation would tend to increase the K_0 values.

Appropriate lateral earth pressure coefficients to be used for design of ringwall foundations will ultimately depend on the type of backfill material specified by the Civil/Structural Engineer and Tank Manufacturer. In addition, the ringwall should be designed to resist hydrostatic pressures from water pressure increases within the interior of the ringwall.

6.1.2 Stability

Ground storage tank stability is typically analyzed for either hydrotest or maximum operational loading conditions (whichever is greater) and is generally controlled by the undrained shear strength of the supporting soil. Tanks supported on ringwall foundations should satisfy three (3) separate bearing capacity concerns: (1) base shear (deep stability), (2) edge shear and (3) ringwall bearing capacity (punching shear). Unless a significant portion of the soil column is weak, base shear is typically not a critical issue. Base and edge shear stability issues and evaluation procedures for primarily cohesive soil profiles are discussed in detail by Duncan and D'Orazio (1984).

The mechanism of base shear failure is very similar to the mechanism for bearing failure of a shallow footing on clay. In this mode of failure, the entire tank acts as a single unit in which the entire base of the tank undergoes downward movement while the foundation soils are squeezed outward laterally from beneath the tank. For base shear stability, a minimum factor of safety of 1.5 is recommended.

In the case of edge shear failure, the near surface soils shear allowing a small section of the tank to distort, deform and subsequently rupture. Edge shear failure is possible because a steel tank is relatively flexible and when local failure occurs, a portion of its perimeter moves independently of the adjacent tank base area. Edge shear failure is the most common mode of bearing failure for ground storage tanks supported on shallow foundation systems. For edge shear stability, a minimum factor of safety of 1.5 is recommended.

As the load increases on the ringwall, vertical movement of the ringwall is accompanied by compression of the foundation soil directly underneath the ringwall. With continued downward movement, the foundation soils shear around the ringwall perimeter. Based on our experience with similar soils and our local practice, we computed allowable bearing pressures for the ringwall footing using a factor of safety of 2.0.

The edge shear and base shear stability of the storage tanks were evaluated based on the tank height and diameter provided by the Client and by assuming a specific gravity of 1.0 for water stored in the tank. Undrained base and edge shear stability evaluations using the pressures provided were performed using the methodology proposed by Duncan and D'Orazio (1984).

Computed factors of safety against the modes of failure described were evaluated using the available bearing capacity theories which consider the characteristics of the underlying foundation soils beneath the tank in comparison with the tank diameter. The stability evaluations were performed using the design soil parameters provided in Appendix F, Figure 1. The results of our tank stability analysis are summarized in Table 6-1 on the following page.

Tank Diameter (ft)	Tank Shell Height (ft)	Hydrotest Load (psf)	Factor of Safety (Base Shear)	Factor of Safety (Edge Shear)
86	24	1,498	6.4	3.9

The factors of safety in Table 6-1 exceed recommended minimum values which are typically on the order of 1.5 and 1.3, respectively, and are considered acceptable. Following the methodology recommended by Skempton (1951) for strip footings supported on clay, for a ringwall width of 1.5-ft (18-in) and bearing depth of 3-ft, an allowable bearing pressure beneath the tank ringwall of 3,950-psf was calculated assuming a factor of safety of 2.0. This value is based on native stiff clay site soils beneath the ringwall and properly-compacted structural clay fill within the interior of the ringwall. This value should be used when evaluating the punching shear failure mechanism during ringwall design.

6.1.3 Settlement

In addition to bearing capacity concerns, the tank should also perform adequately with regards to settlement from induced hydrotesting and long-term operating conditions. Settlements can be expected due to immediate elastic compression and long-term consolidation of the foundation soils beneath the tank footprint. Significant settlements of the new ground storage tank structure are not expected provided the surcharge loads exerted by the tank are no greater than the bearing capacity of the foundation soils within the new tank footprint.

We evaluated hydrotest and consolidation settlement of the ground storage tank using the computer program Settle 3 by Rocscience. Immediate (hydrotest) settlements were computed using estimated design elastic modulus values and a hydrotest loading of 1,498-psf assuming the tank is full of water to the sidewall height provided by the Client. Conventional Terzaghi's theory of one-dimensional consolidation was used for our analysis of long-term operating conditions. Long-term sustained loadings were estimated based on an average operating level of 75% of the provided tank sidewall height over the life of the tank. The estimated long-term sustained loading for the tank used for our long-term consolidation settlement analysis was 1,124-psf, respectively. The magnitudes of the computed long-term settlements were corrected to account for the three-dimensional excess pore water pressure dissipation effects as recommended by Skempton and Bjerrum (1957). The results of our settlement analyses are summarized in Table 6-2 below.

Tank Diameter	Hydrotest Settlement (in)		Long-Term Settlement (in)	
	Center	Edge	Center	Edge
86-ft	Less than 1.0	Less than 1.0	1.0 - 1.5	Less than 1.0

Please note our empirical settlement estimates in Table 6-2 on the previous page could be +/-20% of the actual values. Immediate settlement (elastic undrained distortion) will be realized during tank hydrotesting whereby some rebound will occur once the hydrotest load is removed (typically about 40% to 60% of the elastic distortion). Long-term consolidation settlement will be dependent upon the sustained loading conditions of the tank over its service life but will typically occur over a duration of 10+ years. We recommend final tank piping connections be designed for the long-term settlement values provided in Table 6-2 on the previous page.

6.1.4 Tank Hydrotesting

A carefully monitored and staged hydrotesting program will be critical for the long-term performance of the proposed ground storage tank. TWE could assist the Client, Tank Manufacturer and Civil/Structural Engineer with the development of a hydrotesting program specific to the proposed ground storage tank. Hydrotesting generally consists of filling the tank with water under controlled conditions after construction is complete to check the competency of the tank shell and bottom, to verify the ability of the ringwall foundation to carry the loads imposed by the tank and to reduce the amount of settlement the tank will experience over its service duration.

We recommend the controlled, stage-loaded hydrotesting program for the tank be accompanied by a settlement monitoring program. A series of reference points should be established and surveyed around the concrete ringwall prior to hydrotesting. Spacing of reference points along the circumference of the ringwall should obey the applicable design standard or guideline. The minimum number of reference points along the tank ringwall to be established for the new tank should be based on the circumferential length of the tank along the ringwall. We recommend elevations of hydrotest hold points be established as follows:

1. Directly after construction of the ringwall and prior to installation of the tank shell to establish a baseline;
2. Once the tank shell is erected and directly before hydrotesting begins while the tank is still empty;
3. Once the hydrotest water height reaches the 25% full mark;
4. Once the hydrotest water height reaches the 50% full mark;
5. Once the hydrotest water height reaches the 75% full mark;
6. Once the hydrotest water height reaches the 100% full mark;
7. 24-hrs after the initial 100% full mark reading; and,
8. Directly after the tank is empty to determine rebound of the ringwall.

Settlement observations should be reviewed by the Client, Tank Manufacturer, Civil/Structural Engineer and TWE as hydrotesting proceeds to assess differential settlement, local slope, tank tilt and out-of-plane distortion. Corrective action should be taken if necessary. Criteria for acceptable settlement should be established by the applicable design standard or guideline. If excessive settlement rates are observed during the events outlined in Items 4 and 5 above, smaller loading increments could be required or tank filling could be halted and not resumed until the situation is reviewed and evaluated by the Project Team.

6.2 Monolithic Mat Foundation/Slab-on-Grade

A monolithic mat foundation or slab-on-grade could also be considered to support the proposed ground storage tank. A monolithic mat or slab foundation should provide uniform pressure distribution and thereby reduce the magnitude of differential settlement.

6.2.1 Allowable Bearing Pressure/Settlement

For design of mat or slab tank foundation options, a maximum allowable bearing pressure of 2,225-psf could be considered assuming a properly-compacted structural clay fill pad is provided beneath the proposed foundation as described in Section 5.5 of this report. This allowable bearing pressure value includes a factor of safety of 3.0 against soil shear failure and assumes the mat or slab will be embedded at least 1-ft below final grade within properly-compacted structural clay fill.

The estimated settlements provided in Section 6.1.3 of this report for the shallow ringwall foundation option could be used for preliminary design of the mat or slab foundation option. However, mat and slab foundations are typically controlled by allowable settlement considerations. Therefore, TWE should be contacted if these foundation options will be considered to update our tank foundation settlement analyses performed for the project to date.

6.2.2 Coefficient of Subgrade Reaction

Typical structural analysis for design of large mat or slab foundations requires a coefficient of subgrade modulus (k), which is defined as the ratio between the pressure at any given point on the surface of contact and the deformation produced by the load application at that point.

A subgrade modulus obtained from a 1-ft by 1-ft plate load test (k_1) is typically applicable to the design of pavements and lightly-loaded slabs where the stress influence from loading occurs at relatively shallow depth. These values are typically available in textbooks for various soil types. Published correlations (Terzaghi, 1948) to determine scaled down k values from the considering actual foundation sizes are also available in textbooks. However, in practice, the application of the scaling formula (Terzaghi, 1948) has severe limitations as the method assumes the soils are uniform beneath the mat foundation to infinite depth and the settlements are assumed to be linear elastic. The soils are often stratified and exhibit non-linear behavior due to load application.

For larger mat or slab foundations with increased loading conditions, the stress influence will be deeper whereby reduced k values should be used based on the foundation size, bearing pressure and predicted actual settlement. TWE should be contacted to evaluate k value for mat or slab foundation design on a case-by-case basis. For a large concrete mats or slabs bearing on a predominantly cohesive soil profile, typical k values are on the order of 5-pci to 20-pci based on our experience.

Structural Engineers often consider a single constant value for subgrade reaction modulus for mat or slab foundation design. However, subgrade reaction modulus is not a fundamental soil property but a function of several other factors including the following (Walker and Holland, 2016):

- Geometry of loaded surface area whereby loads with larger surface areas influence deeper soil deposits that can be very soft or compressible;
- Due to soil behavior being highly nonlinear, the subgrade modulus would be lower when subjected to larger loads;
- Soil stiffness and strength parameters as well as compressibility indices within the stress bulb;
- Type of loading (long term or short-term loads) for cases where the foundation soil is compressible; and,
- Mat/soil stiffness ratio which affects distribution of the soil bearing pressure.

The geometry of the loading surface and the type of loading must be provided by Structural Engineers for appropriate estimation of subgrade reaction. Using the former parameter, the Geotechnical Engineer will determine the depth to which stress influence extends. Using the latter parameter, the Geotechnical Engineer will decide whether to include consolidation in the calculation of subgrade reaction modulus. Once final mat or slab dimensions and loading have been established, TWE can assist with determination of modulus of subgrade reaction considering the actual foundation size and loading if published methods of adjustments of these values are not preferred for this project.

7 ELEVATED STORAGE TANK DESIGN

Based on the information provided by the Client, we understand the elevated tank will be a pedesphere or multi-column design whereby individual shallow or deep foundations are anticipated beneath each pedestal or column. Based on the soil subsurface and groundwater conditions encountered at the referenced tank site, we anticipate shallow spread footings and/or deep foundations such as straight-sided drilled shafts are suitable for supporting the elevated storage tank as discussed in the following report sections.

7.1 Shallow Spread Footings

Shallow spread footing systems can be considered provided some movement can be tolerated due to consolidation settlement of the underlying soils. The recommendations provided herein for square spread footings assume the foundations will be supported on competent native site soils at the recommended embedment depths.

7.1.1 Foundation Depth/Allowable Net Bearing Pressure

Individual spread footings can be placed in properly-prepared native soils above the static groundwater table within the elevated storage tank site. For the purposes of this report, we have assumed possible embedment depths of 2-ft, 5-ft and 10-ft below existing grade. Please note accurate groundwater measurements were not possible in the upper 12-ft depth range of boring TB-2 due to caving of the borehole at a depth of about 8-ft below existing grade. We anticipate the free groundwater level at this site is within the 10-ft to 12-ft depth range based on our field observations made at the time the boring was conducted. However, a design groundwater level of 6-ft below existing grade for design purposes.

Based on the loose sands encountered in the 6-ft to 18-ft depth range and the weak clays encountered from 18-ft to 33-ft below existing grade at this site, we recommend the allowable net soil bearing pressure be limited to 1,000-psf or less to keep total settlements less than 1-in. Settlements for shallow spread footings are discussed in further detail in Section 7.1.2 of this report.

Individual spread footings should have minimum widths of 24-in even if the actual bearing pressure is less than the design value. We recommend footings with widths greater than 10-ft be analyzed on a case-by-case basis to consider rigidity/flexibility ratio and footing settlements induced by the applied loads.

7.1.2 Settlement

We analyzed square rigid spread footings with widths of 2-ft, 4-ft, 6-ft, 8-ft and 10-ft at sustained net loading pressures of 500-psf and 1,000-psf considering embedment depths of 2-ft, 5-ft and 10-ft below existing grade within properly-prepared native site soils. The analyses were performed using the computer program Settle 3 by Rocscience, Inc. (Toronto, Canada). The immediate and consolidation settlement estimates for various footing sizes and pressures are provided in Appendix G. The magnitudes of the computed long-term settlements were corrected to account for the three-dimensional (3D) excess pore water pressure dissipation effects as recommended by Skempton and Bjerrum (1957).

Immediate settlements are typically completed during or shortly after construction. Consolidation settlements will occur within the first few years of service but could last for a period of 10+ years. Total settlements are computed as the summation of the immediate and consolidation settlements. The settlement estimates provided in Appendix G are approximated based on the information derived from this study. Actual settlements could vary $\pm 20\%$.

The settlement estimates provided in Appendix G assume uniformly-loaded, rigid foundations with pressures no greater than the sustained net foundation loading pressured indicated. These estimates also assume the foundations will be designed and constructed in accordance with the recommendations provided in this report. In addition, the estimates assume the foundations will be isolated whereby the clear spacing between foundations will be at least the width of the larger adjacent foundation so stress influence between adjacent foundations is negligible.

7.1.3 Uplift Resistance

Resistance to vertical force (uplift) is provided by the weight of the concrete footing plus the weight of the soil directly above the footing. If the footings will be installed above the static groundwater level within the site, ultimate uplift resistance can be based on total unit weights of 120-pcf and 150-pcf for soil and concrete, respectively. In the case of submergence, ultimate uplift resistance should be based on buoyant unit weights of 60-pcf and 90-pcf for soil and concrete, respectively. The calculated ultimate uplift resistance should be reduced by a factor of safety of 1.2 to calculate the allowable uplift resistance.

7.1.4 Lateral Resistance

Resistance of spread footings to lateral loads can be provided by sliding resistance acting on the base of the foundation and by passive resistance of soil adjacent to the foundation. For design purposes, the sliding resistance and passive soil pressure can be assumed to be developed simultaneously. The lateral loads on spread footings are typically transient or short-term such as the wind load. Therefore, the passive resistance and the sliding resistance recommendations are provided below for short-term condition.

For transient or short-term conditions, a uniform allowable passive soil pressure of 750-psf for properly-compacted native site soils or structural clay fill against the foundations can be added to the footing lateral load capacities. This value includes a factor of safety of 2.0. We expect the allowable passive soil pressure will be developed at about 0.5-in of lateral foundation displacement. If lateral displacement tolerances are less than 0.5-in, about 50% of the allowable passive pressure can be used. The soil passive resistance in the upper 1-ft depth range should be neglected unless concrete paving is provided around the foundations.

If the lateral displacement tolerance is greater than or equal to 0.5-in, 100% of the allowable passive pressure for lateral foundation displacements can be used for design. In any case, the soil passive resistance in the upper 1-ft should be neglected unless paving around the foundation is provided. For concrete footings bearing on native soils at the site, a coefficient of friction of 0.40 can be used to compute base friction. Ultimate base friction can be taken as the normal vertical force times the friction coefficient. A factor of safety of 2.0 is recommended to compute allowable base friction.

For design purposes, sliding resistance and passive soil pressure can be assumed to be developed simultaneously.

7.1.5 Resistance to Overturning Moments

The design of shallow footings subjected to vertical loads and overturning moments should incorporate a stability ratio as selected by the Design Engineer in accordance with the project design guidance documents or specifications. The stability ratio is defined as the ratio of the stabilizing moment to overturning moment. The maximum foundation contact pressure should not exceed the recommended net allowable soil bearing pressure provided above.

7.1.6 Eccentrically Loaded Footing

Eccentrically loaded footings should be designed using reduced effective dimensions ($L' = L - 2e_L$, $B' = B - 2e_B$) of the footing, where e_L and e_B are load eccentricities in the length and width directions, respectively. For footings subjected to applied moment loadings, the eccentricities in any direction should be evaluated as the ratio of the corresponding applied moment and the vertical load.

The bearing pressure below the footing should be computed based on a reduced footing area using the effective footing dimensions ($A' = L' \times B'$). The maximum contact pressure below the footing should be less than the allowable bearing capacities provided herein.

7.2 Straight-Sided Drilled Shafts

This section applies to deep foundation recommendations pertaining to the 500,000-gal capacity elevated storage tank if shallow spread footings are not considered feasible. Based on the subsurface conditions encountered in boring TB-2, and our experience with similar elevated tank foundations in the project area, straight-sided drilled shafts (SSDSs) are considered a suitable foundation option. Based on the loose sands and weak clays encountered in boring TB-2, we anticipate the SSDSs will extend through these layers and will be tipped into the underlying competent clays at a minimum depth of 40-ft below existing grade. Geotechnical recommendations for the referenced deep foundation type are provided in the following sections.

7.2.1 Axial Capacity

We used the computer program SHAFT Version 2017 (Ensoft, Inc.) to compute ultimate axial compression and tension capacities of SSDSs with diameters of 18-in, 24-in and 36-in. The ultimate axial capacity curves for these specified foundation sizes are provided in Appendix H.

Ultimate axial capacity obtained from the curves in Appendix H should be reduced by an appropriate factor of safety to compute the allowable axial capacity. A factor of safety of 2.5 is recommended to compute allowable compression capacity based on the empirical capacity estimates provided in this report. A factor of safety of 3.0 is recommended to compute allowable tension capacity. Reduced factors of safety as low as 2.0 can be considered if a static, dynamic, or combination thereof, load testing program is performed. The buoyant weight of the shafts can be added to the tension capacity. However, the computed weight of the shaft should be reduced by a factor of 1.2 for design.

We discounted frictional resistance of the soils to 5-ft below existing grade to account for shaft cut-off elevation and possible disturbances during installation. Please note the tension capacity is based solely on soil/shaft interaction. Shafts and shaft cap connections should be structurally capable of resisting design uplift loads.

7.2.2 Individual Shaft Settlement

A detailed analysis of axial load versus settlement for deep foundations was beyond the scope of this investigation. However, for single-isolated shafts designed in accordance with this report, individual shaft settlements should be less than about 0.5-in. For a single element, the primary component of settlement is due to elastic shortening. Therefore, the variation of single shaft settlement with variation of loading could be approximated as a linear variation. If the shafts will have center-to-center spacing of less than three (3) diameters or widths, group efficiency should be evaluated.

7.2.3 Lateral Response

For deep foundations, lateral loads are resisted by the soil as well as the rigidity of the shaft. Response to lateral loads will vary with shaft type and properties, degree of fixity and spacing. Typically, lateral loads are analyzed using the p-y method in which the soil is modeled as a series of non-linear springs. This procedure with appropriate computer codes (i.e., LPILE by Ensoft, Inc.) has the advantage where major factors influencing soil resistance are inherently included in the semi-empirical p-y design criteria.

For the subsurface conditions observed within the elevated storage tank site, we recommend the soil design parameters in Appendix I for use with lateral analysis of pile foundations associated with this project. Horizontal loads acting on shaft caps, if applicable, can also be resisted by passive earth pressure acting on one (1) side of the cap. An allowable passive pressure of 750-psf can be used for properly-compacted Structural Clay Fill or General Fill material used as backfill around pile/shaft caps. This value should provide a factor of safety of 2.0 with respect to the ultimate value.

7.2.4 Group Considerations

If groups of shafts will be considered for this project, TWE should be contacted to evaluate the final shaft sizes, lengths and group spacing for static axial group effects, lateral group effects and shaft group settlement.

8 CONSTRUCTION CONSIDERATIONS

The performance of the new tanks will ultimately depend upon the underlying foundation soils and the quality of construction. Our recommendations for pertinent construction activities and observations are provided in the following report sections.

8.1 Site Preparation/Subgrade Proofrolling

Areas designated for new construction should be stripped of existing vegetation, organics, debris and other deleterious materials to the depth of competent subgrade capable of supporting proofrolling activities, if applicable. Isolated or localized areas requiring deeper stripping for removal of soft, wet or otherwise unsuitable soils to the depth of competent subgrade should be anticipated. The geotechnical design recommendations provided in this report, including bearing capacities and settlement estimates, are based on addressing areas where soft or otherwise unsuitable materials are encountered during proofrolling as recommended herein.

After stripping, areas designated for construction should be graded to establish positive drainage across the sites so ponding of surface water does not collect and inhibit site access or construction activities. After site grading is completed to establish positive drainage, the exposed subgrade soils should be proofrolled as indicated below.

Prior to placement of fill, backfill or improved surface materials, we recommend the existing subgrade soils be proofrolled by crossing the area repeatedly and methodically with a 10-ton minimum weight rubber-tired pneumatic compactor or a loaded dump truck to detect significant weak areas. We do not recommend using off-road earth moving equipment (e.g. loaders or scrapers) or tracked vehicles for proofrolling. Proofrolling should be performed during dry periods and not immediately after wet weather events.

Proofrolling should be observed and documented by TWE and areas which do not meet acceptance criteria should be delineated. Remedial options could include scarifying and recompacting, excavation and replacement and/or chemical treatment. If proofrolling demonstrates ruts less than 2-in deep, we recommend the surficial 6-in of material be scarified and recompacted. For areas where ruts exceed 2-in deep, we recommend the surficial 12-in of material be scarified and recompacted. The exposed subgrade soils should be moisture-conditioned to within 2% dry to 3% wet of optimum moisture content and compacted to at least 95% of the maximum dry density as determined by ASTM D698 (standard Proctor). If scarification and recompaction does not improve the subgrade conditions, we recommend over-excavation and replacement or chemical stabilization be considered to similar depths or deeper, as required, based on the subgrade conditions at the time of the construction activities.

Proper site drainage should be maintained during construction so ponding of surface runoff does not occur. If the subgrade is exposed to excess moisture, the natural soils will likely soften and lose strength. Once the soils soften and lose strength, it generally becomes necessary to either consider scarification and drying efforts, removal and replacement of the wet material with structural fill or stabilization using various chemical reagents.

8.2 Excavations

8.2.1 Groundwater Control/Dewatering

Shallow foundation excavations at the ground storage tank site should be able to be performed in the dry based on test boring TB-1. Based on the subsurface conditions encountered in project boring TB-2, we expect some groundwater seepage could be encountered within excavations below the 6-ft depth range at the elevated storage tank site.

In the event groundwater, perched water or seepage is encountered, provisions should be made to remove any water which accumulates within excavations to maintain a dry bottom. Provisions should also be made to divert surface water runoff from open excavations. If encountered, any water accumulations within foundation excavations should be pumped out immediately and not allowed to deteriorate the foundation soils. The Contractor should be responsible for assessing the need for appropriate dewatering systems within each site according to their construction sequence and planned activities.

Positive drainage should be established and maintained so ponding of surface water does not collect near foundation excavations or inhibit construction activities. If the subgrade soils are exposed to excess moisture, the bearing soils will likely soften and lose capacity. Once this occurs, it generally becomes necessary to either consider drying efforts, removal and replacement of the saturated material with structural fill or chemical stabilization.

8.2.2 OSHA Considerations

The sides of open excavations are susceptible to deterioration upon exposure and could become unstable. The Contractor's competent Supervisor should inspect all excavations and take appropriate safety measures including the use of trench shields and sloped excavations. We recommend Occupational Safety and Health Administration (OSHA) standards be observed with all excavations.

According to Occupational Safety and Health Administration (OSHA) standard 29 CFR - Subpart 1926 - Subpart P, if excavations are deeper than 5-ft and the excavations are not performed in stable rock, the excavations must be sloped, shored or shielded. Protective systems for use in excavations greater than 20-ft in depth should be designed by a registered Professional Engineer in accordance with OSHA standard 29 CFR - Part 1926.652(b) and (c). Soil classification, per OSHA guidelines, is based on three (3) types of soils: Type A, Type B and Type C.

Based on the OSHA definitions, the soils encountered within the elevated storage tank site and ground storage tank site can be interpreted as Types C and B, respectively. Cohesive soils with an undrained shear strength of 1,000-psf or more are classified as Type B whereas cohesive soils with an undrained shear strength less than 1,000-psf and cohesionless or semi-cohesionless sands are classified as Type C soils. Excavations in Type B soils should have side slopes no steeper than 1H:1V or sloped angles no steeper than 45° from the horizontal. Excavations in Type C soils should have side slopes no steeper than 1.5H:1V or sloped angles no steeper than 34° from the horizontal.

8.3 Fill/Backfill Materials

Fill material types can be grouped according to their application. Fill materials used to support foundations, structures and within pavement sections are typically identified as structural fill and are usually associated with engineering specifications. Our recommendations for structural fill are provided in the following subsections.

8.3.1 Structural Clay Fill

Structural clay fill used for the project should consist of clean lean clay (CL) or lean clay with sand (CL) material with a liquid limit (LL) less than 40 and a plasticity index (PI) between 10 and 20. Structural clay fill should be placed in thin lifts (maximum 8-in loose lifts), moisture conditioned between -2% to +3% of optimum moisture content and compacted to a minimum 95% of the maximum dry density as determined by ASTM D698 (standard Proctor).

8.3.2 Structural Fill Alternative

As a structural fill alternative, available clean site materials could be stabilized with a chemical admixture such as lime, cement, fly ash, or a combination thereof, depending on their soil type and corresponding properties. Chemically-modified soils can be used in all applications where structural fill is required.

The type and quantity of chemical stabilization required should be determined by TWE via a laboratory treatability study on the actual soils planned for use. TWE would be pleased to further evaluate the composition of available samples and potential stabilization options upon request. Actual reagent type and dosage requirements should be determined in the laboratory by TWE via plasticity index, pH or compressive strength methods on soil samples obtained after site stripping is performed.

8.3.3 Crushed Aggregate Flexible Base

Crushed aggregate flexible base material should be composed of crushed limestone meeting the requirements of TxDOT 2014 Standard Specifications Item 247, Type A, Grade 1-2. The aggregate material can be placed in maximum 6-in compacted lifts to at least 95% of the maximum dry density determined by ASTM D698 (standard Proctor) and to within $\pm 3\%$ of optimum moisture content.

8.3.4 Controlled Low-Strength Material

Controlled low-strength material (CLSM), or flowable fill, can be used for seal slabs beneath foundations and backfill around foundations. CLSM should be in accordance with published information from the American Concrete Institute (ACI) Committee 229R-99, the National Ready Mixed Concrete Association (NRMCA) Guide Specification for Controlled Low-Strength Materials (CLSM) and ASTM International standard test methods.

Prior to placing CLSM, a representative of TWE should observe and document the condition of the excavation subgrade to confirm the consistency and homogeneity of the subgrade soils. If soft, weak or otherwise unsuitable subgrade soils are encountered, the exposed soils should be over-excavated to competent soils and backfilled with structural fill or CLSM. CLSM should be thoroughly-mixed and the aggregate used should contain no more than 30% fines.

A minimum compressive strength of 50-psi at 7-days or 100-psi at 28-days should be achieved while remaining workable for placement. Construction activities over CLSM should not be performed until a minimum set time of 4-hrs has been achieved for the CLSM.

8.3.5 Fill/Backfill Compaction

Prior to use, samples of proposed fill and backfill materials should be obtained by TWE for laboratory testing of classification, index, gradation and moisture-density relationship properties. These tests will provide a basis for acceptance as well as evaluation of compaction when compared to in-place density test results. TWE should be retained to perform sufficient in-place density tests during placement of fill and backfill materials to verify compaction requirements are met.

Maximum loose lift thicknesses for fill placement will depend on the type of compaction equipment used and the material type. Recommended fill layers are summarized in Table 8-1 below.

Description	Maximum Loose Lift Thickness
Structural Fill using Hand-Operated Equipment	4-in
Structural Fill using Conventional Equipment	8-in

8.3.6 Fill/Backfill Testing

We recommend any proposed source of fill and backfill material be tested by TWE for compliance with the project specifications prior to use. In addition, it is imperative specific provisions be made to include testing of the actual fill and backfill materials used to verify they meet the material specification requirements stated herein or in the project plans and specifications.

8.4 Shallow Foundation Construction

The performance of shallow foundation systems associated with the project will be highly dependent upon the quality of construction. Thus, we recommend shallow foundation construction be monitored by TWE to help evaluate construction activities in accordance with this report.

Excavations for construction of shallow foundations could be either open-cut and formed, neatly-excavated or temporarily shored using proprietary systems. Excavations for shallow foundations should be made with a smooth-mouthed bucket or hand labor. Foundation excavation bottoms should be level, suitably benched and free of any loose, wet or weak soils which have been impacted by surface runoff, groundwater seepage or the construction process.

Positive drainage should be established and maintained so ponding of surface water does not collect in or near foundation excavations or impact the bearing soils. If the bearing soils are exposed to excess moisture, they will likely soften and lose capacity. Once this occurs, it generally becomes necessary to either consider drying efforts, removal and replacement of the saturated material with structural fill or chemical stabilization.

In the event groundwater, perched water or seepage is encountered, provisions should be made to remove any water which accumulates within shallow foundation excavations to maintain a dry bottom. Provisions should also be made to divert surface water runoff from the open excavations. If encountered, any water accumulations within foundation excavations should be pumped out immediately and not allowed to deteriorate the foundation soils.

8.5 Drilled Shaft Installation

The performance of the elevated storage tank supported on straight-sided drilled shafts will be directly related to the Contractor's adherence to the recommendations in this report and the project plans and specifications. Therefore, we recommend shaft installation monitoring services be provided by TWE for this project. Shaft installation monitoring services will provide verification the shafts are installed in accordance with the intentions of this report and the following items:

1. All shaft excavations should be observed by TWE to determine when the proper bearing stratum is encountered and to record other observations regarding shaft construction such as size, installation method and other pertinent items related to casing, slurry, reinforcement and concrete as applicable.
2. Shaft excavations should be checked for size and depth prior to the placement of concrete. Precautions should be taken during the placement of reinforcement and concrete to prevent the loose excavated material from falling into the excavation.
3. Drilled shafts should be installed in accordance with the "Manual on Drilled Shafts: Construction Procedures and Design Methods", [U.S. Department of Transportation-Federal Highway Administration (Pub. No. FHWA-IF-99-025) and ADSC: The International Association of Foundation Drilling Contractors (Pub. No. ADSC-TL-4), August 1999] by Lymon, C. Reese and Michael W. O'Neill
4. SSDS depths at the elevated storage tank site will depend upon the loads imposed. Based on the subsurface conditions encountered in boring TB-2, we anticipate the need for drilling slurry or casing to maintain shaft sidewall stability and facilitate proper drilled shaft installation. If slurry is utilized, the slurry should be left in the excavation until completion of drilling and the concrete should be placed with the use of a tremie to displace the slurry from the bottom up immediately upon completion of drilling.
5. Slurry should be checked for density, viscosity, sand content and pH during construction. It is recommended that the "Manual on Drilled Shafts: Construction Procedures and Design Methods", [U.S. Department of Transportation-Federal Highway Administration (Pub. No. FHWA-IF-99-025) and ADSC: The International Association of Foundation Drilling Contractors (Pub. No. ADSC-TL-4), August 1999] by Lymon, C. Reese and Michael W. O'Neill be used as a guide for developing slurry placement and material specifications.

6. Prompt placement of concrete in the shaft excavations as they are completed, cleaned and inspected is strongly recommended to limit deterioration of the bearing stratum. Under no circumstances should a shaft be drilled which cannot be filled with concrete before the end of the workday.

9 DESIGN REVIEW/REPORT LIMITATIONS

9.1 Design Review/Construction Monitoring

9.1.1 Geotechnical Design Review

Geotechnical review of the design drawings and specifications should be performed by TWE prior to construction. This review is recommended to check the geotechnical recommendations and construction guidelines presented herein have been properly interpreted and incorporated into the construction documents. At this time, design review is outside of the scope of this study.

9.1.2 Construction Monitoring

We recommend construction activities be monitored by TWE. TWE would be pleased to assist in the development of a plan for construction monitoring to be incorporated in the overall quality control program. Construction surveillance by TWE has been assumed in preparing our recommendations. These field services are required to check for changes in conditions which could result in modifications to our recommendations. Performance of the project structures will be directly related to the Contractor's adherence to the recommendations in this report and the project plans and specifications. TWE would be pleased to provide these services to verify construction is performed in accordance with the intentions of this report upon request.

9.2 Limitations

9.2.1 Scope of Study

The scope of this study, as well as the conclusions and recommendations provided herein, were developed based on our understanding of the project. Assumptions were made when specific information was unknown. Revisions to our conclusions and recommendations could be necessary as a result of any significant project changes or if our assumptions are incorrect.

Construction dewatering design, earth retention design and construction site safety are the responsibility of the Contractor and have not been addressed herein. The scope of our study did not include evaluation of geologic faults. In addition, assessment of environmental conditions, including investigation for hazardous materials/pollutants/wastes, regulatory compliance, threatened or endangered species, cultural resources, floodplains, and jurisdictional wetlands were beyond the scope of our study.

9.2.2 Warranty

The professional services which form the basis for this report have been performed using a degree of care and skill ordinarily exercised, under similar circumstances, by reputable geotechnical engineers practicing in the same locality. No warranty, expressed or implied, is made as to the professional advice set forth.

9.2.3 Subsurface Variations

Our interpretations of subsurface conditions are based on subsurface data obtained at the project exploration locations only and only at the times of our field explorations. Subsurface variations could exist between the exploration location and at areas not investigated within each tank site. The validity of our recommendations is based, in part, on assumptions made about subsurface conditions in areas not explored. Such assumptions can only be confirmed during construction. Therefore, construction observations by TWE are recommended to check for variations in subsurface conditions. Significant changes from our assumptions could require modification to our findings and recommendations.

9.2.4 Report Reliance

This report was prepared as an instrument of service for the sole and exclusive use by Action Civil Engineers, PLLC and their designated project design team, subject to the limitations stated herein and with specific application to the referenced project. This report should not be applied for any other purpose or project, except as described herein.

No third party may use or rely upon the information provided herein without the written consent of TWE. If any party other than Action Civil Engineers, PLLC chooses to rely on this instrument without our consent, said party expressly waives any rights it may otherwise have to claim its reliance on this instrument of professional service that resulted in injury, loss, or damage of any kind and will defend and indemnify TWE from any such claim.

9.2.5 Report Distribution

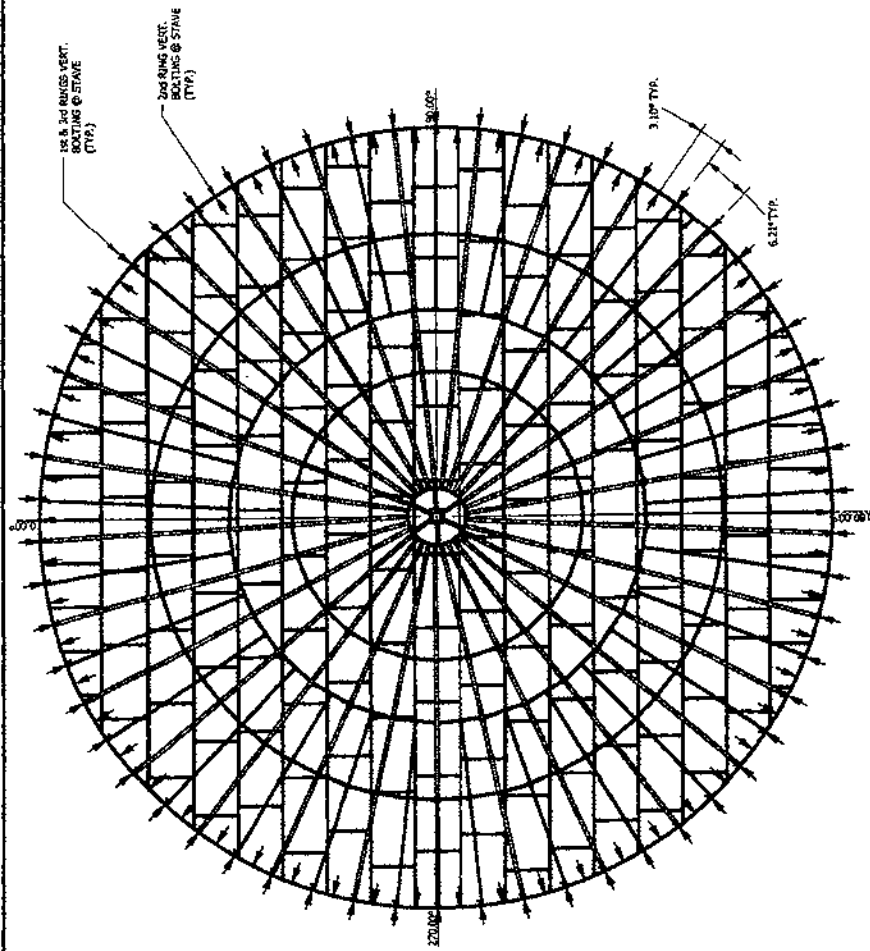
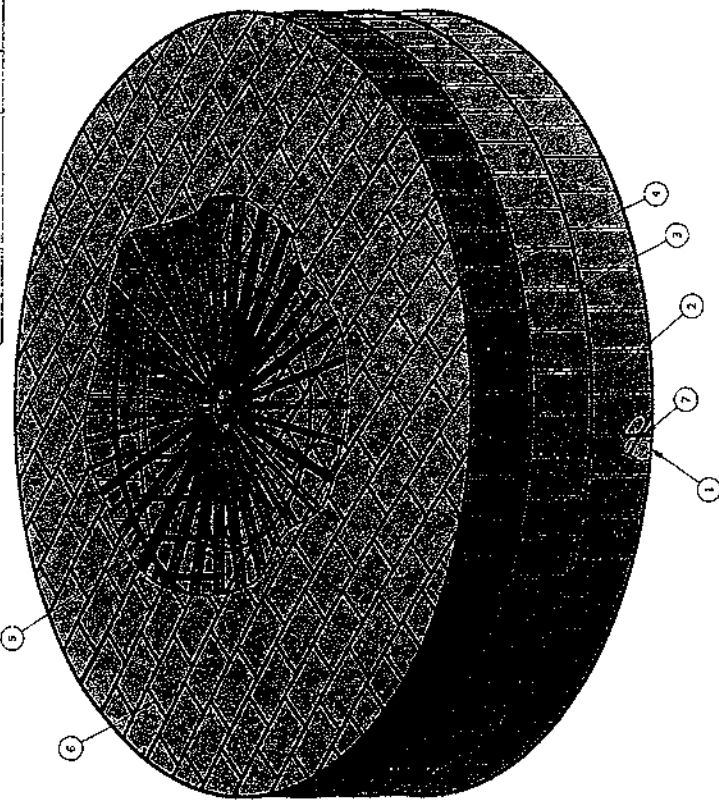
This report is intended to be used in its entirety. This report should be considered as a whole and should not be distributed or made available in partial form.

If any changes in the nature, design or location of the project are planned, the conclusions and recommendations contained in this report should not be considered valid unless the changes are reviewed and the conclusions modified or verified in writing by TWE, who is not responsible for any claims, damages or liability associated with interpretation or reuse of the subsurface data or engineering analyses without the expressed written authorization of TWE.

APPENDIX A

CLIENT-PROVIDED INFORMATION

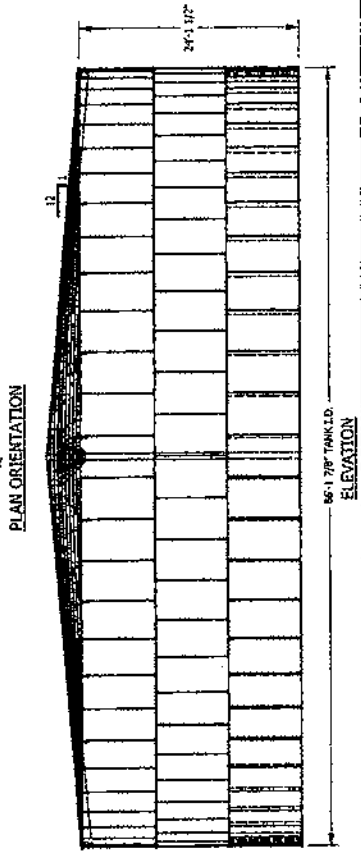
SFC REVISION HISTORY						
REV	ECO	DESCRIPTION	DATE	DESIGNER	CHECKED	APPROVED
1	0055A	CHSD 2-BAY TO GR.50	02/15/10	E. NEAR	BA	BB

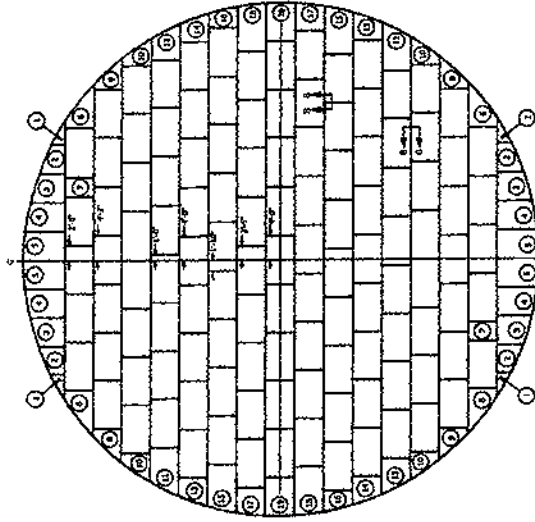


ITEM	PART NUMBER	DESCRIPTION	QTY	UOM
1	8624-001-001	ROOF STRUCTURE 86'-1 7/8\"/>		
2	8624-001-002	COL-ROLLED RASTER MAT.	1	EA
3	8624-001-003	86'-1 7/8\"/>		
4	8624-001-004	86'-1 7/8\"/>		
5	8624-001-005	86'-1 7/8\"/>		
6	8624-001-006	86'-1 7/8\"/>		
7	8624-001-007	86'-1 7/8\"/>		
8	8624-001-008	86'-1 7/8\"/>		

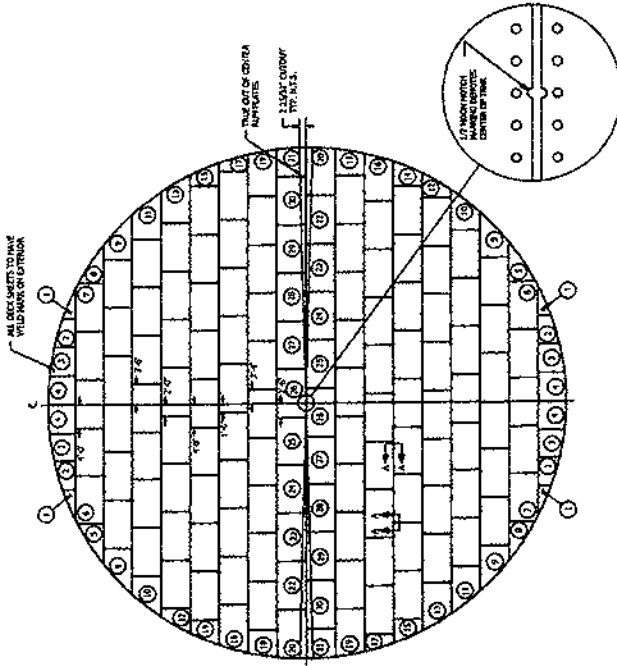
APPROVALS		DATE
DESIGNED BY	DATE	
CHECKED BY	DATE	
APPROVED BY	DATE	

COMPANY INC. 8600 LUCAS GATCHEL RD. HANNA, MISSISSIPPI 39240 Phone: (601) 812-0580 Fax: (601) 812-0586	
BOULDER STEEL TANK, ANKWA DUGS-87 (TCC) PROJECT NO. 8624-001-002	
SCALE	1 OF 3

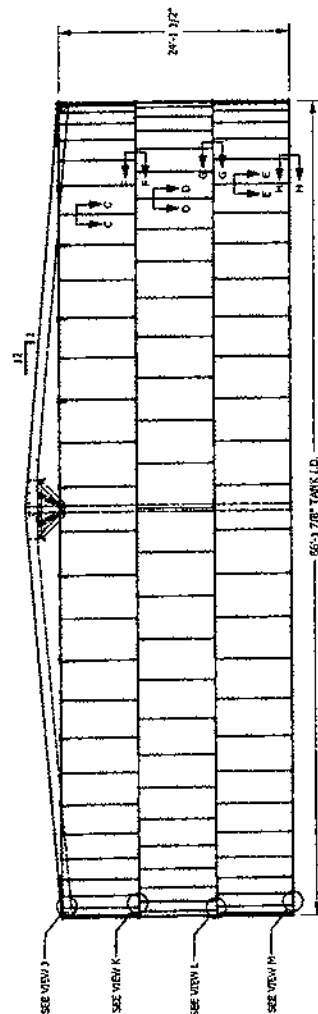




BOTTOM PLAN



DECK PLAN

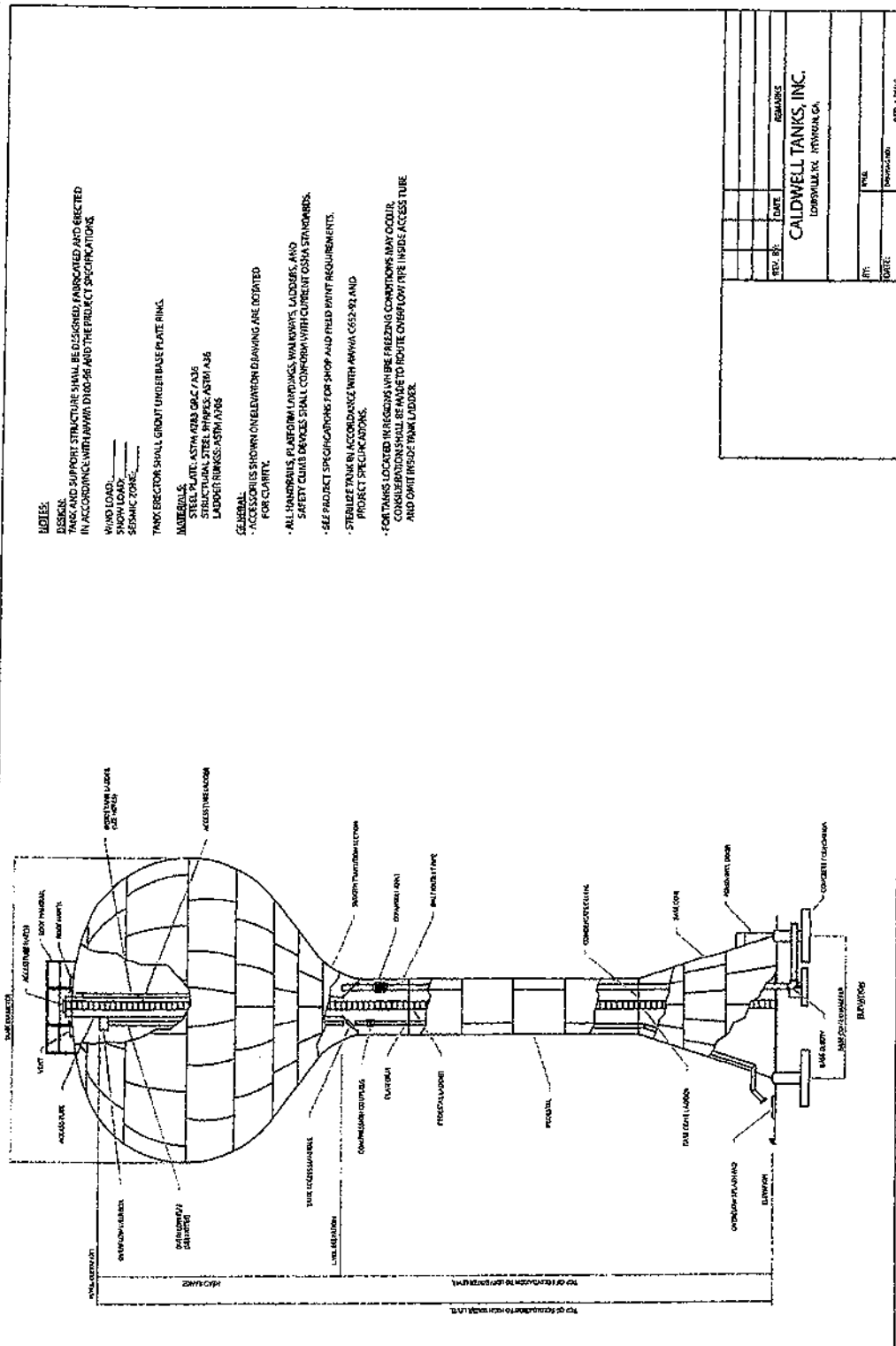


3 RING ELEVATION

COMPANY INC.
 8900 LUCAS RANCH RD.
 RANCHO CUCAMONGA, CA. 91730
 Phone: (909) 912-0888
 Fax: (909) 912-0885

TITLE: 86-1 7/8" DIA. x 2'-1 1/2" HIGH
 BOULDER STEEL TANK ANVMA D.103-97 (PFC)
 SIZE PROJECT: 86-1
 SCALE: 1/4" = 1'

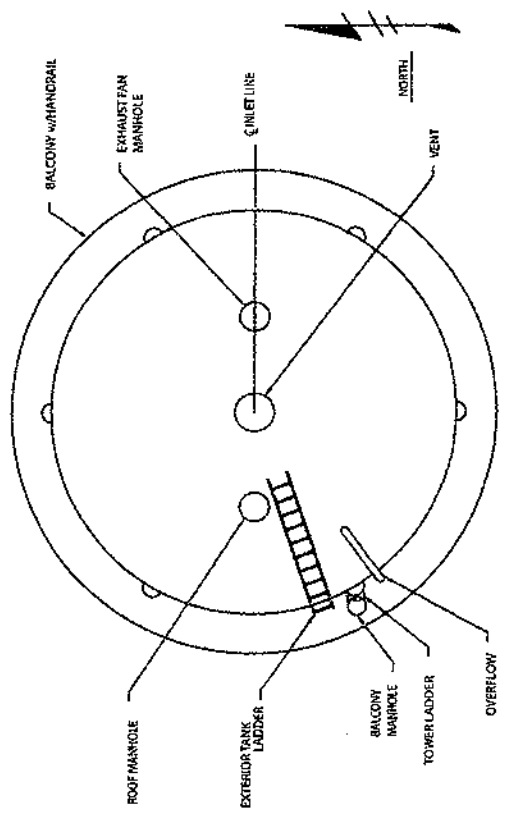
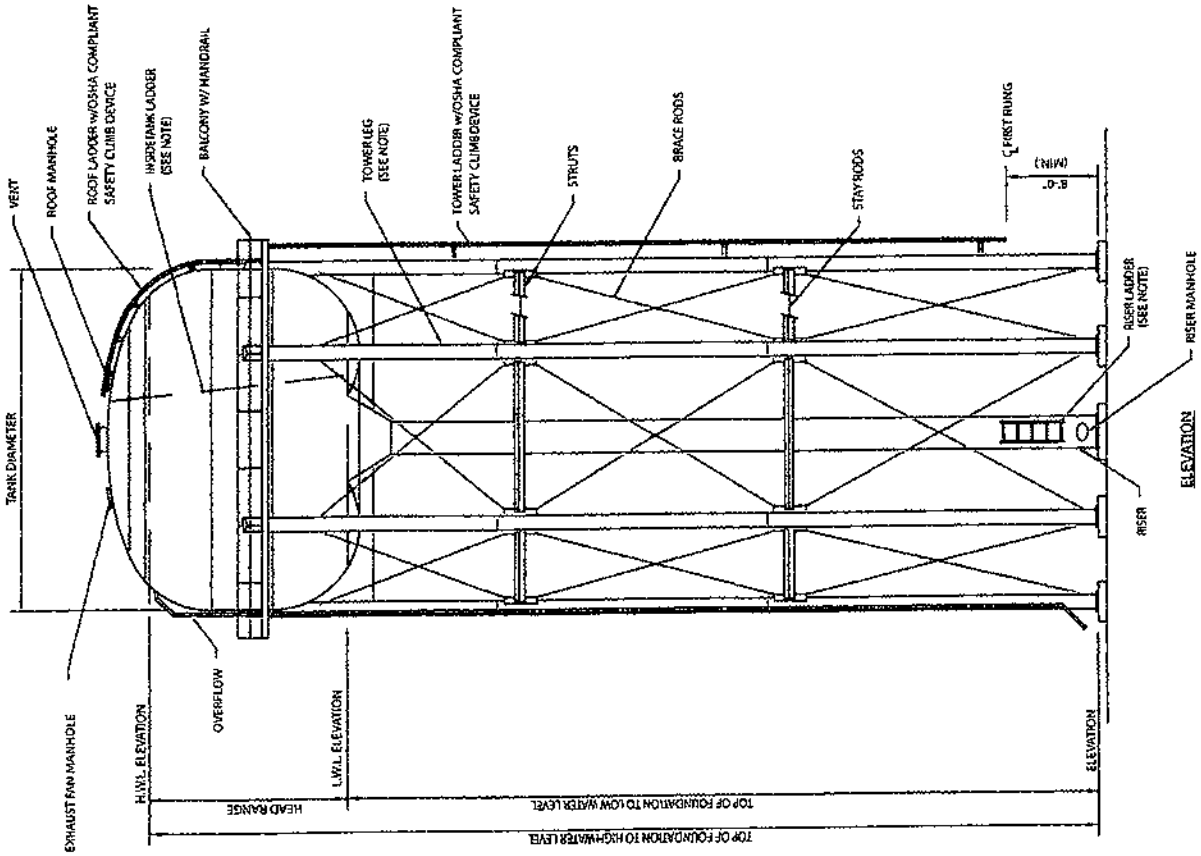
PROJECT: 8624-001-002
 SHEET: 3 OF 3



NOTES:
DESIGN:
 TANK AND TOWER SHALL BE DESIGNED, FABRICATED AND ERECTED IN ACCORDANCE WITH
 AWWA D100-96 AND PROJECT SPECIFICATIONS.
 WIND LOAD: _____
 SNOW LOAD: _____
 SEISMIC ZONE: _____

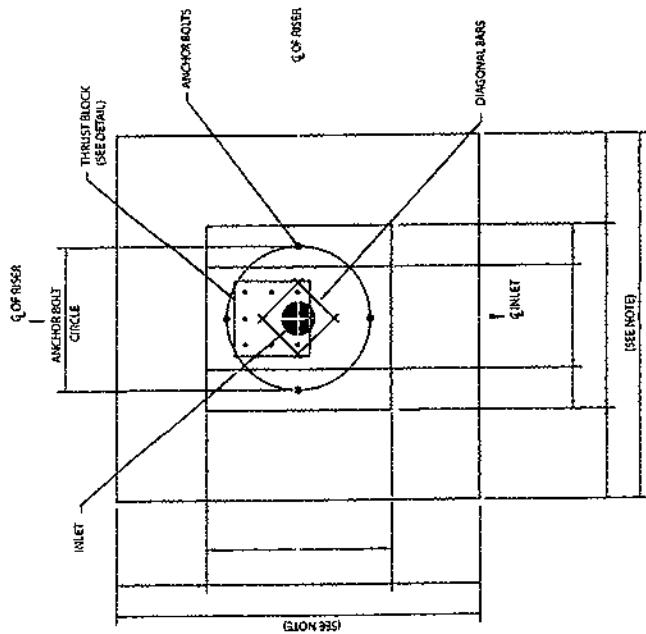
MATERIALS:
 STEEL PLATE: ASTM A283 GR. C / A36
 STRUCTURAL STEEL SHAPES: ASTM A36
 BRACE RODS AND STAY RODS: ASTM A36
 LADDER RUNGS: ASTM A796

- GENERAL:**
- ACCESSORIES SHOWN ON ELEVATION DRAWING ARE ROTATED FOR CLARITY.
 - ALL HANDRAILS, PLATFORM LANDINGS, WALKWAYS, LADDERS, AND SAFETY CLIMB DEVICES SHALL CONFORM WITH CURRENT OSHA STANDARDS.
 - SEE PROJECT SPECIFICATIONS FOR SHOP AND FIELD PAINT REQUIREMENTS.
 - STERILIZE TANK IN ACCORDANCE WITH AWWA C652-92 AND PROJECT SPECIFICATIONS.
 - FOR TANKS LOCATED IN REGIONS WHERE FREEZING CONDITIONS MAY OCCUR COOPERATION SHALL BE GIVEN TO OMISSION OF INSIDE TANK LADDER.
 - NUMBER OF TOWER LEGS PER MANUFACTURER'S STANDARD DESIGN.

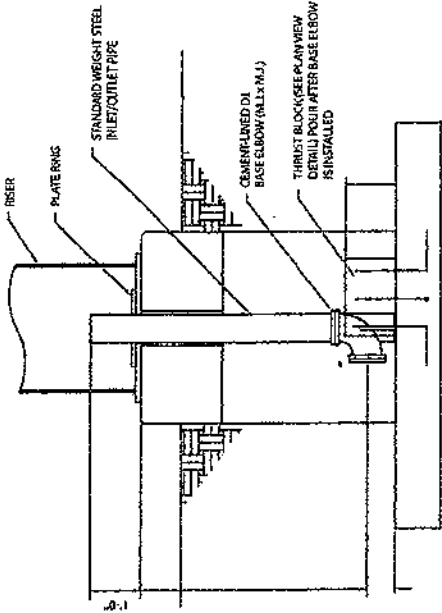


ORIENTATION

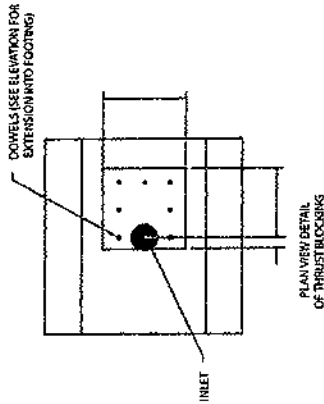
REV. BY:	DATE	REMARKS
CALDWELL TANKS, INC. LOUISVILLE, KY. NEWNAN, GA.		
BY:	TITLE	ELEVATION DETAILS
DATE	DRAWING NO.	



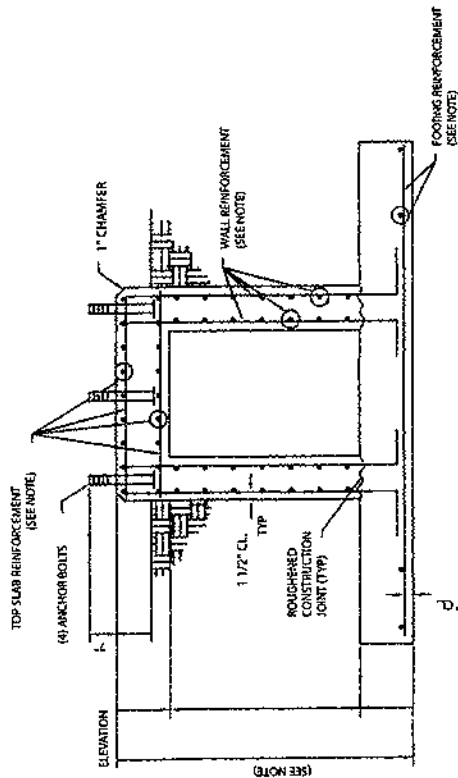
CENTER PIER PLAN



INLET/OUTLET PIPE



NOTE:
CENTER PIER FOUNDATION DIMENSIONS AND CONCRETE REINFORCEMENT REQUIREMENTS SHALL BE DETERMINED BY TANK CONTRACTOR.



SECTION THRU CENTER PIER
(PIPING NOT SHOWN)

REV. BY:	DATE	REMARKS

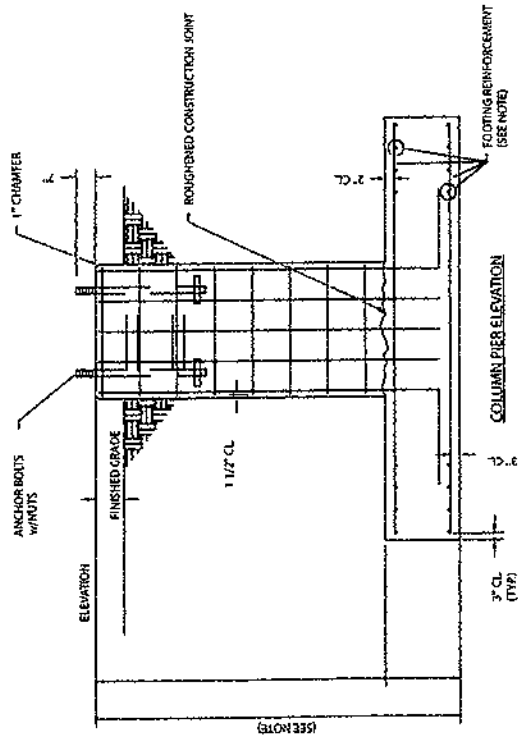
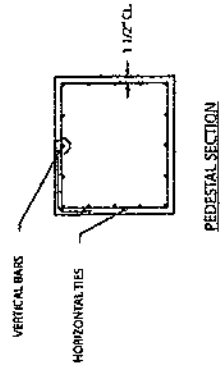
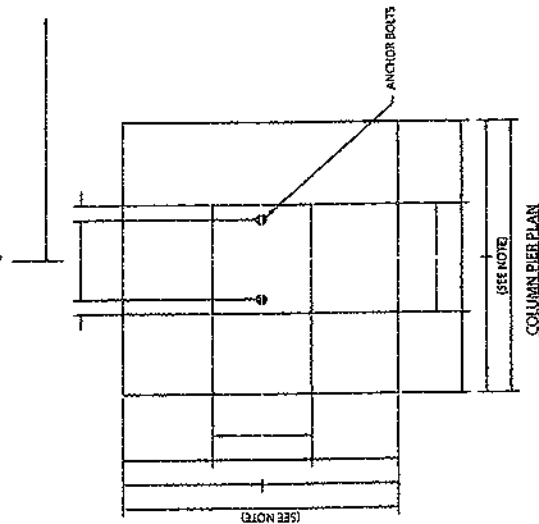
CALDWELL TANKS, INC.
LOUISVILLE, KY. RIEMANN, GA.

BY:	TITLE	CENTER PIER FOUNDATION
DATE:	DRAWING NO.	DE-FO-DWG

NOTES:

- FOUNDATION DESIGN WILL BE THE RESPONSIBILITY OF THE TANK CONTRACTOR.
- PEDESTAL AND FOOTING DIMENSIONS AND CONCRETE REINFORCEMENT SHALL BE DETERMINED BY THE TANK CONTRACTOR.
- FOUNDATION CONSTRUCTION SHALL COMPLY WITH AWWA D100-96, A.C.I. 318-99, A.C.I. 301-96 AND APPLICABLE SECTIONS OF THE PROJECT SPECIFICATIONS AND THE PROJECT SOils REPORT.
- CONCRETE COMPRESSIVE STRENGTH SHALL BE 4,000 PSI @ 28 DAYS.
- REINFORCEMENT SHALL CONFORM TO A.S.T.M. A615 GR. 60.
- CONSTRUCTION JOINTS SHALL BE ROUGHENED ACROSS ENTIRE FACE WITH 1/4" MINIMUM DEPTH IDENTATIONS.
- THE TOP OF CONCRETE FOR ALL PIERS INCLUDING THE CENTER PIERS SHALL BE LEVEL AND SHALL BE THE SAME ELEVATION UNLESS OTHERWISE NOTED BY A SPECIFIED ELEVATION WITH A MAXIMUM DIFFERENTIAL OF (+) 1/4".
- ANCHOR BOLTS SHALL BE PLACED WITHIN (+) 1/8" OF THE PLAN DIMENSIONS AT THE TOP OF THE CONCRETE PLUMB WITHIN 1/4" IN 12" AND EXTEND WITHIN 1/2" OF THE SPECIFIED PROJECTION ABOVE THE TOP OF THE FOUNDATION.

C. PEDESTAL, FOOTING AND ANCHOR BOLTS



REV. BY	DATE	REMARKS
CALDWELL TANKS, INC.		
LOUISVILLE, KY. NEWNAN, GA.		
BY:	TITLE:	COLUMN PIER FOUNDATION
DATE:	DRAWING NO.	LEG-F1.DWG

APPENDIX B

EXPLORATION LOCATION PLANS



CP1-1

TS-1

CP1-2

CP1-3

HIGHWAY 365



SANDY LANE

10-2

APPENDIX C

TB LOGS AND KEY TO SYMBOLS AND TERMS

LOG OF BORING TB-1

PROJECT: WJCMWD - New Storage Tanks
Jefferson County, Texas

CLIENT: Action Civil Engineering, PLLC
Port Arthur, Texas

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	COORDINATES: N 29° 55' 06.66" W 95° 10' 35.83"	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	STD. PENETRATION TEST BLOWCOUNT	N ₆₀	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	LAB MINI VANE SHEAR (tsf)	COMPRESSIVE STRENGTH (tsf)	FAILURE STRAIN (%)	CONFINING PRESSURE (psi)	PASSING #200 SIEVE (%)	OTHER TESTS	
				SURFACE ELEVATION: --														DRILLING METHOD: Dry Augered: 0' to 20' Wash Bored: 20' to 100'
	0			Stiff gray FAT CLAY (CH), with ferrous nodules	(P)1.50													
				-becomes brown and tan at 2'	(P)1.50			29	94	72	52		1.17	7	3			
				-with sand seams from 4' to 8'	(P)2.00													
				-with calcareous nodules from 6' to 40'	(P)2.75													
	5				(P)1.50			25		62	39							CO
					(T)0.60			35	87				1.07	11	9			
				-slickensided from 13' to 35'	(P)1.50			40		103	66							
	10				(P)2.25													
					(P)2.25			37	83	102	73		1.20	7	20			
	15				(P)2.50													
					(P)2.25			41										CO
	20																	
	25																	
	30																	
	35																	

COMPLETION DEPTH: 100 ft
 DATE BORING STARTED: 11/16/2023
 DATE BORING COMPLETED: 11/16/2023
 LOGGER: C. Hughes
 PROJECT NO.: 23.23.170

NOTES: Free Water Depth = 18.0-ft. 15-min Static Water Depth = 15.8-ft. 15-min Total Ho
 Depth = 17.1-ft. Borehole was backfilled with cement-bentonite grout. CON: One-
 Dimensional Consolidation.

LOG OF BORING TB-1

PROJECT: WJCMWD - New Storage Tanks
Jefferson County, Texas

CLIENT: Action Civil Engineering, PLLC
Port Arthur, Texas

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	COORDINATES: N 29° 55' 06.66" W 95° 10' 35.83"	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	STD. PENETRATION TEST BLOWCOUNT	N ₆₀	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	LAB MINI VANE SHEAR (tsf)	COMPRESSIVE STRENGTH (tsf)	FAILURE STRAIN (%)	CONFINING PRESSURE (psf)	PASSING #200 SIEVE (%)	OTHER TESTS
				SURFACE ELEVATION: --													
	35			Stiff, brown and tan FAT CLAY (CH), with ferrous nodules													
	40			-with sand seams from 38' to 40'	(P)2.25			27		58	30						
	45			Medium dense gray SILTY SAND (SM)		6/6" 8/6" 8/6"		22									48
	50					8/6" 12/6" 12/6"											
	55					9/6" 11/6" 9/6"											
	60			-becomes dense at 58.5'		9/6" 18/6" 17/6"		22									21
	65					10/6" 15/6" 20/6"											
	70			Very dense gray POORLY GRADED SAND with SILT (SP-SM)		8/6" 20/6" 50/5"											

COMPLETION DEPTH: 100 ft
 DATE BORING STARTED: 11/16/2023
 DATE BORING COMPLETED: 11/16/2023
 LOGGER: C. Hughes
 PROJECT NO.: 23.23.170

NOTES: Free Water Depth = 18.0-ft. 15-min Static Water Depth = 15.8-ft. 15-min Total Horizontal Depth = 17.1-ft. Borehole was backfilled with cement-bentonite grout. CON: One Dimensional Consolidation.

LOG OF BORING TB-1

PROJECT: WJCMWD - New Storage Tanks
Jefferson County, Texas

CLIENT: Action Civil Engineering, PLLC
Port Arthur, Texas

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	COORDINATES: N 29° 56' 06.66" W 95° 10' 35.83"		(P) POCKET PEN (tsf) (T) TORVANE (tsf)	STD. PENETRATION TEST BLOWCOUNT	N ₆₀	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	LAB MINI VANE SHEAR (tsf)	COMPRESSIVE STRENGTH (tsf)	FAILURE STRAIN (%)	CONFINING PRESSURE (psi)	PASSING #200 SIEVE (%)	OTHER TESTS
				SURFACE ELEVATION: -														
				DRILLING METHOD: Dry Augered: 0' to 20' Wash Bored: 20' to 100'		MATERIAL DESCRIPTION												
				Very dense gray POORLY GRADED SAND with SILT (SP-SM)			10/6' 28/6' 50/3'		23									11
				Very stiff gray FAT CLAY (CH), with ferrous nodules -with sand seams from 78.5' to 90'			8/6' 10/6' 11/6'		26		57	35						
						(P)4.50			22	103				3.51	7	70		
						(P)3.75			21		62	43						
					-becomes brown and tan with calcareous nodules and slickensides at 93'	(P)3.25												
						(P)4.25												
				Bottom @ 100'														

COMPLETION DEPTH: 100 ft
DATE BORING STARTED: 11/16/2023
DATE BORING COMPLETED: 11/16/2023
LOGGER: C. Hughes
PROJECT NO.: 23.23.170

NOTES: Free Water Depth = 18.0-ft. 15-min Static Water Depth = 15.8-ft. 15-min Total Ho Depth = 17.1-ft. Borehole was backfilled with cement-bentonite grout. CON: One-Dimensional Consolidation.

LOG OF BORING TB-2

PROJECT: WJCMWD - New Storage Tanks
Jefferson County, Texas

CLIENT: Action Civil Engineering, PLLC
Port Arthur, Texas

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	COORDINATES: N 29° 55' 41.10" W 94° 14' 00.70"		(P) POCKET PEN (tsf) (T) TORVANE (tsf)	STD. PENETRATION TEST BLOWCOUNT	N ₆₀	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	LAB MINI VANE SHEAR (tsf)	COMPRESSIVE STRENGTH (tsf)	FAILURE STRAIN (%)	CONFINING PRESSURE (psi)	PASSING #200 SIEVE (%)	OTHER TESTS
				SURFACE ELEVATION: -														
				DRILLING METHOD: Dry Augered: 0' to 12' Wash Bored: 12' to 100'		MATERIAL DESCRIPTION												
0				Medium dense tan SILTY SAND (SM)			3/6" 5/6" 12/6"		11									
				-becomes loose at 2.5'			5/6" 3/6" 4/6"										24	
5				Very stiff, gray and tan SANDY LEAN CLAY (CL), with ferrous nodules		(P)2.50			19	109				2.35	12	4		
				Gray and tan CLAYEY SAND (SC)					20		37	23					32	CO
10				Very loose, gray and tan SILTY SAND (SM)			2/6" 1/6" 3/6"		25									12
				Very loose gray CLAYEY SAND (SC)			1/6" 2/6" 1/6"											
15				Very loose gray CLAYEY SAND (SC)			2/6" 1/6" 1/6"		34									35
20				Very soft gray SANDY FAT CLAY (CH)			1/6" 2/6" 1/6"		36									64
25				Very soft gray FAT CLAY (CH)														
				Very soft gray FAT CLAY (CH)			WOH/ 18"											
30				Very soft gray FAT CLAY (CH)			1/6" 2/6" 1/6"		52		64	41						
35				-firm from 33' to 40'		(P)1.00			49	76	64	39	0.77	3	28			

COMPLETION DEPTH: 100 ft
DATE BORING STARTED: 11/15/2023
DATE BORING COMPLETED: 11/15/2023
LOGGER: C. Hughes
PROJECT NO.: 23.23.170

NOTES: Groundwater was not encountered during dry auger drilling due to borehole instability. Caving of the borehole was noted at 7.8-ft below existing grade. WOH: Weight of Hammer. CON: One-Dimensional Consolidation.

LOG OF BORING TB-2

PROJECT: WJCMWD - New Storage Tanks
Jefferson County, Texas

CLIENT: Action Civil Engineering, PLLC
Port Arthur, Texas

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	COORDINATES: N 29° 55' 41.10" W 94° 14' 00.70"		(P) POCKET PEN (tsf) (T) TORVANE (tsf)	STD. PENETRATION TEST BLOWCOUNT	N ₆₀	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	LAB MINI VANE SHEAR (tsf)	COMPRESSIVE STRENGTH (tsf)	FAILURE STRAIN (%)	CONFINING PRESSURE (psi)	PASSING #200 SIEVE (%)	OTHER TESTS
				SURFACE ELEVATION: -														
				DRILLING METHOD: Dry Augered: 0' to 12' Wash Bored: 12' to 100'		MATERIAL DESCRIPTION												
35				Firm gray FAT CLAY (CH)		(P)1.00												
40				-becomes gray and tan at 43' -stiff from 43' to 50'		(P)2.00												
45						(P)2.75		24	101	54	35		1.91	10	41			
50				-becomes hard at 53'		(P)4.50		22									96	
55						(P)2.50		25	101	33	15		1.64	15	49			
60				Stiff, gray and tan LEAN CLAY (CL)		(P)3.00												
65				Stiff, gray and tan FAT CLAY (CH)		(P)2.75		31		85	56							
70																		

COMPLETION DEPTH: 100 ft
DATE BORING STARTED: 11/15/2023
DATE BORING COMPLETED: 11/15/2023
LOGGER: C. Hughes
PROJECT NO.: 23.23.170

NOTES: Groundwater was not encountered during dry auger drilling due to borehole instability. Caving of the borehole was noted at 7.8-ft below existing grade. WOH: Weight of Hammer. CON: One-Dimensional Consolidation.

LOG OF BORING TB-2

PROJECT: WJCMWD - New Storage Tanks
Jefferson County, Texas

CLIENT: Action Civil Engineering, PLLC
Port Arthur, Texas

ELEVATION (FT) DEPTH (FT)	SAMPLE TYPE SYMBOL	COORDINATES: N 29° 55' 41.10" W 94° 14' 00.70"	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	STD. PENETRATION TEST BLOWCOUNT	N ₆₀	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	LAB MINI VANE SHEAR (tsf)	COMPRESSIVE STRENGTH (tsf)	FAILURE STRAIN (%)	CONFINING PRESSURE (psi)	PASSING #200 SIEVE (%)	OTHER TESTS
		SURFACE ELEVATION: -													
75	[Hatched Pattern]	Stiff, gray and tan FAT CLAY (CH)	(P)3.00			35	83				1.99	13	62		
80	[Hatched Pattern]	-becomes very stiff at 78'	(P)3.00												
85	[Cross-hatched Pattern]	Very dense gray SILTY SAND (SM)		28/6" 37/6" 39/6"		23									22
90	[Cross-hatched Pattern]			32/6" 41/6" 30/6"											
95	[Cross-hatched Pattern]			15/6" 34/6" 40/6"		24									25
100	[Cross-hatched Pattern]	Bottom @ 100'		19/6" 40/6" 41/6"											
105															

COMPLETION DEPTH: 100 ft
DATE BORING STARTED: 11/15/2023
DATE BORING COMPLETED: 11/15/2023
LOGGER: C. Hughes
PROJECT NO.: 23.23.170

NOTES: Groundwater was not encountered during dry auger drilling due to borehole instability. Caving of the borehole was noted at 7.8-ft below existing grade. WOH Weight of Hammer. CON: One-Dimensional Consolidation.

KEY TO SYMBOLS AND TERMS USED ON BORING LOGS FOR SOIL

Most Common Unified Soil Classifications System Symbols

	Lean Clay (CL)		Well Graded Sand (SW)
	Lean Clay w/ Sand (CL)		Well Graded Sand w/ Gravel (SW-GM)
	Sandy Lean Clay (CL)		Poorly Graded Sand (SP)
	Fat Clay (CH)		Poorly Graded Sand w/ Silt (SP-SM)
	Fat Clay w/ Sand (CH)		Silt (ML)
	Sandy Fat Clay (CH)		Elastic Silt (MH)
	Silty Clay (CL-ML)		Elastic Silt w/ Sand (MH-SP)
	Sandy Silty Clay (CL-ML)		Silty Gravel (GM)
	Silty Clayey Sand (SC-SM)		Clayey Gravel (GC)
	Clayey Sand (SC)		Well Graded Gravel (GW)
	Sandy Silt (ML)		Well Graded Gravel w/ Sand (SP-GM)
	Silty Sand (SM)		Poorly Graded Gravel (GP)
	Silt w/ Sand (ML)		Peat

Miscellaneous Materials

	Fill		Concrete		Asphalt and/or Base
--	------	--	----------	--	---------------------

Sampler Symbols

Meaning

	Pavement core
	Thin-walled tube sample
	Standard Penetration Test (SPT)
	Auger sample
	Sampling attempt with no recovery
	TxDOT Cone Penetrometer Test

Field Test Data

2.50	Pocket penetrometer reading in tons per square foot
(T)1.13	Torvane Measurement in tons per square foot
8/6"	Blow count per 6-in. interval of the Standard Penetration Test
	Observed free water during drilling
	Observed static water level

Laboratory Test Data

W _c (%)	Moisture content in percent
Dens. (pcf)	Dry unit weight in pounds per cubic foot
Q _u (tsf)	Unconfined compressive strength in tons per square foot
UU (tsf)	Compressive strength under confining pressure in tons per square foot
Str. (%)	Strain at failure in percent
LL	Liquid Limit in percent
PI	Plasticity Index
#200 (%)	Percent passing the No. 200 mesh sieve
()	Confining pressure in pounds per square inch
*	Slickensided failure
**	Did not fail @ 15% strain

RELATIVE DENSITY OF COHESIONLESS & SEMI-COHESIONLESS SOILS

The following descriptive terms for relative density apply to cohesionless soils such as gravels, silty sands, and sands as well as semi-cohesive and semi-cohesionless soils such as sandy silts, and clayey sands.

Relative Density	Typical N ₆₀ Value Range*
Very Loose	0-4
Loose	5-10
Medium Dense	11-30
Dense	31-50
Very Dense	Over 50

* N₆₀ is the number of blows from a 140-lb weight having a free fall of 30-in. required to penetrate the final 12-in. of an 18-in. sample interval, corrected for field procedure to an average energy ratio of 60% (Terzaghi, Peck, and Mesri, 1996).

CONSISTENCY OF COHESIVE SOILS

The following descriptive terms for consistency apply to cohesive soils such as clays, sandy clays, and silty clays.

Typical Compressive Strength (tsf)	Consistency	Typical SPT "N ₆₀ " Value Range**
q _u < 0.25	Very soft	≤ 2
0.25 ≤ q _u < 0.50	Soft	3-4
0.50 ≤ q _u < 1.00	Firm	5-8
1.00 ≤ q _u < 2.00	Stiff	9-15
2.00 ≤ q _u < 4.00	Very Stiff	16-30
q _u ≥ 4.00	Hard	≥ 31

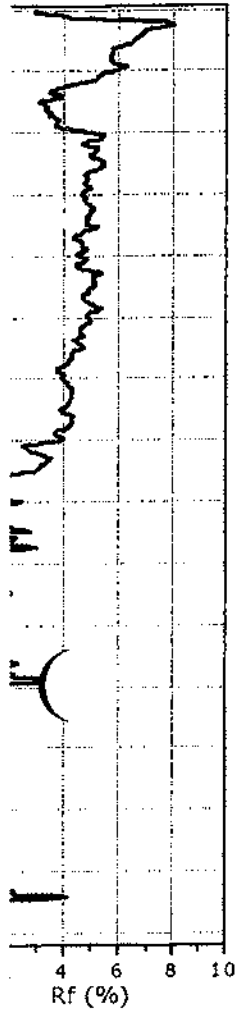
** An "N₆₀" value of 31 or greater corresponds to a hard consistency. The correlation of consistency with a typical SPT "N₆₀" value range is approximate.



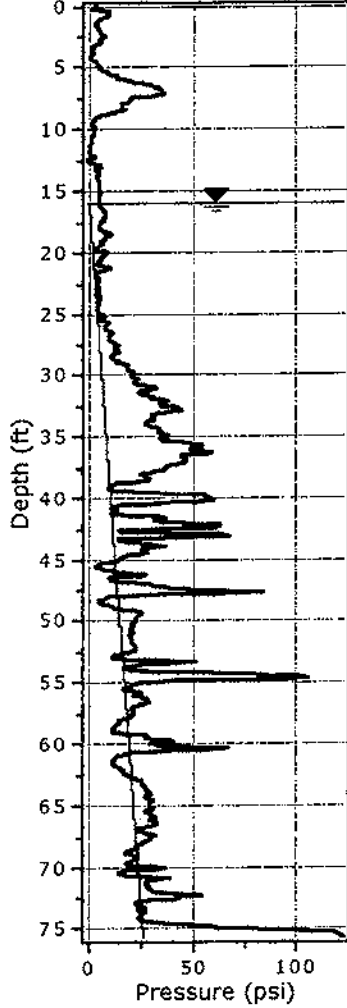
APPENDIX D

CPT SOUNDING LOGS

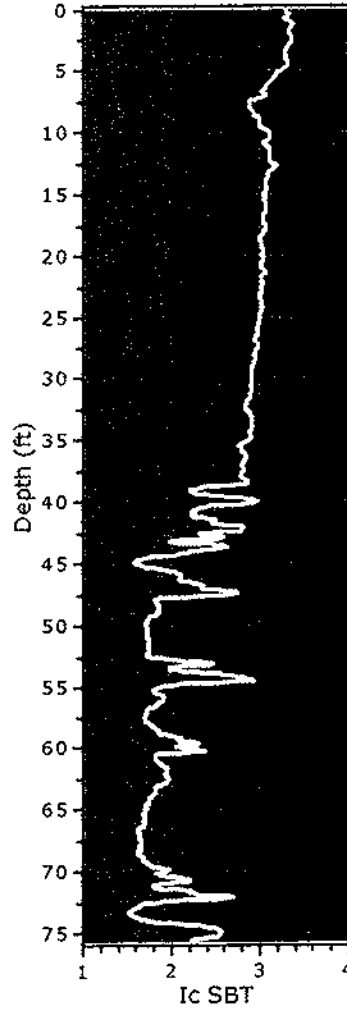
Friction ratio



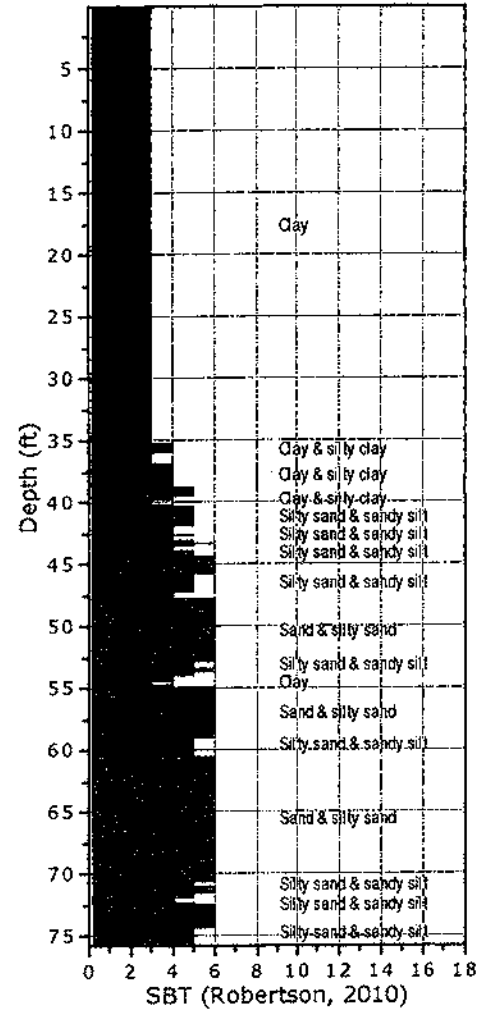
Pore pressure u



SBT Index

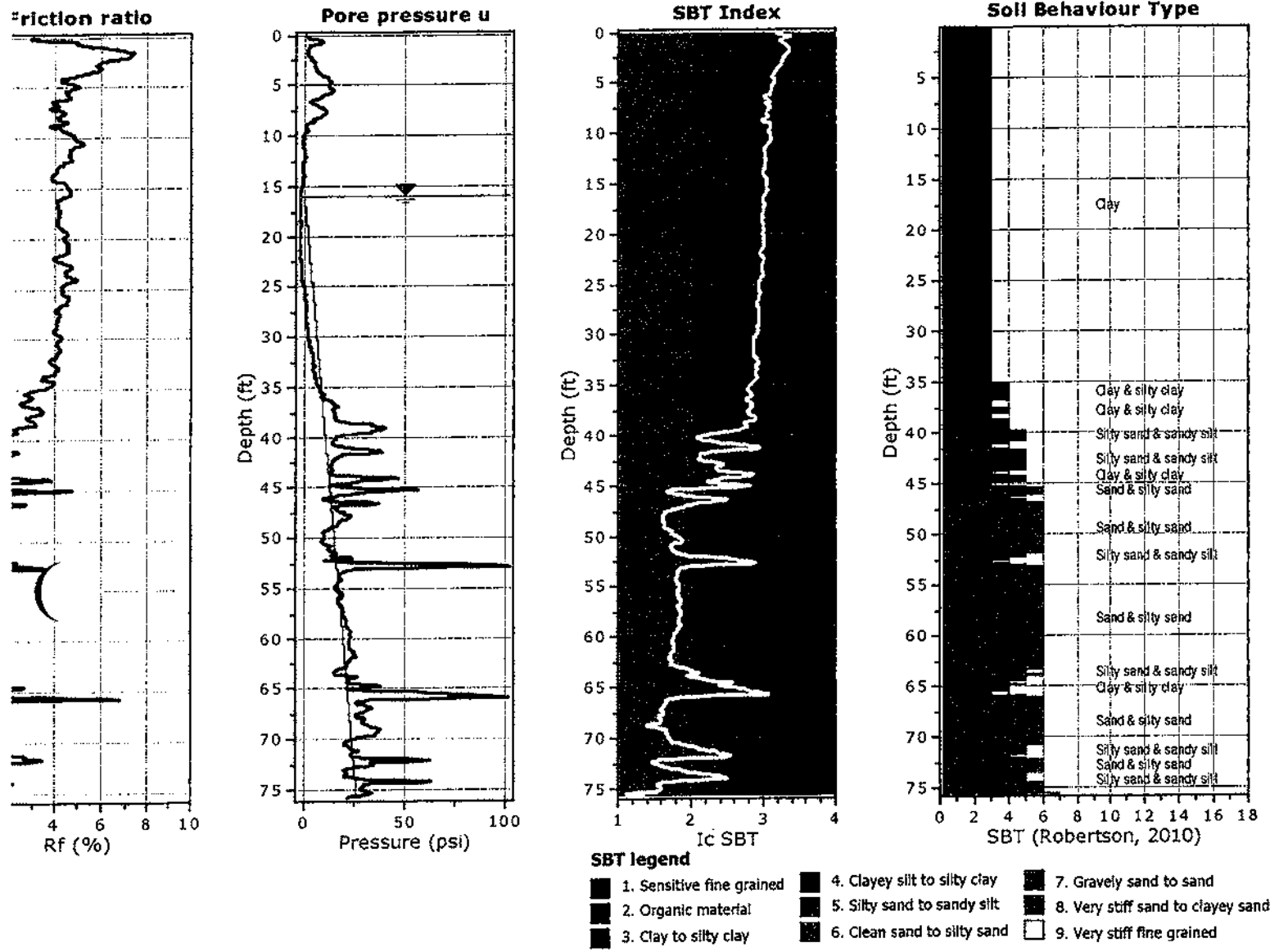


Soil Behaviour Type

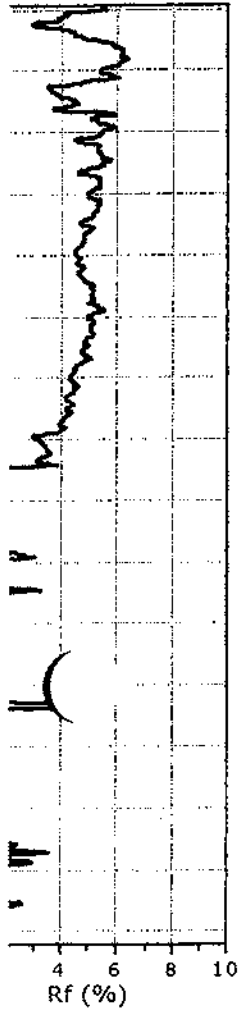


SBT legend

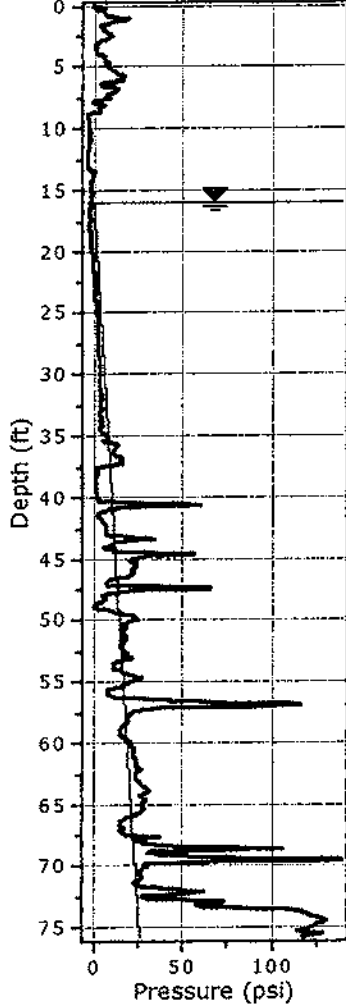
- | | | |
|---------------------------|------------------------------|-----------------------------------|
| 1. Sensitive fine grained | 4. Clayey silt to silty clay | 7. Gravely sand to sand |
| 2. Organic material | 5. Silty sand to sandy silt | 8. Very stiff sand to clayey sand |
| 3. Clay to silty clay | 6. Clean sand to silty sand | 9. Very stiff fine grained |



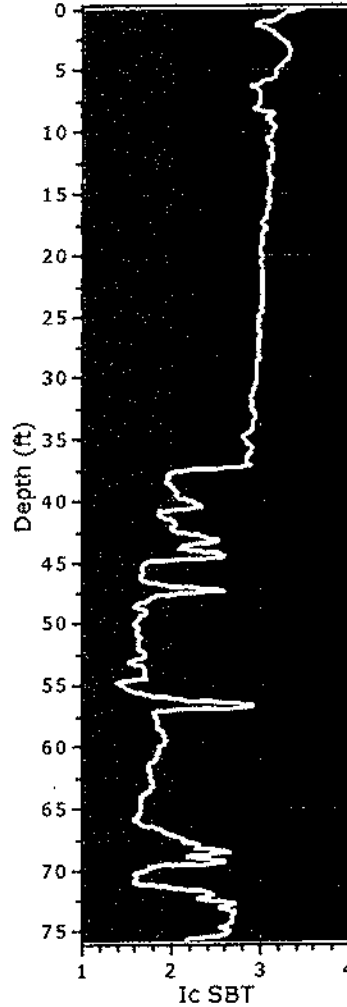
Friction ratio



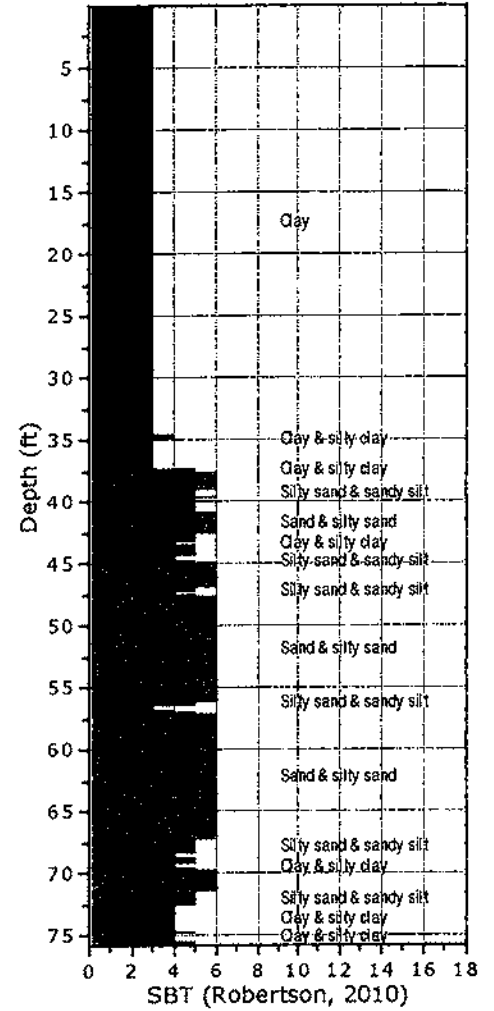
Pore pressure u



SBT Index



Soil Behaviour Type



SBT legend

- | | | |
|---------------------------|------------------------------|-----------------------------------|
| 1. Sensitive fine grained | 4. Clayey silt to silty clay | 7. Gravely sand to sand |
| 2. Organic material | 5. Silty sand to sandy silt | 8. Very stiff sand to clayey sand |
| 3. Clay to silty clay | 6. Clean sand to silty sand | 9. Very stiff fine grained |

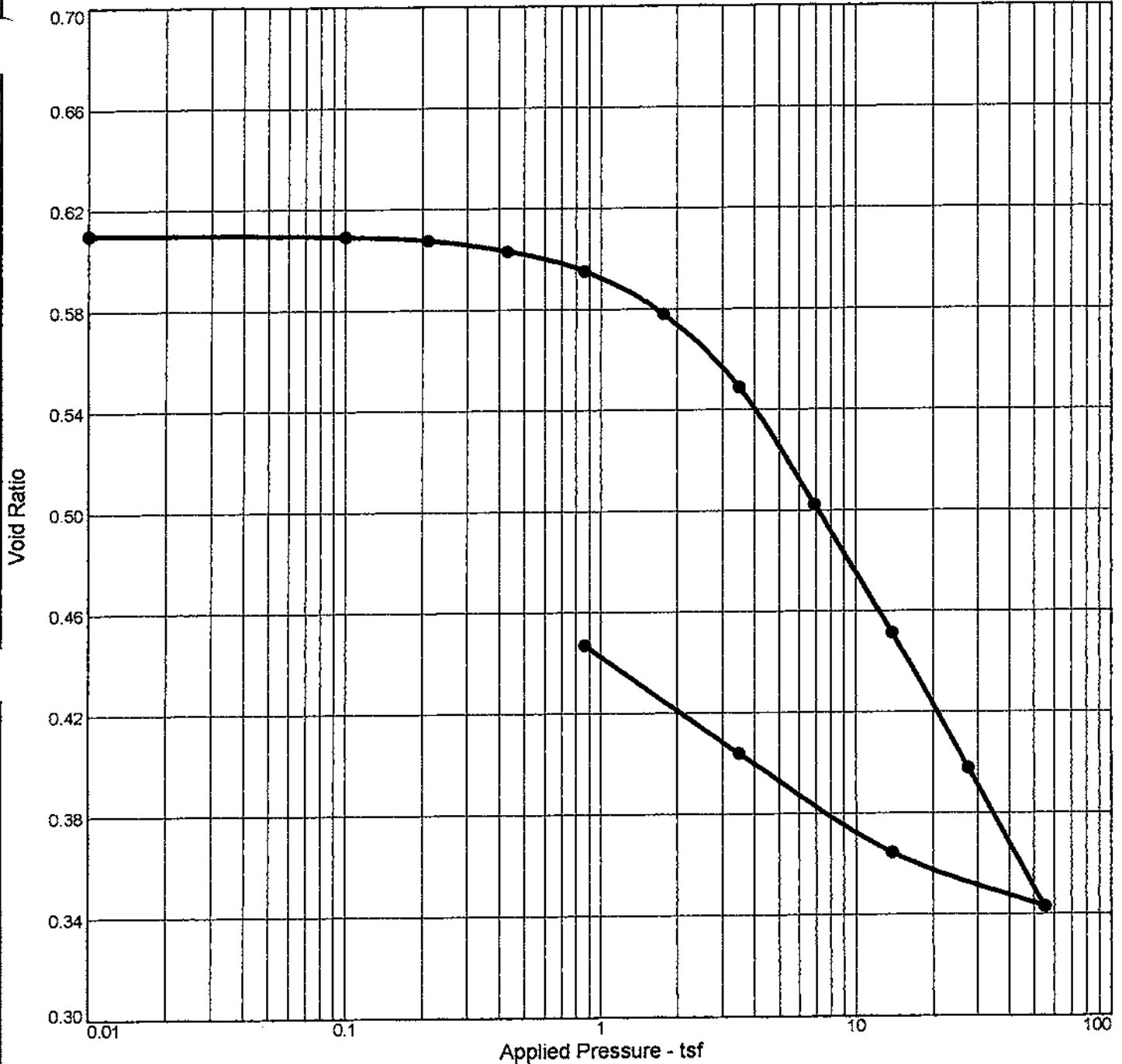
APPENDIX E

RESULTS OF ONE-DIMENSIONAL CONSOLIDATION TESTING

TWE

Project No. 23.23.170
Report No. 148649

CONSOLIDATION TEST REPORT



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	USCS	AASHTO	Initial Void Ratio
Saturation	Moisture							
92.4 %	20.9 %	104.7	62	39	2.70	CH		0.610

MATERIAL DESCRIPTION

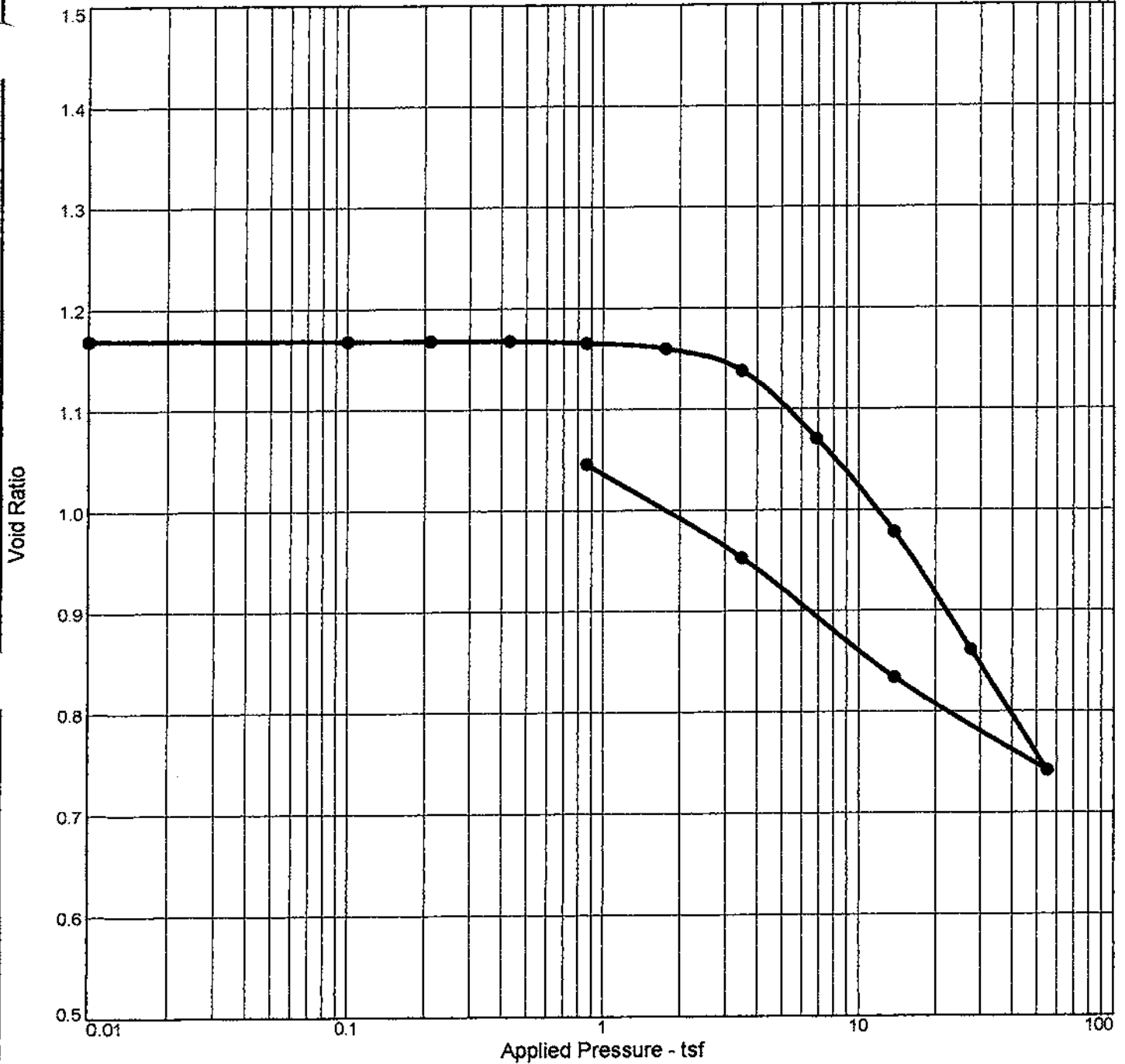
Stiff, brown and tan FAT CLAY (CH), with calcareous nodules

Project No. 23.23.170	Client: Action Civil Engineering, PLLC
Project: WJCMWD - New Storage Tanks Jefferson County, Texas	
Source of Sample: TB-1	Depth: 8-10
Tolunay-Wong Engineers, Inc.	
Beaumont, TX	

Remarks:
ASTM D2435 - Method B
Specific Gravity: Assumed

Figure

CONSOLIDATION TEST REPORT



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	USCS	AASHTO	Initial Void Ratio
Saturation								
99.2 %	41.4 %	80.6	--	--	2.80	CH		1.169

MATERIAL DESCRIPTION

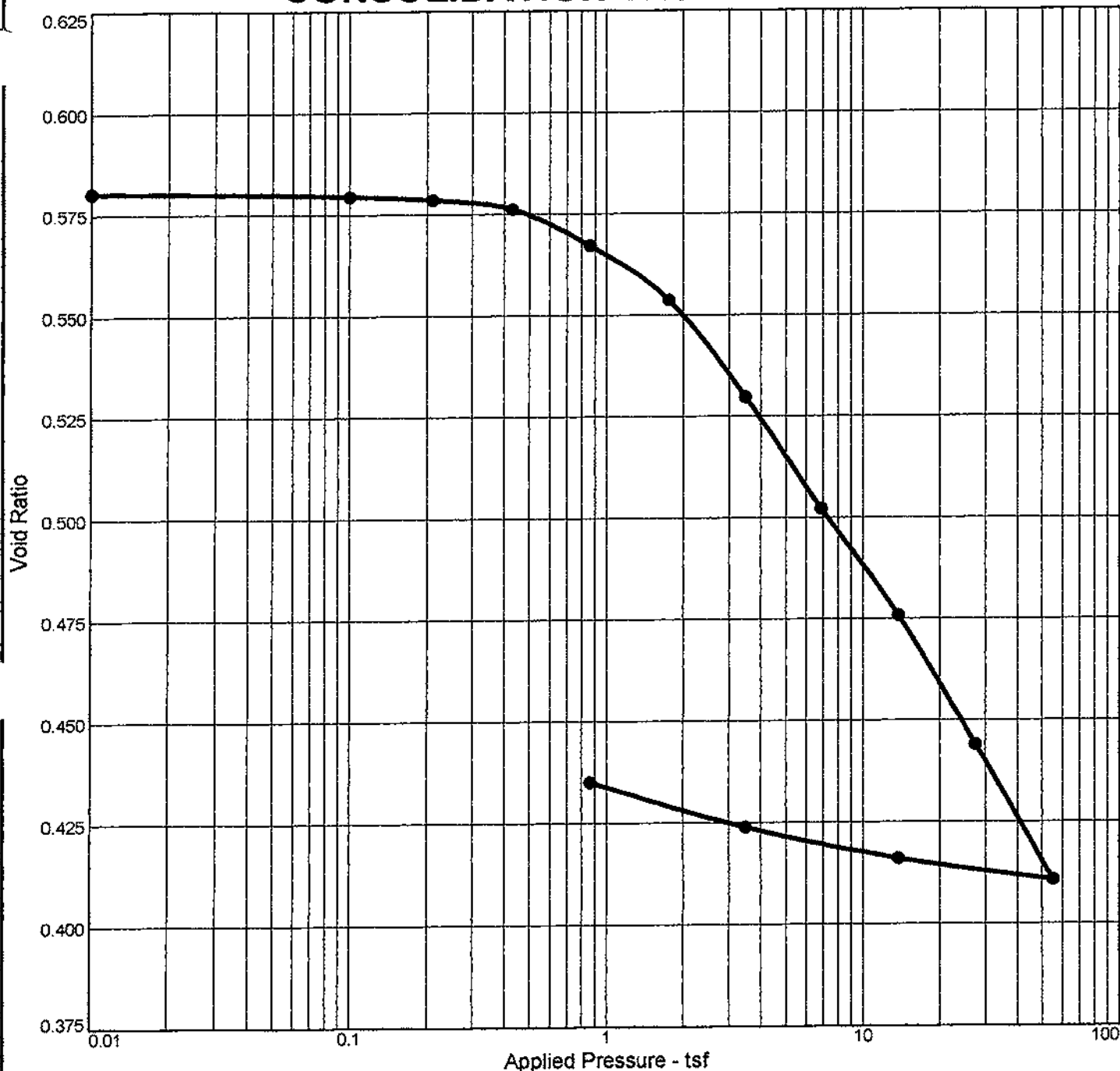
Stiff, brown and tan FAT CLAY (CH), with slickensides

Project No. 23.23.170	Client: Action Civil Engineering, PLLC
Project: WJCMWD - New Storage Tanks Jefferson County, Texas	
Source of Sample: TB-1	Depth: 33-35
Tolunay-Wong Engineers, Inc.	
Beaumont, TX	

Remarks:
ASTM D2435 - Method B
Specific Gravity: Assumed

Figure

CONSOLIDATION TEST REPORT



Natural	Dry Dens. (pcf)	LL	PI	Sp. Gr.	USCS	AASHTO	Initial Void Ratio
Saturation							
93.1 %	20.0 %	106.7	37	23	2.70	SC	0.580

MATERIAL DESCRIPTION

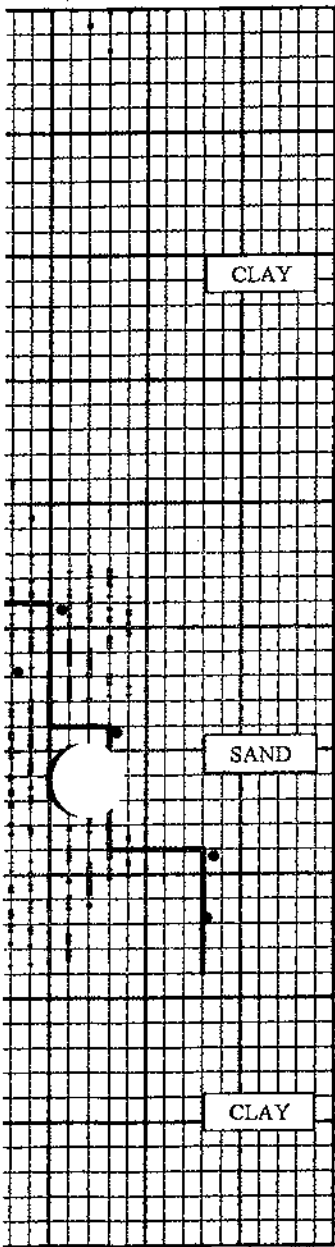
Gray and tan CLAYEY SAND (SC)

Project No. 23.23.170 Client: Action Civil Engineering, PLLC Project: WJCMWD - New Storage Tanks Jefferson County, Texas Source of Sample: TB-2 Depth: 6-8 Tolunay-Wong Engineers, Inc. Beaumont, TX	Remarks: ASTM D2435 - Method B Specific Gravity: Assumed
---	---

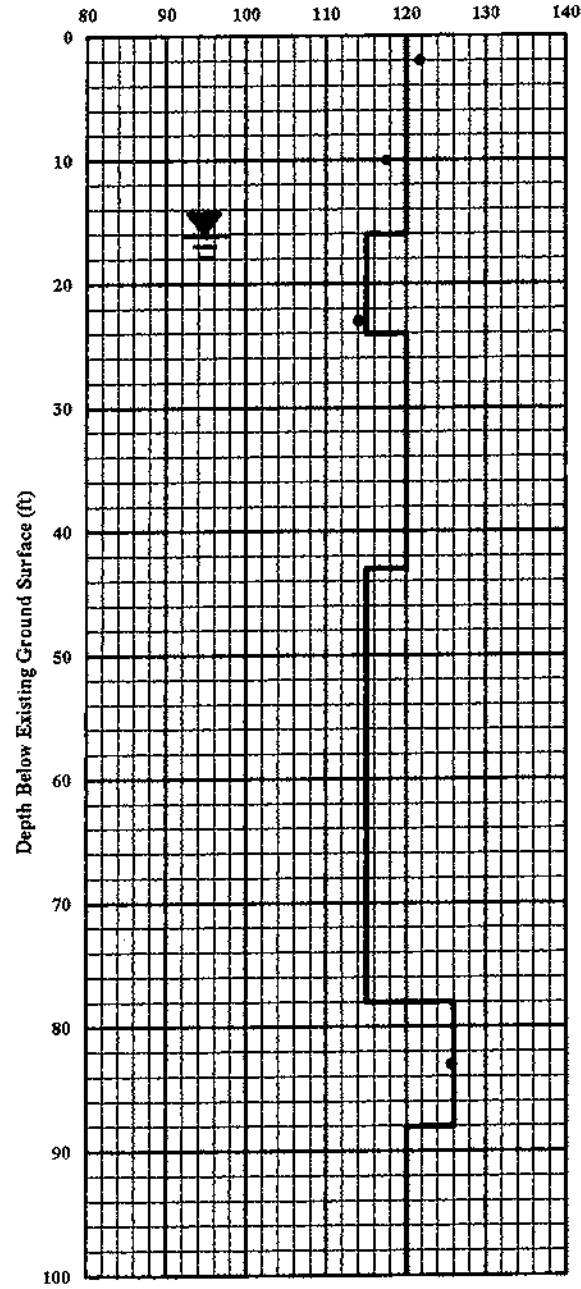
APPENDIX F

SOIL DESIGN PARAMETERS

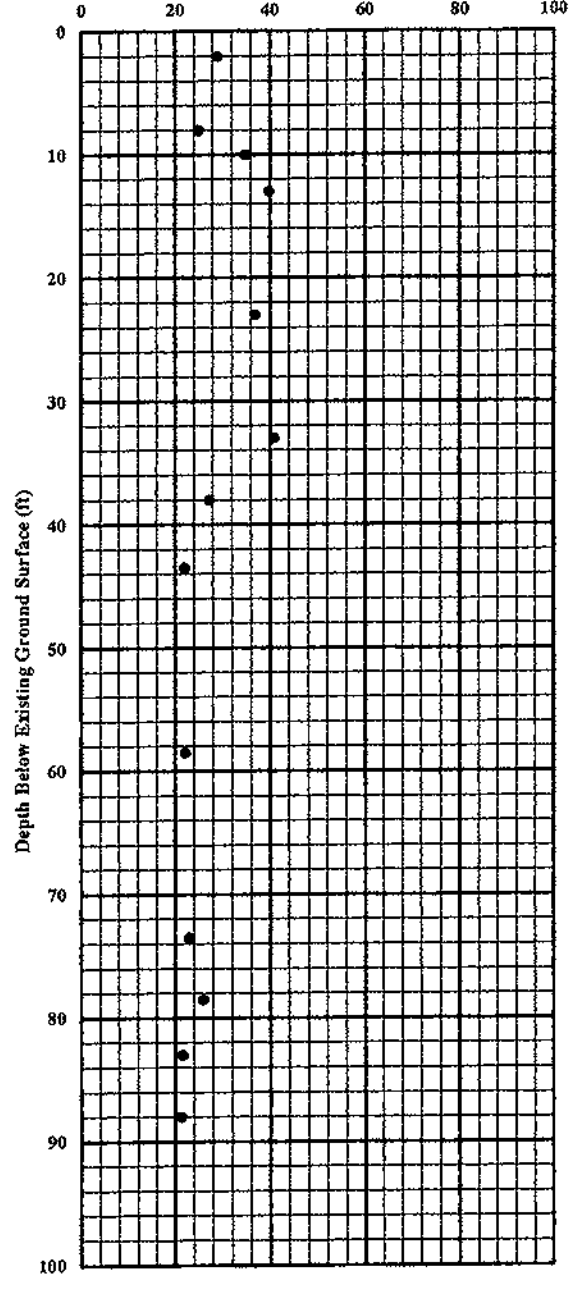
ern...tion Degrees (°)
35 40 45 50



Total Unit Weight (pcf)



Water Content (%)



—Design

—Design

Y-WONG
N E E R S

Project Number: 23.23.170

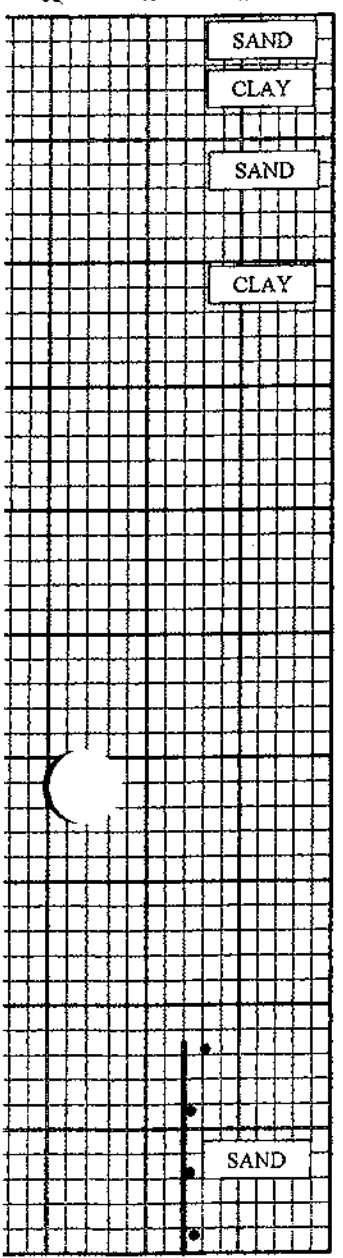
Report Number: 148649

am...
Storage Tank
ough CPT-3)

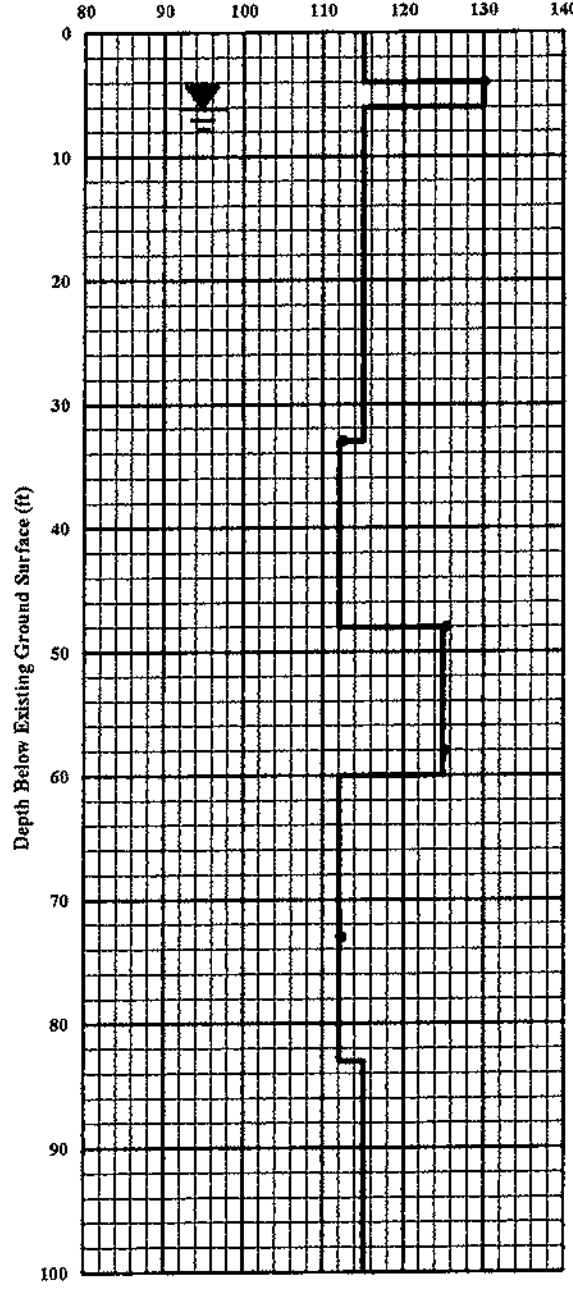
Appendix F

Figure 1

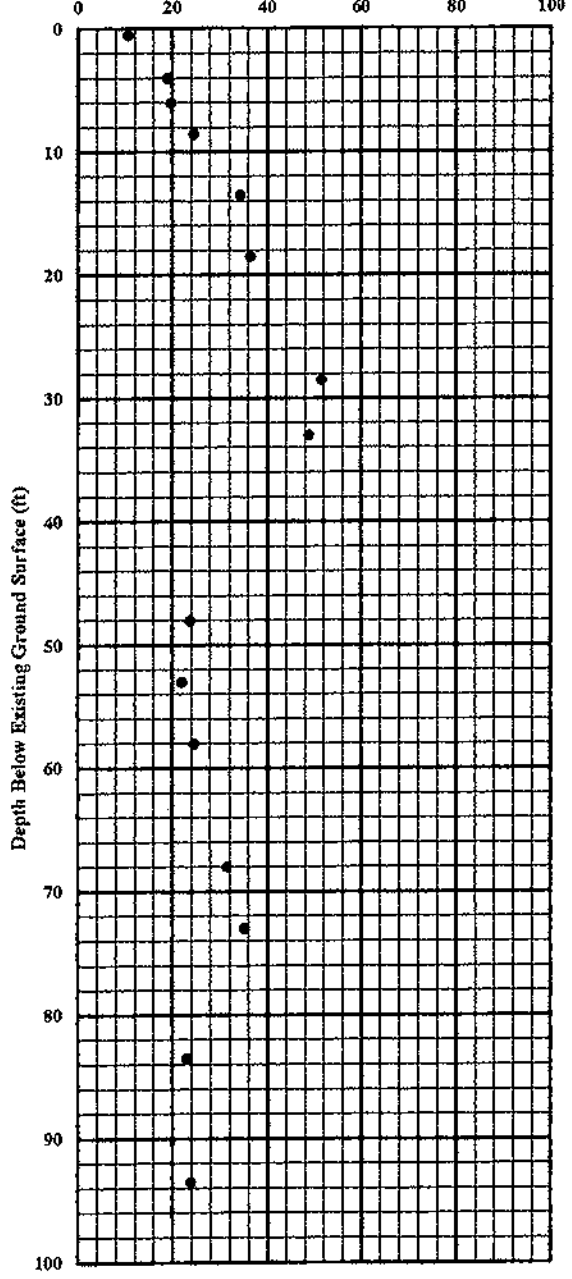
ern ... tion Degrees (°)



Total Unit Weight (pcf)



Water Content (%)



—Design

—Design

WONG
ENGINEERS

Project Number: 23.23.170

Report Number: 148649

am
Storage Tank (TB-2)

Appendix F

Figure 2

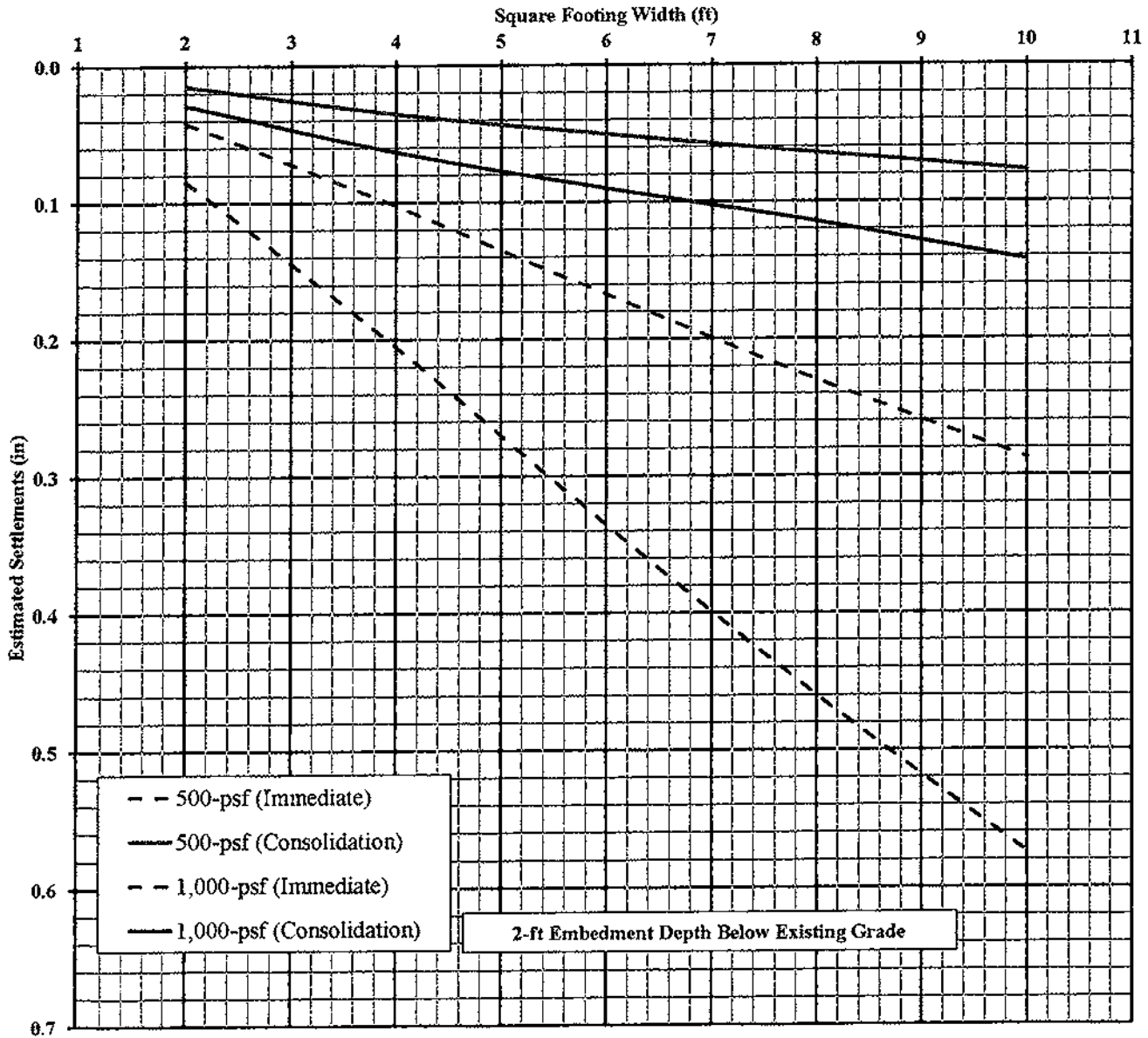
APPENDIX G

ELEVATED STORAGE TANK SPREAD FOOTING WIDTH VS SETTLEMENT PLOTS

TWE

Project No. 23.23.170
Report No. 148649

SETTLEMENT VS. FOOTING WIDTH 500,000-GAL ELEVATED STORAGE TANK SQUARE SPREAD FOOTINGS

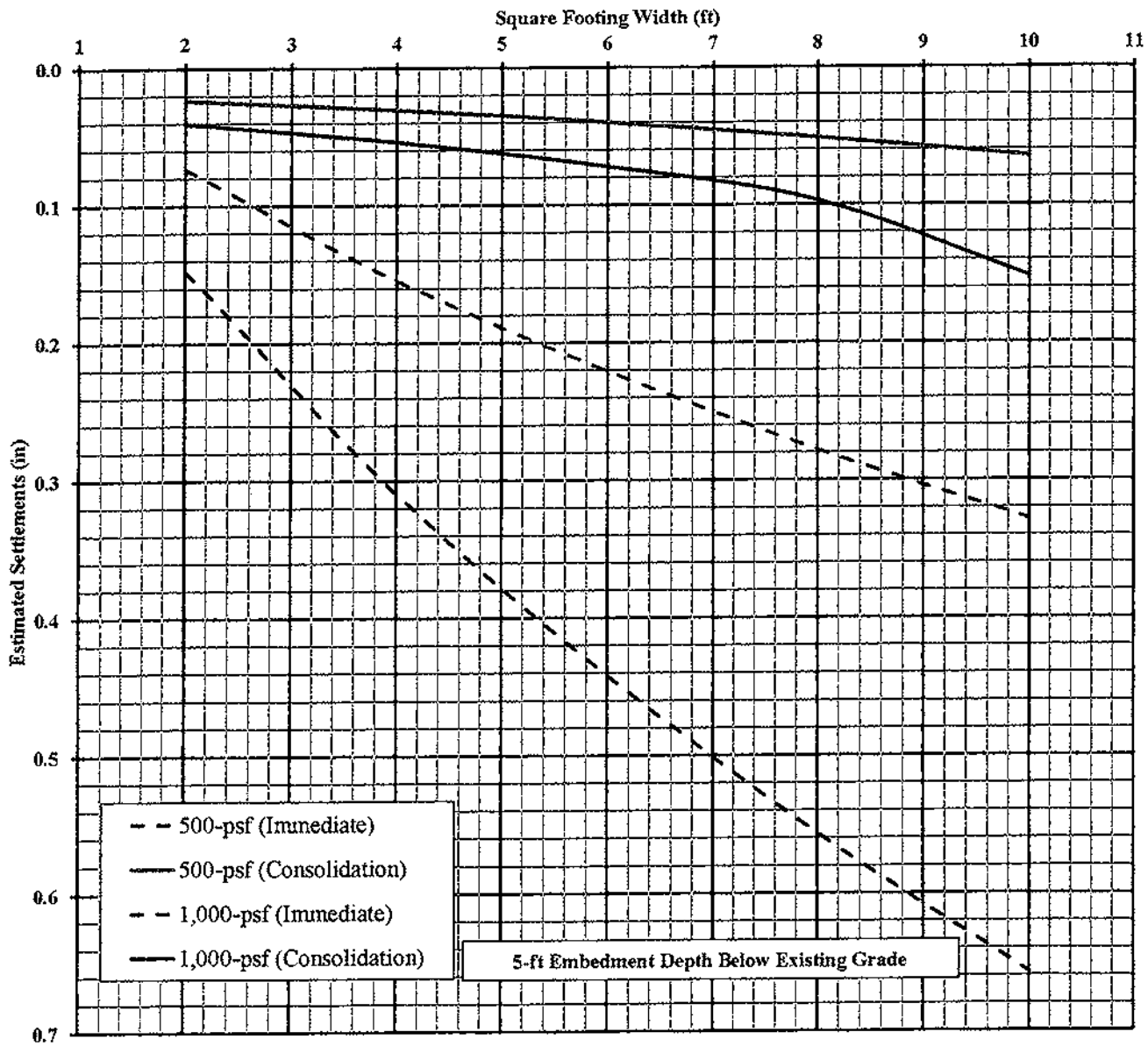


NOTES:

- (1) The estimated settlements are for individual rigid square spread footings bearing on properly-prepared native subgrade at a depth of 2-ft below existing grade assuming uniform bearing pressure.
- (2) Total settlement can be computed by estimating immediate and consolidation settlements separately from the plots and adding them together.
- (3) The estimated settlements are valid for isolated foundation conditions wherein the clear spacing between adjacent foundations is at least the width of the largest foundation. TWE should be contacted to evaluate the influence of adjacent foundations if clear spacing is considered an issue.
- (4) Settlement for rectangular footings having a length (L) to width (B) ratio of 2 or less can be computed from the above chart using the width of an equivalent square footing (i.e., for a 4-ft by 8-ft rectangular footing, the equivalent width of a square footing will be 5.66-ft).
- (5) Immediate settlements will occur during construction or immediately upon loading. Consolidation settlements will occur under sustained net load over a period of approximately 10+ years after construction.

Project: WJCMWD - New Storage Tanks Jefferson County, Texas	Tolunay-Wong Engineers, Inc.	Project No. 23.23.170 Report No. 148649
Client: Action Civil Engineering, PLLC Port Arthur, Texas	Settlement vs. Footing Size 500,000-gal Elevated Storage Tank Square Spread Footings (2-ft Embedment Depth)	Appendix: G Figure: 1

SETTLEMENT VS. FOOTING WIDTH 500,000-GAL ELEVATED STORAGE TANK SQUARE SPREAD FOOTINGS



NOTES:

- (1) The estimated settlements are for individual rigid square spread footings bearing on properly-prepared native subgrade at a depth of 5-ft below existing grade assuming uniform bearing pressure.
- (2) Total settlement can be computed by estimating immediate and consolidation settlements separately from the plots and adding them together.
- (3) The estimated settlements are valid for isolated foundation conditions wherein the clear spacing between adjacent foundations is at least the width of the largest foundation. TWE should be contacted to evaluate the influence of adjacent foundations if clear spacing is considered an issue.
- (4) Settlement for rectangular footings having a length (L) to width (B) ratio of 2 or less can be computed from the above chart using the width of an equivalent square footing (i.e., for a 4-ft by 8-ft rectangular footing, the equivalent width of a square footing will be 5.66-ft).
- (5) Immediate settlements will occur during construction or immediately upon loading. Consolidation settlements will occur under sustained net load over a period of approximately 10+ years after construction.

Project:

WJCMWD - New Storage Tanks
Jefferson County, Texas



**Tolunay-Wong
Engineers, Inc.**

Project No. 23.23.170
Report No. 148649

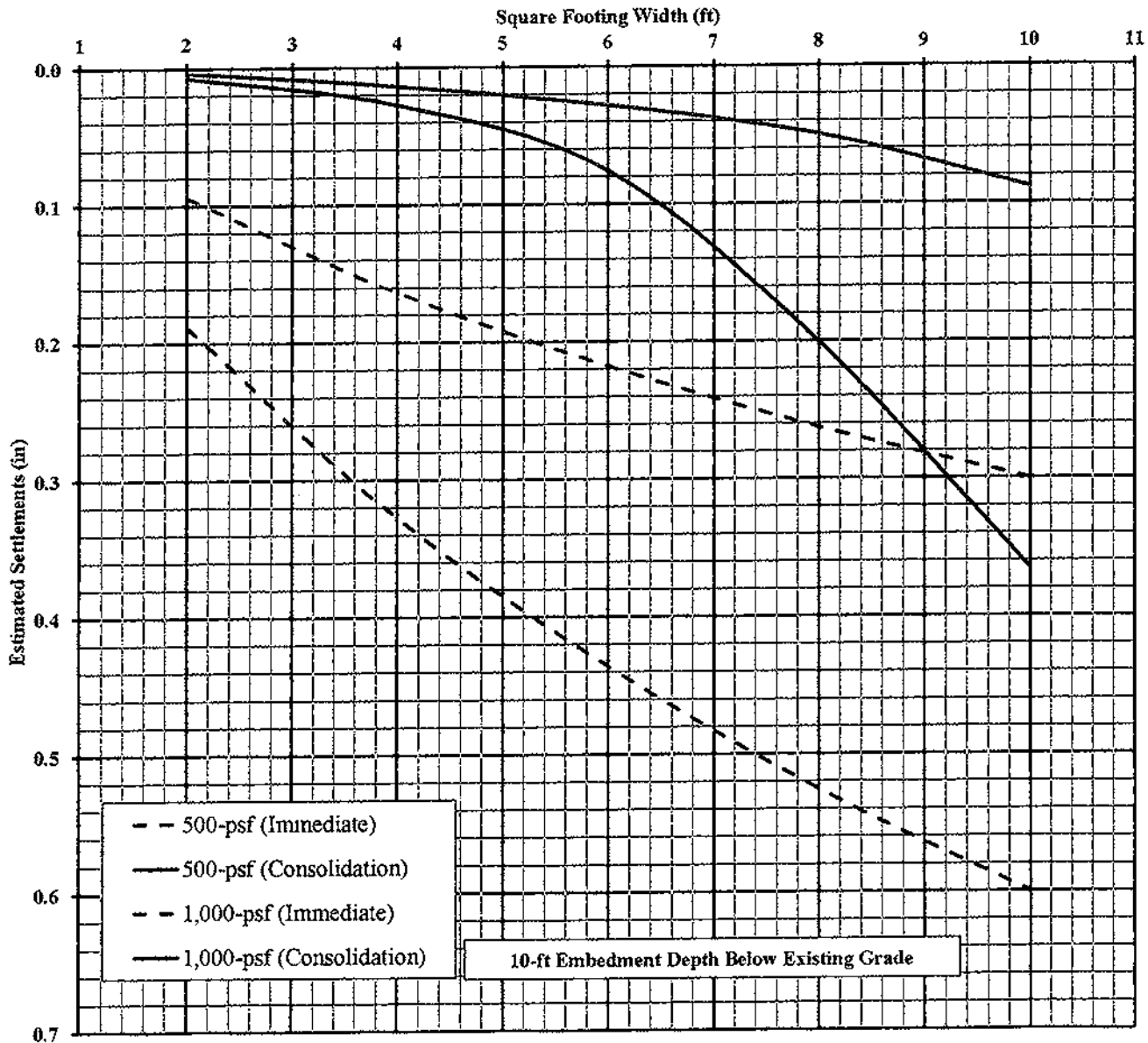
Client:

Action Civil Engineering, PLLC
Port Arthur, Texas

Settlement vs. Footing Size
500,000-gal Elevated Storage Tank
Square Spread Footings
(5-ft Embedment Depth)

Appendix: G
Figure: 2

SETTLEMENT VS. FOOTING WIDTH 500,000-GAL ELEVATED STORAGE TANK SQUARE SPREAD FOOTINGS



NOTES:

- (1) The estimated settlements are for individual rigid square spread footings bearing on properly-prepared native subgrade at a depth of 10-ft below existing grade assuming uniform bearing pressure.
- (2) Total settlement can be computed by estimating immediate and consolidation settlements separately from the plots and adding them together.
- (3) The estimated settlements are valid for isolated foundation conditions wherein the clear spacing between adjacent foundations is at least the width of the largest foundation. TWE should be contacted to evaluate the influence of adjacent foundations if clear spacing is considered an issue.
- (4) Settlement for rectangular footings having a length (L) to width (B) ratio of 2 or less can be computed from the above chart using the width of an equivalent square footing (i.e., for a 4-ft by 8-ft rectangular footing, the equivalent width of a square footing will be 5.66-ft).
- (5) Immediate settlements will occur during construction or immediately upon loading. Consolidation settlements will occur under sustained net load over a period of approximately 10+ years after construction.

Project:
WJCMWD - New Storage Tanks
Jefferson County, Texas



**Tolunay-Wong
Engineers, Inc.**

Project No. 23.23.170
Report No. 148649

Client:
Action Civil Engineering, PLLC
Port Arthur, Texas

Settlement vs. Footing Size
500,000-gal Elevated Storage Tank
Square Spread Footings
(10-ft Embedment Depth)

Appendix: G
Figure: 3

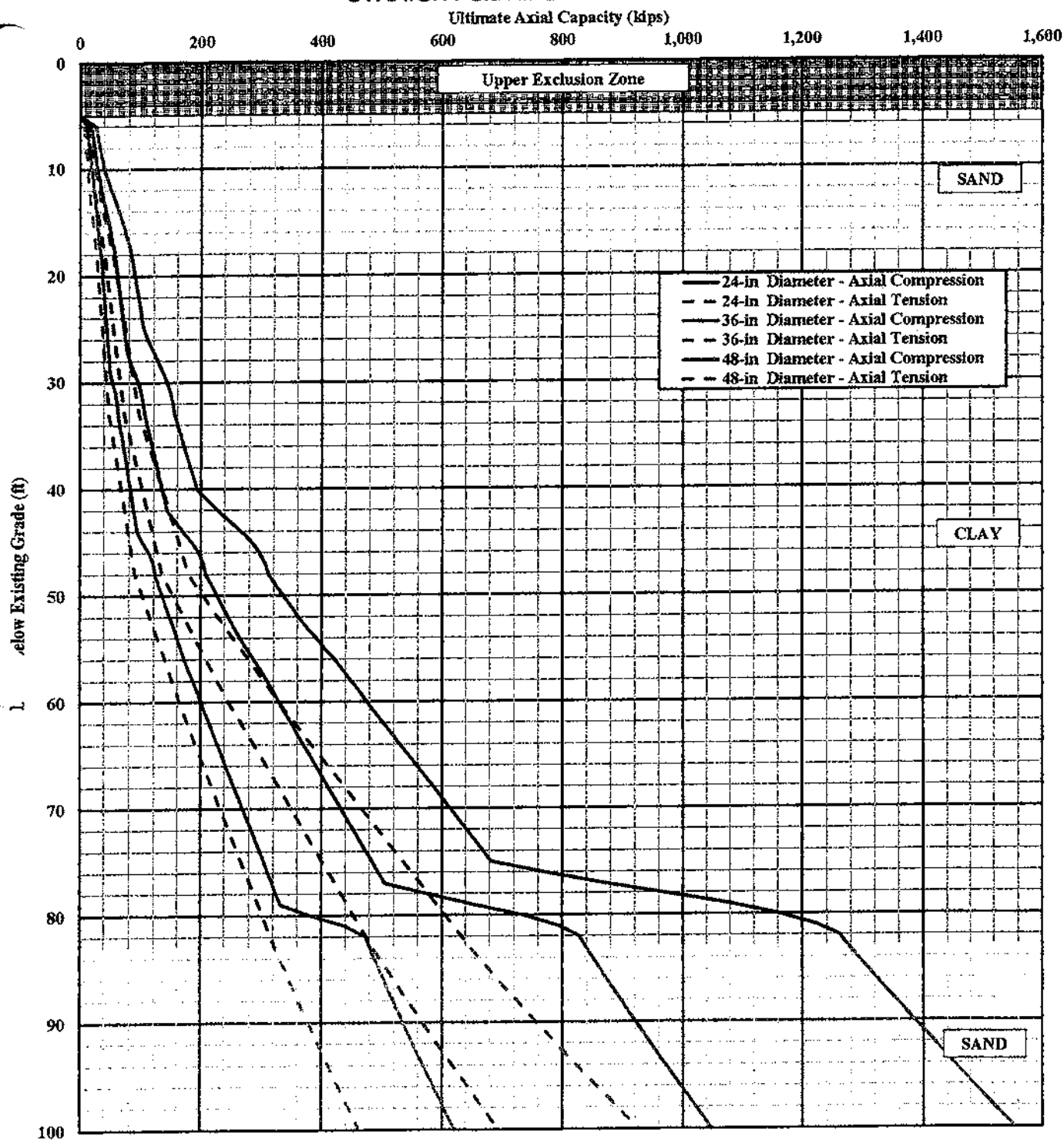
APPENDIX H

ELEVATED STORAGE TANK ULTIMATE AXIAL SHAFT CAPACITIES

TWE

Project No. 23.23.170
Report No. 148649

ULTIMATE AXIAL CAPACITY VERSUS DEPTH STRAIGHT-SIDED DRILLED SHAFTS



NOTES:

- 1) Center-to-center spacing of the shaft should be at least three (3) times the shaft diameter.
- 2) A factor of safety of 2.5 is recommended for allowable compression loads.
- 3) A factor of safety of 3.0 is recommended for allowable tension loads (does not include the weight of pile).
- 4) Reduced factors of safety can be considered if a load testing program (static, dynamic or combination) is performed.

<p>Client</p> <p>WJCMWD - New Storage Tanks Jefferson County, Texas</p>	<p>Tolunay-Wong Engineers, Inc.</p>	<p>Project No. 23.23.170 Report No. 148649</p>
<p>Client</p> <p>Action Civil Engineering, PLLC Port Arthur, Texas</p>	<p>Ultimate Axial Capacity vs. Depth Straight-Sided Drilled Shafts 500,000-Gal Elevated Storage Tank</p>	<p>Appendix H Figure 1</p>

APPENDIX I


ELEVATED STORAGE TANK LPILE PARAMETERS

TWE

Project No. 23.23.170
Report No. 148649

Lateral Pile Analysis Soil Design Parameters - 500,000 gal Elevated Storage Tank

	Depth (ft)		Effective Unit Weight, γ' (pcf)	Cohesion, c (psf)	Friction Angle ($^\circ$)	Static Lateral Modulus, k (pci)	Strain Factor, ϵ_{60}
	Top	Bottom					
	0	4	115	--	31	25	--
Layer	4	6	130	2,300	--	1,000	0.005
	6	18	53	--	25	20	--
	18	33	53	400	--	30	0.020
Layer	33	48	50	800	--	100	0.010
Layer	48	60	63	1,800	--	500	0.007
Layer	60	83	50	2,000	--	500	0.007
	83	100	53	--	42	125	--

Storage Tanks County, Texas	Tolunay-Wong  Engineers, Inc.	Project Number: 23.23.170 Report Number: 148649
Engineering, PLLC Texas		Lateral Pile Analysis Soil Design Parameters Appendix I Figure 1



ACTION CIVIL ENGINEERS, PLLC

Firm Registration No. F-16376

Construction Documents and Technical Specifications

West Jefferson County Municipal Water District
Jefferson County, Texas

List of Proposals

PROPOSAL I - 500,000 Gallon Single Pedestal Spheroid Steel Tank

PROPOSAL II-400,000 Gallon Single Pedestal Spheroid Steel Tank

PROPOSAL III-300,000 Gallon Single Pedestal Spheroid Steel Tank

PROPOSAL IV-250,000 Gallon Single Pedestal Spheroid Steel Tank

PROPOSAL V-Painting of Letters and Logo on Proposals I thru IV

SUPPLEMENTAL ITEMS PROPOSAL

*All proposals located at the end of this document for ease of access by bidders.

PROPOSAL I

**500,000 GALLONS
ELEVATED POTABLE WATER STEEL STORAGE TANK**

ACE Job No. 123-01C

SCOPE OF WORK

Furnish and construct a 500,000-gallon capacity potable water's **Single Pedestal Spheroid** elevated storage tank high water level elevation **156 MSL** including foundation, steel erection, welding, shrouding, blasting, and standard three coat paint system for the interior and exterior tank surfaces, and electrical, all related tank construction, welding and coating testing, disinfection, site development, and final clean up. The amount bid is to include all labor, materials, equipment, insurance, payroll, taxes, permits, and supervision to provide a complete and functional project.

Bid for Proposal I as outlined in the Scope of Work for 500,000 Gallon Elevated Storage Tank for the Lump Sum Amount of:

Bid for Proposal I as outlined in the Scope of Work for 500,000 Gallon Elevated Storage Tank for the Lump Sum Amount of:

_____ Dollars

And _____ Cents.

(\$ _____)

Bid price must be written in words and the written words shall govern amount bid.

STATEMENT FOR SEPARATE CONTRACT COMPLIANCE

Non-consumable Material and Installed Equipment:

\$ _____

Skilled Labor and Consumable Materials, Tool and construction equipment:

\$ _____

The undersigned agrees to commence work within ten (10) days after the date of written notice to commence work and to substantially complete the work on which he has bid within _____ calendar days as provided in the General Conditions of the Agreement. Enclosed herewith is a cashier's check, certified check, or bid bond in the sum of 5% of the greatest amount bid which it is agreed shall be collected and retained by the OWNER as liquidating damages in the event this proposal is accepted by the OWNER within sixty (60) days after the date advertised for the reception of bids and the undersigned fails to execute the contract and the required bond with the OWNER, under the conditions hereof, within ten (10) days after the date said proposal is accepted, otherwise said check or bond shall be returned to the undersigned upon demand.

CONTRACTOR _____

BY _____

ADDRESS _____

PHONE _____

PROPOSAL II

**400,000 GALLONS
ELEVATED POTABLE WATER STEEL STORAGE TANK**

ACE Job No. 123-01C

SCOPE OF WORK

Furnish and construct a 400,000-gallon capacity potable water's **Single Pedestal Spheroid** elevated storage tank high water level elevation **156 MSL** including foundation, steel erection, welding, shrouding, blasting, and standard three coat paint system for the interior and exterior tank surfaces, and electrical, all related tank construction, welding and coating testing, disinfection, site development, and final clean up. The amount bid is to include all labor, materials, equipment, insurance, payroll, taxes, permits, and supervision to provide a complete and functional project.

Bid for Proposal II as outlined in the Scope of Work for 400,000 Gallon Elevated Storage Tank for the Lump Sum Amount of:

_____ Dollars

And _____ Cents.

(\$ _____)

Bid price must be written in words and the written words shall govern amount bid.

STATEMENT FOR SEPARATE CONTRACT COMPLIANCE

Non-consumable Material and Installed Equipment:

\$ _____

Skilled Labor and Consumable Materials, Tool and construction equipment:

\$ _____

The undersigned agrees to commence work within ten (10) days after the date of written notice to commence work and to substantially complete the work on which he has bid within ____ calendar days as provided in the General Conditions of the Agreement. Enclosed herewith is a cashier's check, certified check, or bid bond in the sum of 5% of the greatest amount bid which it is agreed shall be collected and retained by the OWNER as liquidating damages in the event this proposal is accepted by the OWNER within sixty (60) days after the date advertised for the reception of bids and the undersigned fails to execute the contract and the required bond with the OWNER, under the conditions hereof, within ten (10) days after the date said proposal is accepted, otherwise said check or bond shall be returned to the undersigned upon demand.

CONTRACTOR _____

BY _____

ADDRESS _____

PHONE _____

PROPOSAL III

**300,000 GALLONS
ELEVATED POTABLE WATER STEEL STORAGE TANK**

ACE Job No. 123-01C

SCOPE OF WORK

Furnish and construct a 300,000-gallon capacity potable water's **Single Pedestal Spheroid** elevated storage tank high water level elevation **156 MSL** including foundation, steel erection, welding, shrouding, blasting, and standard three coat paint system for the interior and exterior tank surfaces, and electrical, all related tank construction, welding and coating testing, disinfection, site development, and final clean up. The amount bid is to include all labor, materials, equipment, insurance, payroll, taxes, permits, and supervision to provide a complete and functional project.

Bid for Proposal III as outlined in the Scope of Work for 300,000 Gallon Elevated Storage Tank for the Lump Sum Amount of:

_____ Dollars

And _____ Cents.

(\$ _____)

Bid price must be written in words and the written words shall govern amount bid.

STATEMENT FOR SEPARATE CONTRACT COMPLIANCE

Non-consumable Material and Installed Equipment:

\$ _____

Skilled Labor and Consumable Materials, Tool
and construction equipment:

\$ _____

The undersigned agrees to commence work within ten (10) days after the date of written notice to commence work and to substantially complete the work on which he has bid within ____ calendar days as provided in the General Conditions of the Agreement. Enclosed herewith is a cashier's check, certified check, or bid bond in the sum of 5% of the greatest amount bid which it is agreed shall be collected and retained by the OWNER as liquidating damages in the event this proposal is accepted by the OWNER within sixty (60) days after the date advertised for the reception of bids and the undersigned fails to execute the contract and the required bond with the OWNER, under the conditions hereof, within ten (10) days after the date said proposal is accepted, otherwise said check or bond shall be returned to the undersigned upon demand.

CONTRACTOR _____

BY _____

ADDRESS _____

PHONE _____

PROPOSAL IV

**250,000 GALLONS
ELEVATED POTABLE WATER STEEL STORAGE TANK**

ACE Job No. 123-01C

SCOPE OF WORK

Furnish and construct a 250,000-gallon capacity potable water's **Single Pedestal Spheroid** elevated storage tank high water level elevation **156 MSL** including foundation, steel erection, welding, shrouding, blasting, and standard three coat paint system for the interior and exterior tank surfaces, and electrical, all related tank construction, welding and coating testing, disinfection, site development, and final clean up. The amount bid is to include all labor, materials, equipment, insurance, payroll, taxes, permits, and supervision to provide a complete and functional project.

Bid for Proposal IV as outlined in the Scope of Work for 250,000 Gallon Elevated Storage Tank for the Lump Sum Amount of:

_____ Dollars
And _____ Cents.
(\$ _____)

Bid price must be written in words and the written words shall govern amount bid.

STATEMENT FOR SEPARATE CONTRACT COMPLIANCE

Non-consumable Material and Installed Equipment:

\$ _____

Skilled Labor and Consumable Materials, Tool and construction equipment:

\$ _____

The undersigned agrees to commence work within ten (10) days after the date of written notice to commence work and to substantially complete the work on which he has bid within ____ calendar days as provided in the General Conditions of the Agreement. Enclosed herewith is a cashier's check, certified check, or bid bond in the sum of 5% of the greatest amount bid which it is agreed shall be collected and retained by the OWNER as liquidating damages in the event this proposal is accepted by the OWNER within sixty (60) days after the date advertised for the reception of bids and the undersigned fails to execute the contract and the required bond with the OWNER, under the conditions hereof, within ten (10) days after the date said proposal is accepted, otherwise said check or bond shall be returned to the undersigned upon demand.

CONTRACTOR _____

BY _____

ADDRESS _____

PHONE _____

PROPOSAL V

PAINTING OF LETTERS AND LOGO ON ELEVATED TANK

PROPOSAL I, II, III, or IV

ACE Job No. 123-03C

SCOPE OF WORK

LETTERING and LOGO

The words "West Jefferson Co. Municipal Water District" are to be painted on the **Elevated Tank** in block style with Seven-foot-tall letters and not to exceed two bays in length for either case. Letters are to be Black without a band. County Logo is to also be seven (7') foot tall and follow the color scheme represented on the Jefferson County logo.

Bid for Proposal VI as outlined in Scope of Work for Lettering and Logo for Lump Sum Amount of:

_____ Dollars
And _____ Cents.

The bid price must be written in words and written words shall govern the amount bid.

STATEMENT FOR SEPARATE CONTRACT COMPLIANCE

Non-consumable Material and Installed Equipment:

Skilled Labor and Consumable Materials,
Tools and Construction Equipment:

TOTAL: _____

The undersigned agrees to commence work within ten (10) days after the date of written notice to commence work and to substantially complete the work on which he has bid within ____ calendar days as provided in the General Conditions of the Agreement. Enclosed herewith is a cashier's check, certified check, or bid bond in the sum of 5% of the greatest amount bid which it is agreed shall be collected and retained by the OWNER as liquidating damages in the event this proposal is accepted by the OWNER within sixty (60) days after the date advertised for the reception of bids and the undersigned fails to execute the contract and the required bond with the OWNER, under the conditions hereof, within ten (10) days after the date said proposal is accepted, otherwise said check or bond shall be returned to the undersigned upon demand.

CONTRACTOR _____

BY _____

ADDRESS _____

PHONE _____

SUPPLEMENTAL ITEMS PROPOSAL

WEST JEFFERSON COUNTY MUNICIPAL WATER DISTRICT

DISTRIBUTION SYSTEM IMPROVEMENTS-WATER STORAGE FACILITIES

ACE Job No.123-01C

NO.	ITEM	UNIT	QUANTITY	UNIT PRICE BID WRITTEN IN WORDS		UNIT PRICE WRITTEN IN FIGURES		TOTAL PRICE BID WRITTEN IN FIGURES	
				DOLLARS	CENTS	DOLLARS	CENTS	DOLLARS	CENTS
1.	MAN HOURS	HOUR	10						
2.	TRUCK HOURS	HOUR	10						
3.	BACK HOE / LOADER HOUR	HOUR	10						
4.	EXTRA CLASS A CONCRETE - BULK	C.Y.	10						
5.	EXTRA CLASS A CONCRETE - FORMED	C.Y.	10						
6.	SERVICE LINE HDPE 3/4" OR 1"	Ft.	100						
7.	SERVICE CLAMP 3/4" OR 1"	Ea.	10						
8.	METER BOX DFW-D-1200	Ea.	10						
9.	ADDITIONAL 6-FOOT CLIMB PROOF FENCE	Ft.	10						
10.	ADDITIONAL REINFORCEMENT STEEL	Lbs.	100						